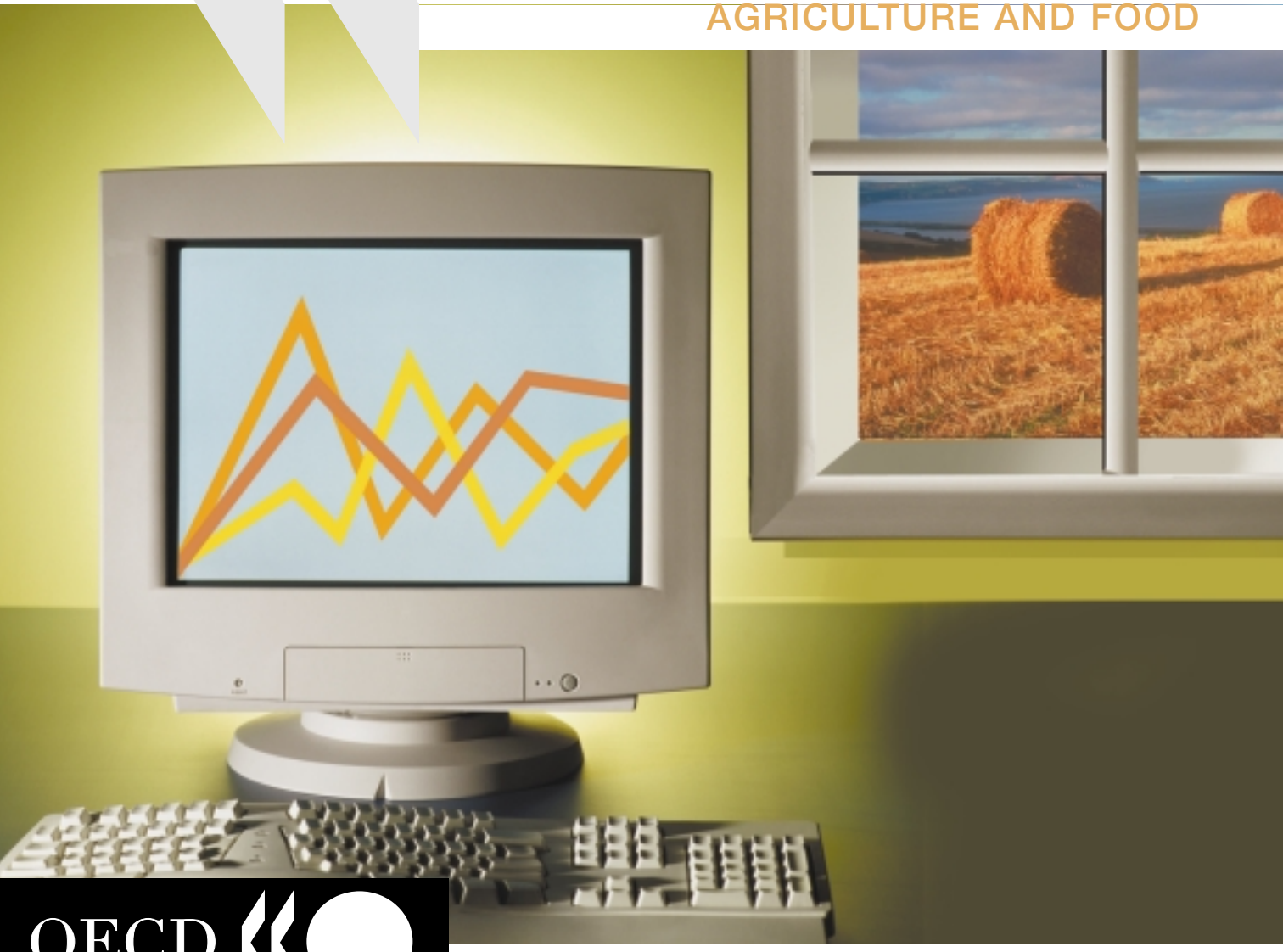
Income Risk Management in Agriculture

AGRICULTURE AND FOOD



OECD

Income Risk Management in Agriculture

OECD

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

Publié en français sous le titre :
GESTION DES RISQUES EN MATIÈRE DE REVENU DANS LE SECTEUR AGRICOLE

FOREWORD

The OECD Workshop on Income Risk Management was held in Paris on 15-16 May 2000. It brought about 60 experts from governments, international organisations, farmers' unions, agro-food industries, insurance and finance companies, and universities, who shared their experience in the area.

The OECD Secretariat introduced the workshop with an overview paper presenting the various market-based and government mechanisms assisting farmers in the management of income risk, in the context of agricultural policy. Individual sessions were dedicated to specific strategies: vertical co-ordination, hedging on futures markets, insurance coverage and public safety nets. Supported by papers from lead speakers and comments from panellists, discussions included a critical evaluation of the tools and instruments. Summarising the workshop, the final session examined implications for government intervention and identified areas for which more information or future work is required.

Part I of this publication provides a synthesis by the Secretariat on income risk management strategies at the farm household level, including a summary of session discussions and policy conclusions reached during the workshop. Part II contains written contributions to the workshop, by lead speakers and panel members, on specific strategies. The Committee for Agriculture declassified these proceedings in September 2000.

ACKNOWLEDGEMENTS

The OECD expresses its appreciation to all participants for contributing to the success of the workshop. The Secretariat would like to thank, in particular, Canada and Switzerland for their financial contribution.

TABLE OF CONTENTS

Part I

List of Boxes

List of Tables

List of Figures

Part II

List of Tables

Section D.1 – *Annexe*

List of Figures

Section A.2

Section C.1

Section D.1 – *Annexe*

AGENDA OF THE WORKSHOP AND LIST OF SPEAKERS
Paris, France, 15-16 May 2000

Monday, 15 May

Opening statement

Mr. Gérard Viatte, Director, Directorate for Food, Agriculture and Fisheries, OECD

Session 1. Overview

Chair Mr. Ken Ash, Deputy-Director, Directorate for Food, Agriculture and Fisheries, OECD

Introductory presentation by Catherine Moreddu of the Secretariat based on a document describing all available strategies to manage income risk in agriculture.

Session 2. Transfer of risk along the food chain

Chair Mr. Michel Debatisse, World Bank

Lead speaker Mr. Leland Swenson, President of the National Farmers Union of the United States

Panel members Ms. Joy Harwood, Economic Research Service of the USDA, USA
Mr. Vincent Magdelaine, Unigrains, France
Mr. Karl Christian Møller, Federation of Danish Co-operatives, Denmark
Ms. Nicola Shadbolt, Massey University, New Zealand
Mr. Steve McCorriston, University of Exeter, United Kingdom

Session 3. Reduction of risk using futures markets

Chair Mr. Marc McCarthy, Agriculture and Agri-Food Canada

Lead speaker Mr. Jean Cordier, École nationale supérieure agronomique de Rennes, France

Panel members Mr. Bobby Matheson, Agriculture and Agri-Food Canada
Mr. Patrick Gentile, MATIF, France
Mr. Francis Blum, Louis Dreyfus Negoce SA
Ms. Joy Harwood, Economic Research Service of the USDA, United States
Mr. Michel Debatisse, World Bank (International Task Force on Commodity Risk Management)

Tuesday, 16 May

Session 4. From risk pooling to safety-nets

A. *Insurance systems*

Chair	Mr. David King, International Federation of Agricultural Producers (IFAP)
Lead speakers	Mr. Robert Dismukes, Economic Research Service of the USDA, United States Mr. Fernando Burgaz Moreno, ENESA, Spain
Panel members	Mr. Gérard Duval, Groupama, France Mr. Weinberger, Director, Österreichische Hagelversicherung, Austria Mr. Pierre Bascou, European Commission Ms. Miranda Meuwissen, Institute for Risk Management in Agriculture (IRMA), Wageningen University, Netherlands Mr. Jerry Skees, University of Kentucky, United States

B. *Agricultural, fiscal and social safety nets*

Chair	Mr. Vicente Forteza, ENESA, Director, Spain
Lead speaker	Mr. Tom Richardson Agriculture and Agri-Food Canada
Panel members	Mr. Craig Burns, Australian Permanent Delegation to the OECD Mr. Rick Phillips, Dairy Farmers of Canada Ms. Carol Brookins, World Perspectives Inc., Unites States

Session 5. Policy implications and recommendations

Chair	Mr. Gérard Viatte, Director, Directorate for Food, Agriculture and Fisheries, OECD
Panel members	Mr. Craig Burns, Australian permanent delegation to the OECD Mr. Tom Richardson, Agriculture and Agri-Food Canada Mr. Willi Schulz-Greve, European Commission Mr. Luc Guyau, FNSEA, France Mr. Jerry Skees, University of Kentucky, United States Mr. Gérard Duval, Groupama, France

SUMMARY AND CONCLUSIONS

The OECD Workshop on Income Risk Management provided an opportunity for experts from different countries and professional backgrounds to evaluate existing market and government approaches and to draw some general conclusions on the most efficient and cost-effective approaches.

A synthesis document prepared by the Secretariat (Part I) sets out the policy context in which risk management approaches are to be analysed, describes the characteristics of risk affecting farm households, considers the rationale for government intervention in income risk management in agriculture, and outlines the diversity of existing strategies comprising a mix of market-based tools and/or policy instruments. Finally, this document stresses the need for thorough evaluations of risks and strategies.

In addition to trying to provide a stable business environment, governments in many OECD countries intervene to support the agricultural sector. On average, the Producer Support Estimate (PSE) for the OECD area as a percentage of the value of farm receipts was 36% in 1997-99, compared to 40% in 1986-88. Although in the last decade, the share of budgetary payments in total support has increased, over two-thirds of transfers to producers from agricultural policies still affect both producer and consumer prices. Some measures are specifically designed to assist farmers to manage income risk, either through the provision of specific instruments or by lowering the cost of existing tools. In all cases, however, government intervention modifies risk faced by farmers, either by increasing income levels or by reducing income variability.

Risk can be characterised by its origin and its consequences. Risks affecting farm households are linked to production (weather conditions, pests and diseases, technological change), to markets (for example, input and output prices, quality requirements), and to changes in the regulatory or institutional environment, including agricultural policy, and regulations on food safety and the environment. Ecological risks resulting from pollution and climate changes also affect production. All risks ultimately affect income, the extent of which depends on the frequency, randomness and distribution of occurrence of the risk in question, the correlation between events and the magnitude of losses. It is necessary to know the characteristics of the risks involved in order to develop an appropriate strategy.

Strategies used by farm households to manage income risk are diverse. They depend on the type and level of risk faced as well as on the range of solutions available and the willingness of governments to become involved. Strategies entail acknowledging risk and its consequences in the first place, and then managing the losses incurred or adopting techniques to reduce risk by spreading it amongst activities or transferring it to other agents. Risk management strategies combine market-based approaches and government intervention. They include a whole range of tools and instruments, such as:

- financial management, for example keeping a low debt/asset ratio or maintaining a certain level of liquidity;
- the diversification of income sources among products with different risk characteristics or to activities outside agriculture;
- production techniques which involve choosing outputs and inputs;
- marketing techniques, including spreading sales, pooling receipts between farmers grouped in co-operatives, supply management, storage, transfer of risk along the food chain using vertical integration or production and marketing contracts with upstream and downstream industries, and transfer of risk to speculators using futures markets;

- insurance systems which pool premiums from a large number of clients and pay compensation for losses when they occur, and in which government might intervene by providing a subsidy or by managing the scheme; and
- social, fiscal and agricultural safety nets.

Government intervention in risk management is justified on economic grounds when risk averse farmers produce below the profit maximising level of output because contingency markets to neutralise risks are not available or do not function well. However, even if government intervention can be justified to correct market failure, it has been criticised because it prevents the development of market solutions, and often transfers support to farmers and leads to rent seeking behaviour.

Whether risk management strategies involve government intervention or not, they need to be evaluated in terms of their cost-efficiency and their impact on producers' decisions and markets. This requires information on risk and its consequences, both in the absence and in the presence of a risk management strategy, as well as on farmers' behaviour when facing risk.

Sessions of the workshop were dedicated to specific instruments that have recently attracted renewed interest, namely vertical co-ordination, futures markets, insurance systems and safety nets (Part II). To help with their evaluation, the following questions were discussed:

- How does a given mechanism or policy instrument operate to reduce income risk to farmers? When is it effective?
- Is there a need for government involvement? If yes,
- What is the level of take-up? How frequently are policy instruments triggered?
- What are the costs and benefits of government intervention? Is it effective with regard to its objectives?
- Do these policy measures meet the policy principles and operational criteria identified by OECD Agricultural Ministers?* In particular, do they distort production and trade?

The following general conclusions emerged from the workshop discussion.

- Risk management is primarily the responsibility of the farmer, as manager, and income risk should be managed at the household level.
- Experience indicates there is no universal approach and that each specific situation requires a different mix of tools and instruments.
- A primary role of government in risk management is to provide a sound business environment with competitive markets and clear regulations.
- All agricultural policies influence the environment in which farmers make their decisions. In many OECD countries, high levels of support shield farmers against downside risk as income fluctuates around a higher average level than would otherwise be the case. However, the expectation is that the process of reducing support and protection will generate a need for measures and instruments to help farmers cope with the resulting increase in income-related risk.
- Before considering government involvement in risk management, the market failure justifying it must be identified.
- Government intervention should be in line with reform principles and, in particular, should facilitate the development of innovative market approaches (*e.g.* through competition policy, regulations, information and training, support for the development of market mechanisms such as insurance and futures markets, etc.), should strengthen the adjustment capacity of the sector, should not encourage rent seeking, and should guard against moral hazard and adverse selection.
- Risk management instruments should be seen within the broad policy framework in relation with other measures.

* See OECD (1998*a*).

- A strong integration between private and public initiatives, including information sharing, was considered essential for the design of successful approaches. Similarly, dialogue at the international level should be developed.
- Evidence shows that market-based approaches such as futures contracts and options are not used to the fullest extent possible. This was partly attributed to government intervention. In particular, subsidised insurance and emergency measures were blamed for undermining the development of private insurance systems.
- Finally, there is still a need for more information on the mechanisms available in different countries as they evolve, their utilisation and performance, and their economic impacts.

Part I

APPROACHES TO INCOME RISK MANAGEMENT IN OECD COUNTRIES

OVERVIEW OF FARM HOUSEHOLD STRATEGIES AND GOVERNMENT INTERVENTION

by
Catherine Moreddu,
Policy, Trade and Adjustment Division,
Directorate for Food, Agriculture, Fisheries, OECD, *Paris, France**

Introduction

Agricultural producers face a series of risks affecting the income and welfare of their households. There are a large number of ers face a strategies dealing specifically with income risk that are available to farm households, but which exist against a general background of widespread government intervention that modify the risks faced by farmers. Some policy measures are specifically designed to reduce production, price and income variability.

A general definition of risk is given in Box 1. In this report, risk refers to uncertainties about income – in particular, income losses – that arise as a result of variations in production and prices.

Types of risk

There are risks common to all businesses, *e.g.* risks linked to family situation, health, personal accidents, or those risks originating from the macroeconomic, financial or business environment (such as credit or default risks). Other types of risks are more specific to agriculture or affect it to a larger extent than they do to other activities. These are mainly ***production risks*** related to weather conditions, pests, diseases and technological change, and ***ecological risks*** resulting from pollution, climate change or to the management of natural resources such as water. These natural risks can be considered as ordinary or extraordinary (calamity) depending on their frequency and the extent of the losses, and vary according to natural conditions, farm structures and production practices. ***Market risks*** depend on output and input price variability, but can also include other aspects of farmers' relationships with participants in the agro-food chain. On the demand side, these can relate, for example, to requirements pertaining to quality, safety and delivery, as well as to the emergence of new products. Finally, ***regulatory or institutional risks*** are also important due to state intervention in agriculture that occurs in most OECD countries and because this sector is subjected to many food safety and environmental regulations.[1]

Risk management process

Risk management is a complex process which includes several steps (Hardaker, 1997). The first step is to identify the risk and its nature. The second is to analyse the risk, *i.e.* to consider the possibility of occurrence and to assess the consequences. Of particular interest are the frequency and distribution of occurrence, the magnitude of potential losses, and their randomness and correlation with one another. Risk assessment consists in deciding if action is needed. Risk management *per se* involves

* Part I is based on a Secretariat document presented in Session 1 of the OECD Workshop on Income Risk Management.

Box 1. **Definition of terms**

***Risk*:** Uncertainty (*i.e.* imperfect knowledge or predictability because of randomness) in outcomes that might involve adversity or losses. Two aspects of risk can be distinguished: variability and downside risk, *i.e.* the probability of extreme low values.

***Risk aversion*:** Economic agents are risk averse when they have a preference for a certain outcome over an uncertain outcome with equal expected value.

Commodity futures market*:** Commodity Exchange in which futures contracts and options are traded. A ***futures contract is an agreement priced and entered on an exchange to trade at a specified future time a commodity with specified attributes. An ***option contract*** is a contract that gives the holder the right, without obligation, to buy or sell a futures contract at a specified price within a specified period of time, regardless of the market price of the futures.

***Moral hazard*:** The ability of an insured to increase his or her expected indemnity by actions taken after buying the insurance.

***Adverse selection*:** A situation in which the insured has more information about his or her risk of loss than does the insurance provider and is better able to determine the soundness of premium rates. As a consequence, the level of risk in the insured population is higher than in the total population.

Source: Harwood *et al.*, 1999; Hardaker, 1997.

choosing a strategy or combination of strategies to reduce the effect of risk on income and welfare and to ascertain the most suitable solution to be implemented. Risk management is primarily an individual process that should take place at the farm household level. The following section will present various risk management strategies used by farm households. The final stage of the risk management process is to monitor and review the strategy applied in order to evaluate the balance between costs and benefits both in the presence and in the absence of this strategy.

Policy issues

Income risk management is also of interest to policy makers. State intervention in risk management has often been justified on the grounds of efficiency: risk-averse farmers do not allocate their resources efficiently when facing risk. In addition to securing a stable environment to economic agents, one could ask whether the specific nature of risk in agriculture requires a sectoral policy. In fact, governments have often intervened explicitly to stabilise production, prices and farm incomes. Moreover, whatever the objective, many policy measures tend to reduce the adverse effects of income variability because they provide support to farmers. In the same way as farm households select their strategy to fit the particular risk problem they are confronted with, governments must find the most cost-effective measure to deal with the risk they wish to reduce. One important issue regarding state intervention is to assess the ability of policy measures to stabilise income without providing support to farmers, in particular the most distortive forms of support.[2] In the context of a reform of agricultural policy as set out in the 1998 Ministerial Communiqué (OECD, 1998*a*), a challenge for policy makers is to better define the role of public policy versus market-based mechanisms to deal with income risk in agriculture.

Objectives

Under Item 4, "Policy Approaches and Instruments to Address Multifunctionality and to Facilitate Structural Adjustment", the 1999-2000 Programme of Work of the OECD Agriculture Directorate includes an activity on income risk management which proposes to examine "new policy approaches to deal with income risk management at farm level, the scope and limitations of market based mechanisms and public policy, and how to minimise production and trade distortions associated with the different policy mechanisms".

A workshop was organised in Paris on 15-16 May 2000 to look at those issues and brought together experts from different countries and professional backgrounds to share their experience. The Secretariat prepared a background report to the workshop which covered the various market-based and government mechanisms available to farmers in the management of income risk. This report has been revised to incorporate additional information from the workshop, including a summary of the presentations and the discussion that took place during Sessions 2 to 4 and the main conclusions drawn in Session 5. This report will form Part I of the workshop proceedings. Risk management strategies currently used by farm households in OECD countries are first identified in this part. Current government involvement is then examined and finally, the main conclusions that emerged from the workshop are presented. Part II is composed of the written contributions by main speakers and some panellists to the workshop.

Part I draws mainly on published information, including previous OECD work on related issues, for example commodity price variability (OECD, 1993), and farm income fluctuations and minimum income guarantees (OECD, 1994). It also uses statistical information available in the Directorate, for example the PSE database, structural indicators and updated work on total income of agricultural households (OECD, 1995 a). Additional information provided by participants during the workshop has been incorporated. In particular, boxes with summaries of the sessions have been included (Boxes 2, 3, 6, 8).

Income risk management strategies at the farm household level

This section contains a description of the various income risk strategies used by farm households. To the extent possible, it also provides information on the degree to which farmers use the available tools and on their efficiency in reducing income risk relative to cost.

Identification, analysis and assessment of risk

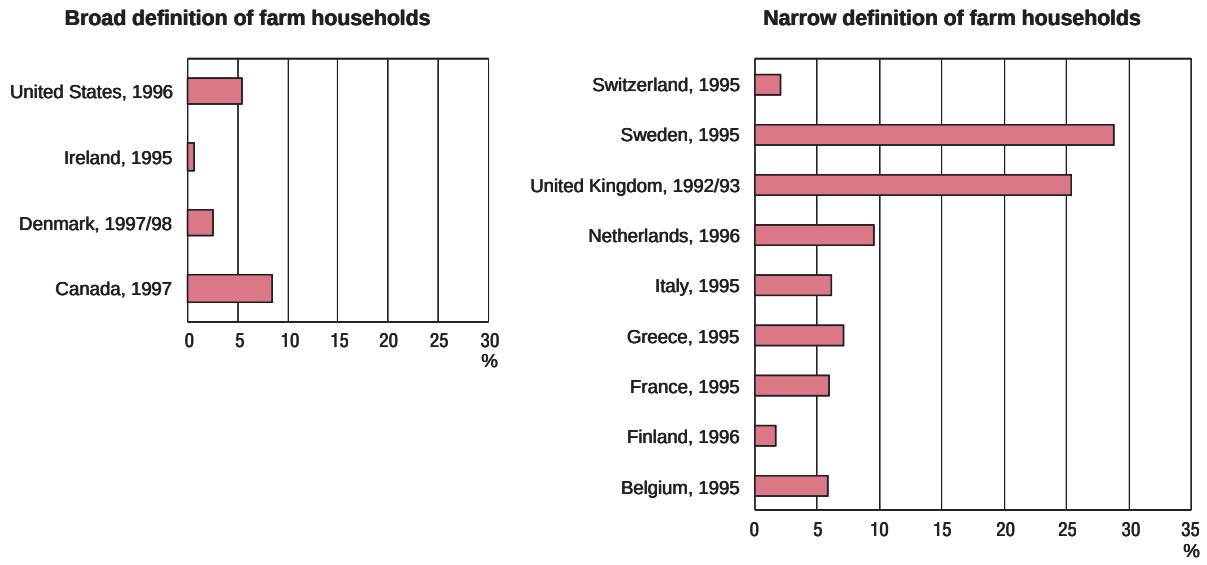
Understanding the origin and nature of risk is necessary to develop risk management strategies. As explained in Hardaker (1997), there is a need for information on risk, its cause, its characteristics (distribution, frequency and correlation with one another), its consequences on farm income and on the capacity of various strategies to reduce income risk. There has been much theoretical research attempting to explain price variability on commodity markets or the use of futures markets and insurance systems. Researchers are also concerned with understanding the behaviour of producers confronted with risk and developing modelling tools to help farmers make decisions in situations where there is risk (Cobble and Barnett, 1999). However, the behaviour of farmers does not always conform to theory and there is a need to better understand their attitude towards risk and the way they adjust their farm operations. A number of surveys have addressed this question, particularly in Australia (Beal, 1996), Canada (AAFC, 1999), New Zealand (Martin and McLeay, 1998) and the United States (Harwood *et al.*, 1999; Jose and Walluru, 1997). A summary of the main findings of some of these surveys is found in the Annex to this part (Figure A1 and Tables A1 to A5). Several contributions to the workshop presented in Part II also report survey results in more detail (see Section A.2 on New Zealand and Section D.1 on Canada).

Once the risk has been identified and assessed, various strategies can be used to reduce income risk at the farm household level. These include an acknowledgement of risk, a spread among activities, reducing or transferring risk to other agents, or the management of losses. While the ultimate objective is usually to reduce farm household income variations, and in particular to avoid large income losses, different parameters are targeted: it can be farm household income or farm income directly, production volume, or input or output prices. Among the various strategies listed below, financial mechanisms and diversification of income sources target income directly, production techniques can be used to control yields, and marketing techniques help stabilise prices. Most existing insurance systems cover production risk but some schemes also cover agricultural revenues.

Financial mechanisms: capital and debt management

Households confronted with a variable annual income must be able to mobilise liquid assets in order to maintain a more stable level of annual expenditures. At the household level, cash flows can derive from savings and borrowings. Investments also provide a source of non-agricultural income. As

Figure 1. **Percentage share of property income in total income of farm households**



Source: Eurostat (1999), *Income of agricultural household sector,* Luxembourg; OECD Structural Indicator database; various national statistics.

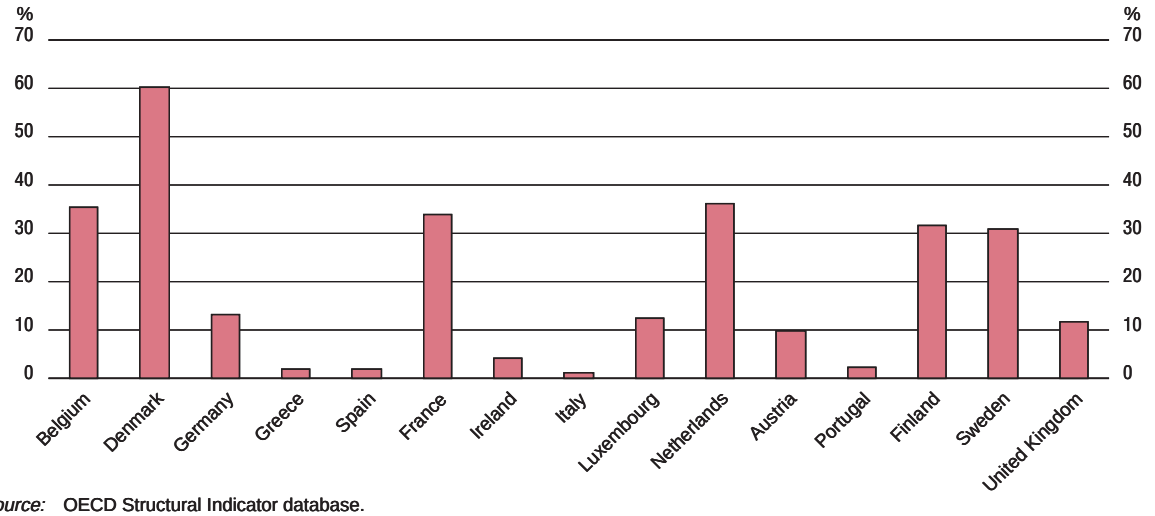
shown in Figure 1, although investment is far from being the main source of income for farm households, its share is significant in many OECD countries, particularly in Sweden and the United Kingdom.

At the farm business level, flexibility in managing investments and withdrawals is also a response to financial risk. For example, the purchase of new equipment is postponed in low-income periods. The degree of financial risk is linked to the level of financial resources available and to the structure of assets. For instance, financial risk is reduced when assets (or other monetary sources) can be easily converted to cash in order to meet current obligations or if credit can be easily obtained. Debt management is a commonly used instrument to reduce financial risk. After deregulation in New Zealand, it was found that one of the main strategies used by 82% of sheep and beef farmers for risk management at the farm level was to keep debt low (Part II, Section A.2). However, because highly indebted businesses are more at risk and adverse events can threaten their survival, they have a greater need to use other risk management strategies. As shown in Figure 2 and Table 1, the share of debt in total assets in European countries is, on average (and particularly where the main production benefits from support and protection), higher than in more market oriented countries such as Australia, Canada and the United States. This share is also higher in countries where capital-intensive livestock production is important. In most countries, larger farms are more indebted than smaller ones. At the individual level, the low share of debt in total assets might reflect the low borrowing capacity of the farmer (Barry, 1995). Another option to reduce financial risk is the introduction of external equity capital. Risks are thus distributed between owner and lender.

Diversification of income sources

One of the most common strategies to reduce income variability is to diversify the sources of income. Producing different commodities and/or varieties can contribute to a more stable farm income to the extent that commodities have different risk patterns. At the household level, income from non-agricultural activities, investments or social transfers form a significant share of total income. While farmers traditionally rely on such means to stabilise household income, agricultural policies in some countries have had the opposite effect. In particular, output related support has permitted, or even promoted, the development of specialised farms.

Figure 2. **Percentage share of debts in total assets in EU Member countries, 1995**



Source: OECD Structural Indicator database.

Table 1. **Share of debts in total assets, by farm size**

	Year	% share
Australia	1996/97	13
First quartile		6
Second quartile		9
Third quartile		12
Fourth quartile		15
Canada	1997	16
Denmark	1996/97	51
First quartile		48
Second quartile		34
Third quartile		45
Fourth quartile		58
European Union	1995	14
First quartile		1
Second quartile		3
Third quartile		8
Fourth quartile		21
Netherlands	1996	30
First quartile		15
Fourth quartile		37
Switzerland	1995	42
First quartile		41
Second quartile		43
Third quartile		42
Fourth quartile		44
United States	1996	13
First quartile		7
Second quartile		5
Third quartile		9
Fourth quartile		17

Notes: Quartiles are ranked in ascending order of gross sales.
The average of each quartile is shown.
Source: OECD Structural Indicator database.

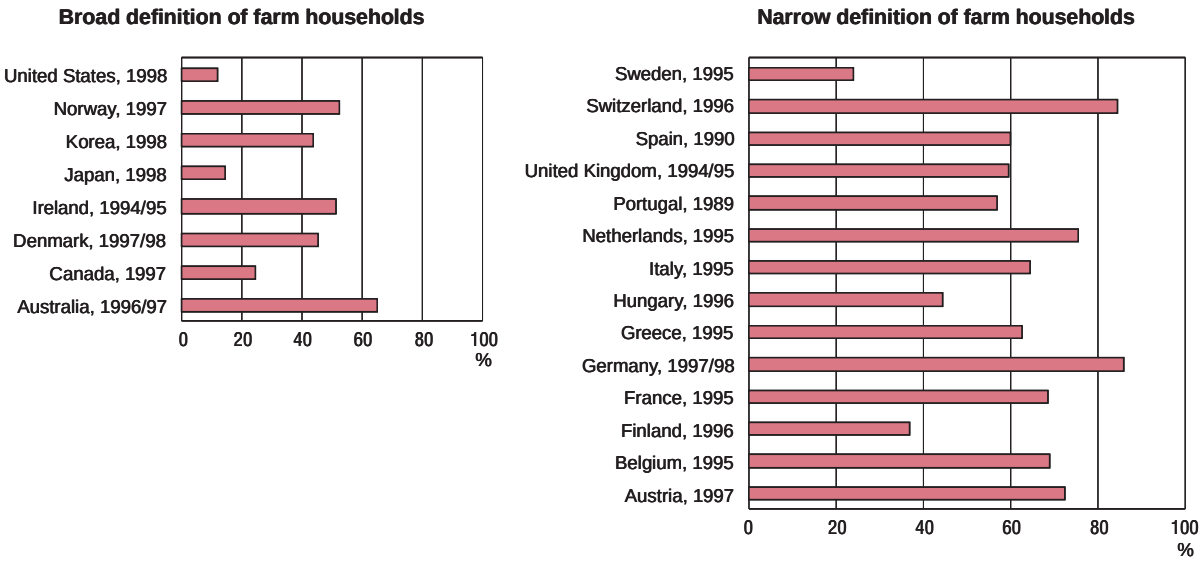
Diversification of productions/varieties

Specialisation and diversification of production at the farm level have opposite effects on income levels and variability. Specialisation allows higher income through a reduction of fixed costs and better managerial expertise but increases income variability. Diversification reduces income risk, and all the more when the commodities produced have different yield and price risks. However, climatic and geographic conditions and farm resources can limit opportunities. Using different varieties allows yield risks to be spread even in monoculture systems.

Diversification of non-farm income sources

This phenomenon is difficult to quantify as official income statistics in many countries exclude part-time farmers. Figure 3, however, indicates that farm households in OECD countries draw a significant share of their income from non-agricultural sources. Reflecting *inter alia* differences in definition, the share of farm income in total income varies from less than 15% in the United States and Japan to over 85% in Germany and Switzerland.

Figure 3. **Percentage share of farm income in total income of farm households**



Source: Eurostat (1999), *Income of agricultural household sector,* Luxembourg; OECD Structural Indicator database; various national statistics.

Non-agricultural sources of income include other independent or salaried activities, property and social transfers. Opportunities for other employment or activities vary according to countries and regions. As for social transfers, income from such sources depends on the structure and composition of the households. Property income comes from investments (interests, dividends) and tangible assets. It derives from investment decisions at the farm and household level and relates to financial strategies presented above.

Production techniques

Agricultural yields are influenced by natural conditions as well as by production practices. Technological change has, in general, increased farmers' control over the production process but because it

allows production in more extreme conditions, it has created new risks. For example, large, intensive livestock operations are more sensitive to animal diseases and losses, and thus when these occur are on a bigger scale. Plants have been adapted to wider climatic zones, but they sometimes require more inputs such as irrigation water and pesticides.

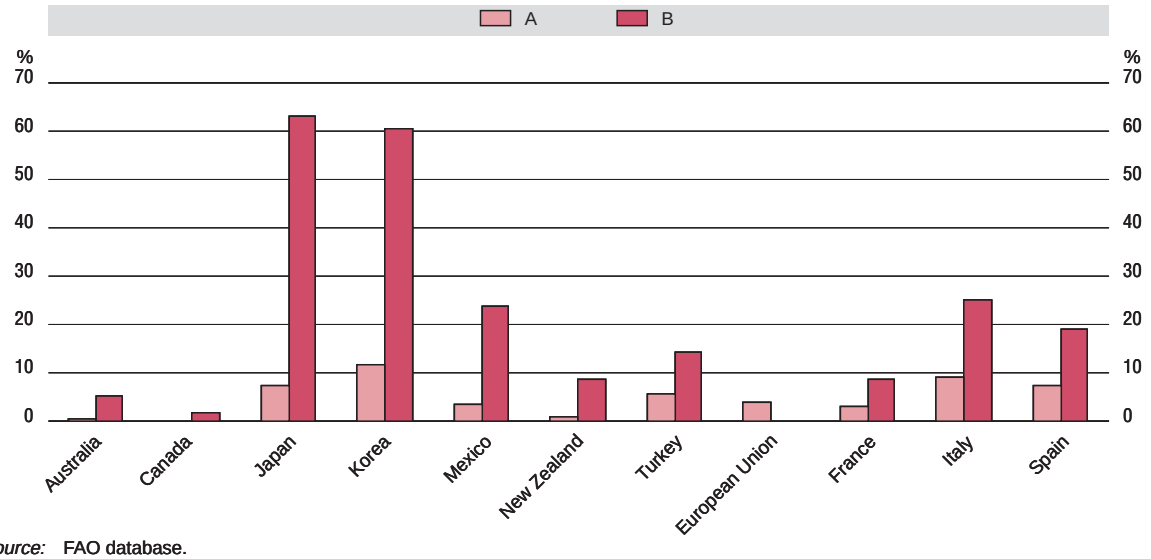
Choosing the type of production is the first step in a production risk management strategy. The farmer can then adopt production practices that are more or less risky. He can also choose to diversify any of the three elements: production, location or production method.

To use production practices that reduce risk, information is required on potential risks. Their occurrence should also be monitored and techniques to reduce risks should be identified. Climatic risks are difficult to forecast and impossible to prevent except in the case of frost where warming devices can be used to protect high value crops such as wine. Ensuring alternative feed supplies in case of drought is another example of dealing with climatic risk, but this is very costly. Water management allows risk due to inadequate rainfall to be reduced but irrigation has a financial cost and, in many countries, there is competition with other uses and/or it raises environmental concerns. Figure 4 shows that in some OECD countries a significant share of crops is irrigated, with the highest levels found in Japan and Korea where a large share of agricultural land is used for rice cultivation. Pest and disease control provides a good example of the arbitrage between cost and risk. Applying high levels of pesticides reduces yield risk but increases input costs and harms the environment. These costs can, to a certain extent, be limited through careful monitoring of the occurrence of the pest; this would entail lower levels of the use of pesticides but would increase labour costs. The same type of reasoning applies to animal health. The strengthening of environmental and food safety concerns may restrict the potential for input management to reduce production risk. In addition, as in all businesses, the introduction of new techniques/products always brings certain risks (financial, environmental and marketing).

Marketing techniques

This section deals with techniques and strategies to reduce the variability of market prices or receipts throughout the year.

Figure 4. **Percentage share of irrigated land in total land area (A) and crop and permanent crop area (B)**



Source: FAO database.

Spreading sales

Product diversification at the farm level helps farmers to spread receipts from sales through the year; for example, by combining livestock production that provides a more regular income with crops or by combining various crops and varieties with different seasonality (in particular fruits and vegetables). With farm storage, farmers can not only spread sales over the year but can also take advantage of higher prices. Storage is a traditional response to price variability, in particular throughout a given year. However, although it can increase net returns and reduce variability, it does have a cost. In addition, it can increase risks of destruction and quality loss, and also requires equipment and facilities that might not be available on smaller farms. In this case, handlers or co-operatives (see section below) can carry out the storage role.

Pooling of risk

In addition to reducing price variability through storage, co-operatives sometimes pool supplies and pay farmers an average price. Price risk is collectivised and therefore reduced for each individual. In general, it is used to protect farmers from short-term fluctuations in prices (Hardaker, 1997, Chapter 11). The extreme case is found with marketing boards that have statutory power to pool prices and thus to equalise all financial receipts at the national level. In principle, such organisations are able to spread risk across years, regions and commodities (Beal, 1996). However, there are concerns about the transparency of pooling practices, their administrative costs and their impact on competition both at domestic and international level (OECD, 2000*e*).

Supply management (public or private)

In a closed market, price variations can be controlled through supply management. Adjusting supply to demand maintains stable prices. Supply management associated with border protection is by definition sanctioned at national government level but groups of producers can also voluntarily limit their sales when seasonality or quality protects them against outside competition. Common market organisations play such a role in the EU fruit and vegetable sector for example. Within geographical indications, producers' organisations can limit global production and allocate production rights (OECD, 2000*f*).

Transfer of risk along the food chain

Agricultural production is part of the agro-food chain, with upstream industries providing inputs and downstream industries buying commodities and then handling, processing and selling end products to consumers. Vertical co-ordination includes all the ways that output is transferred from one stage to the next, including vertical integration and production and marketing contracts. Various degrees of integration can be found between stages, depending on commodities and market specific characteristics. In general, however, agriculture has become more integrated, thus allowing for greater processed product diversification as demanded by consumers and allowed for by technology. Vertical co-ordination can be used to spread risks over several stages of the food chain. As in the case of many other strategies, transfer of risk might involve lower returns on assets and lower profit margins for the farmer (see below).

With ***vertical integration,*** a firm retains ownership control of a commodity over several levels of activity. There are different ways for a farm to be vertically integrated. It applies when a farmer grows cereals and forage to feed its own livestock. It also refers to a farmer or farmers' organisation which extend control of the product beyond the farm gate (or *vice versa*). It is common in speciality crops, like vegetables, to sort and pack at the farm. Vertical integration is also found in the poultry sector (in particular for turkey in the United States, see Table 2) where the same company controls the whole process, from providing feed to packing the final product. Vertical integration can also be part of a strategy to increase value-added at the farm, as for example in the case of quality farm products with specific characteristics or labels. For several speciality cheeses, farmers own the co-operative that transforms their milk into cheese (Parmigiano regiano, fruitières in Franche-Comté). Vertical integration reduces

Table 2. **Percentage share of US farm production coordinated by vertical integration**

Commodity	1970	1990
Broilers	7	8
Turkeys	12	28
Hogs	1	6
Sheep and lambs	12	28
Food grains	1	1
Feed grains	1	1
Processed vegetables	10	9
Fresh vegetables	30	40
Potatoes	25	40
Citrus	9	8
Other fruits and nuts	20	25
Total agricultural production	5	8

Source: Harwood *et al.* (1999).

risks by guaranteeing supplies and market outlets in terms of quantity, price, quality and timing of delivery. These benefits are larger when markets are imperfect as marketing risk is greater. However, there are costs in terms of management. To the extent that it spreads price risk over several products for different processing stages it has similar cost or benefit implications for farmers as does diversification in primary production. For example, returns on assets for the farmer might be lower in processing than they would be either in primary production or for a specialised processor.

With ***production contracts***, the level of integration is lower as the contractor (usually a processing firm) does not own the supplier (farm) but controls the production process; he specifies the quantity and quality of input used and output to be delivered by the farmer at a specified price. In the United States, production contracts are commonly used in the poultry and hog sectors (Table 3). Vegetables for processing are also often produced under contract. The risk shifting/reducing characteristics of the contract depend very much on its terms. When the price is fixed, the price risk is shifted to the contractor but some risk remains for the farmer if the quality or the quantity cannot be met. A part of the price paid may depend on the individual performance of the farmer (bonus/penalty system) in which case the farmer bears some specific risk (*e.g.* from disease). Studies of the broiler and the pork industry in the United States have found that production contracts reduced income risk to a large extent (90-95%) (Harwood *et al.*, 1999). Production contracts have, however, been criticised because they limit farmers' entrepreneurial capacity and may increase other types of risks such as quality,[3] investment[4] and contractual risks.[5]

Table 3. **Percentage share of the value of selected commodities produced under production contracts in the United States, 1997**

Commodity	Share
Broilers	99
Cattle	14
Eggs	37
Hogs	33
Vegetables	8
Total agricultural production	12

Source: Harwood *et al.* (1999).

A ***marketing contract*** is an agreement between a producer and a buyer which sets a price (or a price formula) and/or an outlet of a given quality within a specified time period, before harvest or before the commodity is ready to be marketed. In the United States marketing contracts are used to a large extent for crops, such as canola, cotton, rice and sugar beets, fruits and vegetables (Table 4). Contrary to production contracts, management decisions typically remain with the producer. Terms can vary, in particular with regard to prices. With "flat price" cash forward contracts, the price is fixed, usually based on current futures quotes less an adjustment reflecting marketing costs between the local elevator and the futures exchange location. In this case, price risk is eliminated for the farmer. If some other price formula is used,[6] price risk is shared between farmers and contractors. With "basis" contracts, the basis – *i.e.* the difference between the futures price and the cash price for the commodity – is fixed but farmers still must face futures price variability (see section on futures market below). "Hedge to arrive" contracts fix the futures price but leave farmers to bear the risk linked to variations in the basis. Moreover, farmers still have to face yield, quality and default[7] risks for all types of contracts. Marketing contracts often refer to futures prices to determine price levels and contractors generally hedge their positions using futures markets.

Table 4. **Percentage share of the value of selected commodities produced under marketing contracts in the United States, 1997**

Commodity	Share
Barley	19
Cattle	9
Corn	8
Cotton	33
Eggs	6
Fruits	59
Peanuts	41
Potatoes	43
Rice	31
Soybeans	9
Sugar beets	82
Vegetables	24
Total agricultural production	22

Source: Harwood *et al.* (1999).

Contracts are used increasingly by the agro-food industry, allowing firms to better respond to market requirements. In general, due to the individual and private nature of contracts, there is little information available on the extent to which they are used or on the specific terms, which determine how risk is shared between the parties. From a risk reduction point of view, farmers may be left bearing much of the risk, because of lack of competition in the agro-food chain (see Part II, Section A.1). This issue is discussed in Box 2 which summarises Session 2 of the Workshop. Co-operatives could play a role by offering contracts with lower levels of risk for individual farmers through risk pooling. The experience of New Zealand's lamb industry with vertical co-ordination is described in Part II, Section A.2.

Market risk management: Futures markets

For some commodities for which futures markets exist, farmers can use futures contracts or options in order to minimise price variability (see definitions in Box 1). Futures markets can be used to sell production or to buy inputs. Such tools allow farmers to shift price risk to speculators willing to accept it in exchange for possible higher profits. The main difference with forward selling on contract is that futures contracts and options are standardised and widely traded, which means that prices are more competitively determined than for a specific contract between individuals (Hardaker *et al.*, 1997). In addition, exchanges cover default risk.

Box 2. Transfer of risk along the food chain

The session was introduced by Mr. Leland Swenson, President of the US National Farmers Union. His main point was that integration and concentration has increased market power for some participants in the food chain, allowing them to transfer most of the unacceptable risk to agricultural producers and retail consumers, who are price takers. Contracts do not therefore reduce risks, in particular price risk which is considered by farmers as the greatest threat to farm survival. In Mr. Swenson's opinion, the variety of programmes and regulations somewhat mitigate risks for farmers, but "past and current policies have generally failed to address a primary cause of the inequity in risk transfer by not ensuring an adequate level of competition throughout the food chain" (see Part II, Section A.1).

In the discussion that followed, experts considered vertical co-ordination as an efficient mechanism to match production with consumer demand, in quantity and quality, allowing the agro-food sector to better respond to increasing market segmentation. In general, contracts are a response to the requirements of the upstream and downstream industries rather than to farmers' needs.

Regarding the effect of contracts on risk for farmers, it was generally thought that contracts reduce price variability but lower the average price farmers receive. Contracts also deal with other risks such as input, quality, safety, and delivery risks. However, it was recognised that in some sub-sectors, farmers might not benefit from contracts because of the absence of reference markets to set the price and the lack of alternative marketing channels.

The need for competition policy was stressed repeatedly. Competitive agro-food chains and open, transparent reference markets are necessary to allow risk transfer mechanisms to develop. The distribution of market power along the agro-food chain differs by country and by sub-sector. In France, for example, it is mainly held by distributors and not so much by input suppliers or processors as in the United States. To gain market power, farmers can organise themselves, for example through co-operatives. Danish pork producers use labels and investment in processing to control prices along the food chain. Generally, co-operatives or marketing boards pay prices that are more stable than they would otherwise be and allow farmers to better market their products. It was widely thought that strategic alliances would benefit the whole sector. The conclusion from the New Zealand experience is that risk management should be considered in the whole farm context and that the optimal strategy depends on the individual situat ion and generally requires a combination of mechanisms (see Part II, Section C.2).

Finally, questions the answers to which would provide a better understanding of the use of contracts in the agro-food sector and its prospects were raised as follows:

- Why are contracts used in some sub-sectors and not others?
- How widely are they available?
- What is their impact on market concentration in the agro-food chain?
- What are the consequences for consumers?

With ***futures contracts***, a farmer agrees to sell part of his production (or to buy inputs) with specified attributes at a specified future time and at a specified price. Futures contracts being standardised, the only parameter to be set is the price. The price the farmer will receive at harvest is the futures price set at trading time plus the basis at harvest, the basis being the difference between the futures price and the cash price of the commodity. Actual delivery or payment is not required until the contract matures but both sellers and buyers are required to make margin deposits with their brokers to guarantee their commitment. Typically, these deposits range between 5 to 10% of the value of the contract. By fixing the price, futures contracts allows the seller to avoid losing from any future price declines and to gain from any future price increases. Not knowing the volume of his production in advance because of yield variability, the farmer takes the risk of contracting to supply a quantity higher than the actual quantity produced. Finally, the risk of eventual changes in the basis is not eliminated. The price difference reflected in the basis may be due to location (transportation costs), time (storage costs) or quality. Basis risk is generally lower than price risk, but in some cases can be large.

A commodity ***option*** gives the holder the right, but not the obligation, to take a futures position at a specified price (called the strike price) before a specified date (Harwood *et al.*, 1999). Futures contracts options protect farmers against adverse price movements, as well as allowing them to take advantage of rises in cash prices (by choosing not to exercise the option and instead to sell in the higher priced cash market). The production and basis risks remain. The premium paid for an option reflects the difference between the underlying futures price and the strike price. It is lost even if the option is not exercised. Theoretical examples of the use of futures markets are given in Part II, Section B.1.

The cost-effectiveness of futures contract and options to protect farmers against price risks depends on yield variability, on the correlation between yield and price variability (natural hedge) and on the distance from markets. If high yield variability makes production less predictable, a farmer may only hedge a small volume in order to avoid having to buy additional products to fulfil his futures contract in case of low yields. In consequence, the hedge ratio, *i.e.* the optimal share of actual production to be hedged, and the risk reduction efficiency is low. Because it reduces risk, a strong natural hedge makes the use of futures market less attractive. Finally, the greater the distance from the futures markets, the higher the cost of hedging.

Futures have been traded on commodity prices since the 19th century, but in the last few decades other contracts, such as on interest rates, foreign exchange rates, price indices, crop yields and catastrophic bonds (CAT), have been developed (Skees and Barnett, 1999). Worldwide, agricultural commodities now account for less than 10% of total futures and options trading volume (Carter, 1999, Harwood *et al.*, 1999). Options also have a long history but the US Congress banned them from 1936 – they were held responsible for the excessive volatility of grain prices before the Great Depression – to 1981, when they were progressively re-introduced. They were fully allowed in 1987 but concerns remain that markets can be manipulated. Exchanges that trade agricultural futures contracts are located primarily in the United States, but also exist in Australia and in Europe (Table 5).

According to economic theory and the empirical literature which estimates optimal hedging ratios (*i.e.* the optimal share of production to be hedged), large potential risk reduction benefits can be derived from hedging on futures markets (Carter, 1999). In addition, costs are relatively moderate (see Box 3). Yet surveys indicate limited use of such risk reduction tools (Figure A1 and Tables A1 to A5 in the Annex). As found by Harwood *et al.* (1999), they can be costly relative to their effectiveness where yield variability is high or where other risk reduction mechanisms exist (such as natural hedging). This is all the more so when other policies stabilise domestic prices and protect farmers' income. In addition, basis risks increase with the distance (or lack of correlation) between the spot market and the futures market; farmers whose closest market is found in a foreign country face exchange rate risks (see Box 9).

Another problem with futures markets is that they extend only slightly over a year . They would offer better protection to farmers against price variability if they could be extended to an investment cycle, particularly in the case of livestock and perennial production. Finally, contracts are not available for many commodities and many smaller farmers lack the information or the technical knowledge necessary to use futures market, or they can not individually reach the specifications (production volume, quality, etc.) of standardised futures and options contracts (see role for the government). This section has referred only to farmers using futures market directly, but it should be noted that producers' organisations, handlers, wholesalers, processors or local intermediaries hedge on futures markets more often than farmers and, in doing so, they are able to offer more stable prices to farmers.

The discussion on futures markets that took place during the workshop (Session 3) is summarised in Box 3. The introductory presentation focussed on recent and foreseeable developments in the area which are detailed in Part II, Section B.1.

Insurance (risk pooling)

As seen above, risk pooling can be managed by groups of farmers, co-operatives or marketing boards, usually with regard to price risks. Private, public or mutual insurance is another tool used to pool risk. There are examples of totally private insurance in agriculture covering, for example, hail

Table 5. **Main exchanges trading commodity futures contracts and options**

USA	Europe	Other regions
Chicago Board of Trade – soybeans, oil, meal (F + O) – corn (F + O) – corn yield (F + O) – wheat (F + O) – oat (F + O) – rough rice (F + O)	**France: ParisBourse/Euronext (Paris)** – milling wheat (F) – rapeseed (F + O) – rapeseed meal (F) – corn (F)	**Australia: Sydney Futures Exchange** – wool (F + O) – wheat (F + O)
Chicago Mercantile Exchange – cattle, beef (F + O) – hog, pork (F + O) – BFP milk, dairy products (butter, dry whey non-fat dry milk, Cheddar) (F + O)	**United Kingdom: LIFFE (London Inter. Financial Futures Exchange)** – cocoa (F + O) – coffee (F + O) – sugar (F + O) – EEC wheat (F + O) – EEC barley (F + O) – potatoes (F + O)	**Canada: Winnipeg Commodity Exchange** – canola (F + O) – feed wheat (F + O) – flaxseed (F + O) – Western barley (F + O) – field peas (F) – oats (F)
Kansas City Board of Trade – wheat (F + O)	**Germany: Commodity Exchange Hanover** – potatoes (F) – hogs (F) – wheat (F) – rapeseed/meal/oil (F)	**Japan: Kansai Agricultural Commodity Exchange** – red beans (F) – raw sugar (F) – US soybeans (F)
Minneapolis Grain Exchange – wheat (F + O)	**Netherlands: Amsterdam Exchange** – potatoes (F + O) – hogs and piglets (F)	**Japan: Tokyo Grain Exchange** – red beans (F) – corn (F + O) – raw sugar (F + O) – US soybeans (F + O) – coffee (arabica and robusta) (F)
Mid America Com. Exchange – cattle (F) – lean hogs (F) – corn (F + O) – oats (F) – soybeans/oil (F + O) – soybean meal (F) – wheat (F + O)	**Hungary: Budapest Commodity Exchange** – corn (F + O) – wheat (F + O) – feed wheat (F) – feed barley (F) – sunflower seeds (F + O) – soybean meal (F) – rapeseed (F) – live hogs (F)	
New York Board of Trade – coffee (F + O) – sugar (F + O) – cotton (F) – cocoa (F + O) – milk index (F + O)	**Spain: Citrus Fruit and Commodity Futures Market of Valencia**	
New York Cotton Exchange – cotton (F + O) – orange juice (F + O) – potatoes (F + O)		

F: Futures contracts.
F + O: Futures and Options.
Source: Internet.

damage to crops, fire and theft of farm assets, death and disability of farmers or farm workers. In the United Kingdom, Dalgety Agriculture Ltd., a private company, has offered since the beginning of 2000 revenue insurance to wheat producers. Most other insurance schemes are provided under subsidised government schemes because the risks being covered are, in fact, not insurable in the sense that a market determined premium would be too high.

The principle of insurance is that premiums collected regularly from a large number of clients are pooled and then used to compensate for losses when they occur, up to a level set in advance, and to pay for administrative costs and profit. As explained in Part II, Section C.3, risk should be spread over a large number of exposure units to be insurable. In addition, risks should not be too highly positively correlated or so high as to make premiums unaffordable. Resulting losses should be accidental and measurable. In addition, information on the frequency and level of claims should be available to estimate premiums in order to balance costs.

Price risk is better managed using futures markets than insurance markets because it affects all producers of one commodity at the same time. Catastrophic risks are also difficult to insure privately because loss events are not independent, can affect large areas and be extremely costly. Nevertheless,

Box 3. Reduction of risk using futures markets

As an introduction to the session, Professor Jean Cordier from the École Nationale Supérieure Agronomique of Rennes, France, presented the basic principles and techniques for managing risk, mainly using futures markets, recent developments in this area, and potential new tools, services and intermediation mechanisms (see Part II, Section B.1). As a consequence of food market requirements and opportunities in financial engineering and communication systems, markets have recently offered innovative tools such as contracts incorporating quality premiums for differentiated product characteristics or contracts mixing pooling and spreading techniques with customised characteristics. In addition, financial contracts dissociated from physical contracts have developed. In the future, it is expected that new products managing risks other than price risk will be available. Derivative contracts using yield and prices in order to secure income are already offered. Margin risk could be managed with derivatives contracts using input and output prices. Other new contracts could manage quality premium risk and the margin that is expected from segmented markets. Moreover, with appropriate fiscal conditions, longer contracts covering the investment period could be envisaged. New services based on new communication technology would include better access to information and to simulation tools, which would facilitate comparisons. As more intermediaries could join the market and new initiatives would develop, competition would be strengthened.

Other participants confirmed the emergence of innovative risk management contracts and the potential contribution of E-commerce to their development. They generally supported the idea that the private sector is ready to answer new needs that might arise as a result of policy reform. This was illustrated by the example of Paris Bourse SA in France. Contracts on rapeseed, introduced in 1994, have been increasingly used by co-operatives and processors and now cover 60% of European production. In the meantime, contracts on wheat, offered in 1998, have developed more slowly as the intervention price still provided a minimum protection. The cost of using futures contracts and options was discussed. According to experts, such costs are very low although they do increase with price volatility and time frame. It was made clear that futures markets help to reduce price volatility but do not prevent longer-term price downturns (see, for example, Part II, Section B.2).

Limited involvement by farmers in hedging on futures markets was attributed to government intervention that already provide a significant degree of protection against income losses, unequal availability depending on products and regions, and lack of understanding of the complex mechanisms involved. The importance of education and training for farmers and local intermediaries was emphasised. For instance, inadequate training and education of smaller farmers, extension officers and local bank managers explains why the Canadian Cattle Option Pilot Programme (see Box 9) was not successful. Either the government or private enterprises could provide the necessary training. A role for the government would also be to establish a regulatory framework promoting innovation yet at the same time providing the necessary level of protection for clients.

outside agriculture property insurance covers catastrophic damage from floods or storms without any government involvement. To face such heavy losses, insurance companies use international reinsurance markets, which pool extremely large and diverse types of risks.

In other cases, insurance systems are difficult to apply because asymmetry in information leads to behaviour that undermines the system. There is adverse selection when the level of risk in the insured population is higher than the average (*i.e.* only people with the highest risks will buy insurance) (see definition in Box 1). Moral hazard occurs when the insured has the ability to increase his or her expected indemnity by actions taken after buying the insurance. It means that farmers covered by an insurance might adopt riskier practices than otherwise (excessive specialisation, production in risky conditions like inappropriate climate or fragile land). However, there are techniques, well known to insurance companies, which limit such behaviour. For example, a high deductible or a bonus/penalty system can to some extent prevent moral hazard.

As discussed in the following section, more problems arise when the scheme is subsidised and government intervenes to fix some parameters; for example, the obligation to provide insurance to everybody, the level of the premium or the rate of coverage. The cost-efficiency of insurance in limiting

risk faced by farmers depends very much on the type of risk and the parameters of the insurance. Compared to other risk management tools, administration and transaction costs can be significant and increase with the coverage and the complexity of the scheme. Some of those questions were discussed during Session 4.A of the Workshop (see Box 6 for a summary).

Insurance schemes are sometimes considered as safety nets, even if there is no minimum level of income guaranteed. To the extent that they compensate for large losses, they limit the occurrence of very low incomes and all the more so when some measure of income is insured. This is recognised, for example, by the fact that insurance facilitates farmers' access to credit.

Farm households' use of government programmes in income risk management

In some countries where participation in government programmes is voluntary, farmers can use such programmes as a specific income risk management instrument or as part of a general strategy, whether they contain specific risk reduction features or simply provide income transfers. Most examples of voluntary programmes are found in North America (see section on insurance programmes). In general, support to agriculture modifies risks faced by farmers and thus affects the risk reducing strategy they are likely to adopt. It is therefore important to examine all government intervention in OECD agriculture and its effect on risk, as will be done in the following section.

Government intervention in income risk management strategies used by farmers

Government intervention affects farm households at different levels. While a key role for governments is to provide a stable economic environment, they often intervene to support the agricultural sector in OECD countries. Some government measures are specifically designed to assist farmers to manage risk, either through the provision of specific instruments or through lowering the cost of existing tools. The rationale for such intervention will first be discussed and the form and level it takes will then be examined in the context of global support to agriculture. The OECD structural indicators and PSE database, and notifications to the World Trade Organisation (WTO) on domestic support will provide information on the cost of such interventions for consumers and taxpayers and on the recipients of such benefits. Finally, some indication of the likely impact on production and trade will be given.

Why does government intervene in risk management?

A certain level of risk is present in all economic activities. Some economic agents are risk neutral and risk does not affect their behaviour. According to surveys and current practices, most farmers are risk averse and risk modifies their behaviour (see definition of risk aversion in Box 1).[8]

In economic theory, there are market solutions enabling agents to neutralise risks. Using such markets, the allocation of resources would be the same as in the absence of risk and individuals would be able to smooth their consumption over time. In reality, such contingency markets[9] are not always available and they have a cost. In their absence or incompleteness, uncertainties affect producers' decisions regarding production and the use of resources, and lead them to produce below the profit maximising level of output (see Hardaker *et al.*, 1997; Myers and Oehme, 1988; Turvey *et al.*, 1997). Not only is the average return to resources reduced, but also supply of the riskier commodities is smaller than it would otherwise be as risk adverse farmers choose low risk activities. Moreover, unpredictability can lead to a misallocation of resources (Sumner, 1988). At the farm level, high fluctuations in income cause welfare problems with a spillover effect on rural areas. In particular, excessive risks make access to credit difficult and can threaten the survival of the enterprise. Consequently, farmers adopt strategies reducing risk. However, as seen in the previous section, most strategies that farmers can use to reduce income risk are likely to increase their production cost or might not be sufficient in the case of natural catastrophes. Such market failures have been used to justify government intervention in risk management in agriculture.

To evaluate the need for government intervention, it is therefore important to assess:

- the extent to which there is market failure and lack of adequate risk management options;

- how costly this failure is in terms of social welfare; and
- the costs and benefits of government intervention, and if such intervention is effective with regard to its objectives.

The evaluation of government intervention should take account of both the costs and benefits of correcting a market failure. The possibility of government failure, implying that regulation is oversupplied thus making the cost of intervening higher than the benefit, must also be taken into account. There is also a danger that government intervention introduces additional risk to the sector when changes in the design and implementation of policies and regulations become too frequent and unpredictable. Both intended and unintended effects should be considered in relation to initial objectives. Finally, the evaluation process should be applied equally to each sector.

Risk in agriculture is often considered as having specific characteristics that explain the more frequent government intervention in risk management than in other sectors. Specifically, the relationship with nature, in particular the dependence on climate and biological processes, makes risk more difficult to control than with mechanical processes. In addition, open world agricultural markets are flexible while there are rigidities in factor markets (such as labour) and price stickiness in non-agricultural markets. Therefore, the burden of adjustment is placed on agricultural prices and factor returns (Meyers and Oehme, 1988). Inelasticity of both demand and supply also contribute to fluctuations in agricultural commodity prices. Lack of price transmission in protected agricultural markets also leads to over-adjustment in more open markets. In consequence, variability in agricultural prices is often higher than that in other products (OECD, 1993) and annual income from agricultural activities can vary to a large extent in the absence of offsetting policy interventions.[10]

It can be argued, however, that risk is part of any business environment and some risks which are larger than those associated with agriculture – *e.g.* speculative risks – are more often taxed than subsidised (Tweeten, 1995). Risks related to changes in demand, for example, are often higher in other sectors. Moreover, risks in agriculture are known and there are a large number of private strategies to deal with income risk at the household level. When government intervention in risk management involves elements of support, as has often been the case in OECD countries, farm families have no incentive to adopt risk strategies at the production and consumption level, or to use market-based approaches. This in turn hampers the development of market, risk-shifting solutions. In addition, reducing risk faced by farmers may encourage them to take production decisions that are not sustainable. Gardner (1988) argues that some degree of instability can be good as it encourages technical progress and innovation in marketing.

In some countries, high variability in prices and yields have also raised concerns regarding food security and have led governments to intervene in order to stabilise domestic food supply.

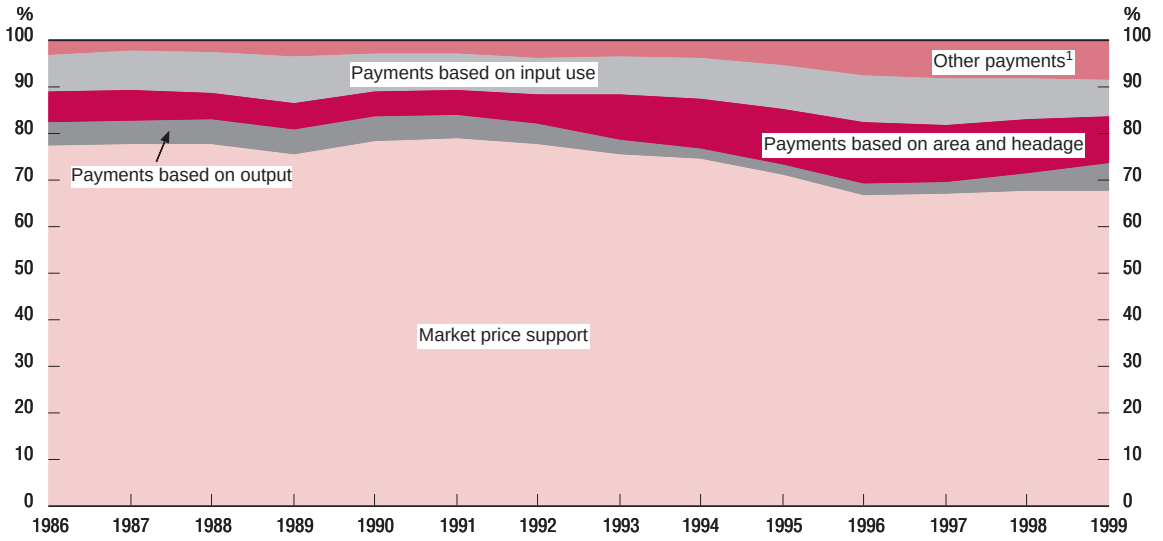
As will be seen in the following section, government intervention in income risk management has also been criticised for its lack of cost effectiveness. High costs occur most often because the programme is used as a vehicle to support farmers' income as well as to stabilise it. In some cases, programmes are complex and expensive to manage. They can also lead to rent seeking behaviour. All these elements contribute to increasing the costs of intervention and lower its efficiency.

In the following section, government intervention in various risk management mechanisms available to farmers will be reviewed and, whenever possible, the market failure justifying the intervention will be identified.

Where and how does government intervene to modify risk to farmers?

Whatever its rationale, the place and nature of government intervention in income risk management strategies at the farm level have been reconsidered in recent years in view of the evolution of support and international constraints, and when considering a reform of agricultural policy along the lines set in the 1998 Ministerial Communiqué (OECD, 1998*a*). As monitored by the PSE, there has been a movement away from market price support towards direct payments, even though output related support still forms the bulk of the total (Figure 5). Moreover, the Uruguay Round Agreement on agriculture imposes reductions in the level of the most distorting forms of support. There are concerns that in some countries these changes will lead to higher levels of risk for farmers.

Figure 5. **Evolution of the structure of support to producers**
Producer Support Estimate, OECD average



1. Other payments comprise payments based on historical entitlements, on input constraints, on overall farming income as well as miscellaneous payments.

Source: OECD (2000*a*).

Policy makers are therefore led to envisage different ways to intervene in income risk management that would be less costly and distorting than traditional output related measures and that would not prevent (or would even enhance) the development of private/market mechanisms. These discussions are occurring in many OECD countries with different types of risk and policy environments. The fundamental question is to identify the most appropriate (*i.e.* potentially cost-effective) form of intervention to address the specific type of risk targeted. Implementation issues are then discussed, such as the level of risk at which government should intervene (*e.g.* catastrophic risk), the variable that policies should target (production, price, receipts, farm or household income, household consumption,[11] etc.) and the specific parameters of programmes.[12]

The following sections discuss the ways in which the general macroeconomic and regulatory functions carried out by governments influence the degree of risk experienced by the agricultural sector. General social and fiscal frameworks are also briefly mentioned. Agricultural policy is then discussed; attention is drawn to the fact that support, despite reform efforts underway, remains high. This is followed by an examination of the impact on risk of different categories of support included in the OECD PSE (OECD, 2000*a*). Many of these measures impact on risk by changing the level or variability of parameters, such as prices and quantities of inputs and outputs or through wealth effects, although this is not always their primary objective. Other measures, such as insurance or disaster payments, are more specifically directed to mitigating income risks.

General economic and regulatory function

A primary role for governments is to create the conditions for a sound business environment. Like other economic agents, farmers need stable macroeconomic conditions on which to base their production and investment decisions. They also need properly functioning markets to purchase their inputs, including land and credit, and to sell their outputs. Interventions in agriculture have often been justified on the grounds that the environment faced by farmers was distorted and that markets were either not competitive or under-developed (see section on agricultural policies below).

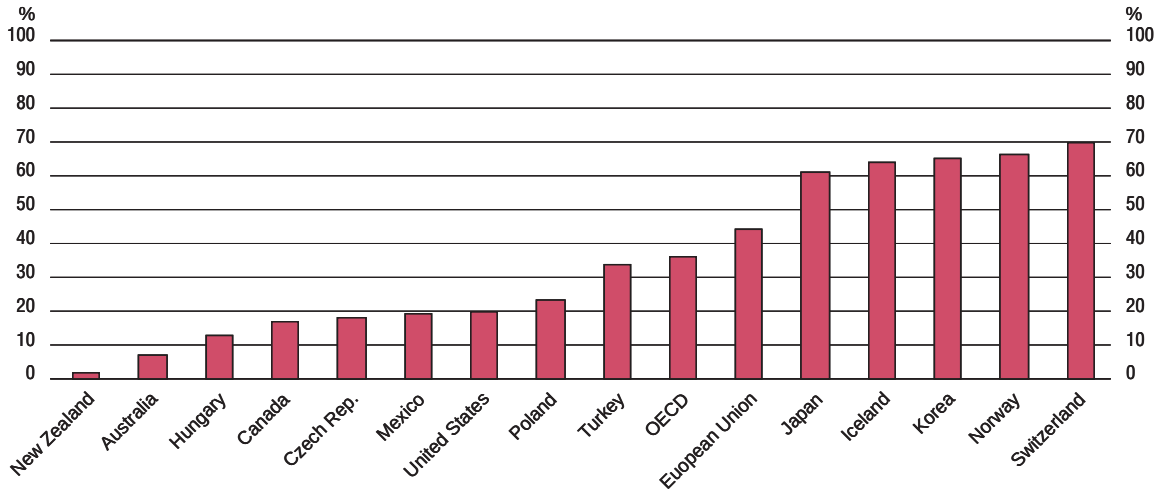
Many regulations affect the agricultural sector, such as those regarding land, labour, food safety, environmental protection, contracts with upstream and downstream industries, etc. In some countries, land regulations in particular have impeded on the development of agriculture and the adjustment of structures (OECD, 1998*b*). Agricultural policies are also part of the regulatory environment facing agriculture and regulations are being reviewed in many countries in order to improve economic efficiency (OECD, 1998*c*). In addition, raising concerns regarding the environment and food safety have led to increased demands for regulatory measures. In consequence, farmers may have to operate in a framework where regulatory risk becomes higher.

Most OECD countries have a well-developed social and fiscal system that transfers income between households with a distributional objective. Direct income taxes are often progressive and social measures are usually inversely proportional to income levels. Social and fiscal measures can help reduce income variations. In addition, some countries have implemented safety nets, such as minimum income schemes, available to all households. In general, it is widely recognised that it would "be appropriate to admit farmers as beneficiaries of the general scheme in order to ensure that the standard of living of farming families does not fall below what is considered the acceptable minimum for the rest of the population" (OECD, 1994). If such general schemes exist but exclude many farm households, it would be interesting to know why.

Agricultural policy

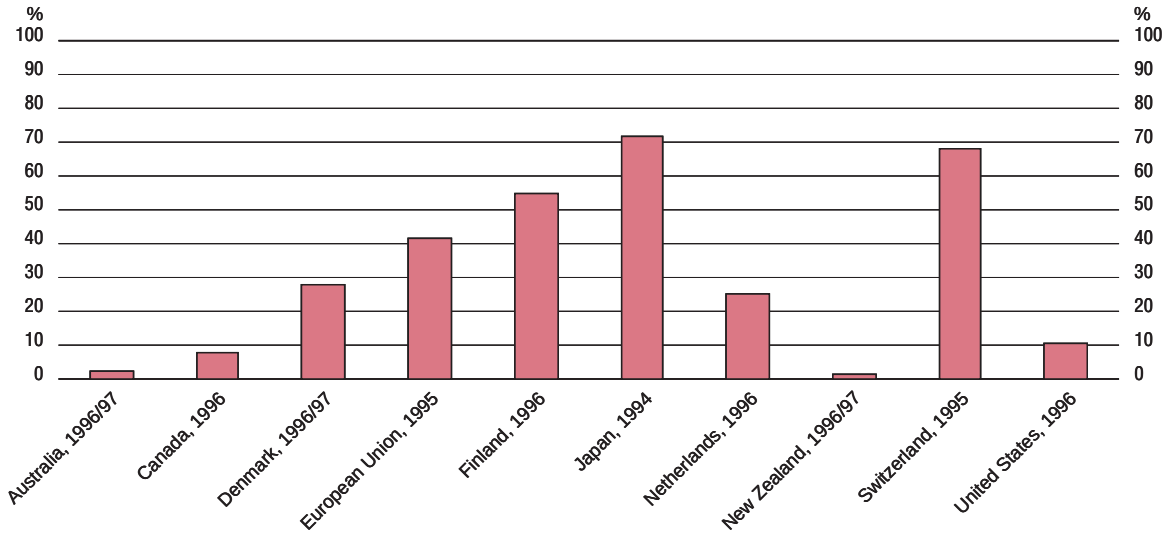
Whatever their objective and their transfer efficiency, agricultural policy measures have an impact on farm income. In fact, because they generate transfers to the sector, they also have an impact on income risk: they either directly reduce income risk by lowering price and income variability or they modify farmers' behaviour with regard to risk by raising income levels[13] or providing cheaper inputs. In the OECD area, transfers from agricultural policies to producers were estimated to amount up to 36% of the value of production for the period 1997-99, with wide differences between countries (Figure 6 and Table A6 in the Annex). At the farm level, government transfers account for a significant share of receipts in many cases (Figure 7), reflecting the global level of support to producers. To give an indication of the relative magnitude of different types of measures in OECD countries, Table 6 and Table A7 in the Annex show the composition of support to agricultural producers, as classified in the OECD Total and Producer Support Estimates.

Figure 6. **Producer Support Estimates as a percentage of the total value of agricultural production, 1997-99**



Source: OECD PSE/CSE database.

Figure 7. **Percentage share of total support[1] in farm revenue in selected OECD countries**



1. Market price support calculated from the PSE database plus direct payments from the structural database.
Source: OECD Structural Indicators and PSE databases; OECD (1999).

Table 6. **Composition of support in the OECD area**

	1986-88	1997-99
As a percentage of the Total Support Estimate		
Producer Support Estimate (PSE)	80	77
General Services Support Estimate (GSSE)	13	16
Transfers from consumers	68	57
Transfers from taxpayers	37	49
Budget revenues	–5	–6
As a percentage of the PSE		
Market Price Support	78	68
Payments based on output	5	4
Payments based on area planted/animal numbers	6	11
Payments based on historical entitlements	0	4
Payments based on input use	8	9
Payments based on input constraints	1	3
Payments based on overall farm income	1	1
Miscellaneous payments	0	0
As a percentage of the GGSE		
Research and Development	9	11
Agricultural schools	2	1
Inspection services	3	3
Infrastructure	30	31
Marketing and promotion	32	41
Public stockholding	19	7
Miscellaneous	5	6

Source: OECD (2000*a*).

Subsidies on input use, whether applied to irrigation water, fertilisers, pesticides or interest rates, by leading to increased input use contribute to a better control of technical production processes, but introduce economic distortions as they lead to over-use of the subsidised input. In particular, they may encourage farmers to produce in areas that are not naturally suitable for such production or where risk would otherwise be too high. Many input subsidies were granted originally to help farmers acquire modern technology or to lower their costs of production, sometimes in recognition of distortions in input markets. In the last decade, their share in the PSE has declined in many OECD countries and is now in the region of 9%. Increasingly, direct payments to farmers are linked to constraints on input use as is the case with some new environmental programmes, but they account for a very small share of the PSE. Such payments have a completely different effect on risk, depending on their parameters. Government transfers to the agricultural sector, such as research, extension and investments in infrastructure, also influence the level of risk in agriculture through their effect on input use.

Market price support continues to represent over two-thirds of all support to producers in the OECD area. Market price support also encourages input use, which tends to make yield more stable but also leads farmers to produce in riskier conditions and in an unsustainable way because it raises domestic producer prices above world levels. It is the most distortive form of support and because of its impact on input use, its efficiency to transfer income to farmers is very low. This type of support can be implemented through different policy instruments, such as intervention on domestic prices and supply management, and border measures through tariffs or import restrictions. In many cases, market price support measures also contain devices to limit price fluctuations on the domestic market (through minimum guaranteed prices, intervention storage, supply management or price stabilisation schemes for example). Such devices reduce the price risk faced by domestic producers, but increase world price fluctuations as adjustment to shocks have to occur on a smaller market.

Market price support measures often involve ***public storage***. Handling and stock depreciation costs paid by taxpayers benefit the sector but not individual producers. Storage redistributes price variability in the market but does not reduce it unless the fundamental source of market disturbance is modified. If operated efficiently in an otherwise undistorted market, government storage can increase social welfare. However, in many cases the private sector could play that role efficiently. Wright (1988) discusses the most common arguments for public rather than private storage and concludes that not only is public storage difficult to justify from a theoretical point of view but its benefits are likely to be too small relative to other private options to justify its existence on grounds of efficiency.

Over the last decade as countries began to move away from market price support measures, various ***direct payments*** have been introduced. Some payments are based on current production or input use levels, in which case their impacts on the supply side are similar to market price support measures or input subsidies, including from a risk point of view. Other types of payments, whether based on area planted, animal numbers, historical entitlements, input constraints or overall farm income, have varying degrees of coupling to production but they are all likely to influence producers' risk environment and behaviour through a wealth effect, just as any other support measure.

As for market price support, some payments can have specific risk reduction characteristics. This is, for example, the case of a ***deficiency payment*** which maintains prices to farmers at a predetermined, fixed level. Some ***stabilisation payments*** aim at minimising downside risk by compensating farmers for part of their losses. Such programmes usually target either commodity yields or receipts from sales of one commodity or all commodities. The trigger variable can be based on past observations, either individual or regional. Such programmes are either totally financed by taxpayers or operate as an insurance scheme. In the latter case, premiums from farmers and government subsidies are pooled to pay for indemnities. The level of losses at which the programme is triggered and the degree of coverage are variable.

Catastrophic losses are covered in some countries by a general insurance scheme while in others there are specific ***disaster payments***. These can be implemented in various ways. In Norway and the United States, such payments are based on crop yield losses; in Hungary, they compensate for overall revenue losses; and, in Australia, they extend welfare benefits to farm families in drought stricken areas.

In Japan, small-scale farms can insure against damage from natural disasters. The insurance system is operated by the Farmers Mutual and the government subsidises 40 to 65% of the premium farmers must pay as well as part of the administrative costs.[14]

Insurance programmes

Government subsidised ***crop insurance*** programmes have been in place, in some cases for a long time, in OECD countries that experience wide yield variations (see Box 4). Recent survey indicate that crop insurance is used by 56% of surveyed Canadian farmers (Table A2 in the Annex) and 30 to 36% of surveyed US farmers, depending on the region (Tables A3 and A4 in the Annex). In Spain, as indicated

Box 4. Crop Insurance Programmes in OECD countries

In ***Canada***, crop insurance is implemented by provincial governments. It covers between 70 and 90% of average yields (depending on the crop and the province) over a 10 to 15-year period. Over the years, government contributions have amounted to 56% of indemnities paid.

In the ***United States***, crop insurance used to exist alongside *ad hoc* disaster assistance, but expectations about the latter undermined the system. The 1996 Farm Act endorsed the legislative reforms proposed in 1994 to integrate the two programmes. Farmers can now obtain a minimum level of insurance coverage (catastrophic coverage, CAT) for a nominal administrative fee (USD 60 in 1999). CAT pays for losses below 50% of a producer's average yield (based on his yield in the previous 4 to 10 years) and covers 55% of the maximum price fixed by the Risk Management Agency (RMA). In addition, producers can obtain higher levels of coverage (50 to 75%) for which they pay a premium. Farmers can also choose a price guarantee set as a percentage of the maximum price fixed by the RMA. A crop disaster assistance programme (NAP) for crops currently not insurable was also created in 1994. Since the 1994 reform, the Federal multi-peril crop insurance scheme is operated by private companies delivering policies to farmers. The government pays part of the administrative cost and subsidises part of the premium. Apart from CAT coverage, which is totally subsidised, the maximum subsidy accounts for 41.7% of the total premium and is offered at the 65% coverage level. The government shares the costs of reinsurance with private companies. Box 6 summarises the main conclusions of the presentation of US insurance programmes made during Session 4.A of the workshop. A detailed description and assessment of US insurance programmes is contained in Part II, Sections C.1 and C.3.

The comprehensive multi-peril crop insurance scheme currently in place in ***Spain*** was established in 1978 and was a continuation of various insurance systems implemented since the beginning of the 20th century. It covers a large number of commodities, including fruits and vegetables, and pools all receipts from farmers' contributions and government subsidies. Participation is voluntary. Farmers can choose the level of coverage and the type of risk insured (drought, hail, flood, etc.). Premiums vary according to regional and individual risks. Public support accounts for around 50% of all costs, including administrative costs. The premium subsidy varies by commodity and with specific conditions, from 8 to 45%. The Spanish insurance system combines public and private institutions, and farmers' representatives, which collaborate in design and implementation of the programme. The ENESA (*Entidad Estatal de Seguros Agrarios*) of the Ministry of Agriculture, Fisheries and Food sets the parameters and provides the subsidies. It also plays a role in promoting the system and spreading information in the agricultural sector. Insurance contracts are delivered to farmers through the commercial network of private insurance companies wishing to participate. These are grouped in Agroseguro (*Agrupación Española de Entidades Aseguradoras de los Seguros Agrarios Combinados*, SA), which manages the system, *i.e.* sets specific tariffs and conditions, pools premiums and subsidies, and makes payments. Claims are assessed by independent experts hired by Agroseguro. The *Consorcio de Compensación de Seguros*, a public company which is operated by the legal framework applied to private companies, provides reinsurance and controls claims *ex post*. The whole system is also reinsured by large international reinsurance companies. The Spanish insurance system, including recent and future developments, was presented at Session 4.A of the workshop (see Box 6 and Part II, Section C.2).

Mexican farmers can also draw on an insurance system for grains, beans, oilseed and livestock production. It is operated by AGRO ASEMEX, a large public company, small farmers' mutual and private companies. The government subsidises 30% of the premium.

Table 7. **Spain: share of insured production as a percentage of total insurable production, for selected commodities, 1987 and 1998**

Main commodities	1987	1988
Almazara olives	2	5
Winter cereals	38	40
Spring cereals	15	34
Citrus fruits	7	37
Sunflower	0	9
Vegetables	6	20
Wine grape	15	44
Eating grape	13	47
Apple	13	71
Peach	18	61
Pear	9	74
Breeding bulls	8	9
Sheep	2	2

Source: Agroseguro.

in Table 7, the share of production insured as a percentage of insurable production has risen significantly in the last decade. It varies according to commodity, from 2% for sheep to over 70% for apples and pears in 1998.

Experience with multiple peril crop insurance around the world shows that governments usually subsidise these programmes to a large extent (Skees, 1999*c*). This is explained by the characteristics of the risk insured but also by asymmetric information leading to moral hazard and adverse selection, by rent seeking behaviour and by high transaction costs. As shown in the table of Part II, Section C.3, premiums paid by farmers have in the past covered only a small share of total costs (indemnities and administration costs). Social benefit-cost analyses have been done on the Mexican and Japanese compulsory schemes. They show negligible social returns relative to the high costs of the schemes (Bassoco *et al.*, 1986; Tsujii, 1986 cited in Anderson and Hazell, 1997; and Skees, 1999*c*).

In the last decade, ***insurance*** schemes have been applied to farm ***revenues***, thereby encompassing price risk in addition to yield risk (see Box 5).

Government intervention in agricultural insurance has been explained by the incompleteness of private insurance and credit markets to stabilise income for farmers. Market risks faced by farmers (and yield risks in some countries) tend to be large, unpredictable and highly correlated across wide geographical areas. As a consequence, pooling is difficult and the premiums charged by private insurers would be higher than farmers are willing to pay. In addition, private insurance is unattractive at market rates because farmers have other risk strategies available, including the support programmes included in the estimates of support to producers (PSEs). However, before intervening in agricultural insurance, governments should first consider whether insurance is the most cost-effective and least distortive instrument to reach the policy objective, which is usually to stabilise incomes or to provide an income safety net. Past experience has shown that government-subsidised programmes can become very expensive and lead to a high level of support to farmers, in addition to their stabilisation effects. They have also been criticised for being an impediment to the development of market based products. Such programmes can also lead to serious equity problems. It is therefore important to define the objectives clearly and to set the parameters to control the level of support to farmers that occurs whenever premiums are subsidised. For that, adequate information on collective and individual risks is crucial. Moreover, attention should be paid to the extent to which these programs influence production decisions.

Different degrees of government intervention in insurance can be envisaged. If the risk is insurable, there is a demand for insurance and the private sector is able to provide a profitable product and the government need only intervene to provide the market conditions for private companies to operate efficiently. Again, a primary role for the government would be to make information available so as to allow for the accurate definition of parameters and avoid moral hazard and adverse selection.

Box 5. Revenue Insurance Programmes in OECD countries

The first revenue insurance programme was implemented by ***Canada*** between 1991 and 1995. The Gross Revenue Insurance Plan (GRIP) provided payments to crop producers based on the shortfall between market revenue and the target revenue for crops. Target revenue per acre for an individual crop was based on historical yields, a 15-year moving average of price and the level of crop insurance chosen by the producer. The plan was financed by farmers (one-third) and government (two-thirds). In the four years of its operation, GRIP accumulated a CAD 1 billion deficit (Turvey *et al.*, 1997). Similar programmes still operate in Ontario (Market Revenue Program) and in Quebec (Revenue Insurance Programme, ASRA). Romain and Calkins (1996) analyse ASRA and criticise its lack of market orientation and the high cost to taxpayers, mainly due to target parameters being set at too high levels and to moral hazard and adverse selection (see also Hum *et al.*, 1997). A study by Agriculture and Agri-Food Canada (AAFC), which attempted to distinguish price stabilisation from structural support in the early 1990s, concluded that structural support accounted for between 35% and 47% of the compensation paid out.

Drawing on the Canadian experience, revenue insurance products have been gradually introduced and developed in the ***United States*** since 1996. Several products are now available to producers of major field crops, some on a pilot basis. The Income Protection (IP) programme was developed by USDA's RMA. Crop Revenue Coverage (CRC) was designed by a private company, American Agrisurance Inc. The Iowa Farm Bureau offers Revenue Assurance (RA). The Group Risk Income Protection (GRIP) adds a revenue component to the Group Risk Plan (GRP) area-yield insurance. The revenue guarantee in these various plans is a combination of yield and price guarantees. Reference yields are similar to those used in traditional crop insurance programmes. Contract prices are based on settlement prices for the commodity futures exchange. In addition, the Adjusted Gross Revenue (AGR) offers coverage on a whole farm rather than on a crop-by-crop basis. Information on the design and the parameters of the plans can be found in various USDA publications such as Harwood *et al.* (1999), Dismukes (1999), and Schnepf and Heifner (1999). It is also available on the USDA and the RMA Internet site (*http://www.rma.usda.gov/*). Box 6 summarises the main conclusions of the presentation of US insurance programmes made during Session 4.A of the workshop. A detailed description and assessments of US insurance programmes are contained in Part II, Sections C.1 and C.3.

If the risk is not privately insurable and the government wishes to intervene, it could do so by setting the objectives, the policy environment and the general framework for insurance (type of risk, commodity), minimum rules and technical parameters (coverage, deductible). The government could go further and act as a direct insurer (*e.g.* crop insurance) or it could subsidise part of the cost (premium and administrative costs) of an insurance product managed by a private insurer and set some of the parameters.

For the most dramatic risks (catastrophes), the government could also provide reinsurance and/or guarantees. It should abstain from giving *ad hoc* direct payments for catastrophic losses that over time would make the insurance product less attractive to farmers. The programme should be evaluated on a regular basis in terms of cost-efficiency and impact on production and trade.

There are other implementation issues regarding government-subsidised insurance schemes which also arise in private insurance systems (see section on strategies). The main issues are moral hazard, adverse selection (defined in Box 1) and rent seeking behaviour. How to set programme parameters to minimise such behaviour, whether insurance should be voluntary or compulsory, whether it should extend to all individuals or if high-risk individuals can be excluded are questions that have all been debated. Moreover, there are discussions about public versus private implementation and management; while public insurers are assumed to have higher administrative costs, private insurers may also engage in rent seeking behaviour or could collude with farmers to maximise claims when they know government will cover losses, in particular through reinsurance. In any case, it is important to improve the transparency of such systems. The success of insurance schemes depends heavily on the policy context in which they are implemented and, in particular, on the existence or otherwise of other types of support. A summary of the discussion that took place on these issues during Session 4.A of the workshop can be found in Box 6.

Box 6. Insurance systems

The session was introduced by a presentation of agricultural insurance systems in two countries: the United States and Spain. Mr. Robert Dismukes from the Economic Research Service of the US Department of Agriculture (USDA) provided a detailed description and evaluation of US crop and revenue insurance programmes, including recent developments (see Boxes 4 and 5; and Part II, Section C.1). Although insurance is available for more than 70 crops, corn, soybeans, wheat and cotton account for nearly three-quarters of insurance premiums. Recent trends show that following the 1994 reform, the number of acres insured have doubled. About two-thirds of the acreage of major crops were insured in 1999, mainly with a 65% coverage – *i.e.* with 65% of the production covered by the insurance – although 70 and 75% coverage account each for more than 10% of acres insured. Farmers usually buy the most subsidised coverage. Farm level crop and revenue insurance plans are more popular than area-yield or revenue plans. Participation in revenue insurance is increasing and was greatest in the US corn belt in 1999. Since 1994, with no major natural catastrophe, the system has been financially solvent as indemnities were below premiums. However, the system in place failed to respond to emergency situations in 1998 and 1999. When examining alternative risk management strategies, including crop and revenue insurance, it was found that the most effective way in reducing risk was the 75% coverage revenue insurance, which, by definition, reduces the probability of revenues less than 70% of expectations to zero. However, insurance cannot offset a general downward trend in prices. In theory, insurance has an effect on production as it could encourage farmers to plant crops that might otherwise be too risky to produce and, when subsidised, raises average profits over time. According to the speaker, how this translates into additional production and trade in practice is unclear as net indemnities are relatively small and vary according to crop, region and year.

Mr. Fernando Burgaz Moreno from the ENESA presented Spain's comprehensive insurance system for farmers, with particular attention to the latest developments (see Box 4 and Part II, Section C.2). Implemented gradually through a try and check procedure, the Spanish system aims at comprehensive coverage of agricultural production, including livestock and fish. Efforts have been made recently to extend the range of commodities, types of risk and level of losses covered. Subsidised by the government, it is characterised by a high level of integration and co-ordination between farmers, insurance companies and public services. Drawing on the Spanish experience, Mr. Burgaz Moreno considers insurance as one of the most efficient risk management tools in agriculture. Through its stabilisation impact on income, its advantages are to limit borrowing to cover losses which might otherwise threaten the survival of the farm, to serve as a guarantee for credit, to allow for specialisation in production, to be equitable to the extent that only real losses are compensated, to complement structural and rural development programmes, to have a stabilisation impact on production and prices, and to have a foreseeable cost for the government which can be budgeted in advance. Finally, with a developed insurance system in place, the government does not have to provide emergency subsidies in the event of a natural disaster.

The discussion that followed focussed on the respective role of the private sector and government in agricultural insurance systems. For insurance companies, some risks can be managed by the farmer himself; others can be insured privately to the extent that profits can be drawn, while large-scale risks require government intervention. Insurers stressed that insurance should be voluntary to be financially sustainable. They would like to see their extensive experience and efficient techniques to prevent moral hazard and adverse selection used in the design and operation of insurance programmes. On the other hand, insurance subsidies are an incentive to moral hazard and can generate rent seeking behaviour. Government intervention in insurance systems was also criticised for impeding market developments and for its high administration and monitoring costs. All experts agreed that with a subsidised insurance system in place, the government could and should refrain from providing disaster payments. Opinions differed as to what risks or products need to be insured and what variable should be targeted. For example, although revenue or income stabilisation is the policy target, income risk is not technically easy to insure as it is difficult to measure. In general, insurance for livestock is less developed than crop insurance. As pointed out by an expert from academia, it is important to distinguish insurance and risk management from safety net and income support. Some experts expressed the opinion that a role for the government was to provide a regulatory framework and taxation system that would facilitate the development of private insurance, and that the government should worry about risk for the sector and not for individuals. Examples of market based mechanisms to deal with catastrophic risk were provided (see Part II, Section C.3).

Income safety nets

There are few examples of purely agricultural safety nets in OECD countries (see Box 7). This category includes assistance to low income farms schemes that help farmers smooth income variations between years through savings and disaster payments that compensate for income or revenue losses. Programmes like the Farm Family Restart Scheme in Australia, the Irish Farm Assist Scheme or the Korean income-based measures to assist small and poor farm families belong to the first category. The second category includes the Canadian Net Income Stabilisation Account (NISA) and the Farm Management Deposit

Box 7. Some measures with safety-net characteristics

The Farm Family Restart Scheme in ***Australia*** aims at providing welfare support to low income farmers and their families who are experiencing financial hardship and who cannot borrow further against their assets. It provides adjustment assistance to those families until they take a decision about their future in the industry. The *Irish* Farm Assist Scheme provides allowances to low income farm families. The *Korean* government provides tuition support to small farmers' children as well as support to reduce the debt burden of small farming and fishing households.

Agriculture Advancing Australia (AAA) includes several programmes to help Australian farmers manage income risk or to provide relief in exceptional circumstances. They are described in Part II, Section D.2. The Farm Management Deposit scheme provides farmers with a tax-linked savings mechanism to allow them to set aside pre-tax income in good years to help better manage their businesses during more difficult years. The Exceptional Circumstances support under the Rural Adjustment Scheme (RAS) provides short-term targeted assistance to long term viable farm businesses facing rare and severe circumstances. If a farm is in a declared Exceptional Circumstances area, its operator may be eligible for:

- business support in the form of interest rate subsidies up to 100%;
- Exceptional Circumstances Relief Payment (ECRP), an income support payment, subject to an income test and off-farm assets test; and
- farmers receiving ECRP may also be eligible for additional Family Payment for dependent children, a Health Care Card and Youth Allowance or study concessions.

Canada introduced NISA in 1990. It is a voluntary farm income safety net scheme under which farmers set aside money in individual accounts matched by government contributions. Farmers can make withdrawals from these accounts when the total gross margin of the farm (gross revenue less cash costs) for all commodities (except supply-managed ones) falls below the average gross margin of the preceding five years or when their taxable household income falls below a fixed level. Based on receipts from several commodities, its impact on production is much less than that of commodity-linked programmes. However, it still has a wealth and a risk impact. Each account being personal, farmers are not motivated to adopt riskier behaviour. In addition, the cost of the scheme is relatively stable as it is based on contributions and not on actual payments. However, questions about the efficiency of NISA as a safety net were raised recently when the 1998-99 fall in farm income did not result in higher NISA withdrawals. In fact, a new *ad hoc* programme, AIDA, was introduced to address farm financial problems resulting from low prices in the previous two years. AIDA is available to any farmer whose whole farm gross margin drops below 70% of the average gross margin over the previous three years. It is therefore not specific to individual commodities. However, AIDA payments may also affect production decisions in that they lead producers to expect that they will receive extra assistance whenever income falls. In July 2000, a three-year agreement on safety net programmes was signed that includes a new, ongoing disaster programme, the Canadian Farm Income Programme (CFIP) (see Box 8 and Part II, Section D.1).

In ***Sweden***, several general fiscal schemes to smooth income variations over time have been successively applied. Following the investment reserve system (1979-90) and the tax equalisation system (1991-93), the profit equalisation system has been operating since 1994. Under this scheme, up to 20% of annual taxable income can be deducted in a given year. It is then added to taxable income in any of the following five years.*

* Lagerkvist (1999) examines the impact of taxation regulations on farm investment.

scheme in Australia. A number of countries, including Sweden, allow farm households to smooth annual income variations through taxation. The third category includes the Australian Exceptional Circumstances support under the Rural Adjustment Scheme (RAS), the Agricultural Income Disaster Assistance Programme (AIDA) in Canada and disaster payments in Hungary (1997-98) and Korea. A Summary of the discussion that took place on Safety nets during Session 4.B of the workshop can be found in Box 8.

Government intervention in market based mechanisms

In recent years, some governments have tried to facilitate access by farmers to market-based mechanisms rather than intervening directly. As seen in the previous section, they have intervened in privately run insurance schemes, either by setting parameters or by subsidising premiums and administrative costs. In looking for ways for governments to be involved in risk sharing markets that are more efficient than the current *ad hoc* disaster payments and subsidised insurance schemes, Skees and Barnett (1999) suggest that the government provide natural disaster index options (see also Part II, Section C.3). These options would be based on either objective measures of events (*e.g.* flood, rainfall or soil moisture) or statistical estimates of area yields. They could be sold through a competitive bidding process. Being protected by such options against catastrophic losses, private companies could then develop tailored insurance products to meet the specific needs of their consumers.

Box 8. Agricultural, fiscal and social safety nets

A presentation of Canadian safety nets by Mr. Tom Richardson of Agriculture and Agri-Food Canada introduced this session (see Part II, Section D.1). The main objectives of Canadian safety nets are risk management and income stabilisation but they also involve income support. Current safety nets include crop insurance (Box 4), NISA, a disaster programme (AIDA) (Box 7) and companion programmes with a focus on adjustment. Within a national framework, provinces have the flexibility to introduce any safety net programme they wish in order to respond to regional objectives and conditions. Participation in programmes is voluntary and the cost of programmes is shared between the federal government, provincial governments and producers. An income-based disaster programme was introduced in 1998 (AIDA) as many farmers did not have sufficient reserves in their NISA account to deal with the crisis. This was the case of hog farmers who had joined NISA too recently to be able to build up sufficient reserves, and of small cereal farmers who had difficulty adjusting to the removal of transport subsidies. Emergency support provided to US farmers also played a role in this decision. Evidence shows that Canadian safety nets succeeded in stabilising income in 1998 and probably in 1999. Support being provided to total income (except in the case of crop insurance), economic distortions seem to have been limited, with little capitalisation in land prices, and production adjustments still occurring. In fact, as half of its agricultural production is exported, Canada has a strong interest in non-trade distorting programmes. Further improvements in current safety nets as well as alternative measures consistent with Annex 2 of the Uruguay Round Agreement on Agriculture are being explored. Nevertheless, according to a Canadian farmers' representative, the government does not devote sufficient funds to safety nets and there are still many farmers for whom the various safety net provisions are not very effective.

The Australian approach to income risk management in agriculture was presented next by Mr. Craig Burns. Australian agriculture faces high levels of risk resulting from its climatic and natural conditions, its export orientation and exposure to world prices. Risk management is the individual responsibility for farm managers operating in a market-oriented sector. The government provides the appropriate economic environment plus institutional and legal frameworks for individual, commercial and industry decisions. Government intervention also involves the provision of a welfare safety net and public goods such as information, research, education and training. Risk management tools and related policies are described briefly in Box 7 and in more detail in Part II, Section D.2.

The Irish social security scheme to support low-income farmers was also mentioned in the discussion. A consultant presented a proposal for a safety net scheme in the United States, targeting whole farm gross revenue. Such a system is thought to be equitable to the extent that payments would only compensate losses. Moreover, as payments would be triggered by a formula, they would not depend on political decisions. Finally, a system covering catastrophic losses and *ad hoc* disaster payments would no longer be required. As in previous sessions, the need to consider risk management instruments in relation to other programmes was stressed.

Some governments have tried to encourage farmers to use futures markets. As seen in the section on strategies, ***futures markets***, where they exist,[15] help to reduce price fluctuations within a given year. As for other strategies, government's first contribution could be to provide information on prices and contracts, and training programmes to farmers on how to use futures markets.[16] Participants in the workshop all agreed that this role is very important, although it can be shared with the private sector (see Box 3). In some cases, governments have acted as intermediaries between farmers and futures exchanges, with or without subsidy. Examples are contained in Box 9.

Box 9. Government intervention to facilitate access to futures market

In ***Canada***, the Cattle Option Pilot Program offered a customised option contract to cattle producers. The contract was available for smaller volumes than is usual in option contracts and was denominated in Canadian dollars according to the value of a live cattle futures contract on the Chicago Mercantile Exchange. The Farm Credit Corporation implemented the programme while Cargill Investors Services Ltd. wrote the actual options. The programme covered the price risk and the exchange rate risk simultaneously. Farmers had to pay the premium and transaction fees but no registration fees. The programme was discontinued because of low participation rates and lack of interest from producers.

In ***Mexico***, an Agricultural Products Option Program (APOP) was introduced in 1994 for cotton. It was extended to corn, wheat, sorghum and soybeans in 1995 and will cover more commodities in the near future. The programme allows producers to hedge their production using commodity options at the Chicago Board of Trade and the New York Cotton Exchange. The implementation organisation, ASERCA, acts as an intermediary between the producers and the US brokers, and subsidises part of the option premium. Under the simple coverage, ASERCA pays 50% of the premium cost. Under the funded coverage, ASERCA may provide a larger contribution but the farmer must deposit the same amount in a fund (FINCA) and any profits from holding the option go into that fund. APOP functions as a price insurance. The typical cost to the farmer is 5 to 8% of the strike price of the option. A minimum size is required, but farmers can group their production. APOP contracts accounted for up to 11% of total production for wheat, but only 1% for corn as most corn farmers are very small. Overall, it is difficult to assess the programme based on 1997 data because of the favourable market conditions prevailing at the time.

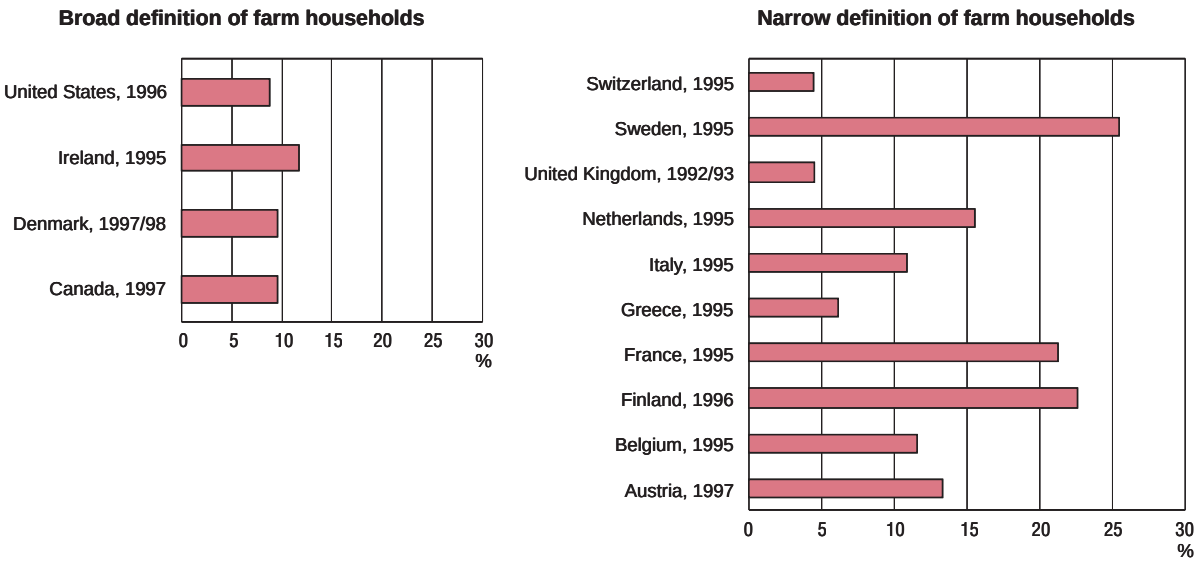
Under the FAIR Act of 1996, a Dairy Option Pilot Programme was introduced in the ***United States***. It gives milk producers in specific counties the opportunity to buy option contracts on a maximum of 600 000 pounds of milk. Costs are shared between producers and the government: USDA pays 80% of the premium of each option as well as broker fees up to USD 30 per option.

Recognising the absence of developed risk management markets in developing countries, the International Task Force (ITF) on Commodity Risk Management of the ***World Bank*** recommends the creation of an international intermediary that would facilitate transactions between private providers of price insurance instruments (banks, brokers or traders) and potential users of such price insurance in developing countries (producer organisations, traders, processors, local banks or public sector entities). It would need to perform three types of functions in the risk management markets: *a*) facilitation, by providing *partial* guarantees to mitigate risks involved in the transaction; *b*) intermediation, by acting as a pass-through between the provider and user of the price insurance instruments, in selected and limited cases; and *c*) provision of core services and technical assistance – in particular, market information and support to local transmission mechanisms (World Bank, 1999).

Social policies

In most countries, farm households are part of the general social system that provides a more or less well-developed safety net to all households. As shown in Figure 8, the share of social transfers in total income of farm households is significant in OECD countries. It is around 10% in many countries and is greater than 20% in Finland, France and Sweden. These transfers include health and invalidity insurance, retirement pensions, students' grants, child allowances, etc. When social measures are triggered by an income test only, farm households who would not qualify if assets were considered become eligible. Such policies reduce income risk for farm households, on the one hand because they

Figure 8. **Percentage share of social transfers in total income of farm households**



Source: Eurostat (1999), *Income of agricultural household sector,* Luxembourg; OECD Structural Indicator database; various national statistics.

contribute to the diversification of their income sources, and on the other hand because they provide an explicit or implicit safety net. To the extent that they are not specific to the sector, such transfers should not theoretically modify the allocation of resources in the economy. In practice, they could retain resources which are already in place and which would otherwise leave the sector.

Does government intervention introduce distortions in production and trade?

A recent OECD paper provides a conceptual overview of decoupling (OECD, 2000*b*). Looking at the various channels through which support affects production and trade, it concludes that when risk mechanisms and dynamic effects are taken into account, "it seems difficult to design a policy measure not having some production or trade effects". In particular, all measures have at minimum a wealth effect, *i.e.* farmers' risk aversion is likely to decrease when income fluctuates around a higher average. The question is to assess the relative importance of these effects.

Annex 2 of the Uruguay Round Agreement on Agriculture (URAA) provides criteria for measures that "have no, or at most minimal, trade distortion effects or effects on production". The fundamental criteria are as follows:

- "the support in question shall be provided through a publicly-funded government programme (including government revenue foregone) not involving transfers from consumers; and,
- the support in question shall not have the effect of providing price support to producers."

Other specific criteria and conditions apply to the various categories of support included in this Annex, also called "Green Box".

As is the case for the PSE, measures with a stabilising impact on income can be found in all the boxes defined by the URAA. Three of the 13 categories of support measures in the Green Box with specific risk reducing or safety net characteristics will be considered here. They are:

- decoupled income support;
- government financial participation in income insurance and income safety-net programmes; and
- payments (made either directly or by way of governmental financial participation in crop insurance schemes) for relief from natural disasters.

Table 8. **Selected measures as a share of total expenditures on Green Box measures, 1995-98**

Percentage share

	Decoupled Income Support	Income insurance and income safety-net	Payments for relief from natural disasters
Australia	0.5	–	7.8
Canada	40.4	1.5	–
Czech Republic	–	–	–
EU	1.1	–	1.7
Hungary	–	–	4.6
Iceland	47.1	–	–
Japan	–	–	2.3
Korea	4.7	–	1.0
Mexico	–	–	–
New Zealand	–	–	0.3
Norway	–	–	1.3
Poland	–	–	6.7
Switzerland	36.0	–	–
United States	7.7	–	0.3
OECD	5.4	0.0	1.2

– No measure is notified under this category.
Source: OECD (2000*d*).

Very few programmes in OECD countries fall into these categories. For the OECD area, they accounted for 6.6% of the value of all Green Box measures during the period 1995-98[17] (Table 8). In Canada, Iceland and Switzerland, however, a large share of expenditures on Green Box measures is decoupled income support.[18] These measures are classified as based on historical entitlement in the PSE for Canada and Iceland, and as based on area in the PSE for Switzerland. Among OECD countries, Australia, Canada and the European Commission have notified programmes involving government financial participation in income insurance and income safety-net programmes: the Farm Management Deposit Scheme in Australia; the Alberta Farm Income Disaster programme and the Prince Edward Island Agricultural Disaster Insurance programme in Canada; and a programme notified for 1996/97 by the European Commission but not used (Table A8 in the Annex). As mentioned in Box 7, the Australian programme is a tax-linked commercial system and is described in Part II, Section D.2. Canadian programmes cover less than 70% of whole farm income losses and are triggered when the farmer's income falls below 70% of the average of the previous three years. There is also a maximum limit for expenditures per fiscal year on these programmes. On the other hand, many OECD countries have notified payments for relief from natural disasters (Table A8 in the Annex).

Conclusions and policy implications

There are many risk management strategies adopted by farmers in OECD countries. Experience is quite diverse as strategies depend on the type and level of risk faced, but also on the range of solutions available and the willingness of governments to become involved. A general conclusion that emerged from the workshop was that risk management is primarily the responsibility of the farmer, as manager, and that income risk should be managed at the household level. It came out clearly from the various experiences that there is no universal approach and that each specific situation requires a different mix of tools and instruments.

A main objective of the workshop was to clarify the potential role of governments in risk management. In addition to providing a sound business environment with competitive markets, government intervention enters at different levels of the risk management strategies used by farm households. First, all agricultural policies influence the environment in which farmers make their decisions as they raise income levels. Second, there are policy measures with specific features to reduce income risk, *i.e.* income variability or the occurrence of extremely low income. Third, some governments intervene by subsidising market-based mechanisms, such as insurance systems and futures markets.

Market price support is still dominant in many countries and, even in the absence of income stabilisation mechanisms, high levels of support shield farmers against downside risk as income fluctuates around a higher average. An agricultural policy reform process was launched by Ministers meeting at OECD in 1987 and has since been reinforced by the Uruguay Round Agreement on Agriculture and by OECD Agricultural Ministers in March 1998. In brief, recognising the diversity of agricultural, economic and social situations across OECD countries, OECD agricultural ministers have committed to increasing the transmission of world prices to domestic markets, reducing support to farmers, lowering protection and trade barriers, and addressing legitimate domestic interests relating to environmental sustainability, food safety, food security and rural development in ways that do not distort production and trade (OECD, 1998*a*).

The expectation is that the process of reducing support and protection would generate a need for measures and instruments to help farmers cope with the resulting increase in income-related risk. Reflecting this expectation, the development of policies to mitigate income risk has been most significant in countries where reform has led to significant falls in support. However, it should also be noted that reform in a number of countries has led to a change in the way support is delivered, with little or no fall in the level of support. Overall, for the OECD as a whole, support as measured by the % PSE[19] is currently at the same level as in the mid-1980s when the reform process was launched.

Recent years have seen the development of market instruments, and both government and private industry have made efforts to encourage and train farmers to use them. In addition, as seen in the section on government intervention, some governments have been developing various insurance and safety net type programmes. However, governments have found it difficult to resist pressure for a series of emergency or *ad hoc* measures that have transferred significant funds to the farm sector during the past two years of low world prices. It is an open question as to whether the resort to emergency measures on this scale is an indication that existing measures are inadequate. There are also concerns that emergency measures have undermined the potential efficiency of existing measures and resulted in farmers being over-compensated for income losses.

Discussion at the workshop regarding government involvement in risk management turned towards identifying situations where market failure justifies government intervention and how that intervention can facilitate the development of market approaches (*e.g.* through competition policy, regulations, information and training, subsidies to market mechanisms such as insurance and futures markets, etc.). Information was shared on the implementation and economic impact of mechanisms currently in place, whether government intervened or not, thus allowing for an assessment to be made. The following questions were discussed:

- How does a given mechanism or policy instrument operate to reduce income risk to farmers? When is it effective?
- Is there a need for government involvement? If yes,
- What is the level of take-up? How frequently are policy instruments triggered?
- What are the costs and benefits of government intervention? Is it effective with regard to its objectives?
- Do these policy measures meet the policy principles and operational criteria identified by OECD Agricultural Ministers?[20] In particular, do they distort production and trade?

There was a general agreement that government intervention should be in line with reform principals and, in particular, that it should facilitate the development of innovative approaches and strengthen the adjustment capacity of the sector. The need for more precise definitions of Green Box measures was called for. Participants stressed many times that risk management instruments should be seen within the broad policy framework in relation to other measures.

A strong integration between private and public initiatives, including information sharing, was considered essential for the design of successful approaches. Similarly, dialogue at the international level should be developed. Finally, there is still a need for more information on the mechanisms

available in different countries, how they can be used and how they perform for individual farmers and at a more aggregate level, the economic impacts of different measures implemented, and why market-based approaches are not more widely used.

Many experts reported the under-utilisation and lack of development of market-based approaches. This was often attributed to the protected environment in which farmers operate, which could limit the demand for other risk management tools. In fact, policy measures and market instruments to address risk specifically are more developed in countries with lower levels of output-related support. Emergency measures were also blamed for undermining existing risk management systems to the extent that farmers are relying on *ad hoc* government intervention in case of a crisis rather than on long term risk management strategies. More generally, there were criticisms that government involvement in risk management systems might prevent the development of private solutions.

NOTES

1. See Boehje and Lins, 1998; Beal, 1996; Sumpsi Viñas, 1999 for a discussion or classification of the different types of risks facing agriculture.
2. Income stabilisation, if it is not to involve support to farmers, should be done along a trend reflecting the long-term evolution of income. Positive and negative government transfers to farmers would be mutually offset over time and costs would be limited to administrative costs (OECD, 1994).
3. Risk that the farmer cannot meet the quality specified in the contract.
4. Risk linked to investments made by the farmer to comply with the contract, which makes him more dependent on the contractor.
5. Risk that the contract will be terminated at short notice.
6. See Harwood *et al.* (1999) for a description of the different types of marketing contracts and their effects on price risk (Table 7).
7. With any type of contract, there is a risk that the contractor cannot respect his commitments because of, for example, bankruptcy.
8. This assumption was questioned during the workshop, in view of the behaviour of some producers, in particular in the livestock sector, who prefer to take advantage of price volatility.
9. Examples of contingency markets are futures markets, options, insurance markets, the bond market and the stock market.
10. See, for example, the evolution of farm income in Australia in OECD (1995), Figure 1, p. 24.
11. Chen and Meilke (1996), for example, think that it is not production, revenue or income that should be stabilised but rather household consumption.
12. An earlier OECD publication (OECD, 1994) contains a discussion of issues related to government intervention to reduce income fluctuations and to provide minimum income guarantees to farm households in the context of agricultural policy reform.
13. Support measures to producers affect farmers' attitude to risk through wealth effects (Hennessy, 1998, OECD, 2000*b*). In other words, better-off farmers would tend to take more risks under certain conditions.
14. See Yungi (2000) for details on the system of agricultural credit guarantee and insurance in Japan.
15. As shown in Table 5, there are many futures markets in OECD countries, but they do not exist for all commodities.
16. For example, Agriculture and Agri-Food Canada proposes a course on market risk management both for classroom and for home study on its Internet site. It covers such topics as the nature of market risk; how futures markets work; what basis is and why it is important; options; hedging with futures and options; managing exchange rate risk; and the various instruments in the cash market. This course should help the reader to compare risk management tools and decide which one is right for their operation. US government and university sites also provide information on principles and specific products.
17. These figures are based on country notifications to the WTO as available in May 2000 (see OECD, 2000*d*).
18. In Canada, the main programme under this item is the Western Grain Transition Payments Program. As Canada submitted its notifications for 1995 and 1996 only, subsequent programmes such as AIDA had not yet been classified. In July 2000, AIDA was classified as belonging to Paragraph 7 in Annex 2 of the Uruguay Round Agreement on Agriculture [G/AG/N/CAN/36].
19. PSE as a percentage of the value of agricultural receipts.
20. OECD (1998*a*).

Annex

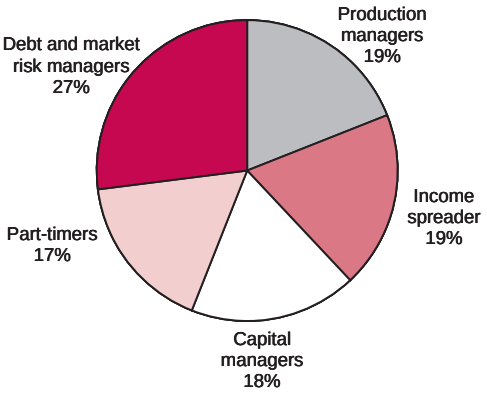
BACKGROUND INFORMATION

Table A1. **Queensland: percentage of farmers using different risk management strategies**

Risk management strategy	Crop growers	Mixed farmers	Fruits and vegetables growers	Livestock producers
Storage	90	84	67	44
Marketing through pools	75	76		–
Forward selling	83	50	45	–
Computer aided livestock marketing (CALM)	–	30	–	25

Note: Survey of 770 farmers in Southern Queensland.
Source: Beal (1996).

Figure A1. **New Zealand: Proportion of farmers in each risk management group**



Notes: 1 384 farmers from the New Zealand Department of Statistics Agricultural Survey data, including 59% sheep and beef farmers. Groups derived from cluster analysis. Their characteristics are described in Part II, Section A.2.
Source: Martin and McLeay (1998).

Table A2. **Canada: percentage of eligible farmers using regularly[1] the following tools or strategies**

Risk management tool or strategy	All farmers	Business oriented producers	Farming oriented producers	Uncertain smaller operators	Traditional farmers	Independent risk takers
Off-farm income	41	17	67	75	0	58
Products with different marketing time of the year	51	56	72	29	36	42
First to try new technologies or products	20	27	26	13	14	16
Marketing boards to stabilise prices	34	5	57	42	53	4
Co-operatives to market products	26	4	49	28	34	5
Buying and selling through the year	34	45	51	14	25	16
Attends seminar or training courses	51	65	59	47	36	35
Changes practices	53	65	62	49	44	36
Contribution to NISA	58	67	67	53	61	32
Use options or commodity futures	20	38	33	9	9	5
Use production contracts	36	52	50	27	27	10
Use consultant services	23	32	29	16	20	7
Use agricultural extension specialists	56	66	61	54	49	40
Use crop insurance	56	55	65	56	56	35
Use hail insurance	47	52	56	44	48	24

Notes: Angus Reid Group study.
2 113 producers whose main farm entreprise is either crops, beef cattle, pigs or horticulture with at least C$10 000 farm sales.
Groups of farmers are described in Part II, Section D.1.
1. Always or often.
Source: Agriculture and Agri-Food Canada (1999).

Table A3. **United States: percentage of respondents indicating use of tool or strategy**

Risk management tool or strategy	%
Used government farm program	69
Diversified operation by raising crop and livestock	39
Planted seed varieties with different maturity dates	39
Contracted inputs	35
Bought crop insurance	30
Used crop-share land rents	25
Kept a credit line open to take advantage of attractive inputs prices	20
Used multiyear leases	16
Irrigated	13
Shared expenses with a landlord	10
Refinanced loans to take advantage of lower interest rates	8
Hired custom operator to reduce machinery expenses	6
Hired custom operator to improve timeliness of crop operations	6
Diversified by growing crops that are not normally grown in the area	3
Leased equipment rather than bought	3
Rented equipment rather than bought	2

Notes: *Farm Futures* survey with 690 respondents, readers of the magazine.
Top 10% of all farmers, 75% in the Corn Belt.
Source: Harwood (1999).

Table A4. **US large scale Corn Belt farmers: percentage of 1993 respondents[1] indicating use of tool or strategy**

Risk management tool or strategy	%
Options	37
Hedging	60
Minimum price contracts	21
Forward contracting	73
Multiple Peril Crop Insurance	35
Back-up management/labour	43
Entreprise diversification	46
Geographic dispersion	43
Government program participation	73
Hail/fire insurance for crops	49
Off-farm employment	17
Off-farm investment	43
Liability insurance	73
Financial/credit reserves	59
Debt/leverage management	56

1. 1993 *Top Farmer Crop Workshop participants*.
Source: Patrick and Musser (1997).

Table A5. **Nebraska: percentage of farmers using crop marketing tools**

Marketing tool	Percentage of crop for which the tool is used[1]				
	1 to 100	1 to 25	25 to 50	50 to 75	75 to 100
Cash forward contracts	68	59	77	88	47
Hedging with futures	22	17	23	46	9
Hedging with options	28	28	25	41	24
Hedge to arrive contracts	14	8	13	22	20
Basis contracts	33	31	33	39	49
Minimum price contracts	14	11	16	12	18
Others	4	1	4	0	13

1. The percentages under each category do not sum up to 100 because more than one tool has been used in some cases.
Stratified random sample of 2 000 representing 32 116 farmers and ranchers with at least 100 acres.
Source: Jose and Valluru (1997).

Table A6. **Producer Support Estimate by country, 1997-99**

	Total PSE in USD million	% PSE
Australia	1 344	7
Canada	3 529	17
Czech Republic	722	18
EU	116 552	44
Hungary	661	13
Iceland	151	64
Japan	53 127	61
Korea	17 398	65
Mexico	4 996	19
New Zealand	98	2
Norway	2 675	66
Poland	3 521	23
Switzerland	4 951	70
Turkey	12 133	34
United States	44 303	20
OECD	266 605	36

Source: OECD (2000*a*).

Table A7. **OECD: Composition of Producer Support Estimate**

Percentage share in PSE

	1986-88	1997-99	1997	1998	1999p
Australia					
Market Price Support	43	40	42	41	36
Payments based on output	0	3	3	3	3
Payments based on area planted/animal numbers	0	0	0	0	0
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	34	44	40	44	49
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	23	13	15	12	12
Miscellaneous payments	0	0	0	0	0
Canada					
Market Price Support	49	60	64	60	57
Payments based on output	17	7	8	7	8
Payments based on area planted/animal numbers	17	5	4	4	6
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	15	10	13	8	8
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	0	17	10	21	21
Miscellaneous payments	2	1	1	1	1
Czech Republic					
Market Price Support	78	64	50	71	70
Payments based on output	3	0	0	0	0
Payments based on area planted/animal numbers	0	3	3	4	4
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	5	25	47	15	14
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	14	7	0	10	12
Miscellaneous payments	0	0	0	0	0
European Union					
Market Price Support	85	60	56	62	63
Payments based on output	6	3	3	3	3
Payments based on area planted/animal numbers	3	23	25	22	22
Payments based on historical entitlements	0	1	1	1	0
Payments based on input use	6	8	9	8	8
Payments based on input constraints	1	4	6	4	4
Payments based on overall farm income	0	0	0	0	0
Miscellaneous payments	0	0	0	1	1
Hungary					
Market Price Support	75	36	20	35	52
Payments based on output	0	13	11	14	13
Payments based on area planted/animal numbers	0	0	0	0	0
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	9	41	56	41	26
Payments based on input constraints	0	0	1	0	0
Payments based on overall farm income	15	10	12	8	9
Miscellaneous payments	1	0	0	0	0
Iceland					
Market Price Support	87	51	44	53	55
Payments based on output	1	27	30	26	26
Payments based on area planted/animal numbers	1	0	0	0	0
Payments based on historical entitlements	0	15	17	13	13
Payments based on input use	11	8	9	8	6
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	0	0	0	0	0
Miscellaneous payments	0	0	0	0	0

Table A7. **OECD: Composition of Producer Support Estimate** (*cont.*)

Percentage share in PSE

	1986-88	1997-99	1997	1998	1999p
Japan					
Market Price Support	90	91	90	91	92
Payments based on output	3	3	3	2	3
Payments based on area planted/animal numbers	0	0	0	0	0
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	4	4	5	4	4
Payments based on input constraints	3	2	2	2	2
Payments based on overall farm income	0	0	0	0	0
Miscellaneous payments	0	0	0	0	0
Korea					
Market Price Support	99	95	94	94	96
Payments based on output	0	0	0	0	0
Payments based on area planted/animal numbers	0	0	0	0	0
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	1	4	4	5	3
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	0	1	1	1	1
Miscellaneous payments	0	0	0	0	0
Mexico					
Market Price Support	n.c.	68	66	67	70
Payments based on output	0	0	0	0	0
Payments based on area planted/animal numbers	0	1	1	1	1
Payments based on historical entitlements	0	19	20	21	18
Payments based on input use	n.c.	11	12	10	10
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	0	1	1	1	1
Miscellaneous payments	0	0	0	0	0
New Zealand					
Market Price Support	26	79	82	75	78
Payments based on output	0	0	0	0	0
Payments based on area planted/animal numbers	0	0	0	0	0
Payments based on historical entitlements	20	0	0	0	0
Payments based on input use	45	21	17	24	21
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	9	0	0	0	0
Miscellaneous payments	0	0	0	0	0
Norway					
Market Price Support	46	41	40	42	43
Payments based on output	24	18	20	18	16
Payments based on area planted/animal numbers	9	9	9	9	10
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	19	29	30	30	27
Payments based on input constraints	2	2	1	2	2
Payments based on overall farm income	0	0	0	0	0
Miscellaneous payments	0	0	0	0	0
Poland					
Market Price Support	63	85	84	87	83
Payments based on output	0	1	0	0	2
Payments based on area planted/animal numbers	0	1	2	0	0
Payments based on historical entitlements	9	0	0	0	0
Payments based on input use	28	14	14	13	14
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	0	0	0	0	0
Miscellaneous payments	0	0	0	0	0

Table A7. **OECD: Composition of Producer Support Estimate** (*cont.*)

Percentage share in PSE

	1986-88	1997-99	1997	1998	1999p
Switzerland					
Market Price Support	82	62	62	64	61
Payments based on output	1	2	1	2	3
Payments based on area planted/animal numbers	6	17	21	19	11
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	8	6	7	6	4
Payments based on input constraints	0	2	2	2	2
Payments based on overall farm income	0	9	5	5	16
Miscellaneous payments	3	3	3	3	3
Turkey					
Market Price Support	75	85	79	86	89
Payments based on output	0	1	1	1	1
Payments based on area planted/animal numbers	0	0	0	0	0
Payments based on historical entitlements	0	0	0	0	0
Payments based on input use	25	14	20	13	10
Payments based on input constraints	0	0	0	0	0
Payments based on overall farm income	0	0	0	0	0
Miscellaneous payments	0	0	0	0	0
United States					
Market Price Support	46	46	49	49	40
Payments based on output	7	9	1	8	18
Payments based on area planted/animal numbers	27	4	1	6	4
Payments based on historical entitlements	0	20	21	18	20
Payments based on input use	16	15	20	13	11
Payments based on input constraints	2	4	6	4	3
Payments based on overall farm income	2	3	3	3	3
Miscellaneous payments	0	0	0	0	0
OECD 24					
Market Price Support	77	65	64	66	65
Payments based on output	6	5	3	4	6
Payments based on area planted/animal numbers	7	13	14	13	11
Payments based on historical entitlements	0	4	3	4	4
Payments based on input use	8	9	10	9	8
Payments based on input constraints	1	3	4	3	3
Payments based on overall farm income	1	1	1	1	1
Miscellaneous payments	0	0	0	0	0
OECD					
Market Price Support	78	68	67	68	68
Payments based on output	5	4	3	4	6
Payments based on area planted/animal numbers	6	11	12	12	10
Payments based on historical entitlements	0	4	3	4	4
Payments based on input use	8	9	10	9	8
Payments based on input constraints	1	3	4	3	3
Payments based on overall farm income	1	1	1	1	1
Miscellaneous payments	0	0	0	0	0

Notes: EU-12 for 1986-94, EU-15 from 1995, EU includes ex-GDR from 1990.
OECD 24 excludes most recent Member countries: Czech Republic (1995), Hungary (1996), Korea (1996), Mexico (1994), and Poland (1996). Austria, Finland and Sweden are included in the OECD totals for all years, and in the EU from 1995. Market price support is net of producer levies and excess feed costs.

p. Provisional.

n.c. Not calculated.

Source: OECD (2000*a*).

Table A8. **Measures notified in categories 6, 7 and 8 of the Green Box by OECD countries**

	Notification G/AG/N/...	Decoupled Income Support: Annex 2, para 6, of the Agreement on Agriculture
Australia	AUS/7/Rev. 1 AUS/14 AUS/20 AUS/30	***Commonwealth Government*** Farm Family Restart Scheme (Income Support): A short-term welfare safety net for low income farmers experiencing financial hardship and who cannot borrow further against their assets. The support is provided while they are deciding their future in the industry.
Canada	CAN/5 (DS:2) CAN/17 CAN/29 (DS:2) CAN/35	Federal – mainly Western Grain Transition Payments Program. National Transition Scheme for Apples. Arable Acres Supplementary Payment. Canada-Alberta Hog Industry Development Companion Program.
EC	EEC/12/Rev. 1 EEC/16/Rev. 1	Transitional aid to agricultural income. Agri-monetary aid.
Iceland	ISL/2 ISL/9 ISL/11 ISL/14	Farmers pension fund (retirement scheme). Direct payments to sheep farmers.
Korea	KOR/7 KOR/14 KOR/18 KOR/24	High school tuition payments, financial assistance to debt-ridden farmers and pension insurance coverage for farmers and fishermen support for retired aged farmers (this subsidy for aged farmers who sell or lease their farmland was established in 1997).
Switzerland	CHE/6 CHE/11 CHE/15 CHE/20 (DS:2) CHE/22	Allowances for the costs of cattle owners in mountain and hill areas (also regional assistance). Allowances for farming and summer pasturing under difficult conditions, for summer pasturing and ecological services (also regional and environment protection assistance). Payments to owners of cows who do not market milk. Crop premiums for feed grains and pulses. Direct additional payments: Payments for services provided in the general interest (protection and maintenance of the countryside, safeguarding the viability of rural areas, supply of foodstuffs, preservation of the basic natural environment necessary to life); supplement to market earnings. Surface area contributions. Contributions for herding animals consuming coarse fodder.
USA	USA/17 USA/27	Farm Service Agency production Flexibility Contract Payments: Payments made to producers and landowners based on acreage and production in a prior base period, as specified in the Federal Agriculture Improvement and Reform Act of 1996.
	Notification G/AG/N/...	**Government Financial Participation in Income Insurance and Income Safety-Net Programmes: Annex 2, para 7, of the Agreement on Agriculture**
Australia	AUS/18 (DS:2)	Farm Management Deposits Scheme
Canada	CAN/8 CAN/29 (DS:2)	Prince Edward Island Agricultural Disaster Insurance Programme. Alberta Farm Income Disaster Program.
EC	EEC/12/Rev. 1 EEC/16/Rev. 1	Income Insurance and Income Safety Net Programmes (1996/97) – Council regulation 1527/95, Commission regulation 2921/95

Table A8. **Measures notified in categories 6, 7 and 8 of the Green Box by OECD countries** (*cont.*)

	Notification G/AG/N/...	Payments for Relief from Natural Disaster: Annex 2, para 8, of the Agreement on Agriculture
Australia	AUS/7/Rev. 1 AUS/14 AUS/20 AUS/30	***Commonwealth Government*:** Rural Adjustment Scheme (Exceptional Circumstances Provisions). For farmers whose farm business incomes have been adversely affected by exceptional circumstances (such as extreme and prolonged drought). Coffs Harbour – Tropical Fruit Producer assistance. Grant to eligible tropical fruit producers in the Coffs Harbour region to reconstruct access roads damaged as a result of storm/flood event of 23 November 1996 to allow access to tropical fruit plantations. Exceptional Circumstances Relief Payment: Assists farm families in exceptional circumstances areas to meet basic living expenses by providing sufficient immediate cash. Contribution to Victorian Farmers' Federation Disaster Relief Fund: A one-off contribution to the Victorian Farmers' Federation Disaster Relief Fund to assist farm families in the Gippsland region to meet the costs of food, utility bills, personal expenses and emergency farm costs. ***State/Territory Governments*:** *New South Wales* Natural disaster relief, primarily in drought declared areas, in the form of electricity assistance payments, transport rebates (for movement of stock, fodder and water) and cash assistance to families. Natural disaster relief in the form of counselling, grants and interest subsidies to provide support to farm families and farm business to mitigate the effects of drought, floods, bushfires, storms and earthquakes. *Northern Territory* To provide assistance in the form of interest subsidy to producers who suffer severe droughts. *Queensland* Interest subsidy to assist recovery from exceptional drought conditions. Drought Relief Assistance Scheme: freight subsidies for water, feed stock, transport to and from adjustment. Emergency Assistance Schemes: provides loans at concessional rates of interest for producers in drought declared areas to purchase seeds, chemicals, fertiliser, fuel and stock. Natural Disaster Relief Assistance Scheme: provides loans at concessional rates of interest to assist producers to recover following natural disasters of substantial magnitude. Assistance would not generally be available where adequate insurance could be effected at reasonable rates. Rural Adjustment Scheme – Drought Exceptional Circumstances Payments: provides an interest subsidy to producers in areas of Queensland, which have been declared as affected by exceptional drought conditions. Support may extend to 100 per cent of the interest payable on either existing or new loan(s). *South Australia* Grants and interest rate subsidies for primary producers in drought declared areas. *Victoria* Flood Relief East Gippsland: Concessional loans, feed and fertiliser transport, fencing grants and farm planning consultancy Flood Relief Northern Victoria: Concessional loans Drought Relief: Concession paid to Victorian farmers for carry-on finance as a result of drought. Exceptional Circumstances: Interest rate subsidies for farm businesses affected by drought *Tasmania* Exceptional circumstances – interest rate subsidies for farm businesses affected by drought. *Western Australia* To assist pastoralists to delay restocking after drought and prepare a recovery plan.

Table A8. **Measures notified in categories 6, 7 and 8 of the Green Box by OECD countries** (*cont.*)

	Notification G/AG/N/...	Payments for Relief from Natural Disaster: Annex 2, para 8, of the Agreement on Agriculture
EC	EEC/12/Rev. 1 EEC/16/Rev. 1	Compensatory payments in respect of weather: restoration of agricultural production potential and natural disasters. 1996: Replanting and conversion of frost-damaged olive groves.
Hungary	HUN/10	Migration of damage caused by drought.
Japan	JPN/21 JPN/34 JPN/47	Agriculture insurance: government subsidies on premiums of scheme agricultural insurance. Natural disaster relief loans: loans for relief of damaged farmers by natural disasters.
Korea	KOR/7 KOR/14 KOR/18 KOR/24	Compensatory payments for losses caused by natural disasters.
New Zealand	NZL/2 NZL/7 NZL/12 NZL/18	Adverse Climatic Events: Provision of support to the agriculture industries in the aftermath of adverse climatic events. 1995: The majority of the funds were used to provide for eight temporary offices to be established in drought stricken regions. The offices provided advisory services to producers *e.g.* on where to buy feed. The funds also paid for technical field days for drought affected areas. The figure includes an estimate of the cost of employing four army personnel for two months distributing water to farm households during the Marlborough drought (at NZD 100 000). 1997: This figure reflects the assistance paid to orchardists affected by hail storms during the period November 1996 through February 1997. Rural Sector Assistance Programme: A benefit provided to agricultural producers in regions the Government recognise as being severely affected by an adverse climatic event. The benefit provides minimum short-term living needs, and is assessed monthly. Drought is estimated to have cost NZD 260 million at the farm gate in terms of feed costs and production losses.
Norway	NOR/5 NOR/11 NOR/22 NOR/25	Natural Disaster Payment. Compensation for crop damage due to natural disasters.
Poland	POL/24 POL/26	Protection against, and relief from, flood and restoration of agricultural production.
USA	USA/10 USA/17 USA/27	Farm Service Agency (FSA) Non-insured Crop Disaster Assistance Program (NAP): Under the 1994 Federal Crop Insurance Reform Act, producers of crops not currently insurable under other programs receive benefits, if it is determined by the USDA that there has been an area-wide yield loss of greater than 35% and greater than 50% for the individual farm. Emergency feed program: Compensates livestock producers for feed crop disasters. Emergency feed assistance program: Compensates livestock producers for feed crop disasters. Forage assistance program: Compensates livestock producers for pastures damaged by drought or related conditions (1988 Disaster Assistance Act). Livestock Indemnity Program (fiscal year): Compensates producers for livestock losses from recent disasters. Tree assistance program: Compensates producers for loss of tree seedlings due to drought or related conditions (1988 Disaster Assistance Act).

Table A8. **Measures notified in categories 6, 7 and 8 of the Green Box by OECD countries** (*cont.*)

	Notification G/AG/N/...	Payments for Relief from Natural Disaster: Annex 2, para 8, of the Agreement on Agriculture
USA (*cont.*)	USA/10 USA/17 USA/27	Emergency loans: Provides loans to cover actual losses sustained by farmers in disaster areas. Derived as the difference between FmHA and commercial interest rates times the value of loans made during the year. Data also include budget outlays for recognised losses on FmHA loan guarantees. Farm Credit System Programs are not included because loans made in 1986-88 were not subsidised. The Farm Credit Amendments Act of 1986 forbids the FCS from under pricing its competition. Also, the FCS interest rates are greater than commercial rates, after adjusting announced rates for the mandatory stock purchase requirement paid by borrower without compensation. Crop disaster payments: Under the Food Security Act of 1985, the Disaster Assistance Acts of 1988 and subsequently, assistance was provided to crop producers suffering from disasters. Assistance was provided when there were production losses of at least 30%. Such *ad hoc* programs were replaced by the 1994 Federal Crop Insurance Reform Act. Disaster Reserve Assistance Program: Compensates livestock producers for losses of feed crops in authorised countries. Cash reimbursements provided for up to 30% of cost of feed replacement if county and producer both have losses of at least 40%.

Source: WTO (2000), Green Box Measures: Background Paper by the Secretariat, G/AG/NG/S/2.

BIBLIOGRAPHY

AAFC (1999),
Adapting to Change and Managing Risk: A *Profile of Canadian Farmer Attitudes and Behaviour*, commissioned to Angus Reid Group, Canada, *http://www.agr.ca/policy/epad/ english/pubs/adhoc/angus/toc.htm*.

Anderson, J.R. and P.B.R. Hazell (1997),
"Risk Considerations in Agricultural Policy-Making", in Huirne, R.M.B., J.B. Hardaker and A.A. Dijkhuizen (eds.), *Risk Management Strategies in Agriculture: State of the Art and Future Perspectives*, Mansholt Studies No. 7, Wageningen Agricultural University, Wageningen, The Netherlands.

Barnett, B. J. and K.H. Cobble (1999),
Understanding Crop Insurance Principles: A *primer for Farm Leaders*, Research Report No. 209, Department of Agricultural Economics, Mississippi State University, February.

Barry, P.J. (1995),
The Effects of Credit Policies on US *Agriculture*, American Enterprise Institute Studies in Agricultural Policy, The AEI Press, Washington, DC.

Beal, D.J. (1996),
"Emerging Issues in Risk Management in Farm Firms", *Review of Marketing and Agricultural Economics*, Vol. 64, No. 3, December.

Boehlje, M.D. and D.A. Lins (1998),
"Risks and Risk Management in an Industrialized Agriculture", *Agricultural Finance Review*, Vol. 58.

Brookins, C.L. (1997),
US Whole Farm Equity Protection: A Whole Farm Concept of Farm Production Risk Management, World Perspectives Inc., September.

Carter, C.A. (1999),
"Commodity Futures Markets: A Survey", *The Australian Journal of Agricultural and Resource Economics*, Vol. 43, No. 2, pp. 209-247.

Chen, K.Z. and K.D. Meilke (1996),
"A Reevaluation of Canada's Safety Net Programs for Agriculture", *Canadian Journal of Agricultural Economics*, Vol. 44, No. 4, pp. 361-368.

Cobble, K.H., T.O. Knight, G.F. Patrick, and A.E. Baquet (1999),
Crop Producer Risk Management Survey: A *Preliminary Summary of Selected Data*, A Report from the Understanding Farmer Risk Management Decision Making and Educational Needs Research Project, Department of Agricultural Economics, Mississippi State University, September.

Cobble, K.H. and B.J. Barnett (1999),
The Role of Research in Producer Risk Management, Professional Paper Series 99-001, Department of Agricultural Economics, Mississippi State University, February.

Collins, R.A. (1997),
"Toward a Positive Economic Theory of Hedging", *American Journal of Agricultural Economics*, Vol. 79, pp. 488-499, May.

Dismukes, R. (1999),
"Recent Developments in Crop Yield and Revenue Insurance", *Agricultural Outlook*, Economic Research Service, United States Department of Agriculture, May.

Fackler, P.L. (1988),
"An Analysis of Alternative Market and Governmental Risk Transference Mechanisms", in *Agricultural Stability and Farm Programs*: *Concepts, Evidence, and Implications*, edited by Daniel A. Sumner, Westview Press, Boulder and London.

Goodwin, B.K. and V.H. Smith (1995),
The Economics of Crop Insurance and Disaster Aid, American Enterprise Institute Studies in Agricultural Policy, The AEI Press, Washington, DC.

Hagstrom, J. (1997),
"Sharing the Risk", *Government Executive*, August.

Hardaker, J.B., R.M.B. Huirne and J.R. Anderson (1997),
Coping with Risk in Agriculture, CAB International.

Harwood, J., R. Heifner, K. Coble, J. Perry and A. Somwaru (1999),
Managing Risk in Farming: Concepts, Research and Analysis, Economic Research Service, United States Department of Agriculture, Agricultural Economic Report No. 774, March.

Harwood, J., R. Heifner, J. Perry, A. Somwaru and K. Coble (1999),
"Farmers Sharpen Tools to Confront Business Risks", *Agricultural Outlook*, Economic Research Service, United States Department of Agriculture, March.

Hennessy, D.A. (1998),
"The Production Effects of Agricultural Income Support Policies under Uncertainty", *American Journal of Agricultural Economics*, Vol. 80, pp. 46-57, February.

Huirne, R.M.B., J.B. Hardaker and A.A. Dijkhuizen (eds.) (1997),
Risk Management Strategies in Agriculture: State of the Art and Future Perspectives, Mansholt Studies No. 7, Wageningen Agricultural University, Wageningen, The Netherlands.

Hum, D., D. Kraft and W. Simpson (1995),
A Framework to Analyze Income Support and Income Stabilization Policies in Canadian Agriculture, Agriculture and Agri-Food Canada, Technical Paper 3-95.

Jose, H.D. and R.S.K. Valluru (1997),
"Insights From the Crop Insurance Reform Act of 1994", *Agribusiness*, Vol. 13, No. 6, pp. 587-598.

Knutson, R.D., E.G. Smith, D.P. Anderson and J.W. Richardson (1998),
"Southern Farmers' Exposure to Income Risk Under the 1996 Farm Bill", *Journal of Agricultural and Applied Economics*, July, pp. 35-46.

Lagerkvist, C.J. (1999),
Essays on the User Cost of Capital and Financing of the Agricultural Firm, Agraria 180, Doctoral Thesis, Swedish University of Agricultural Sciences, Uppsala.

Martin, S. and F. MacLeay (1998),
"The Diversity of Farmers' Risk Management Strategies in a Deregulated New Zealand Environment", *Journal of Agricultural Economics*, Vol. 49, No. 2, Spring, pp. 218-233.

Meyers, R.J. and J.F. Oehmke (1988),
"Instability and Risk as Rationales for Farm Programs", in *Agricultural Stability and Farm Programs: Concepts, Evidence, and Implications*, edited by Daniel A. Sumner, Westview Press, Boulder and London.

Meuwissen, M.P.M., R.M. Huirne and J.B. Hardaker (1999),
Income Insurance in European Agriculture, Report prepared for the European Commission, Brussels.

OECD (1993),
Commodity Price Variability: Its Nature and Causes, Paris.

OECD (1994),
Agricultural Policy Reform: New Approaches – The role of direct income payments, Paris.

OECD (1995*a*),
A Review of Farm Households Incomes in OECD countries [OECD/GD(95)97], Paris.

OECD (1995*b*),
Adjustment in OECD Agriculture: Issues and Policy Responses, Paris.

OECD (1998*a*),
Agriculture in a Changing World: Which Policies for Tomorrow?, Meeting of the Committee for Agriculture at the Ministerial level, Press Communiqué, Paris, 5-6 March.

OECD (1998*b*),
Adjustment in OECD Agriculture: Reforming Farmland Policies, Paris.

OECD (1998*c*),
"Regulatory Reform", OECD *Synthesis* No. 4, Paris.

OECD (1999),
Distributional Effects of Agricultural Support in Selected OECD Countries [AGR/CA(99)8/FINAL], Paris.

OECD (2000*a*),
Agricultural Policies in OECD Countries: Monitoring and Evaluation 2000, Paris.

OECD (2000*b*),
Decoupling: A Conceptual Overview, Paris (forthcoming).

OECD (2000*c*),
A Matrix Approach to Evaluating Policy: Preliminary Findings From PEM Pilot Studies of Crop Policy in the EU, the US, Canada and Mexico [COM/AGR/CA/TD/TC(99)117/FINAL], Paris.

OECD (2000*d*),
Market Access, Domestic Support and Export Subsidy Aspects of the Uruguay Round Agreement on Agriculture Implementation in OECD Countries, Paris (forthcoming).

OECD (2000*e*),
State Trading in Agricultural Markets: A conceptual Analysis, Paris (forthcoming).

OECD (2000*f*),
Designations of Origin and Geographical Indications in OECD Member Countries: Economic and Legal Implications, Paris (forthcoming).

Patrick, G.F. and W.N. Musser (1997),
"Sources and Responses to Risk: Factor Analyses of Large-Scale US Cornbelt Farmers", in Huirne, R.M.B., J.B. Hardaker, and A.A. Dijkhuizen (eds.), *Risk Management Strategies in Agriculture: State of the Art and Future Perspectives*, Mansholt Studies No. 7, Wageningen Agricultural University, Wageningen, The Netherlands.

Petersson, J. and H. Anderson (1996),
"The benefits of share contracts: some European results", *Journal of Agricultural Economics*, Vol. 47, pp. 158-171.

Roman, R. and P. Catkins (1996),
"Pressures to Reform Agricultural Safety Net Programs: Quebec Perspective", *Canadian Journal of Agricultural Economics*, Vol. 44, No. 4, pp. 375-383.

Schnapps, R., R. Heifner and R. Dismukes (1999),
"Insurance and Hedging: Two Ingredients for a Risk Management Recipe", *Agricultural Outlook*, Economic Research Service, United States Department of Agriculture, April.

Schnapps, R. and R. Heifner (1999),
"Crop and Revenue Insurance: Bargain Rates But Still a Hard Sell", *Agricultural Outlook*, Economic Research Service, United States Department of Agriculture, August.

Skees, J.R. (1999*a*),
"Agricultural Risk Management or Income Enhancement?", *Regulation*, Vol. 22, No. 1.

Skees, J.R. (1999*b*),
"Agricultural Insurance in a Transition Economy", *Agriculture, Finance and Credit Infrastructure in Transition Economies*, Proceedings of OECD Expert meeting, Moscow, February, OECD publication, Paris.

Skees, J.R. (1999*c*),
"US Agricultural Insurance Programs: Lessons for Brazil", presented at the International Workshop on Insurance for Agribusiness, Piracicaba, Brazil, 10-11 December.

Skees, J.R. and B.J. Barnett (1999),
"Conceptual and Practical Considerations for Sharing Catastrophic/Systemic Risks", *Review of Agricultural Economics*, Kentucky Experiment Station Number 99-04-62.

Spriggs, J. and T. Nelson (1997),
"Effects of Enhancing NISA on Income Stabilization and Support", *Canadian Journal of Agricultural Economics*, Vol. 45, No. 2, pp. 123-129.

Sumner, D.A. (ed.) (1988),
Agricultural stability and farm programs: Concepts, evidence and implications? Boulder: Westview.

Turvey, C., K. Meilke, A. Weersink, K. Chen and R. Sarker (1997),
The Transfer Efficiency Assessment of Individual Income-Based Whole Farm Support Programs, Agriculture and Agri-Food Canada, Technical Paper 5-95, September.

Tweeten, L. (1995),
"The twelve Best Reasons for Commodity Programs: Why None Stands Scrutiny", *Choices*, Second quarter, Vol. 4(7).

Woods, P. (1997),
"Use of a Mix of Risk Management Options", *Australian Farm Journal*, February.

World Bank (1999),
Commodity Risk Management in Developing Countries: a Proposed Market-Based Approach, Progress Report of the International Task Force on Commodity Risk Management in Developing Countries, September [*http://www.worldbank.org/commrisk/*].

World Trade Organisation (2000),
Green Box Measures: Background Paper by the Secretariat [G/AG/NG/S/2].

Wright, B.D. (1988),
"Storage, Stability and Farm Programs", in *Agricultural Stability and Farm Programs: Concepts, Evidence, and Implications*, edited by Daniel A. Sumner, Westview Press, Boulder and London.

Yurugi, T. (1999),
"The Agricultural Credit System in Japan", *Agriculture, Finance and Credit Infrastructure in Transition Economies*, Proceedings of OECD Expert meeting, Moscow, February, OECD publication, Paris.

Part II

SPECIFIC APPROACHES

A. TRANSFER OF RISK ALONG THE FOOD CHAIN

A.1. Income Risk Management: the Perspective of United States Farmers

by
Leland Swenson*
President of the National Farmers Union
United States

The evolution of the food chain from a competitive industry characterised by many participants at all levels to an increasingly integrated system provides a unique risk management opportunity to those who have market power. In the absence of effective intervention by public institutions, highly integrated firms are able to transfer the majority of unacceptable risk to the ends of the chain; in particular, to farmers, ranchers and retail consumers.

Food production and marketing face many types of risk. There are supply risks at all stages of the agri-food chain, from the production of commodities, through the processing function, and the distribution and marketing processes. These risks are evident when one considers the potential for quantity and quality shortfalls in both agricultural production of agriculture and the intermediate steps required before the customer actually consumes the product. Demand risk is also faced by all involved in the food chain due to changes in product prices throughout the chain, disposable income of consumers, and the various "needs and wants" of customers. In addition, a number of less obvious external risks also impact at all stages, from the agricultural producer to the retail consumer. These external risks can include the need to manage or adjust to legal requirements, labour issues, environmental regulations and a number of public policy decisions.

The goal of all food chain participants is to reduce or transfer to others those risks considered as being above a reasonable or affordable level of acceptance, which in turn is based on real or perceived economic returns to risk assumption. This can be accomplished through a variety of mechanisms including proprietary management decisions, options available through the private sector, various forms of government intervention and combinations of various components of each strategy. Initially, each participant in the food chain must evaluate or assess the level of risk and the cost/benefit of its acceptance. Once this has been determined, a broad range of potential alternatives can be considered to either minimise the risk within the firm or to transfer the risk to an outside player. Internally, risk may be managed through research and development, inventory management, logistics, quality and safety control mechanisms or production and marketing strategies. The same risk may be transferred to others through contracting or other arrangements within the private sector. Services such as banking, insurance and brokerages may allow financial risks to be reduced or better managed. In addition, nearly all other risks can be addressed through contracting for other services or by specialised advisers.

* This contribution was presented in *Session 2: Transfer of risk along the food chain*.

The public sector also provides a range of risk management tools useful to the food industry, such as inspection services, insurance, procurement and consumption programmes, infrastructure development, and research and development programmes.

With all these risk management tools available to the industry, how can it be suggested that producers and consumers are subject to risks others will not accept?

Production risk remains high for individual farmers, although it may be much lower across a region or for a particular crop sector. Applied technology, such as irrigation, crop varieties, crop protection products or livestock confinement, does not eliminate all environmental risk associated with production and in some cases only changes the nature of the risk within a category or among categories.

In addition to production risks faced by individuals, most farmers and ranchers in the United States view commodity price risk as the greatest threat to their survival. This is probably true for most producers in industrialised nations. Market characteristics and the level of organisation within a market will influence the capacity to transfer risk. Given that agricultural producers are price takers in relatively price inelastic markets, the price discovery function either does not exist, such as in markets dominated by contract production or high levels of vertical integration, or it is accomplished through markets dominated by a few large firms. In the United States, the poultry industry is an example of the former, while the grain exchanges would be an example of the latter. Since individual producers do not influence commodity pricing, they have a strong incentive to maximise their individual productivity and overall production in order to increase the revenue level of their farm. This is largely a result of increased market power through integration and concentration in other food sectors that effectively minimise their input commodity risk, in terms of both quantity and price, at the expense of the farmer and, ultimately, the consumer. In commodity sectors where production has become concentrated into very large units, it is not the individual producer who exercises market power, but the integrated cluster to which the agricultural producer is little more than an employee. Due to market power, integrators are able to transfer unacceptable level of risk to the two extremes of the food chain, the producers and retail consumers.

Individual producers seek to maximise production in order to maintain or enhance total revenues that generally lead to aggregate overproduction and depressed commodity prices. This action ensures supply and commodity price-risk protection to merchandisers and processors and provides supply risk protection to consumers. As individual producers attempt to minimise production and quality risk, they do so as input price takers because integrators able to differentiate charges for those products are increasingly providing the products and services. Price differentiation can occur through the use of fees, such as those charged for technology, or more general price discrimination, such as the existing differentials in chemical input costs in global markets.

Generally, producers in the United States have available some form of crop or revenue insurance to further provide production and/or crop revenue guarantees. However, most such policies whether available privately or publicly require a significant loss before coverage commences. Most producers in the United States are subject to a 25-50% loss or deductible before insurance protection is initiated. Thus even with subsidised producer premiums, the level of coverage is inadequate.

Commodity price risk management occurs in cash, futures or contract markets dominated by a small number of purchasers who effectively determine the transaction in terms of price, quantity, delivery and quality specifications. As a result of the inability of individual farmers to pass production and market risk to others, public price and/or income stabilisation measures have been initiated in most developed countries. However, because of their generally short-term, reactionary nature they have a limited impact on longer-term structural changes that are leading towards increased concentration of the food chain. The effects of market concentration also allow risk to be shifted to consumers. In general, consumers face three risks: adequate supply and product diversity; quality and safety; and product prices. Basic food supply risk has been mitigated in industrialised nations through public and private production, delivery and distribution investment, and the rational economic behaviour of commodity producers to seek increased productivity and production. Food quality and safety risks have been significantly reduced as a result of new technology applied to processing, storage and

handling, as well as policy intervention in the areas of product testing and enforceable quality and safety standards. However, retail customers, like commodity producers, have very little individual market power and are thus price takers in a market that reflects the costs and returns of increased concentration and reduced competition at both the wholesale and retail levels. Increased costs within the food chain quickly result in higher retail prices to consumers. Cost reductions are more slowly, if at all, reflected in retail food prices.

In conclusion, acceptance of risk should result in an economic return to the risk taker that is commensurate with the economic value of the risk. Unfortunately, concentration and integration in the food chain has increased the market power of food clusters to the point where they are able to transfer unacceptable risk to others, such as agricultural producers and consumers, without providing adequate compensation. While public policy intervention may partially mitigate risk through a variety of programmes and regulations designed to address risk symptoms, past and current policies have generally failed to address a primary cause of the inequity in risk transfer by not ensuring an adequate level of competition throughout the food chain.

A.2. Risk Management Strategies in the Whole Farm Context: the New Zealand Experience

by
Sandra Martin, Lincoln University
and
Nicola M. Shadbolt, Massey University
*New Zealand**

Introduction

Management of risk is an important activity for farmers world-wide. Many strategies for managing risk are conceptually possible, including a number of production, marketing and financial strategies. The management task facing farmers is to choose that combination of risk strategies that best suits the unique circumstances of their particular farm.

Governments form part of the risk environment facing farmers. They can reduce farmers' risk exposure to the market by policies that insulate farmers from the volatility of market prices, such as market support or price stabilisation schemes. Similarly, they can reduce the risk from financial sources by offering input subsidies to shield farmers from the market cost of those inputs. However, Governments can impose their own source of risk when they change the very policies that they designed to ameliorate market or financial risk, thereby introducing a further source of volatility into the farmers' risk environment.

In many countries, the role of intervention by governments in agriculture is coming under increasing scrutiny. There is an awareness that farmers will face increased risk with a decrease in protection for agriculture. There are discussions on appropriate policy initiatives for dealing with income risk management at the farm level; these usually centre on marketing strategies for managing risk because farmers will be more fully exposed to the vagaries of the international market.

However, this focus on particular strategies, or a class of strategies, for managing risk, ignores the whole-farm context in which farmers manage risk. This may result in an incomplete picture of income risk management, leading to a lack of understanding of how farmers might react in a more deregulated market environment.

In the late 1980s and early 1990s, New Zealand farmers were exposed to a sudden deregulation of both agriculture and the economy in general. This led to a dramatic change in their risk environment, which required radical readjustment of their risk management practices. They now operate in a largely deregulated environment, employing a variety of risk management practices to manage their farming operations.

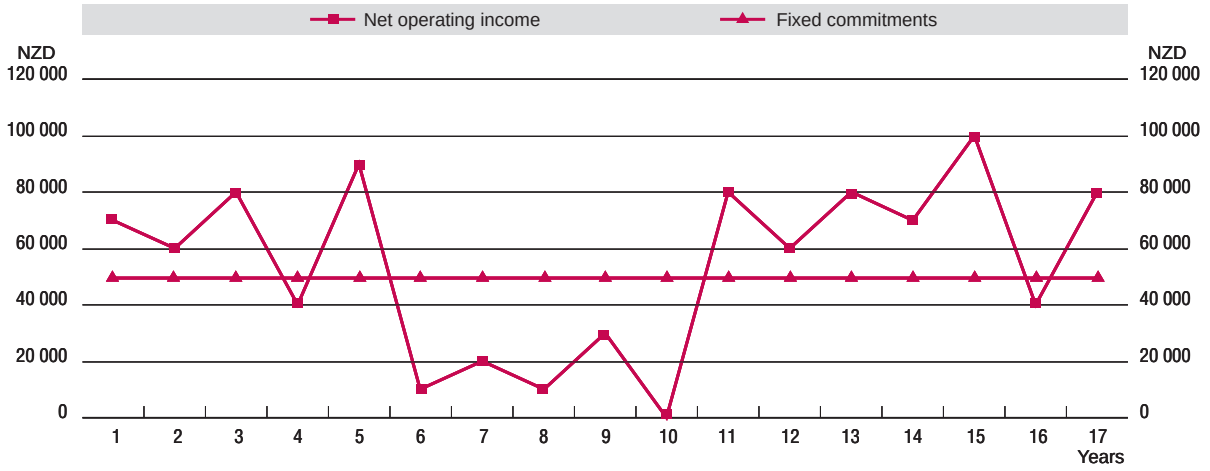
The New Zealand experience offers some insight into the risk management behaviour of farmers where government support is minimal. This may provide some assistance in predicting how farmers in other countries might respond to a reduction in support. In this paper, the risk management behaviour of New Zealand sheep and beef farmers in a deregulated environment is discussed within a whole-farm context (which can be used to understand and analyse risk management by farmers) with particular reference to the transfer of risk along the food chain.

* This contribution was presented in *Session 2: Transfer of risk along the food chain*.

The whole farm context

The whole farm context within which risk management occurs is shown in Figure 1, using a framework based on Gabriel and Baker (1980). The net operating income of the farm is a function of yields, prices and variable input costs. The variability in this net operating income reflects the business risk faced by the farm and is made up of production risk and price risk. Fixed commitments are the prior claims on the business that must be met by the cash generated by the farm. Debt servicing commitments usually account for a large component of these prior claims. These fixed commitments represent the financial risk faced by the farm.

Figure 1. **The whole farm risk context**



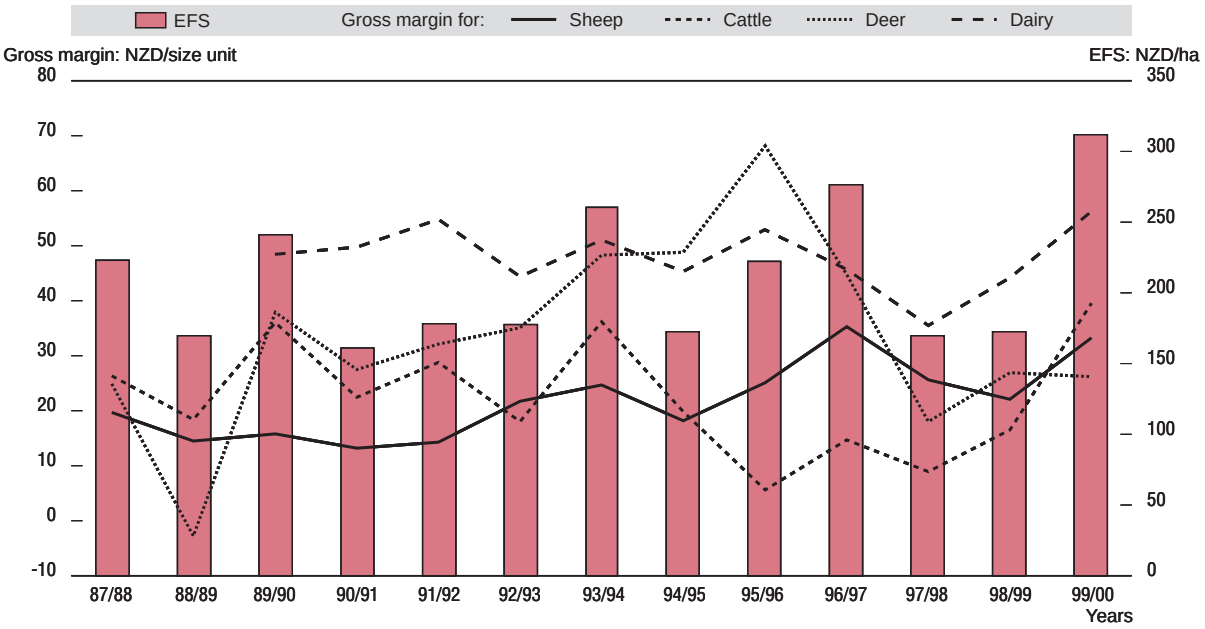
Source: Authors.

If the net operating income of a farm business consistently fails to exceed prior financial commitments, then the survival of the farm business is threatened. The basic objective of risk management is to reduce the chances of a vulnerable situation such as this while achieving the highest possible returns for the owners of equity consistent with their attitudes to risk.

Figure 1 illustrates a particular situation with respect to risk exposure. In this case, there are three episodes when the net operating income of the farm does not exceed the fixed commitments. For one episode, this occurs for a prolonged period of time and could possibly jeopardise the survival prospects for this business. In these circumstances, active risk management would be warranted and the challenge in this particular instance would be to choose a set of risk management strategies that reduces risk to a more tolerable level.

A further illustration of the variability of net operating income, described as Economic Farm Surplus (EFS), is given in Figure 2. This case study farm, described in Shadbolt and Carroll (1997), has a number of enterprises that are, theoretically, sufficiently counter cyclical to provide a relatively consistent EFS from year to year. The enterprise gross margins and the overall EFS per hectare for the farm for each of the last thirteen years are illustrated in Figure 2. Although over time extreme variability has occurred between enterprises, the overall farm result has been relatively steady due to the diversification. However, as all of the enterprises are reliant on pasture production any counter cyclical trends in market prices tend to be negated when significant production variability occurs, such as in a drought year. Similarly, a significant movement in the exchange rate can negate improved production in any one year.

Figure 2. **Gross margins and operating profit from 1988 to 2000 for a New Zealand case study farm**



EFS: Economic Farm Surplus.
Source: Updated by authors from original of Schadbolt and Carroll (1997).

The fixed commitments this farm could afford to carry in order to minimise downside risk would appear to be an annual charge of NZD 150 per hectare. However, in view of its growth goal, this farm maintains a lower NZD 95 per hectare level of commitments thereby ensuring there is profit available in all years to reinvest in the business.

For this farm to transfer risk along the food chain, a clear recognition of what factors generate both production risk and price risk must be made. Identifying which of these factors can be managed by either the farm business or those further along the chain is necessary if business structures and arrangements are to be made to share that risk. The term managed is used here in recognition of the fact that there are a number of factors, such as climate and global financial markets, that seem impossible to control. Successful (farm) business managers identify what they cannot control and develop a suite of contingency plans that can be put in place for each of the various uncontrollable scenarios that might occur. A simple example of this for the case study farm is the storing of sufficient feed reserves to feed 350 dairy cows in the event of a flood while feed crops and pasture are restored on flood prone plains. The ability of managers to identify not only the factors that generate risk but also the management responses required to mitigate the effects of those factors is the most important requirement of risk management. Once managers have recognised and practice the control mechanisms available to manage risk they are said to have an "internal" locus of control in their business (Kaine *et al.*, 1994). The opposite, an external locus of control, is characterised by much greater variability in results, a short term fire-fighting style of management and a tendency to lay blame on others for poor performance.

Successful transfer of risk along the food chain would require managers at all stages to have strong internal loci of control. Managers in this position will most likely have a better appreciation of the strategic weaknesses of their business and a greater willingness to find solutions to minimise them. The development of strategic alliances between the links in the food supply chain in recent years has been an attractive solution for some.

Vertical co-ordination and contracts in the New Zealand lamb industry

Within the context of the New Zealand lamb industry, the participants, or links, of the supply chain are breeders, finishers, processors, exporters, Meat New Zealand and retailers. The flow of information and lambs (live animals, carcasses, cuts) should be co-ordinated and managed as a unique system, since the industry's competitiveness depends on the effectiveness of the value chain as a whole.

Recently, there has been a paradigm shift in parts of New Zealand's lamb and beef sectors with increased integration between farmers and processors through supply contracts. As a result, processing companies involved in supply contracts have expanded their capacity despite the downward trend in sheep numbers. The processing companies have undertaken to produce to order rather than to the dictates of seasonal supply. Their aim is to "deliver product in full, on time, to specification, at the agreed price with a margin for all participants in the supply chain". They are encouraging their suppliers and exporters to use a similar approach to ensure the long-term satisfaction of customer needs and allow continuous improvement in product quality (McDermott and Shadbolt, 1998).

One characteristic of New Zealand sheep and beef farmers that may reduce the suitability of co-operative co-ordination is the lack of a co-operative culture that is necessary for the successful implementation of alliances. Farmers are typically individualists and fiercely independent, and in the sheep and beef cattle industry compete directly against one another in the marketplace. Most trading of livestock and livestock produce in these two sectors is on the spot market. The many years spent by the industry operating in an "open adversarial" commodity market has meant a strong distrust between suppliers (breeders and finishers) and customers (processors) has developed (McDermott and Shadbolt, 1998). The same situation has developed in the United Kingdom (Palmer, 1996) and the United States (Ashkenas *et al.*, 1995). As a consequence of this lack of trust, profit and risk sharing arrangements have been limited (Boehlje *et al.*, 1998).

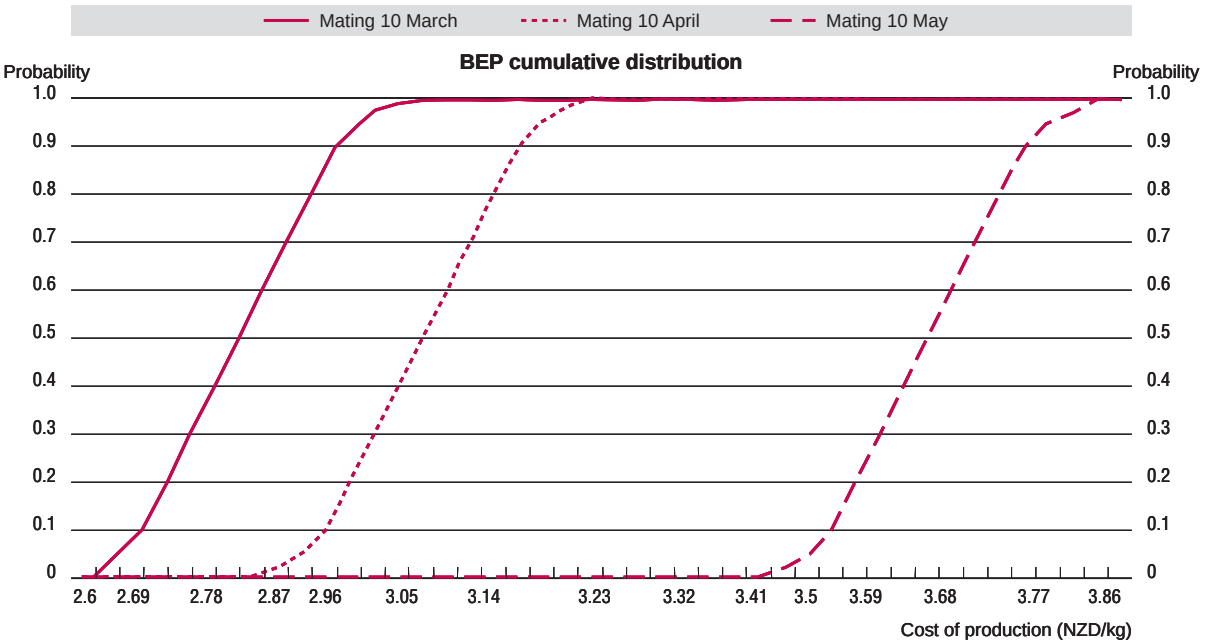
New Zealand's seasonal pastoral systems are characterised by their heavy dependence on external variation (*i.e.* weather and market prices). Prices fluctuate depending on global production, the climate, currency exchange rates, economic growth and product access to different markets. Sheep product prices also depend on domestic issues, including trends in sheep numbers and the financial performance of processors. Seasonal pasture production determines a well-defined lamb supply pattern and affects the price that farmers receive for their produce. This seasonal production pattern is not always compatible with processors' requirements for a steady, consistent production throughout the year.

A discrete stochastic programming (DSP) model was developed by Montes de Oca and Shadbolt (2000) to evaluate the impact of variation on lamb production cost (risk exposure of the enterprise). The stochastic variables considered were lambing percentage, wool production, lamb purchase price and wool price. Three possible mating dates (10 March, 10 April, 10 May) were evaluated under three different scenarios of pasture production with an equal probability of occurrence for a representative farm. The DSP model produced cumulative distribution functions (CFD) for the lamb meat cost of production or Break-Even Point (BEP) market price (Figure 3).

The objective of the DSP model was to assess the lamb cost of production for each combination of mating dates and sales policies in order to assist decision-makers to forecast a production cost that could be used to consider forward contracting. The option of mating on 10 April is clearly the option that produces lamb meat at the lowest cost of production for the system but it also supplies lambs when prices are at their lowest. This form of modelling provides a useful measure of the effect of a wide range of risk factors on the cost of production and its likely variability. Just as the cost of production varies so do the prices paid as processors target a consistent flow of product.

New Zealand farmers have basically two options to sell their produce: spot market or forward contracts. Under the spot market, New Zealand farmers receive a price according to a weekly lamb schedule based on individual meat processing company's overseas market requirements. On the other hand, payment for New Zealand lamb under contracts is a complex combination of exchange rate fluctuations, market price movements, performance bonus for meeting commitment to deliver stock in

Figure 3. **Cumulative distribution functions for cost of production with three mating dates for the representative farm**



BEP: Break-Even-Point.
Source: Montes de Oca and Shadbolt (2000).

full and on-time, meat grade classification according to market destination, premium matrix, pelt characteristics, livestock presentation, drafting rebates and transport cost. Despite the complexity of this payment system, long-term relationships can reduce the risk of interruption of supply, reduce costs in the long term through repetition and increase the efficiency of the supply chain to accomplish the consumer's requirements.

The modelling exercise suggested that a mix of contractual arrangements for the premium produce of the farm and spot market for the remaining production could be considered by farm managers as the best alternative to maximise farm income from the sheep enterprise. It illustrated how computer simulation techniques and risk analysis could assist lamb producers to estimate the cost of production for specific supply patterns that are essential for the success of forward contracting.

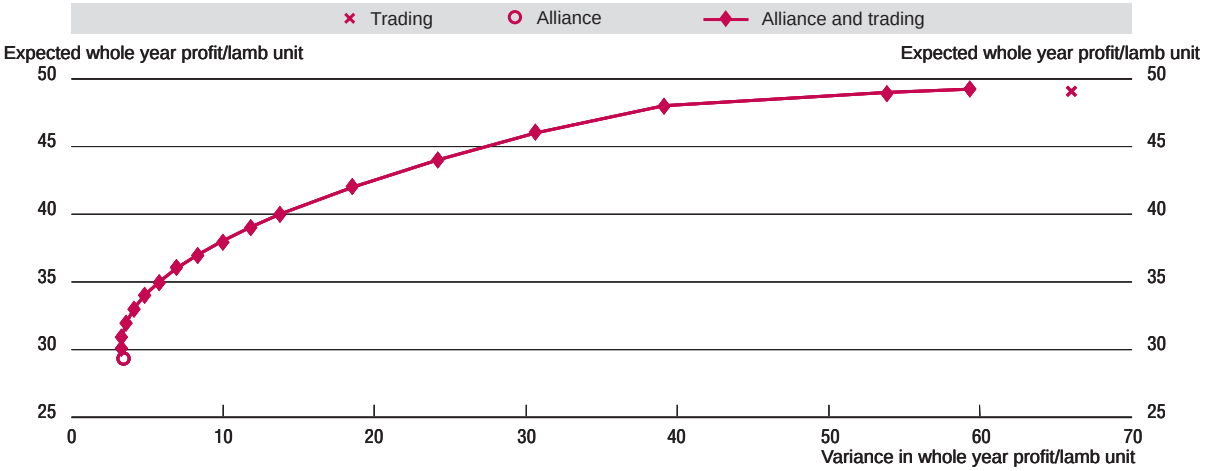
Quantifying the effect on the whole farm business' net operating income of possible production and price variation is a necessary part of risk management. Current computing technology enables these estimates to be made using simple spreadsheet functions. The range of possible outcomes can be better understood if presented in a cumulative probability distribution, as in the example above. There is not much benefit in simulating a complex stochastic system to present the results afterwards as averages of the data.

A similar example involved a case study of supply chain co-ordination between a breeder of sheep and a lamb finisher who had formed a co-operative (alliance) farming venture in an attempt to improve the quality and timeliness of lamb supply (McDermott and Shadbolt, 1998). Using the DSP technique they determined the effect of the alliance on farmer risk-return profiles. The alliance reduced business risk for the finisher by about 90% and generated variable changes in profit by season (–60% to +11%). The alliance had little impact on the breeder's risk-return profile in spring, but reduced profit by 20% and lowered risk by 13% in summer. It was concluded that a win-win situation with respect to risk and profit was not created by the alliance.

To determine the best mix of spot market and contractual arrangements for the finisher a mean-variance (E-V) curve, which is a risk efficiency frontier curve, was calculated. Neither the alliance nor market strategies implemented individually by the finisher are as risk efficient as a combination of both co-ordination strategies because they fall below the line of the curve. This means that for a given level of risk, more profit can be achieved or the given level of profit can be achieved using a less risky enterprise mix.

The risk efficiency frontier curve (Figure 4) shows that the pure market and the pure alliance strategies are visually insignificantly different from two respective combinations of the two strategies, but arithmetically the combined strategy slightly dominates both the pure market and the pure alliance strategy.

Figure 4. **Mean-variance (E-V) risk efficiency frontier curve for the whole year profit/lamb unit for the finisher**



Source: McDermott and Shadbolt (1998).

As was also concluded by the Montes de Oca and Shadbolt (2000) analysis, the E-V risk efficiency frontier curve of this case study farm (Figure 4) shows that neither the alliance or spot market strategies implemented individually by the finisher are as risk efficient as is a combination of both co-ordination strategies.

The solution to the transfer of risk along the food supply chain in the two analyses hitherto discussed did not involve a simple change to production and marketing contracts. Instead, it required a vigorous assessment of potential production and price variability and an understanding of how contracts provided advantages and disadvantages under differing scenarios and seasons. The range of risk management strategies adopted by farmers is governed by their understanding of the risks involved, their ability to manage risk and their relative aversion to risk. Which strategies farmers might adopt in certain circumstances will not always be predictable. The following section provides useful evidence of the various risk management strategies adopted by New Zealand farmers following deregulation.

Risk management in the New Zealand sheep and beef industry

Deregulation and adjustment

The deregulation of agriculture in New Zealand in the mid-1980s saw the removal of a range of input and output subsidies, development incentives and taxation deductions. These were part of a

much wider deregulation package for the economy. As a result, prices for many farm products fell, some quite dramatically, and became more volatile. In addition, on-farm costs, including the cost of debt, rose substantially. That is, farmers found that their net operating income fell and became more variable, and their fixed commitments rose, narrowing the gap between this and net operating income. This increase in both market and financial risk disturbed individual farmer's risk profiles, with overall risk increasing beyond levels that were compatible with their risk attitudes.

Farmers responded in a number of ways. In sheep farming, which was heavily affected by deregulation, many farmers took steps to reduce their fixed commitments by repaying and restructuring debt. Over the adjustment period, discretionary expenditure was reduced and capital expenditure deferred. Many farmers did not put on fertiliser for a few years and reduced their use of precautionary inputs, such as drenching and spraying. Although this potentially introduced more production risk to their farming system, farmers reasoned that they could afford to do this for a few years until their debt was at more controllable levels. Another response was to increase the net operating income of sheep farms. Many farmers diversified to reduce their dependence on relatively low and variable sheepmeat incomes. They added beef, horticulture or forestry to their farming operation, or converted land to dairying.

Risk management in the sheep and beef industry after deregulation

By the early 1990s, some equilibrium had been re-established for many agricultural industries, although some, such as kiwifruit still faced adjustment problems unrelated to deregulation. A nation-wide survey in 1992, reported by Martin (1996), identified the important strategies used by farmers in a range of different industries to manage risk under a deregulated regime. This included sheep and beef farmers.

Routine spraying and drenching and maintaining feed reserves were, on average, the most important risk management strategies used by sheep and beef farmers (see table). These strategies alleviated risk by maintaining physical performance and smoothing out variability in such performance. Keeping debt low was also a critical risk management strategy which would increase the ability of farmers to absorb downturns.

Spreading sales and market information were also considered to be important risk management strategies. Such marketing strategies can smooth out price fluctuations and increase price performance. Having more than one enterprise was also considered to be an important method of smoothing out price fluctuations. The ability to be flexible in the short-term was another supplementary strategy which would allow farmers to respond to changes in weather or to respond to favourable market conditions when used in conjunction with market information.

A range of auxiliary financial strategies supported these measures; these included managing capital spending, holding insurance and holding financial reserves. Maintaining long-term flexibility was another supporting strategy.

Some strategies were not ranked highly by sheep and beef farmers. One of these was irrigation, which was used by very few farmers. Instead, dryland farmers used feed reserves and the ability to react quickly to weather factors to reduce climatic uncertainty. Similarly, forward contracting was unpopular as a risk management response. Farmers used market information instead, spreading sales and short-term flexibility to manage market risk. Rather than lock themselves into prearranged prices, they preferred to maintain the flexibility to get the best possible market prices. The paradigm shift, described and analysed by McDermott and Shadbolt (1998) and Montes de Oca and Shadbolt (2000), has been a noticeable development since this 1992 survey. Off-farm work was also not considered to be an important risk reducing strategy, with sheep and beef farmers having an on-farm focus to their risk management.

Variations within sheep and beef farmers

While the above analysis gives an impression of how sheep and beef farmers manage risk, it tends to obscure variations amongst farmers with respect to their risk management practices. As a result, the data from the 1992 survey were further analysed using factor and cluster analysis to determine whether groups of sheep and beef farmers differed in their management responses to risk. Full results of this analysis are reported in Martin and McLeay (1998).

Ranking, mean importance and standard deviation of management responses to risk and proportion using each response for sheep and beef respondents[1]

Management response	Rank	Mean[2]	Standard deviation	% using strategy
	Extremely important			
Routine spraying and drenching	1 =	4.0	1.0	95
Maintaining feed reserves	1 =	4.0	1.0	94
Spreading sales	3 =	3.6	1.3	85
Keeping debt low	3 =	3.6	1.5	82
Market information	3 =	3.6	1.3	89
More than one enterprise[3]	6 =	3.4	1.5	79
Store term flexibility[4]	6 =	3.4	1.4	80
Managed capital spending[5]	6 =	3.4	1.5	83
Long run flexibility[6]	9	3.3	1.4	81
Insurance	10 =	3.0	1.7	75
Financial reserves[7]	10 =	3.0	1.6	62
Debt management[8]	12	2.9	1.8	69
More than one variety, breed or production technique	13 =	2.8	1.4	69
Not producing to full capacity	13 =	2.8	1.4	63
Arranging overdraft reserves[9]	15	2.7	1.7	67
Monitoring pests, crops, climate	16	2.2	1.6	47
Off-farm investment	17	2.0	1.7	42
Forward contracting	18	1.6	1.5	31
Family members working off-farm	19	1.4	1.6	30
Main farm operator working off-farm	20	1.1	1.5	20
	Not important			
Irrigation	21 =	0.8	1.5	15
Futures markets	21 =	0.8	1.1	6
	Not applicable			

1. N = 488.
2. Ranking from 1 = Not important to 5 = Extremely important; 0 = Not applicable is included in the mean.
3. More than one type of crop, animal or other enterprises on property to reduce risk.
4. Adjusting quickly to weather, prices and other factors to reduce risk.
5. Pacing of investment and expansion to reduce risk.
6. Ability to make major changes in the longer term to reduce risk.
7. Having cash and easily converted financial assets.
8. Monitoring debt and working with lenders to ease debt burdens in bad times.
9. A capacity to borrow above normal requirements as an extra buffer.

To facilitate the analysis, risk management strategies were collapsed into six risk management dimensions: income spreading, market risk reduction, debt management, capital management, off-farm work, feed management and pest and disease management. The analysis itself yielded five types of sheep and beef farmers who differed in their management of risk despite operating within the same farming system and facing the same aggregate external environment. The differences between the five groups were associated with particular farm and farmer characteristics (see Part I, Figure A1).

Income spreaders

Nineteen per cent of farmers were classified as income spreaders. They focussed on income spreading and debt management types of strategies, paying little attention to other strategies. Their primary concern appeared to be a steady cash flow, which they gained by smoothing out income through enterprise diversification, sales spreading and information gathering. These farmers ran more beef than other groups, which gave them the flexibility to keep animals longer or sell them earlier depending on market conditions and feed availability. Being predominantly North Island farmers, they are better able to spread sales of lamb through twice-yearly or eight-monthly shearing.

The emphasis on cash flow by these farmers was supported by debt management, suggesting that they may hold short-term debt and face liquidity constraints. Not surprisingly, they held high levels of debt as a proportion of assets.

Capital managers

Capital managers, who made up 18% of the sheep and beef farmers surveyed, relied on strategies for managing capital, and supported this by income spreading measures. Moderate emphasis was placed on sound production management.

These farmers are protecting their capital base by maintaining financial reserves, planning capital spending, having long-run flexibility and investing off-farm to diversify their portfolio. These farmers are older than other groups and, therefore, more likely to be concerned about their retirement. They are unlikely to get much financial support from government when they retire and zero estate duty means that they will focus on managing their capital rather than divesting it. Not surprisingly, they have low debt and few concerns about their business and financial risk.

The supporting income spreading strategies give these farmers a steady cash flow, which is facilitated by being situated primarily in the North Island and running larger numbers of beef cattle. These relatively older farmers have low gross incomes from predominantly on-farm sources.

Part-timers

The 17% of farmers in this category place greatest emphasis on off-farm work, but also place importance on market risk reduction strategies. These preferred strategies are supported by capital and production management.

Part-timers have moderate debt levels, relatively low farm incomes and, not surprisingly, the greatest reliance of all groups on off-farm income. They appear to have a lower family net worth and smaller properties than the average farmer. They have made the decision that working off-farm is a more feasible option than expanding the farm operation to a more viable size in the short-run.

Part-timers are likely to schedule their off-farm commitments so that they do not conflict with peak labour requirements on the farm. In this way, they obtain high performance through intensive management of their predominantly sheep enterprises, as indicated by their high lambing percentages.

Debt and market risk managers

The 27% of farmers in this category have a strong on-farm focus, utilising a wide range of activities. Their preferred strategies relate to debt management and market risk reduction, which are supported by income spreading, capital management, pest and disease management and feed management.

These farmers have a relatively high level of indebtedness so their emphasis on debt reduction is understandable. It is possible that they have a higher proportion of long-term debt than income spreaders. These are the youngest group of farmers and they are likely to be very aware of the negative impact of deregulation on highly leveraged properties. They have relatively high gross incomes (with little emphasis on off-farm income) and are likely to be less constrained by their consumption needs than income spreaders, which would allow them to focus on reducing their debt as quickly as possible.

Their secondary emphasis on market risk reduction suggests they are confident of their ability to manage market risk. Although their financial characteristics are similar to those of income spreaders, they have lower beef numbers which reduces their ability to smooth cash flows. These subtle differences are associated with a different combination of activities for managing risk.

Production managers

These farmers (19% of the total) focussed on pest and disease management and feed management strategies, with more moderate emphasis on debt management and market risk reduction. These farmers have low debt levels and relatively low gross incomes with little emphasis on off-farm sources. They have average lambing performances and beef cattle numbers and are primarily North Island based.

These farmers are likely to be owner-operators who rationalise their competencies by concentrating on production even though their gross income levels indicate performance levels are only average. They appear to be more complacent about their situation than most other groups, being less concerned about their levels of risk. Their preferred responses to pest and disease management and feed management differentiate them from all other groups.

Conclusion

The above discussion on risk management strategies in the New Zealand sheep and beef industry and the case study analyses of risk-return tradeoffs in the supply chain illustrate the inherent potential of a whole-farm approach to analysing risk. They illustrate how farmers risk management strategies will change when their risk environment changes, how particular risk management strategies will be preferred in particular industries, and how risk management strategies within an industry will vary according to farm and farmer characteristics.

Before deregulation, farmers in the New Zealand sheep and beef industry had relatively smooth net farm incomes and a relatively high fixed commitment. With deregulation, their net farm incomes fell and became more volatile, while their fixed commitments rose. They reacted to this with a combination of approaches. They reduced the gap between net operating income and fixed commitments by reducing their fixed commitments (paying back debt) and increasing their net operating income (enterprise switching and diversification). Simultaneously, they reduced the increased variability in their net operating income (enterprise switching and diversification).

Once sheep and beef farmers had re-established some equilibrium with respect to their risk exposure, a pattern of risk management that was appropriate for a dryland pastoral farming system emerged. Keeping debt low and a range of other financial management strategies preserved a suitable gap between fixed commitments and net operating income. The yield risk associated with the variability in net operating income was managed by production strategies aimed at maintaining steady physical performance (routine spraying and drenching, maintaining feed reserves and short-run flexibility to respond to changes in weather). Similarly, price risk was aimed at smoothing out prices (enterprise diversification, spreading sales) and boosting prices (market information and short-run flexibility).

However, there was a range of approaches to managing risk within this general pattern. Income spreaders had a small gap between fixed commitments and net operating income and focused their energy on reducing the variability in their net operating income, giving a steady cash flow. The older capital managers appeared to be more risk averse and maintained a larger gap between their fixed commitments and a smooth income flow by low debt levels and other capital management strategies. Part-timers had moderately high fixed commitments and reduced their risk exposure by increasing and smoothing out their relatively low incomes through off-farm work and market risk reduction. Debt and market risk managers had high fixed commitments and high gross incomes and sought to reduce their gap by lowering their debt and smoothing out their net operating income through market risk reduction. Finally, production managers with their low gross incomes and low debt focused their risk management efforts on smoothing out their net operating income by reducing their yield risk by maintaining physical performance.

There are four basic approaches that can be taken by farmers to manage risk. These are:

- reducing the variability in net operating income;
- truncating any troughs in net operating income;
- increasing the gap between net operating income and fixed commitments by reducing fixed commitments;
- increasing the gap between net operating income and fixed commitments by increasing the net operating income.

In practice, farmers employ a combination of these approaches using a variety of risk management strategies, such as production, marketing and financial strategies. The size of the gap between fixed commitments and net operating income, and the number, duration and intensity of episodes where net

operating income does not exceed fixed commitments, which any particular farmer is prepared to tolerate, will depend on his or her attitude to risk. That is, each farmer will have a particular risk profile that he or she prefers. A very risk averse farmer may want a smooth net operating income that is somewhat low, but well above the level of fixed commitments. A less risk averse farmer may opt for a higher but more volatile net operating income, and a relatively high level of fixed commitments.

There are many examples of strategies that farmers can use to reduce risk. For example, marketing strategies such as forward contracts, futures markets or enterprise diversification can smooth out price risk, while irrigation, precautionary spraying and drenching, and using more than one variety, can smooth out production risk. Similarly, insurance can be used to truncate the troughs in net operating income. The gap between net operating income and fixed commitments can be reduced either by lowering fixed cost commitment, such as debt, or by increasing the net farm income, either by increasing prices and yields of existing products, or investing in new enterprises with a greater return. These examples are merely a small subset of the range of risk management strategies that are potentially available to farmers.

It is clear that when the risk environment facing farmers is changed, they will adjust their risk management behaviour until the relationship between net operating income and fixed commitments returns to a state that they feel comfortable with. For example, a reduction in market support may reduce prices and increase their volatility. Therefore, the level of net operating income will reduce and become more variable. Farmers will respond to this by increasing their net operating income, reducing its volatility or truncating its troughs, reducing their fixed commitments, or a combination of these responses.

Risk analysts often assume that there is a relationship between the type of risk and the response which should be used to manage this risk. For example, if market risk increases because market support has been withdrawn, then marketing strategies such as forward contracts or futures markets are often recommended to reduce the increased market risk faced by farmers. However, such reasoning is not necessarily valid when viewed in a whole-farm context. Instead, farmers may choose to absorb the increased market risk by lowering their fixed commitments. Alternatively, they might diversify into other enterprises to increase the level of their net operating income and reduce its volatility.

Although a wide range of risk-reducing strategies are possible in principle, the number of strategies which are effectively available to an individual farmer is likely to be much more limited. Some strategies may not be appropriate for a farm of a particular size, type or ownership structure, or may not be available in a particular industry or region. Some strategies may be more effective in reducing risk in particular circumstances and each farmer will have his or her own preference, or distinctive competence, in managing risk.

B. REDUCTION OF RISK USING FUTURES MARKETS

B.1. Farmer Risk Management and Futures Markets

by
*Professor Jean Cordier**
École Nationale Supérieure Agronomique de Rennes
France

The use of futures markets in risk management is not new. However, the development of new technologies, particularly in the fields of biology, communication and transportation, has contributed to major changes in commodity market behaviour, agricultural policies and firm strategies. Changes can therefore be expected in the use of futures market, and perhaps even more so in the indirect use of such reference markets. This chapter is divided into three sections, with the first presenting an update on farmer risk management, particularly as it pertains to the main techniques used concerning the direct and indirect use of futures markets. The second section presents three new developments in risk management under the new market conditions and the third section consists of a "speculative" analysis on the future of farmer risk management by examining the expectations of new products and services.

The need for risk management and the basic techniques

The agricultural markets environment

The agricultural market environment can be characterised by three risk factors: "natural" market volatility, consumer demand and agricultural policy.

Commodity markets are competitive, and sellers as well as buyers are price takers. Farmers, traders and first-hand industry** have low financial margins due to high competition. In addition, prices fluctuate as various shocks affect commodity demand and/or supply, with the volatility of these fluctuations differing according to the "natural" conditions of the market (Sarris, 1997). The table below presents the volatility of prices for a three-month period in the United States and France for 1999/2000. Most agricultural prices had a "natural" volatility in the 20 to 30% range; two exceptions occurred in France where there was exceptionally high volatility for cauliflower and low volatility for wheat. The high volatility of cauliflower prices was due to the volatility in daily supplies which is largely explained by variations in local weather conditions. The low volatility of wheat prices, as opposed to the "natural" volatility in the United States, was the consequence of agricultural policy within the European Union.

In theory, price inelasticity increases with the size of the marketing margin. Therefore, agricultural price volatility increases when the share of the agricultural value decreases within the total value of food products. Over the years, there has been a steady decline in the agricultural share of food products in all countries with the consumer spending more on services and reputed food products. As a consequence, agricultural markets are confronted with the necessity of incorporating risk management in their future strategies.

* This contribution was presented in *Session 3: Reduction of risk using futures markets.*
** The first-hand industry grades raw agricultural products, stores them and divides them into other quasi-commodities.

Volatility of certain products over a three-month period, 1999/2000, France and United States

	Products	Volatility (mean) %	Standard deviation %
United States	Wheat	21	0.4
	Corn	19	0.5
	Soybean	20	0.1
	Beef	22	0.8
	Hog	24	1.1
France	Wheat	4	0.3
	Rapeseed	21	0.1
	Hog	38	0.1
	Cauliflower	340	12.0

Low margins and high financial risks are "natural" conditions for farmers operating on competitive markets. The strategic requirements are cost competitiveness and risk management. Cost competitiveness is required in order to adjust to the market price level and risk management in order to deal with price volatility.

This traditional view has several consequences. At the farm level, it is well known that expected returns and related risks influence the farmer's behaviour in terms of choice of production, size and intensity of production, and inputs use. Each of these decisions has consequences for local economic development (Dehn and Gilbert, 1999). The negative consequences of excessive risk for development have been known for a long time. Recently, the International Task Force on Commodity Risk Management in Developing Countries, organised by the World Bank, studied the practical consequences of such situations in several countries heavily dependent on commodity prices (see Part I, Box 9).

Market price volatility affects not only farmers but also many other economic agents of the food chain. The food chain includes farmers with their input suppliers, the first-hand industry, the food industry, the retail industry and, finally, the consumer. First-hand industries stabilise sales of raw agricultural products. Trading companies move products from surplus to deficit regions. Many types of economic agents are therefore interested in agricultural market behaviour; all these agents are usually risk averse. As a consequence, they add a risk premium to their required rate of return on a risky investment in case they are not able to manage their market risk. As such, all the intermediary agents placed between the farmer and the consumer add a risk premium to their business margin, thus increasing the total marketing margin. As a consequence, the producer price is lowered with negative consequences on his margin and the consumer price is increased with negative consequences on the volume of consumption (Anderson and Danthine, 1980; Newbery and Stiglitz, 1981).

The second concern in terms of risk management is consumer demand. The demand of the affluent consumer is increasingly qualitative, with greater emphasis on food safety as well as on environmental and animal welfare aspects. Traditional food quality was designed and produced by the food industry using available agricultural products. The new consumer demands, enhanced by fears of biotechnology-derived products (genetically modified organisms, hormones, etc.) are modifying the dynamics of the food chain. The quality of agricultural products is now under scrutiny, particularly with regard to the types of genetics, pesticides and herbicides to be used, how products are stored, what types of chemicals are used to stabilise the products, and so on.

The farmer is now involved in the food quality process and is required to complete quality charts on both products and on production methods. Such a move towards more vertical co-ordination results in a greater dependency on outside sources, and therefore more derived risks (Cordier, 2000; Hueth and Ligon, 1999).

As a consequence of these quality requirements, there has been a greater segmentation of the agricultural market which will certainly lead to an increase in price and income risk. In general, production costs increase in relation to higher quality products and price quality premiums present a specific

volatility due to the uncertainty of demand and supply of goods of differentiated qualities. This has been the case, for example, for organic products, grains with specific industrial use and genetically modified organisms.

The third factor playing an important role in risk management is the fact that agricultural policy changes are occurring around the world. For example, agricultural market deregulation is underway in order to adhere to the rules imposed by the World Trade Organisation. As a result, many domestic markets with historically low price volatility are facing increased competition with all the consequences on farm margins and risks.

In order to face such important changes, as well as to meet consumer demand, agricultural policies are increasingly involved with qualitative aspects, including the value placed on the good's origin as well as on the farming process itself. In the future, support to farmers should be more indirect than has been the case with the development of new strategic objectives and greater importance given to a market-based approach of risk management.

Risk management techniques

Two types of techniques have been traditionally used by farmers: risk pooling and risk spreading techniques. These techniques have been extensively studied and currently benefit from new analytical concepts in finance (Hull, 1989; Leuthold *et al.*, 1992; Manfredo and Leuthold, 1998; Wang *et al.* 1998; Williams and Schroder, 2000). In addition, some "government hedging" techniques have also been used with great efficiency, although they have not benefited from much external analysis. Indeed, the academic work on agricultural policies has been oriented more towards the consequences of price levels than it has towards price or income volatility.

Risk pooling techniques include all price smoothing mechanisms organised by groups of producers. For example, average pricing for a crop year as offered by co-operatives is a very efficient risk management instrument. The farmer delivers his crop at harvest time and receives an advanced payment. He will receive a bonus in June in order to obtain the average market price of the past crop year. Some co-operatives offer a price averaged according to specific periods of time. For example, a farmer who decides to store his grain on the farm can contract at harvest a February delivery. He will receive the average price of a three-month period based on the date of delivery. For livestock production, some co-operatives offer moving average prices; for example, a twelve-week average price. These price smoothing techniques reduce the impact of price volatility and the related risk premium for the farmer. However, the use of reference markets – centralised and organised markets, spot markets and/or futures markets – is necessary.

Other risks have been managed through insurance techniques run by public and private organisations. Insurance is a well-known pooling technique. Producers organised in marketing orders are also involved in pooling techniques. Marketing orders differentiate between markets and thus maximise returns by controlling the quantities sold on each segmented market. As a consequence, the farmer's income is improved with the right to produce a certain quantity and to receive an average market price.

Risk spreading techniques have solid theoretical support on the optimum design of sets of investments called portfolios. It is borne out by the old aphorism of not putting all your eggs in one basket. Risk is spread among various risky assets characterised by an expected return, a risk parameter such as a variance or a bêta. Correlation coefficients between the risky assets offer the opportunity for portfolio risk diversification. A set of optimal portfolios draws an efficient frontier. The manager, in theory, chooses his optimal portfolio with respect to its utility function and therefore its risk aversion.

In practice, farmers have traditionally used crop diversification in order to manage farm income risk. When the major part of the farm production was self-consumed, crop diversification was an efficient technique to manage pure yield risk. When farmers began to produce for the market, they faced competition from other farmers to fulfil market demand and, as a result, their incomes were affected not only with yield risk, but also with market price risk. Over time, farmers have specialised in fewer products in order to decrease their production costs and have increased the size of their farms; as a result they have been able to obtain greater financial leverage through loans. The sensitivity of the final income earned tends to increase when the efficiency of traditional crop diversification decreases.

Agriculture has always been considered by governments as a strategic sector, particularly given that food is a basic requirement. This basic motivation has shifted towards the concept of food independence often associated with market isolation, price support and various agricultural policy instruments. All these instruments have been checked country by country by OECD in order to compute farmer protection due to price support from the world price level as measured at international borders. By adding market price support to other categories of policy measures (direct payments, reduction of input costs, tax concessions and services) we arrive at the concept of the "Producer Support Estimate" (PSE). The PSE is an indicator of the value of the monetary transfers to agriculture resulting from agricultural policies in a given year. Recently, food safety has been used as a criterion to accept or reject the trade of certain types of products (*e.g.* hormones used for beefmeat production) or to differentiate products (Genetically Modified Organisms, GMOs, and European rules on consumer information) (Mahé and Ortalo-Magné, 1998).

Most studies on agricultural policies deal with price levels and few with the effects of price volatility. Many agricultural policy instruments decrease price volatility, with the consequence of transferring private risk to the public sector. The direct consequences in terms of total production as a consequence of lower risk premium and degree of protection of farmers have rarely been studied.

As a final "government hedging technique", farmers are aware that the consequences of catastrophic situations for production due to flood or drought are financed by special funds of the Ministry of Agriculture. When prices are very low and farmers publicly demonstrate their opposition, political measures may be taken in order to support prices.

The use of futures markets as a diversification tool

Futures markets are centralised and organised markets where futures contracts and options are traded. All economic agents, both professionals and speculators, can buy and sell such contracts at low transaction costs and on a competitive basis. Market liquidity guarantees the quality of the futures prices as well as the premium values of the put and call options. This means that the futures price incorporates all available information. In other words, at any time and for a set of current information, the futures price is the best predictor of the future spot price.

Theoretical use

The farmer grows his crops with an expected satisfactory financial return. Very early in the season, he will check on the futures market the price of the product at harvest time. A soybean grower in Illinois, for example, will check the November Chicago Board of Trade soybean futures price and a rapeseed grower in the centre of France will check the November ParisBourse/Euronext rapeseed futures price. Depending on futures prices and various agronomic constraints, the farmer will choose to produce on a defined number of acres or hectares. The farmer is "long" when he plants or buys seeds. This means he bears the risk of a price decrease between planting and harvesting times. The value of his crop is at risk.

For years, the farmer observed a close relationship between the futures price quoted at the Exchange and the spot price offered at the farm gate by the local trader. The difference between the two prices, often called the basis, represents the value of three factors: quality, transport and storage. If the quality described on the futures contract is different from the local quality, the difference requires a price premium or a price discount of the local price with respect to the futures price considered as the reference price. The value of the quality premium/discount may change through time depending upon general conditions of supply and demand of the two qualities. Transportation costs also induce a price differential. The value of this differential depends once again on supply and demand of transportation services. If the demand for transportation increases when supply is fixed, the cost of transportation will increase. If the delivery place of the futures contract is between the farm area and the consuming regions, the farmer spot price will be lower than the futures price. Finally, the spot price is discounted from the futures price by the market value of storage. For example, if the market value of storage is 1% per month, a mid-September spot price will be about 2% lower than the November futures price (at the futures market delivery place and for an equivalent quality).

Thus, the farmer is aware that in a normal crop year the cash price in mid-September at the farm gate for the average quality product he is producing has an expected value of euros 8 under the November futures price. At planting time (1 October), the November futures price for the following year is euros 123. His target price is then euros 123 – 8 = 115, which gives him a fair financial margin on direct costs.

The farmer has three basic potential strategies:

- Strategy 1: do nothing with the hope of a spot price increase. This position is usually called speculative.
- Strategy 2: hedge future production by selling futures contract at euros 123 for a volume equivalent to the expected crop. The farmer is covering the market price risk and fixing his financial margin.
- Strategy 3: buy a put option at-the-money, meaning the right to sell at euros 123, for a euros 5 premium.

Two possibilities may occur after the farmer's decision on 1 October: the market price can increase or decrease during the production cycle. In Case 1, the price decreased from euros 123 on 1 October to euros 105 on 15 September of the following year. In Case 2, the price increased from euros 123 to euros 144 during the same time period.

As expected, the speculative strategy (Strategy 1) has the highest result variability, with very high and very low results with respect to market behaviour. With no basis risk, the hedging with futures contract (Strategy 2) offers as final payment the value of the target price in both cases. Finally, the purchase of a put option (Strategy 3) is a good "second best" strategy, bringing financial results very close to the best results of any of the above cases. This example presents the basic interest of futures contract as well as options. Combinations of strategies are required. Risk diversification comes from the positive correlation between futures and spot prices as well as asymmetric risk outcomes of options.

Case 1. **A price decrease**
October futures price in September = euros 105

	Strategy		
	1	2	3
1 October	Do nothing	Sell futures at euros 123	Buy puts at euros 123 euros 5 premium
15 September	He sells on spot market at S = 105 – 8 = euros 97	He sells on spot market at S = 97 and buys back the futures at euros 105	He sells on spot market at S = 97 and sells the premium value (123 – 105 = 18)
Financial result	He receives euros 97	He receives 97 + (123 – 105) = euros 115	He receives 97 – 5 + 18 = euros 110

Case 2. **A price increase**
October futures price in September = euros 144

	Strategy		
	1	2	3
1 October	Do nothing	Sell futures at euros 123	Buy puts at euros 123 and pays euros 5 premium
15 September	He sells on spot market at S = 144 – 8 = euros 136	He sells on spot market at S = euros 136 and buys back the futures at euros 144	He sells on spot market at S = euros 136 The intrinsic premium value is null
Financial result	He receives euros 136	He receives 136 + (123 – 144) = euros 115	He receives 136 – 5 = euros 131

This hedging activity should be managed as a dynamic position. The question is when to sell futures contract. Should the farmer sell the entire expected crop quantity when planting seeds? Should he choose a time between planting and harvest? In fact, the farmer must diversify the hedging times in order to really diversify price risk and manage yield risk. A satisfactory hedging programme could be the following. At planting time, October for example, the farmer sells futures contracts for a quantity equivalent to 20% of the expected crop; during spring, when the plant is well developed and yield risk is low, he sells 30% more; at harvest time he sells 20% and delivers about 70% of the real crop. Finally, the farmer sells 20% of stored products in January, the new fiscal year, and the remaining 10% some time during the first semester and before the new harvest. The risk is spread over a twenty-month period and the futures market is used in the first part of the marketing programme.

Optimal hedging has been studied extensively by academics, first in the seventies/early eighties using purely futures contracts and then in the late eighties/nineties using option contracts. The models are increasingly complex but are all based on price correlation between the futures and the local spot prices. They give important information on the quantity to be hedged with respect to both the cash position and the correlation coefficient between the futures and the spot prices. Practical analysis also gives useful information on the diversification potential of futures markets. This is called hedging effectiveness computed as the reduction in variance that results from maintaining a hedged position rather than an unhedged position. The measure of hedging effectiveness, E*, is equal to $\sigma^2_{SF}/\sigma^2_S.\sigma^2_S$ which is the coefficient of determination from the regression $\Delta S_t = \alpha + \beta\Delta F_t$ with ΔS_t the series of first differences in spot prices and ΔF_t the series of first differences in futures prices. All these types of practical computations are bridging the gap between theoretical analysis of risk management and practical use of futures markets.

Practical use

In practice, it is well known that farmers are not trading directly on futures markets. They usually sell their future crop using forward contracts negotiated with local intermediaries, private traders and co-operatives. For example, the farmer checks the futures market in October for the reference price (October of the following year) and begins to negotiate the basis for delivery at harvest time (or later, after a period of storage on the farm). When the farmer and the buyer agree, the forward contract is signed for a defined quantity, with quality premium/discount conditions, one or several periods of delivery and a fixed price. The intermediary trader who is long on his cash position will then sell on the futures market as a temporary substitute for a cash buyer.

The farmer is indirectly using the futures market, which presents several advantages. First, he is able to negotiate the exact volume he wants to sell and not a multiple of the futures contract quantity. He can sell the expected quality, choose the period of delivery and, more generally, fix the basis. He is not taking any basis risk on the transportation, storage or quality markets.

Another advantage is the absence of margin deposits, margin calls and all the mechanisms designed to maintain the financial integrity of the futures market. This benefits the farmer who, as a small market participant, usually has high intermediary costs for trading on the futures market. The corresponding disadvantage of forward contracts is the absence of financial guarantees.

Current developments on risk management using futures markets

Three current developments of farmer risk management should be noted. They are a direct consequence of food market requirements and of developments in the fields of financial engineering and communication systems.

A *need for management of new specific risks*

The present consumer demand for food safety and environmentally friendly products requires the development of new contracts between the food chain agents. If production costs are different for products of higher and lower quality, the total income risk is increased as compared to a product of

homogeneous quality. In addition, where the price correlation between the two products is normally positive, this impedes on the potential for product risk diversification when using traditional techniques. This is the case of organic or GMO products which are now well-known to consumers, as well as for waxy corn, barley for brewing, erucic rapeseed and other products which are of interest to industry, the food industry and others.

All these products, which provide temporary additional return to farmers, also increase income risk. As a consequence, new risk management techniques arise, which are simultaneously based on traditional use of futures market and new financial engineering. For example, a quality contracted crop can be priced for its basic value with reference to the futures market price. This risk, which can be diversified, is opened. In portfolio terminology, it is called an unsystematic risk. The additional income due to higher quality attributes required by the buyer presents yield risk as well as a quality premium risk. This risk, called a systematic risk, cannot at present be diversified on the "traditional" futures markets.

In order to manage this additional risk, producers and sellers look for "independent" parameters whose variability will allow for the computing of flexibility values according to the option theory, and therefore allow for a set of quality premiums paid by the user to the producer whatever the circumstances. In other words, the contract incorporates a payment method which offers at once a wide margin to determine the basic value of the product and which is very specific on the characteristics of that product.

Mix of pooling and spreading contracts

A few years ago, farmers were using either pooling or spreading techniques. There were two types of intermediary, clearly separated: some offered average pricing as a pooling technique and others offered an instant market price for immediate or delayed delivery. This dichotomy is disappearing. First, co-operatives with a pooling approach are now offering more instant market prices with greater access to futures markets. They provide services for selling and buying on the futures market in order to facilitate market access and decrease transaction costs. On the other hand, private traders offer a range of marketing contracts from classical forward contracts to averaged price contracts, with a great number of customised options contracts. For example, farmers can weigh differently weekly prices for computing a weighted averaged price over a long period of time. In doing so, farmers mix a price smoothing technique with some personal market ideas on price seasonality. Another type of contract by private traders o ffers an initial payment for harvest delivery very close to the spot market price, with a bonus in the case of a price increase during the storage season. The date for fixing the bonus will depend on the farmer. This contract is a mix of a co-operative initial payment for product delivery and an option contract, with the option premium included in the initial payment. Its value is minimised by a back-to-back management with final users and/or international traders.

Competition between all types of intermediaries brings many innovative contracts for marketing agricultural products as well as the necessity for each intermediary to offer a complete set of contracts in order to satisfy the diversity of farmers' needs. Farmers have access to more complete, accurate and up-to-date information. Therefore, some farmers want to manage the market relationship and use their intermediary as a pure service activity (assembling, storage, transportation). Others do not want to deal directly with the market, but do want to promote a modern image by using the techniques that intermediaries are offering. A co-operative which offers only an averaged annual price is out of date. Even though few of its members may use sophisticated tools, the co-operative must be in a position to offer such tools in order to maintain a positive image.

The dichotomy between physical and financial contracts

As a consequence of vertical co-ordination, farmers tend to deliver their contracted products at harvest time or at pre-defined periods of time. Therefore, they cannot "play" the market with respect to their own intuitions and constraints. This is why new derivative contracts in finance try to separate the physical exchange from the financial result. The interest is twofold. First, financial contracts are much easier to design. Independent parameters are required for pure financial contract settlements. For

example, an income insurance contract based upon price and yield requires a price as quoted on a futures market and a regional yield as published by national public organisations. For some products, such as grains, regional quality attributes are estimated for each variety by professional organisations (moisture, protein and so forth). Based on such estimations, the quality premium could also be managed.

The second interest is cost efficiency. Separating the flow of goods from immediate financial results can improve the relationship of the market agents with their counterparts. Thus, various marketing costs can be minimised. For example, a grain elevator operator may have an opportunity after the harvest to sell grain having particular quality characteristics. If this quality is stored at the farm level, the grain elevator operator may spend quite a lot of energy and money on buying that grain from the farmer. This is why the operator has an interest in buying the product at harvest time and take advantage of any market opportunity.

As a result of being in such a position, the grain elevator operator who would normally sell a put option to the farmer will offer instead a call option. The farmer who accepts the call option delivers grain at harvest time and receives the spot price. If the price decreases at a later date, the farmer is pleased with the harvest spot price he received. If the price increases, the call premium also increases. When selling the call option, the farmer receives the difference between the current spot price and the harvest spot price.

In conjunction with the dichotomy of contracts, it should be noted that the traditional local intermediary is no longer the only partner for the farmer. New agents are offering the same financial services to farmers, either directly or through a local intermediary. All these new services, however, are based on the extensive use by reference markets of new communication techniques for keeping a close contact with farmers. Physical distance between partners of financial contracts is no longer a problem. It is more a question of intellectual distance.

Speculation on a future for farmer risk management

To successfully speculate, it is necessary to first agree on the "cash position", meaning the current forces that will influence the future. Risk management will develop along the following three axes: new products, new services and new intermediaries.

Analysis of the "cash position"

The cash position can be described as follows:

- more general risk on margins due to changes in agricultural policies around the world;
- more specific risks, especially on quality premium, due to vertical co-ordination;
- greater opportunities in terms of financial engineering which allows an increasing mix of pooling and spreading techniques; and
- greater opportunities in terms of communication through the use of common hardware, software and languages.

In stating that the demand for risk management as well as the potential supply should increase in quantity as well as in quality, it is normal to infer that much innovation will take place in the near future.

A potential future for risk management

New products

New financial contracts should be developed using several parameters. Derivative contracts using local yield and prices in order to secure income are already offered. Additional derivative contracts using input and output prices are feasible and should fulfil the need to manage margin risk.

Other new contracts will manage the quality premium risk and the margin that is expected from segmented markets. These contracts are required to manage current specific qualities, for instance GMO as opposed to non-GMO products. The need is already expressed with the launching of non-GMO

grain futures contracts in Japan. New GMO products with direct consumer advantages, however, should be developed soon and will require a range of adapted risk management contracts.

Another product innovation may come from the length of the contracts. To date, risk management contracts have been oriented towards the production cycle, with the horizon period running for a maximum of two years. Innovative products should be of interest for the investment cycle; for example, it is reasonable to think that a hog producer will face high and low prices and thus when borrowing money for production investment, multi-annual contracts can be of interest. It is clear that fiscal conditions can facilitate the development of such types of contracts.

New services

In conjunction with new products, there is a need for better information. Farmers will demand better information systems with more parameters, greater accuracy and consistent updating.

New services may also come from systems presenting market information. Instant market prices, market reports from private companies or governmental agencies will flood the computer screen. Adequate means to process information, present and store it efficiently are required. Some systems are already offered to intermediaries that should reach farmers soon.

Sophisticated derivative contracts require simulation tools in order to better understand their interest and to manage them better once they are introduced within a portfolio of contracts. Simple individual simulation tools, such as option valuation software, are now available. Simulation on internet is available for innovative contracts.

New information services should also provide commercial comparative positions. For example, a farmer will be interested to know of offers of various intermediaries, both close to his farm and beyond. Such comparisons can concern output and inputs prices, as well as innovative risk management contracts (their content, costs, constraints). All these potential services will be affected by the new generation of mobiles using the Wireless Application Protocol (WAP). At present, the farmer uses risk management techniques with limited exchange with other farmers. Internet mobiles will allow greater interaction between farmers and therefore increase competition between products, services and intermediaries. The rate of diffusion of innovation should also increase. Finally, new services should affect the capacity to trade directly on futures markets or on derived markets. This will affect the position of intermediaries.

New intermediaries

Who will provide new products and new services to farmers? What is the future of the futures market within the new agricultural world?

The comparative advantage of being local is disappearing, the business is much more segmented than in the past, and new capabilities and resources are required. Therefore, it is possible to expect new intermediaries, or at least new initiatives from companies involved in some way on the grain market. Input suppliers, local traders, brokers, banks, insurance companies should design the expected products and services individually or through collective efforts. Alliances can be expected between large and well-established companies and innovative start-ups.

If such initiatives are successful, the new intermediaries can organise active derived markets for specific risks and specific regions specialised in some productions.

In terms of futures markets, the concentration of exchanges around the world should progress. The futures price for corn could be world-wide using a unique computerised network with regional delivery specifications and a negotiated premium/discount system. Innovation on new products for risk management on the local basis requires a good wholesale market, meaning efficient futures markets with high liquidity and low access costs.

It will be interesting to verify in coming years the limits between the futures market and the derived risk management markets. They are mutually dependent and will grow together. However, they will compete in the innovation process. For example, new contracts should be developed by futures markets to forward prices based on various quality attributes or to deal with income risk (price times yield). The technology could decrease development and launching costs of innovative contracts. Exchanges in charge of futures markets, however, are also heavy organisations. The question is whether they are flexible enough or not to take care of local problems.

Conclusion

Innovation in risk management is required to deal with farmers who are worried about their margins and constrained by the vertical co-ordination of contracts required by final demand. It is beyond doubt that futures markets will be used not only as a direct risk management tool, but also as a reference for derived risk management contracts. Innovation can be expected in terms of the new types of contracts offered and in the sources of information and services offered.

In parallel, many customised contracts designed for local risk management should be offered and will be supported by services based on new communication technology. The traditional dichotomy between risk pooling and spreading techniques should vanish, allowing new types of intermediaries to appear on the market. Competition will increase to catch the farm markets for inputs, outputs and services. The structure of upstream and downstream industries should change to cope with this increasing competition; concentration will continue of course but with new alliances between firms. The package product/services will promote not a virtual farmer, but a very talented one producing the right agricultural product and managing the agricultural value at risk.

B.2. A Canadian Perspective on Reducing Risk Using Futures Markets

by
Bobby Matheson*
Agriculture and Agri-Food Canada

In Canada, the federal government has a long history of developing and delivering income risk management programmes. More recently, the federal government has also become involved in the development and promotion of private sector risk management products to manage income risk and ensure greater self-reliance in the agricultural sector. The following comments rely heavily on Canadian expertise with respect to private risk management products. Although these observations are based on a North American perspective and markets, the information is valuable to countries wishing to maintain, increase or introduce private risk management products.

One of Professor Cordier's conclusions (Section B.1) is that there will be growth in innovative new risk management contracts. I would support this observation. We have already begun to see innovative new products ranging from weather derivatives to currency translated options. The financial community will always seek new ways to diversify their market risk by further developing these types of products for the agricultural sector.

Producers are also interested in these products in view of the growing importance of export markets, competitiveness and expectations of continued trade liberalisation. There are a number of constraints, however, which may limit or even hinder the extent to which these products can be successfully developed.

Liquidity for trading these products – changing market structures

The changing market structures in the agriculture and agri-food sectors will influence the feasibility of many potential new products. If the end result is fewer buyers and sellers in the market (further accelerated by the possibility of increased vertical integration or co-ordination throughout the supply chain) there may not be sufficient trading volumes either in the over-the-counter market or the underlying futures or options exchange markets. In order to have the necessary level of liquidity in futures markets there must be a sufficient number of traders. This will ensure that the traded prices are representative of a competitive market. These new market structures, however, may form the basis for new risk sharing arrangements throughout the chain and further reduce the demand for traditional hedging tools.

Competition from other products and market related risk premium

There are a number of ways to manage income risk, which can be either a complement or a substitute for privately traded products such as futures. What comes first and foremost to mind are the income risk management programmes provided to farmers by governments. Depending on the level and how the support is provided there may be less incentive for a farmer to utilise private products. Governments should be cognisant of this fact when designing programmes.

* This contribution was presented in *Session 3: Reduction of risk using futures markets.*

Other products and processes may be sufficient to minimise risk. Diversification has been used by farmers for years and will continue to be an effective means of managing risk. Integration, vertical co-ordination, co-operatives, improved production practices and self-insurance (savings, off-farm income) are different tools used by farmers.

It should be noted that futures contracts are not available for all commodities and never will be. While relationships may exist where linkages can be made using another type of commodity contract, this can be difficult. For these commodities, other risk management tools will form the basis of any strategy to minimise risk.

Marketing and education are key

New products can be versatile and effective, but that does not in itself guarantee success. There needs to be an effective marketing strategy to ensure that an understanding exists of the benefits and costs of these products. In many cases, this will include education for farmers, particularly those with small- to medium-size operations. The experience in Canada has shown that the larger farms are quite familiar with and frequently utilise futures, options and other types of forward contracts.

The Cattle Options Pilot Program (COPP) is an example of such a case. The COPP provided Canadian feedlot producers with a currency-translated option, which took into account the correlation between the cattle price in US dollars and the USD/CAD exchange rate. Given that there is a correlation of less than one, buying the two options effectively means the farmer would be buying too much protection. The COPP option sold at a substantially lower price versus the cost of buying separate options on the cattle price and the exchange rate. A cost analysis on the option price indicated the currency protection was basically free as a result of this option design.

Producers will need to be increasingly aware of currency risk for products traded on foreign exchanges. A rise in value of the domestic currency can wipe out any remaining margin or limit profit opportunities. Increased globalisation will increase risk due to currency; however, additional risk management products could easily be developed to deal with this risk.

Extended downturns

While these products work well for commodities when there is volatility in the market, they do not deal with extended downturns, such as is currently the case with cereal grains. It is difficult to say in today's environment whether such a downturn is a market signal or the result of ongoing government support programmes throughout the world. It is possible that future contracts extended out over a number of years could deal with such an event, and is something financial markets could consider developing for the sector.

Regulatory environment

The expertise needed to develop new products is concentrated in the financial market where there are opportunities for profit and the regulatory environment is conducive to the introduction of innovative new products. This is not always the case in agriculture. For example, there are constraints in the United States on the type of over-the-counter agricultural derivative products which may be sold. In order to attract new products, governments will need to ensure that there is a regulatory framework in place which is both dynamic and provides a level of protection to clients.

Conclusions

Government and industry can deal with these constraints. Internet will accelerate the process as more information and products become more easily accessible to farmers. The tools and products demanded by individual farmers will vary, depending on their financial situation, risk preferences and other factors. There is no general risk management strategy that will address the needs of all farmers.

It is important to keep in mind that risk or volatility is not necessarily negative. A high variance implies both large losses and gains. Typically, the higher the risk the greater the expected return; otherwise a farmer would switch to another crop or stop production. We generally speak of downturns in prices, but tend to forget about the upside! The value of private risk management products lies in their ability to limit downside risk, allowing producers to have more predictable income levels and to become more self reliant in the global market place.

I would suggest risk or volatility might not be a good measure of the economic viability and stability of a commodity over time. In the case of New Zealand, Professor Shadbolt looked at the level of income (average income) over time (Section A.2). Perhaps it is the risk-return relationship which warrants the greatest amount of research and policy discussion. These are all items to be kept in mind as we continue to examine the nature of risk in the agricultural sector and the role of government.

C. INSURANCE SYSTEMS

C.1. From Risk-pooling to Safety Nets: Crop and Revenue Insurance in the United States

by
Joy Harwood, Robert Dismukes,
Monte Vandeveer and Richard Heifner
*United States Department of Agriculture**

Yield and price variability have long been a hallmark of crop production and, since the 1930s, various policies of the United States for field crops have attempted to help farmers manage those risks. In the 65 years preceding passage of the 1996 Farm Act, most United States government support for agriculture has focused on supporting prices by taking land out of production and making payments to crop producers in response to low market prices. Since implementation of contract payments in 1996, however, the policy focus has shifted toward greater emphasis on risk management. As a result, the Federally-subsidised crop insurance programme, available for selected crops and in certain areas since 1938, has gained heightened visibility and new types of policies have been made increasingly available, particularly those providing revenue insurance protection.

Emphasis on agricultural insurance as a policy tool has recently materialised in bills passed by both the House and Senate of the United States Congress in 1999 and 2000. Budget resolutions have provided an additional USD 8.2 billion for risk management assistance over fiscal years 2001-2005. Both houses of Congress have passed, in the fall 1999 and winter of 2000, bills channelling virtually the entire funding amount into increasing subsidisation of crop and revenue insurance products. As of early May 2000, the House and Senate agriculture committees are in the process of reconciling the two bills. In addition, the fiscal year 1999 and 2000 agricultural appropriations bills provided substantial assistance through crop-loss and market-loss assistance payments.

The heightened focus on insurance and recent emergency assistance provisions raise a number of questions, particularly in the context of the pending 2002 United States farm bill debate and the World Trade Organisation negotiations. Key questions include: Why is the government involved in subsidising agricultural insurance? How do the different insurance products work, and what have been government expenditures for insurance and disaster payments in recent years? How do the different types of risk protection tools reduce income risk to farmers? Does subsidised insurance distort production and trade?

The basic concepts and rationale for government involvement

A key characteristic of all insurance markets (including automobile collision and homeowner's insurance) involves the pooling of risk. Risk pooling combines the risks faced by a large number of individuals who contribute through premiums to a common fund, which is used to pay those individuals in the pool who experience losses that qualify for indemnities. When an insurance company sells policies to many different individuals who have less than perfectly correlated risks, the total portfolio is

* This contribution was presented in *Session* 4.A: I*nsurance systems*.

less risky than the average of the individual policies. This is because, at any point in time, the odds of all insured individuals in the pool having a claim are extremely low. Thus, the insurer spreads non-systemic (uncorrelated) risks across the insurance pool.

In part because of several "market failure" arguments, the Government operates the multi-peril crop insurance programme. One market failure argument is based on the idea that many of the natural disaster risks associated with crop production (such as drought, flooding and disease) are correlated across wide geographic areas. As a result, it has been argued that pooling risks on a scale that is feasible for most private insurers is difficult and that the issue of correlation makes the need for crop insurance unique (Miranda and Glauber, 1997; Ray, 1980).[1] Others argue that many reinsurance options in international markets allow systematic risks to be diversified. Goodwin and Smith (1995), for example, indicate that international reinsurance markets are more than able to permit sufficient diversification so that risks that appear to be systematic to individual markets can be spread across a wider range of activities and markets. Whether private reinsurance capacity would be consistently available for crop insurance, however, may affect its feasibility as a means of risk diversification.

Problems of asymmetric information, including moral hazard and adverse selection, may also affect the private sector's ability to offer individualised multi-peril insurance (Ahsan, Ali and Kurian, 1982; Chambers, 1989; Goodwin and Smith, 1995). Moral hazard is present when a person can increase his or her expected indemnity by personal intervention after buying insurance. Adverse selection occurs when a farmer has more information about the risk of loss than does the insurer and is better able to determine the fairness of premium rates. A lack of extensive producer-specific yield-risk information, which is needed to control adverse selection, has been a problem and monitoring farmers' practices, the basis for controlling moral hazard, is difficult and costly. Empirical research provides evidence of moral hazard in multi-peril insurance (Just and Calvin, 1993; Coble, Knight, Pope and Williams, 1997), as well as adverse selection (Makki and Somwaru, 2000; Goodwin, 1994; Quiggin, Karagiannis and Stanton, 1994).

In contrast to multi-peril crop insurance, certain farm risks such as those associated with hail damage or the death of livestock are insured solely through private mechanisms. In particular, hail insurance has been quite popular, with producers in 46 states paying about USD 550 million in crop-hail premium in 1998. In addition, producers in many situations can insure their livestock as part of the farm's business property. Unlike multi-peril crop insurance, these markets are generally characterised by risks that are not correlated across producers, similar to the risks underlying liability, automobile, life and other types of uncorrelated private-sector types of insurance.

How the programme operates

Although product specifics can often be complicated, the basic conceptual operation of the United States crop insurance programme is relatively straightforward. For an individual producer, the purchase of insurance involves the exchange of a fixed payment (the premium) for protection from uncertain, but potentially large, losses. When a loss occurs, virtually all types of crop insurance policies require a deductible, meaning that the individual must assume a portion of the value of the loss.

Indemnities compensate individuals for losses up to the level of the insurance guarantee, which is based on the deductible chosen by the insured (within ranges set by policy terms).

The multi-peril crop insurance programme has generally operated in this manner since 1938, and has likewise had several common features throughout its history. Since its inception, the Federal crop insurance programme has been voluntary,[2] providing producers with the choice in each year as to participation. Participating producers pay a premium to cover part of the policy cost. Significant subsidisation of the remainder of the premium, as well as other programme facets, is made by funds authorised by Congress. The programme insures against all natural perils, including drought, excessive moisture and flooding, frosts, insect and disease damage, hurricanes, hail, and other events, but not theft or negligence. Since 1980, private companies deliver policies; these are some of the same companies (with agents in small towns) that also may offer homeowner, vehicle, and other types of insurance.

While the programme's operation has had many similarities over time, the pressures imposed upon it have changed considerably. In the mid- and late-1980s, participation (measured as insured acres divided by total eligible acres) was generally in the 25-33% range and the actuarial soundness of the programme was approximately 1.5. Actuarial soundness is measured by the loss ratio, which is calculated as total indemnities divided by total premium (including the premium subsidy). Although the loss ratio would be expected to be high in disastrous years, a ratio of 1.5 for many years means that, on average, USD 1.50 in indemnities were paid relative to each dollar in total premium. With high programme costs and low producer participation – as well as *ad hoc* disaster assistance in 1988-94 – Congress decided to reform the programme in 1994.

The resulting Federal Crop Insurance Reform Act of 1994 increased the level of the premium subsidy provided to producers, as well as grower participation. With passage of the 1994 Act, Congress introduced catastrophic (CAT) coverage, for which growers do not pay a premium. Rather, producers who choose to obtain CAT pay an administrative fee, currently at USD 60[3] per crop per county. CAT policies pay for losses below 50% of a producer's average yield (based on a 4- to 10-year "actual production history", or APH, yield series for the grower). When a qualifying loss occurs, indemnity payments are made at a rate of 55% of the maximum price (typically based on a projected season average price) set by USDA's Risk Management Agency.[4]

Producers select among a wide variety of coverage levels. More specifically, they can obtain multi-peril crop insurance at levels between 50 and 75% of APH yield, using 5% increments. Growers also select a price coverage level of up to 100% of a price set by the Risk Management Agency. Coverage above the catastrophic level, up to a maximum of 75/100[5] (the first number refers to the yield coverage and the second to the price coverage level), is termed "buy-up" coverage. Producers receive indemnities under the programme according to the following equation:

Indemnity = Max [(Guaranteed yield – actual yield), 0] * Price guarantee.

Within this equation, the guaranteed yield is calculated by multiplying the producer's APH yield by the coverage level that he or she selects. To illustrate, assume that a soybean producer has an APH yield of 40 bushels per acre, and selects a coverage level of 75%. The guaranteed yield is then 30 bushels per acre (40 multiplied by 0.75). If the actual yield is 20 bushels in a given year, an indemnity would be paid on the 10 bushels (30 – 20) of shortfall from the yield guarantee. If the actual yield is above the guarantee, the farmer receives no indemnity. The price chosen by the farmer places a dollar value on the loss. If the farmer chose a USD 5 per-bushel price election, for example, the indemnity would total USD 50 per acre (10 bushels multiplied by USD 5 per bushel).

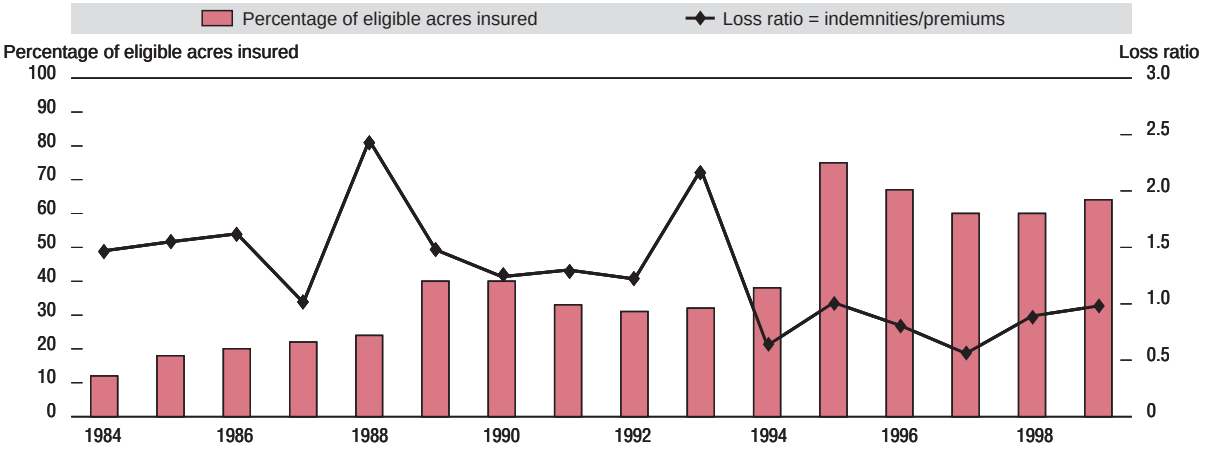
Except at the CAT level, producers pay a premium for coverage. The Risk Management Agency of the United States Department of Agriculture (USDA), which determines rates for multi-peril crop insurance policies, sets rates so that, to the extent possible, expected premiums (including the subsidy) are in balance with total expected indemnities. Since 1990, USDA has increased premium rates substantially for certain crops and in selected areas, and loss ratios have declined from the high levels realised in the 1980s (Figure 1).

Types of subsidisation and costs to the government

Since 1980, the crop insurance programme has been federally supported in several ways: subsidies on premiums faced by farmers, administrative and operating subsidies to the private companies that deliver insurance policies (formerly called delivery expense reimbursement), underwriting losses (when indemnities exceed premiums), and costs of operating the Risk Management Agency.[6] Between 1995-99, USDA spent about USD 1.3 billion per year for premium subsidies, administrative subsidies to the companies, net underwriting losses and administrative costs (Figure 2).[7] These costs to the Government are explained in this section.

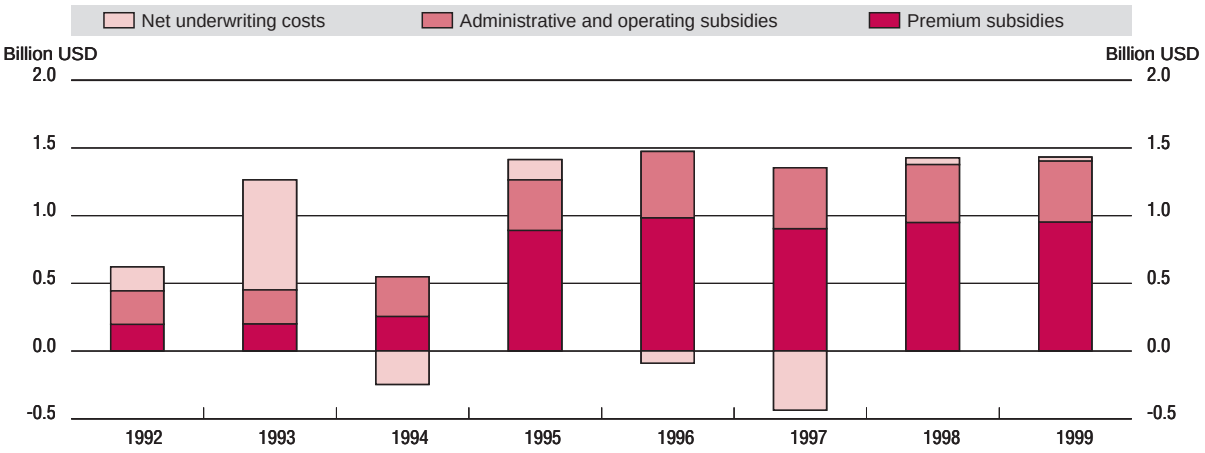
The 1994 Reform Act had a major impact on the premium subsidy, which is a major cost to the Government associated with the programme. Since 1980, the premium paid by producers has been subsidised, with the subsidy depending on the level of coverage. At 65% yield coverage, indemnified at

Figure 1. **Participation rates and loss ratios, 1984-99**



Source: US Department of Agriculture.

Figure 2. **Government costs of federal Crop Insurance, 1992-99**



Source: US Department of Agriculture, Economic Research Service.

100% of the projected price, for example, the premium subsidy was 30% between 1980 and 1994. Under the Reform Act, however, the subsidy for this level of coverage is 41.7% of the total premium. The subsidy varies with other levels of coverage and by type of product.

The increase in premium subsidy and the introduction of CAT coverage (as well as revenue insurance starting in 1996) have had a major impact on participation – and on the costs to the Government. In 1995, the first year of the Reform Act, participation increased to about 80%, partly because of "linkage" in 1995 and partly due to the higher subsidy. The "linkage" provision in the Reform Act (which was greatly disliked by many producers) required that farmers participating in the annual commodity programmes (*e.g.* those eligible for commodity loans and deficiency payments) also obtain at least the CAT level of insurance coverage.

The 1996 Farm Act eliminated linkage and, as a result, CAT participation dropped by about 28 million acres in 1996. It has declined each year since, falling in 1999 to less than half of its 1995 level. In contrast, participation at "buy-up" levels grew modestly between 1995 and 1998, and rose sharply in 1999 as additional premium discounts reduced producers' costs. Total costs to the Government have risen substantially since the 1994 Reform Act. This is largely due to the higher subsidy (which raises the cost to the Government for each policy sold) and in part because of greater participation (which results in more policies that are subsidised). Between 1995-99, the premium subsidy component of government costs averaged about USD 930 million annually.

Under privately-offered insurance policies, premiums include the costs associated with paying agent commissions, paperwork, and other related expenses as well as profit. With the Federal crop insurance programme, however, this is not the case. The Risk Management Agency separately provides administrative and operating subsidies to insurance companies to cover the costs of selling and underwriting policies, adjusting losses, and processing policy data.[8] As of 1999, companies were reimbursed for their sales and service expenses at 11% of total premium for CAT coverage, and 24.5% of total premium at buy-up levels for APH insurance. The buy-up reimbursement is higher than for CAT because of the higher probability of claims, and the associated added paperwork and loss adjustment likely to be realised by the companies. The expense reimbursement to private companies averaged between 1995-99 about USD 430 million annually.

In addition, the Government reinsures private companies that sell policies (*i.e.* shares in the risk of loss) to help reduce financial losses in years of widespread disasters. Companies can also earn underwriting gains when certain conditions are met, as determined in the Standard Reinsurance Agreement (SRA). The companies can obtain additional reinsurance in commercial markets. In 1992, the companies' total capital at risk – the maximum losses after USDA reinsurance – was about USD 227 million. Since then, as risk-sharing provisions of the SRA have been renegotiated to place more risk on the companies, and the size of the crop insurance business has grown, the companies' total capital at risk has grown to about USD 1.5 billion.

With the exception of 1993, growing conditions have been generally favourable in the United States since 1992 and company underwriting gains have been sizeable. Underwriting gains totalled about USD 1.1 billion over 1992-98, an average of about USD 155 million per year. Over 1995-99, the average annual underwriting gain was about USD 255 million. The average, however, masks wide variation among areas, companies and years. For instance, net underwriting gains in 1997 were USD 352 million, while yield losses due to floods and cool weather in 1993 were responsible for net underwriting losses of USD 84 million.[9] While the potential for underwriting gains is large, the private companies are also exposed to significant potential losses. For example, had the 1988 drought occurred in 1998, when more acres were insured and the companies' risk exposure was larger, it is estimated that net underwriting losses would have exceeded USD 450 million.

Overall, taxpayers' contribution to funding the programme is substantial, as are the premiums paid by producers. In 1999, growers paid about USD 950 million in crop insurance premiums for about USD 31 billion in guarantees. About 180 million acres of crops were covered in that year. Of that total, some type of insurance product covered about two-thirds of planted corn, soybean and wheat acreage.

Revenue insurance and other new insurance products

Since the early 1990s, the variety of insurance products, guarantee levels and crops included in the Federal crop insurance programme has grown substantially. Insurance product choices have expanded from a single offering – individual-farm yield insurance – to include area-yield insurance and a variety of crop revenue insurance products. Guarantee levels have been enhanced in some areas. In addition, the list of crops for which insurance is available has grown from about 50 in the early 1990s to more than 70 in 2000.[10] Crops currently covered include not only major field crops (corn, wheat, cotton, etc.), but also many types of fruits, vegetables, and nuts (such as cherries, blueberries, stonefruit, almonds, and walnuts), certain speciality crop trees (carambola, mango), nursery stock, and rangeland.

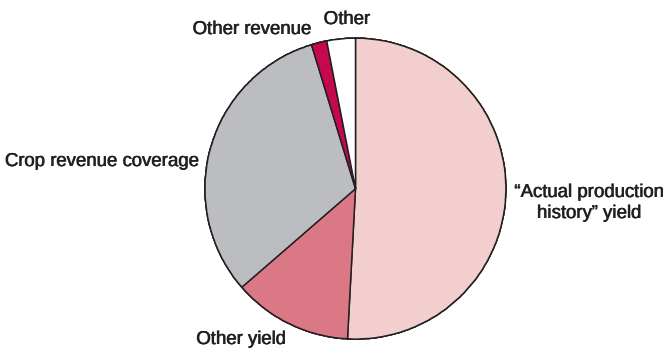
Starting with the 1990 Farm Act, Congress encouraged the development of new types of policies, particularly with involvement from the private sector. Group Risk Plan (GRP) insurance, which is based on county (rather than individual) yields, was first introduced on a pilot basis in 1993 and has been expanded to nearly all major field crops in the late 1990s (Skees, Black and Barnett, 1997). Because GRP is based on county yields, producers with significant yield losses may find themselves unprotected because the county yield does not warrant an indemnity payment. Various studies have shown that GRP is most effective at protecting individual yield risk when a strong correlation exists between individual and county-level yields (Miranda, 1991; Glauber, Harwood and Skees, 1993). Participation in GRP remains low, in aggregate, relative to individual yield-based insurance.

In addition, both producers and policymakers have expressed considerable interest since the early 1980s in the concept of revenue (and cost of production) insurance. In the 1981 Farm Act, for example, Congress mandated a study on the feasibility of revenue insurance. In the 1994 Federal Crop Insurance Reform Act, Congress mandated a cost of production insurance plan that was to compensate producers for reductions in yield and/or price resulting from an insured cause. In the 1996 Farm Act, Congress clearly signalled the need for introducing pilot revenue insurance programmes, in part due to the elimination of deficiency payments in that year, which formerly provided an element of price protection.

While individual farm yield (or APH, for actual production history) crop insurance still accounts for the bulk of Federal crop insurance business at the national level, the new revenue insurance products, in particular, have attracted considerable interest (Figure 3). Two revenue insurance products – Income Protection (developed by USDA's Risk Management Agency) and Crop Revenue Coverage (developed by a private insurance company) – first became available for a few crops and in selected areas in 1996. These products were expanded to more areas in 1997 and 1998. Revenue Assurance (designed by another private company) was added for the 1997 crop year. Since the introduction of revenue insurance, more crops and more areas have been added, and revenue insurance has come to cover a substantial portion of insured acreage in some areas. Not all of these revenue insurance products, however, are available in all areas.

The revenue insurance products are similar in that they are based on expected revenue, but each has different features. Each product combines price and yield risk protection in one programme, providing protection against low yields, a decline in prices, or a combination of both. Indemnities under each plan equal the amount, if any, by which guaranteed revenue exceeds the revenue realised at harvest. All products calculate guaranteed and realised revenues based on farm yields and futures prices at sign-up and harvest time. All use policy terms associated with basic coverage under the

Figure 3. **Share of premium, by insurance plan, 1999**



Source: US Department of Agriculture, Economic Research Service.

multi-peril crop insurance programme. In addition, each product requires that producers pay a premium for coverage, which is subsidised by the Federal government in a manner similar to multi-peril crop insurance.[11] The Government also reinsures private companies against a portion of the losses associated with each of the products, and provides reimbursement for delivery expenses. Each product is unique, however, in its exact coverage design, its rating methodology, and the producer's ability to subdivide acreage into individual parcels for insurance purposes.

Crop Revenue Coverage (CRC), the most popular of the revenue insurance products, has been distinguished by its "replacement cost" feature. CRC allows the potential indemnity (calculated as a futures market price, multiplied by the producer's coverage level and APH yield) to increase over the season if the harvest-time futures market price is higher than the futures price used to set the guarantee at planting time. Thus, a CRC-insured producer with a production loss would be able to buy replacement production at potentially higher prices, and meet forward pricing contract obligations. Although CRC, when it was introduced, was the only product to offer the "replacement cost" feature, Revenue Assurance (RA) adopted in 1999 a "replacement cost" option similar to CRC. The Income Protection product has always used a fixed revenue guarantee based on an average of planting futures price quotes for harvest delivery, and does not provide for a price increase over the season. Each of the products calculates the harvest-time revenue as the product of the producer's realised yield and the harvest-time quote on the futures contract. Indemnities are the difference between the guarantee and the harvest-time revenue.

Revenue insurance has been especially popular for corn and soybeans, crops that were the initial focus of the privately-developed RA and CRC. In 1999, revenue insurance products accounted for about half of the corn and soybean acres insured above the CAT level. These products covered more than 65% of corn acreage insured above the CAT level in Iowa and 55% in Nebraska, and more than 50% of above-CAT insured acreage for soybeans in these two states. Although wheat accounts for a smaller portion of the overall crop insurance business than corn or soybeans, revenue insurance policies covered more than one-quarter of the wheat acreage insured above the CAT level in 1999 in Kansas and North Dakota, major wheat producing States.

Revenue insurance choices continued to expand in 1999 with the introduction of Group Risk Income Protection (GRIP) and Adjusted Gross Revenue (AGR) insurance. GRIP adds a revenue component to Group Risk Plan (GRP) area-yield insurance. GRIP coverage is based on county-level revenue, calculated as the product of the county yield and the planting period futures market price. GRIP is available for corn and soybeans under a pilot programme in selected counties in Iowa, Illinois, and Indiana where GRP is offered.

In contrast to GRIP, which is offered on a commodity-by-commodity basis, AGR, the second new product, offers coverage on a whole-farm basis. AGR bases insurance coverage on income from agricultural commodities reported on the Schedule F of the grower's Federal income tax return. AGR targets producers of crops – particularly speciality crops – for which individual crop insurance programmes are not presently available. Producers who obtain AGR must obtain crop-by-crop coverage to insure crops for which such individual plans are available when the individual plan crops make up more than half of the farm's expected revenue. In these cases, the AGR whole-farm liability and premium are adjusted. AGR is currently offered only in selected counties.

In addition to the growth in variety of insurance plans, the range of insurance guarantees (the product of expected yield or revenue and percentage coverage level) has been expanded. This has been in part because many farmers believe the 25% deductible is too high and would like to see greater coverage (*i.e.* a smaller deductible). As a result, the Risk Management Agency increased the maximum coverage level for selected crops in selected areas from 75% to 85% for the 1999 crop year. One area included counties in the central Corn Belt where many growers have historically insured at the maximum level and where losses have been infrequent. The other area focused on counties in the Northern Plains where recent low yields may have reduced the yield history on which guarantees are calculated. Higher coverage levels are more costly. The premium charged for 85% coverage is generally about 81% higher than that for 75% coverage, and the premium on the marginal coverage above the 75% level is unsubsidised.

While the maximum coverage level has been a concern to some growers, others have focused on the effectiveness of CAT coverage. As noted earlier, CAT is a low coverage level – here 50% of the expected yield is covered, with pay-outs on losses at 55% of the expected price – for which producers pay a flat fee of USD 60 per crop per county. Despite the minimal cost of CAT to producers, many have questioned whether it provides adequate coverage. The yield trigger, at 50% of the expected yield, has been criticised as too low to provide a benefit except in rare cases and the maximum indemnity, at less than 30% of the expected value of the crop, has been criticised as inadequate. The intent of CAT coverage, however, was not to provide significant coverage but to provide minimal coverage to many producers.

How effective are various risk management tools?

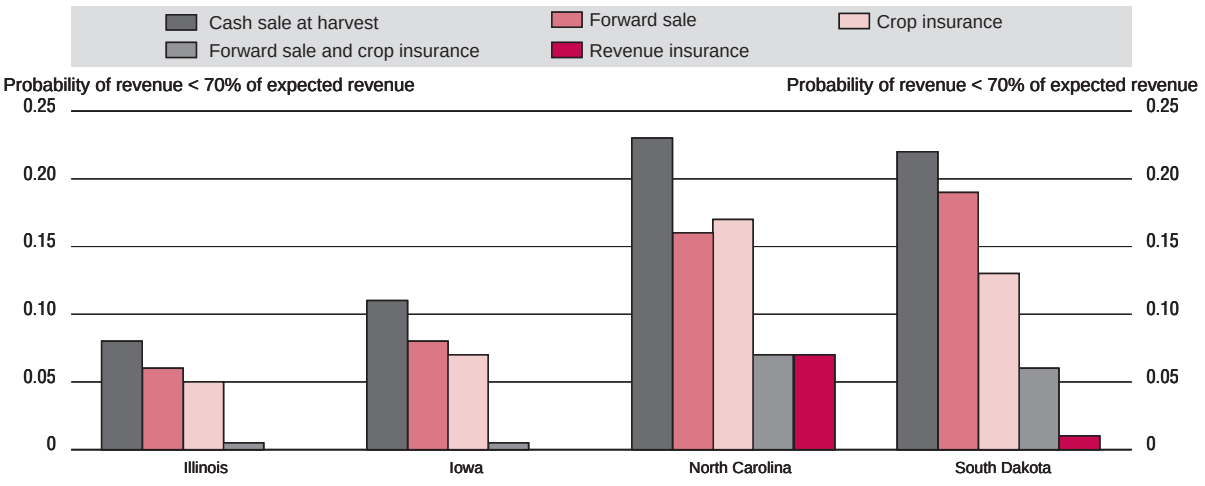
The many options available for managing income risk lead to questions about their effectiveness and about how they can best be combined, and particularly, their relative effectiveness in different regions. To address these questions, USDA's Economic Research Service examined four risk management strategies: forward selling a portion of expected output (for example, through a futures hedge); purchasing crop insurance at the 75% coverage level; combining crop insurance and a forward sale; and purchasing revenue insurance at the 75% coverage level (based on a fixed price guarantee). Although there are many ways in which risk can be measured, the approach used here assumes a "safety first" criteria, where risk is measured as the probability of revenue falling below 70% of expected revenue.

In making the comparisons, the Economic Research Service focused on risk and did not estimate the effects of the different strategies on average revenues. Forward selling generally has little effect on average revenues, but with government subsidies, crop and revenue insurance increase average revenues for most farmers. Subsidisation provides an additional incentive for farmers to insure.

The effects of the four strategies were compared with the use of a "no risk-reducing strategy" for representative corn producing locations in Illinois (in the central Corn Belt), Iowa (in the central Corn Belt), North Carolina (on the East Coast) and South Dakota (in the Great Plains). This strategy assumes that producers sell their crops at harvest for the local cash prices. As seen below, the effectiveness of the various risk-managing strategies varies by location. These differences stem largely from differences in yield variability, yield-price correlation and basis variability among the locations.

The results indicate that a representative corn producer in Iowa or Illinois who does not sell forward or buy crop insurance would expect, on average, that revenue would be less than 70% of pre-planting expectations, based on the producer's history, about 8-11% of the time (Figure 4). In

Figure 4. **Probability of low revenues for corn producers**



Source: US Department of Agriculture, Economic Research Service.

contrast, the probability of such a low revenue is much higher in North Carolina or South Dakota, about 20-25% of the time. This is because yields are more variable in North Carolina and South Dakota than in the central Corn Belt. Moreover, the negative relationship between yield and price, called the "natural hedge", is relatively weak in North Carolina.

The natural hedge is an important concept in analysing risk. In the major producing areas of the Corn Belt, for example, widespread low corn yields can cause prices to increase significantly. Conversely, low prices are often associated with bumper-crop years. This partially "offsetting" relationship between prices and yields tends to stabilise farm revenues over time in these areas. Yield and price variations are less likely to offset each other where the natural hedge is weak. In states such as North Carolina, low corn prices and low yields (or high prices and high yields) are more likely to occur at the same time than in the Corn Belt, making corn revenues inherently more variable. This is because these areas have less impact than the Corn Belt on national output and prices.

Forward selling, either through futures hedging, buying a put option, or forward contracting with a local elevator, reduces risk modestly compared with the "no strategy" case, although the impact varies considerably across locations. When the optimal amount is sold forward, the probability of revenue amounting to less than 70% of expected levels declines to 6-8% in the central Corn Belt and to 15-20% in North Carolina and South Dakota. Forward selling reduces revenue risk substantially in North Carolina, where the natural hedge is relatively weak.

Each of the various forward selling methods has pros and cons depending on the farmer's situation and risk preferences. Futures hedging ensures a highly competitive price, for example, but requires access to credit or cash reserves to meet margin calls if prices rise substantially before harvest. In contrast, buying put options gives producers the right (but not the obligation) to sell a futures contract at a specific price. Put options provide protection against price declines, without completely eliminating opportunities to gain from price increases, but there is a premium cost. Cash forward contracting with a local buyer is the simplest for many farmers and assures a physical outlet, but offers less flexibility and may not result in the highest price.

Crop insurance tends to be more effective when used alone than is forward pricing in reducing revenue variability. The effect is the greatest in South Dakota, where yields are more variable than in the other three states in the Economic Research Service study. Whether crop insurance or forward selling is more effective by itself depends on the relative variability of yields and on the fact that crop insurance typically offers a maximum of 75% coverage.

When a producer combines a forward sale with the purchase of crop insurance, the probability of low revenue is reduced dramatically for each of the locations, compared with the no-strategy case. The two strategies complement each other strongly, particularly where the natural hedge is strong. Probabilities of revenues below 70% of expectations are reduced significantly in every case and reduced to nearly zero in Illinois and Iowa.

The greatest risk reduction among the alternatives examined is provided by 75% coverage revenue insurance. (The revenue insurance plan assumed here is an intra-seasonal guarantee based on individual farm yields and futures price projections, and does not allow coverage to increase over the season. As a result, this product is more like Income Protection than either CRC or RA.) Such coverage reduces the probability of revenues less than 70% of expectations to zero, except for risk associated with differences between local prices and futures prices at harvest-time (*i.e.* basis risk).

These examples show that probabilities of revenues falling below 70% of expectations at the time the insurance was contracted can be reduced substantially by combining forward pricing and crop insurance. Direct revenue insurance can be even more effective in reducing probabilities of such low revenues. Moreover, the consistent use of these strategies in successive years can be expected to reduce year-to-year variability in revenues because sign-up time yield and price expectations are less variable than the yields and prices realised at harvest.

Emergency assistance and insurance reform

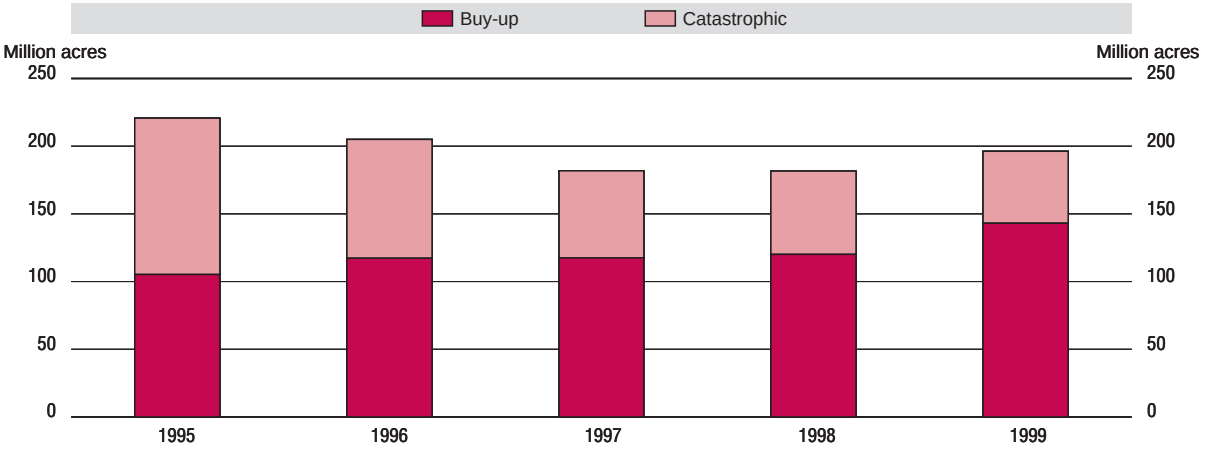
Despite the risk reduction associated with many public and private sector tools, a combination of events since 1996, including low commodity prices and low yields in certain areas, have caused financial reverses for many farmers, and put added pressure on policymakers for assistance. Prices for many field crops have trended downward since 1996, primarily due to large global supplies and weak demand. The season average price received by soybean farmers for the 1999/2000 crop year, for example, is projected to be the lowest since 1973 and for cotton farmers, the lowest level since 1974. Many producers affected by these low prices have felt that the risk management tools either were not available or were not practical for the situations that they faced. In response, Congress passed legislation in both 1998 and 1999 making emergency income and disaster-based payments to farmers.

The direct payments associated with these disaster relief measures were quite sizeable in both years. For fiscal year 1999, approximately USD 6 billion was appropriated for various types of assistance including: market-loss assistance (direct payments in response to low prices) and multi-year[12] and single-year[13] crop assistance for yield losses, some of which was used for crop insurance premium discounts. The discount reduced the premium paid by producers by about 30%. For fiscal year 2000, about USD 9 billion was appropriated, including approximately USD 5.5 billion in market-loss assistance. This total also included funding for single-year crop-loss assistance, as well as USD 650 million for additional crop insurance premium discounts for 2000 crops (which are expected to reduce the premium paid by producers by about 25%).

The increase in the premium subsidy appears to have had an impact on producers' choice of coverage levels and among insurance products for the year 1999. In comparison with 1998, net acres insured increased by more than 15% and total premium increased by more than 30%. At the same time, buy-up business (including both APH and revenue insurance policies) increased substantially (Figure 5). Although the bulk of the crop insurance business remains at the 65% coverage level – where the percentage premium subsidy is the highest – the share of net acres insured at the 70 and 75% coverage levels increased significantly (Figure 6).

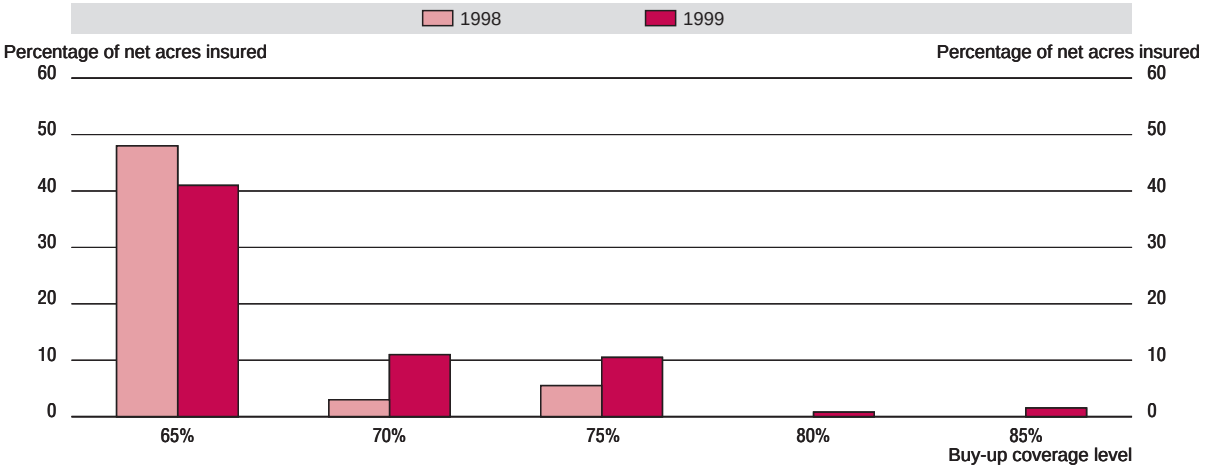
While emergency funding through agricultural appropriations bills is a year-to-year event, the fiscal year 2001 budget resolution provided an additional USD 8.2 billion to increase crop insurance subsidies (including premium subsidies, expense reimbursements for the companies, and other costs)

Figure 5. **Net acres insured, by coverage level, 1995-99**



Source: US Department of Agriculture, Economic Research Service.

Figure 6. **Shares of insured acres, by coverage level, 1998-99**



Source: US Department of Agriculture.

for fiscal years 2001-2005. As of May 2000, the House and Senate each passed a crop insurance bill. Both bills provide additional premium subsidies for producers as well as other provisions. The House and Senate agriculture committees are working on a compromise bill.

Does subsidised insurance distort production and trade?

Pending legislation to increase the subsidisation of the Federal crop insurance programme raises questions as to the impact on production and trade. More specifically: "to what extent do crop insurance subsidies contribute to overproduction, depressed prices and consequent trade distortions?" In theory, insurance can increase crop production by encouraging farmers to plant crops that might otherwise be too risky to produce. By subsidising insurance, the government creates an additional incentive of raising average profits over time as farmers receive more in indemnities than they pay in premium. Indeed, it has been the explicit policy in some developing countries to use subsidised crop insurance to encourage farmers to switch from traditional crops to more profitable, yet somewhat riskier crops (Mishra, 1996). What are the effects of crop insurance in the case of United States crop production?

It must be recognised, of course, that a variety of factors, both economic and otherwise, influence farmers' cropping decisions. From an economic standpoint, a farmer is interested in which crop provides the highest net return. Each crop's net return is a function of its market price, yield, production costs, and other factors such as government payments. Are the net benefits of crop insurance large enough, relative to these other factors, to cause a switch in crops?

The table below shows net indemnities (indemnities minus farmer-paid premiums) per acre across all coverage levels and product choices made by producers over the 1990-99 period for corn, soybeans, wheat, and cotton. These crops are most important in terms of insured acres, representing over 80% of the acres insured in 1999. Clearly, the net benefits of insurance vary from year to year, depending on weather and other factors affecting yields. As a caveat, notice that these data may imperfectly represent future loss patterns, since they cover a relatively short time with regard to weather patterns, and since there were considerable changes in premium levels, participation rates, and coverage levels chosen over the 1990s. Even so, the results are instructive.

The table below shows that average net indemnities were USD 1.54 per acre for corn, USD 0.95 per acre for soybeans and USD 3.46 per acre for wheat over the 1990-99 period. For both corn and soybeans, however, large areas of the Corn Belt realised net indemnities that were actually negative; that is, farmers paid more in premiums than they received in indemnities. Similar analysis for wheat shows that

Net indemnities (indemnities – farmer premiums) per acre for major US field crops during 1990-99 in US dollars

	Crop			
	Corn	Soybeans	Wheat	Cotton
1990	–1.58	0.69	0.93	10.03
1991	3.91	1.90	3.42	24.59
1992	0.54	–0.92	3.26	52.82
1993	20.85	11.63	4.59	7.30
1994	–4.91	–2.54	2.50	–1.49
1995	2.97	1.33	2.32	12.91
1996	–0.20	–0.46	4.84	14.55
1997	–2.08	–1.13	1.66	5.71
1998	1.03	0.80	0.28	27.41
1999	1.21	2.08	8.49	21.87
1990-99 average[1]	1.54	0.95	3.46	17.56

1. Weighted average based on acres insured each year, adjusted for inflation and expressed in 1999 USD; annual results in nominal dollars.
Source: USDA.

the primary wheat producing regions receive an average net indemnity between USD 0 and USD 10 per acre. Net indemnities for cotton were somewhat higher, with a national average of over USD 17 per acre. There were also significant differences across production regions: Texas cotton received a net indemnity of over USD 20 per acre, while the lower Mississippi River valley area received less than USD 10 per acre, due to the fact that most acres there are insured at the CAT coverage level.

How do these average net indemnities compare with crop costs and returns? In the case of corn and soybeans, average net indemnities represent less than 1% of expected gross revenue and less than 2% of returns over variable costs in 1998. Net indemnities for cotton and wheat each averaged to about 8% of returns over variable costs in 1998. Of course, returns vary from year to year and also across regions, but it appears that in the past, average net indemnities have represented a fairly small amount relative to expected revenues and costs for these major crops.

In comparison, other United States government programmes supporting farm income have created far bigger subsidies that influence cropping decisions. Loan deficiency payments (LDPs) are most notable in this regard over the last two years. For corn, LDPs provided an average return of about USD 24 per acre in 1998 and USD 37 per acre in 1999. In years with low prices, LDPs provide far greater incentives to farmers than does crop insurance.

It may be helpful to interpret LDPs and crop insurance coverage as option contracts when examining their incentive effects. An LDP can be thought of as a free option with respect to price, which goes "in the money" when the expected market price drops below the marketing loan rate. When prices are quite low, it is deep in the money and represents considerable value. In contrast, crop insurance works like a partially subsidised option on yield, but it is "out of the money" because the yield coverage deductibles preclude indemnities under normal growing conditions. Its value will necessarily be lower because the benefits of crop insurance are contingent on low yields.

There have been a few situations where crop insurance has functioned like an in-the-money option with considerable effect. The most notable case occurred in 1999 for durum wheat CRC contracts in the Northern Plains. The price coverage component was set inaccurately in that year and in effect guaranteed producers nearly an extra dollar per bushel, or about USD 40 per acre. A significant number of producers signed up for the policy and durum planted acres in 1999 were 15% higher than in 1998. This was the case even though spring 1999 farm prices for durum were at five-year lows, down about 40% from spring 1998 farm prices.

A few studies have attempted to rigorously quantify the effects of insurance on cropping decisions, but their estimates have varied significantly and to date there is no single study that is considered a definitive work on the subject at the national level. Some of the challenges faced by earlier studies

include: finding data that reflect crop costs and returns at the local level, where cropping decisions are made; incorporating the contingent benefit of crop insurance with other expected returns when analysing cropping choices; and isolating statistically the effects of crop insurance from the effects of other variables such as price and other government programmes as well as macroeconomic policies such as treatment of capital gains. USDA's Economic Research Service recently started a project that can hopefully resolve some of these questions.

The brief evidence presented here suggests that crop insurance may have some effect on crop choice, but its net benefits appear to be relatively small in comparison to expected crop returns; in most cases, insurance probably plays only a minor role in cropping decisions. As a result, its distorting effect on output, prices, and trade are likely small. However, if premium subsidies increase in the future, these effects will undoubtedly become greater. This may be particularly important in regions where higher-value crops like cotton and soybeans have recently begun to encroach on lands traditionally planted to lower-value crops like wheat.

NOTES

1. Other economists argue that private insurance fails because certain farmer responses to risk, such as diversification and the smoothing of consumption over time through savings and borrowing, greatly reduce the added effect of insurance in smoothing consumption and make insurance unattractive when offered at competitive rates (Wright and Hewitt, 1994).

2. In 1995, producers who participated in the annual commodity programmes and received certain other farm programme benefits were required to obtain at least catastrophic coverage. As a result, many producers in that year did not view insurance as a "voluntary" option, but one required due to this "linkage" provision. See later discussion for more details.

3. Before 1999, producers paid an administrative fee of USD 50 for CAT coverage.

4. Starting in 1999, CAT coverage declined from 50% yield and 60% price coverage to 50% yield and 55% price coverage.

5. In some counties, coverage is now available at the 85/100 level. See later discussion for more details.

6. The Federal Crop Insurance Reform Act of 1994 legislated that operation of the programme (including the setting of premiums) is to be conducted in a manner so that the loss ratio (total indemnities divided by total premium) is not to exceed an expected maximum of 1.075 over the long run. In recent years, loss ratios have averaged less than 1.0, in part due to relatively favourable weather on average across the country, and in part due to premium rate increases.

7. The administrative costs associated with funding USDA's Risk Management Agency are appropriated annually by Congress, and are currently about USD 65 million per year. This funding supports the Risk Management Agency's development of rates and policy terms for the multi-peril crop insurance programme, the research and development costs associated with new products, compliance functions associated with private companies delivering policies, and other activities.

8. Sixteen insurance companies delivered crop insurance in 1999. The companies' insurance portfolios vary in size and scope. The four companies with the largest amounts of crop insurance account for about two-thirds of the volume of total premium and each delivers insurance in about 40 states. While these companies have large and widely-spread portfolios, other companies deliver smaller amounts of crop insurance over smaller areas. Most of the companies with small portfolios deliver policies in five or fewer states, and tend to operate in low-risk states. About 18 000 crop insurance agents work for these companies, either as independent or captive agents.

9. Under the SRA currently in effect, losses of the companies in 1993 would have been substantially larger.

10. Crops as defined by the Risk Management Agency typically include all types (such as winter wheat, durum and other spring wheat) or all varieties (such as pinto beans, kidney beans, etc.) that may be considered separate crops by others.

11. The premium subsidy for revenue coverage cannot exceed the amount of subsidy on APH yield coverage at a comparable level.

12. Under the multi-year provisions, USDA compensated insured farmers with losses in three or more years from 1994 through 1998 with an additional payment equal to 25% of insurance claim payments made during that period. Producers could not receive a payment for both multi-year and single-year losses.

13. Under the single-year loss provisions, farmers were compensated if their losses exceeded 35% of their historic yields. Farmers with eligible losses of insured crops were compensated at 65% of the crop insurance market price election; those without insurance were compensated at a rate of 60%. Producers receiving assistance were required to obtain insurance in both 1999 and 2000.

C.2. Insurance Systems and Risk Management in Spain

by
Fernando J. B*urgaz**
E*ntidad* E*statal de los* S*eguros* A*grarios* (ENESA)
M*inistry of* A*griculture,* F*isheries and* F*ood, Spain*

Insurance systems

Agriculture, by its nature, has always been viewed as one of the forms of production with the highest exposure to the adversities of natural risk. Nevertheless, the uncertainty that surrounds farming is growing and will continue to grow as it is an activity which is at once rapidly expanding, opening its markets and recognising the need for more environment-friendly practices. As a consequence, farmers are faced with greater uncertainty and new forms of risk (it is important to bear in mind the major implications of risks which follow from market instability, economic liability for environmental damage caused by farming or affecting farming but caused by other sectors, and outbreaks of contagious disease among livestock).

To minimise the adverse effects of these risks and their economic impact on farm businesses, and to help farmers remain within the production cycle and to continue to play a vital role in rural areas, governments must take active steps to provide adequate systems of cover against the main forms of risk.

This chapter will review the systems currently available to insure farmers against natural risk, with particular emphasis on Spain's experience of agricultural insurance systems, and will suggest a number of possible future trends regarding the improvement and development of insurance systems.

Agriculture and risk

The kinds of risk that affect the development of farming are many and varied. However, risk management policies have always been devised largely to address the consequences of climate risk. Again, farming is a particularly unreliable business since production is directly linked to weather conditions. For that reason investment in farming, so crucial to expansion, carries a high degree of uncertainty. However, many other risks weigh on farming besides the climate and these can be broadly grouped under the following headings:

- ***Climate risks*:** the impact of meteorological events on agricultural production.
- ***Production risks*:** the impact of other natural factors, such as pests and disease, or of farming techniques on the final harvest.
- ***Price or market risks*:** resulting from unpredictable market trends in both inputs and outputs.
- ***Institutional risks*:** resulting from changes in the policies regulating production or trade.
- ***Environmental risks*:** resulting from the adverse effect of specific forms of farming on the environment and the impact of other sectors on agriculture.
- ***Commercial or financial risks*** also threaten other sectors of production.

* This contribution was presented in *Session* 4.A: I*nsurance systems*.

A farmer's attitude to and awareness of risk depend on many factors. As agriculture becomes more sophisticated, producers are demanding insurance systems to cover a greater number of risks. The fact that farmers in the developed world, who are subject to a wide range of possible risks, can take out cover against only a few of them (such as hail or fire) means that their genuine insurance needs are not being met. Work needs to be done on providing the broadest possible systems of insurance as an efficient means of giving farmers the chance to maintain their agricultural income when faced with situations or events that are out of their control.

Role of agricultural insurance schemes in risk management

There are many different facets to risk management in agriculture, ranging from the correct use of farming techniques (*e.g.* selecting species and varieties to suit the local environment, or diversifying into other crops or types of production) to schemes based on financial or insurance procedures. In every country, forecasting- and insurance-based systems have evolved significantly over time from the less sophisticated mutual risk-spreading schemes to agricultural insurance systems, which are probably the most advanced.

The disaster funds set up by some European countries take the narrow approach to the problem so typical of risk management in the 1960s and 1970s. Apart from the way they actually operate, they pose more general problems in that they involve too many administrative requirements and take longer than insurance systems to pay out compensation. If such funds are to compensate farmers adequately, contributions must be compulsory and cover restricted to rare events causing large-scale losses.

Another classic procedure for managing risk, reviewed and introduced in OECD countries over the past few years with substantial government support, is the use of financial mechanisms. Farmers fund a reserve account from the economic surplus earned in successful years. They can then cope with losses and low income in less successful years. To operate properly, this kind of mechanism requires sufficient initial funding to cover future losses and works best in low-risk areas.

Agricultural insurance systems are definitely the most rational and modern way of managing the risks inherent to farming. Insurance, of course, means passing on risk to an insurer who is paid a premium to bear the cost of any compensation. Farmers then factor the insurance premium into their production costs.

Advantages of insurance systems in risk management

Agricultural insurance is one of the most efficient ways of managing the risks inherent to farming as it offers clear benefits over other systems in terms of development and use. These benefits include the following:

- For farmers, it is a financial instrument that pays out compensation to stabilise their income. Compensation for any losses comes in the form of an income allowing the farmer to remain in the production cycle without incurring debt.
- It serves as additional collateral when applying for loans, improving financial solvency by offering a more stable annual income.
- It enables farmers to specialise more when expanding their business, without increasing the risks inherent to the activity.
- It gives agriculture a fair and equitable system of compensation for losses after they occur. Farmers do not have to claim *ad hoc* government support since their insurance policies entitle them to rapid compensation from the insurance company for any business losses.
- It provides additional back-up for agricultural guidance and rural development programmes. Agricultural insurance that is consistent with farm policy can help to achieve policy goals.
- Governments also benefit from the introduction of these systems, which rule out the need for *ad hoc* budgetary measures in the wake of a disaster. They already know, at the start of each financial year, how much financial input is required for agricultural insurance purposes.

- These insurance systems benefit society at large in that stable incomes help to preserve the rural population while fostering social cohesion and stability in predominantly agricultural areas.
- In another connection, it is worth remembering that the less uncertainty there is about natural disasters and unpredictable markets, the greater stability there is in output; this helps, to some degree at least, to alleviate inflationary pressure on food prices.

Basic features of the Spanish agricultural insurance system

Since virtually the turn of the century, Spain has been seeking effective insurance solutions to cope with the problem of climate risks to farming. Hence, a whole range of procedures and organisational models, from mutual risk-spreading schemes and local mutual societies to agricultural insurance systems, have been developed.

The current agricultural insurance system, launched in 1978 with the adoption of Act 87/1978, has all the hallmarks of the most sustainable system to date. It is the largest in terms of insurable risks and commodities, and the most comprehensive in that it includes all the stakeholders and, more importantly, gives them specific roles relating directly to the areas in which they have the most skill and experience.

This new system of insurance does away with the old distinction applied throughout the industry between natural risks that can be insured on the insurance market and uninsurable risks that can be covered only by *ad hoc* government intervention or disaster funds.

In 1978, a consensus between political and social forces on Act 87/1978 led to what emerged as an effective solution based on the idea that any uncontrollable risks affecting the development of farming could be insured by the private sector, with government support, provided that such cover was deemed technically and actuarially viable.

The statutes and regulations underpinning the agricultural insurance system are Act 87/1978 (see above), Royal Decree 2329/1079 approving the implementing regulations, and the Annual Insurance Plans approved by government on the proposal of the Ministry of Agriculture, Fisheries and Food. The main features of the system can be outlined as follows:

- The system covers damage to crop, livestock and forestry production from uncontrollable risks.
- Its development and use depends on joint action by the relevant public and private institutions. It is therefore an integrative system requiring consensus and full stakeholder involvement.
- The system is voluntary, both for farmers taking out insurance policies and for insurance companies choosing to co-insure, and is open to any entity wishing to join.
- The relevant terms and tariffs comply with the general principles governing insurance. Based on the characteristics of the specific type of farming and the area in question, the terms and tariffs are used by all the insurance companies in the system.
- The insurance, available countrywide, can be taken out at any local agency in the commercial insurance network. Farmers can take out individual policies or joint insurance, in which case proxy must be appointed as policyholder. Farming and breeding associations can play this role.
- One of the basic features of the system, common to any insurance system, is risk pooling. Private insurance companies provide co-insurance through a pool managed by the Spanish Group of Combined Agricultural Insurance Companies (*Agrupaciün Espan ola de Entidades Aseguradoras de los Seguros Agrarios Combinados*, SA, *Agroseguro*).
- Farmers who decide to insure a crop must include under the same policy any other parcels of the same crop they may be growing elsewhere in the country.
- Losses are assessed by independent professionals who are specially recruited for that purpose by Agroseguro and work to specially devised standards.

- The cost of this insurance to farmers is subsidised by the Ministry for Agriculture, Fisheries and Food to the tune of between 8 and 45% depending on the type of commodity and the terms set out in the policy. Regional governments also grant smaller additional subsidies.
- The system is re-insured by the Insurance Compensation Consortium (*Consorcio de Compensaciün de Seguros*), a state-owned company with its own legal personality and assets governed by private company legislation. In addition, the system as a whole has taken out re-insurance with major international companies.

Crops can be insured against leading risks such as hail, frost, flood, wind and fire. For non-irrigated crops such as cereals, olives, grapes, oilseeds, protein crops or almonds, farmers can take out "yield" insurance which provides farmers with average-harvest cover whatever the risk, including losses caused by drought. With this kind of insurance, farmers are sure that their income will cover their production costs, regardless of the climate; if they do incur losses, they recover their costs and can thus continue the production cycle.

Livestock farmers can insure their stock for mortality, compulsory culling, and temporary or permanent loss of use due to accident or disease.

These insurance policies are private agreements promoted by the following institutions, either as policyholders or insurers:

- Trade organisations and farming co-operatives, which represent policyholders (*i.e.* the final users), play an active role in developing and operating the system.
- Agroseguro represents insurers. On behalf of the private firms that own it, the company draws up terms and tariffs, inspects the policies signed by insurance agencies in the various networks, calls in premiums, deals with the subsidies covering insurance costs, evaluates losses and pays out compensation.
- Government services through various entities in the Ministry for Economic Affairs and Finance (Directorate-General for Insurance and the Insurance Compensation Consortium), in the Ministry for Agriculture, Fisheries and Food (*Entidad Estatal de Seguros Agrarios*, or ENESA) and in the Autonomous Communities.

Responsibility for co-operation between the private and public entities in the system lies with the ENESA, whose remit is to promote the system in a number of ways, and in particular:

- To draw up the Annual Agricultural Insurance Plan and implement the viability studies required before new forms of production and new risks can be incorporated into the system.
- To define the farming specifications relating to the insurance, such as growing conditions, insurable yields and guaranteed prices for the insured commodities.
- To grant crop and livestock farmers subsidies towards their insurance costs.
- To promote and disseminate insurance in the agricultural sector.

To conclude this section, it is important to note that private insurance companies and farmers alike, definitely the leading players in the system, stress how comprehensive the system is and their satisfaction with the way it operates.

Main initiatives in Spain in recent years

Over the past few years, Spain's Ministry of Agriculture, Fisheries and Food has focused on enhancing and perfecting the agricultural insurance system to offer crop and livestock farmers greater cover and stability in terms of income. Below are the main steps it has taken, in terms of importance and impact on the sector:

- In 1997, cover was extended to all forms of agricultural production when the insurance system was broadened to include some economically significant types of commodities that had previously been uninsurable. A special form of insurance was introduced to give these farmers a chance to take out cover against the basic risks liable to cause losses.

- The year 1998 saw a great breakthrough in agricultural insurance with the introduction of general flood damage cover available to all farmers. Policyholders with commercial companies now receive compensation for losses caused by floods or torrential rain under the agreed terms, without the government having to take *ad hoc* measures for damage to crops and livestock.
- More was done in 1999 to enhance specific types of insurance and extend cover to new risks. In particular, additional cover was provided for beef farmers to increase compensation for compulsory slaughtering on public health grounds. For insured livestock culled as part of an official eradication campaign, insurance companies pay farmers the difference between the official compensation rates for culling and the full market value of the slaughtered livestock.
- Today, in the year 2000, the system has been extended to cover drought damage to non-irrigated crops. This has become possible thanks to yield insurance covering common crops such as cereals, legumes, oilseeds, olives and grapes.

In the agricultural insurance system, Spanish growers and breeders therefore have a regulatory framework that allows them to cope with the economic implications of damage from virtually any natural risk, without having to incur debts or apply for *ad hoc* government support.

Agricultural insurance in Spain today

The table below summarises the main features of agricultural insurance in Spain today.

Main features of agricultural insurance in Spain

Insurable commodities	• All types of crop production, including materials used to cover crops. • Beef, sheep and goat production. • Specific forms of fish farming (sea-bream, bass, turbot, trout and mussels).
Risk covered	• For crops, the main natural risks (hail, frost, flood, drought, wind, fire, etc.). • For livestock, mortality or culling, whether accidental or due to specific diseases. • For aquaculture, accidental damage, losses due to contamination or specific diseases.
Number of policyholders	• Over 350 000 growers, livestock farmers and fish farmers.
Rate of insurance	• About 45% for all agricultural commodities, and figures in excess of 70% for crops such as cereals or orchard fruit. • About 15% in insurable livestock products. • About 5% in insurable fish products.
Value of insured assets (in 1999)	• Over ESP 700 billion (euros 4 207 billion).
Cost of insurance (in 1999)	• Over ESP 50 billion (euros 300.5 million).
Government subsidies towards insurance costs (in 1999)	• ESP 23 billion (euros 138.2 million).

Spain's experience: main implications

Strong expansion of the Spanish agricultural insurance system in recent years, due to ongoing enhancement, makes it one of the best systems of cover in the European Union, serving as a benchmark for international comparisons of insurance systems.

This expansion has been achieved thanks to the determination of numerous players and a combination of factors. Those I view as the keys to success are outlined below:

- ***Extension of cover to other risks*** . One of the reasons for the failure for many years of insurance systems set up in Spain was the inability of insurance companies to cover farmers for risks other than hail or fire. Since the adoption of the Agricultural Insurance Act, the insurance system has been extended over the past 20 years to cover all climate risks to farming.

- ***Involvement of private insurance companies.*** One of the conclusions emerging from an analysis of the long history of agricultural insurance in Spain is that, if the system is to operate satisfactorily, insurance needs to be provided by private companies with the government's role confined to co-ordination, promotion and dissemination.
- ***Importance of farming organisations.*** Because farming organisations and co-operatives sit on the operational and decision-making bodies of the ENESA, they could be relied upon to assist with policymaking on agricultural insurance and undertake to achieve the policy's objectives. This, in turn, has made it possible to draw up and present to farmers new types of insurance based on the reality of the situation and in full knowledge of the industry's needs.
- ***Agricultural insurance for cover against natural disasters.*** The Agricultural Insurance Act (87/1978) clearly defines the role of the insurance system as the sole means of compensating for losses due to poor climate conditions. The advantage for government was that it no longer had to grant *ad hoc* support for losses caused by insurable risks, a factor that helped to establish the insurance system and relieved some of the pressure on government from farmers demanding *ad hoc* support.
- ***Co-ordinated initiatives set up by government services and entities.*** Close collaboration between all the sectors with a stake in expanding the system encouraged them to join forces to achieve the objectives.
- ***Technical enhancement of the system.*** Much effort has generated an ongoing process of enhancement, adapting insurance to the agricultural and geographical realities of farming and risk.
- ***Government support for the system.*** Another key to the system's success has been the active support of the Spanish government throughout the 20 years of its existence. It is important to note that the Ministry for Agriculture, Fisheries and Food views this system as one facet of an effective income policy.
- ***Government re-insurance.*** The Insurance Compensation Consortium has played a major role in stabilising the system since, by acting as a re-insurer, it has enabled private insurance companies to become involved and cover new risks.

Future outlook

The main thrust of Spain's agricultural insurance policy in the future can be summarised as below.

Further developing loss insurance

Due to the substantial progress of recent years, extensive non-irrigated crops are now covered against any natural threat to harvests, including drought. This applies to common crops such as cereals, legumes, oilseeds, olives, grapes and almonds, but as yet not to intensive irrigated crops which can be insured against major risks, such as hail, frost, wind or flood, but lack additional cover against climate risks in general. In the future, there are plans to study the provision of basic supplementary insurance for irrigated crops to cover against losses caused by currently uninsurable climate risks. These new types of cover would provide comprehensive cover for farmers, who would receive compensation for climate-related losses of any kind.

Setting up income insurance

While climate can cause wide variations in yields, it is not the only uncertainty variable affecting farming. Lack of price stability, more common on certain markets (particularly fruit and vegetables) and likely to affect other crops with the liberalisation recommended under the World Trade Organisation (WTO) agreements, is a growing factor of risk. To solve this problem there is a need for specific forms of cover such as income insurance.

Income insurance guarantees farmers a basic gross income at the end of the crop year, for either a particular crop or their entire production. This insurance is in fact a combination of guaranteed yields and guaranteed prices. The usefulness of combining the two lies in the close link between output and price when losses are high. In terms of a farmer's final income, for example, substantially lower prices may be offset by higher than expected yields.

Extending cover to other sectors of production

In spite of substantial progress in the agricultural sector, there are still major branches such as forestry or fisheries with no access to insurance against specific risks. In this case, current work is focusing on the following areas:

- Inclusion in extensive livestock insurance of compensation for losses caused by pasture drought.
- Extension of the agricultural insurance system to cover forestry. Twenty years after the adoption of the Combined Agricultural Insurance Act (87/1978), cover has still not been developed for forestry. If development is to be promoted in this sector, it is particularly important to introduce cover against forest fires.

Longer-term plans also include paving the way for a new system of insurance in the fisheries sector, to help reduce the uncertainty inherent to this activity. The sector lacks cover against natural risks.

Enhancing the quality of management procedures and policyholder services

Initiatives in this area are based on the following priorities:

- Enhancing policyholder service provision to increase satisfaction with the agricultural insurance system.
- Helping to give farmers access to the system and encouraging them to remain in it by establishing policies and terms that match conditions in the farming sector.
- Including new information technologies in the management process. Although this is beginning to happen, there is still considerable room for improvement since the benefits will be felt right down the line in terms of both speed and quality.

Conclusions

The most outstanding features of the Spanish system of agricultural insurance are as follows:

- The trend towards universal coverage for farmers, in terms of the scope it offers to insure against all production risks and its application to crop, livestock and forestry production.
- The fact that the system has been devised and developed to be constantly enhanced on a trial and error basis.
- The involvement of all institutions and bodies with a stake in the system's development, *i.e.* farmers, insurers and society as a whole, represented by government institutions.
- The confidence placed in it by both farmers and insurance companies, demonstrated by the high take-up rate and strong expansion.
- Its financial success, attributable to its technical sophistication in terms of both definition and use.
- The commitment by government to co-ordinate, encourage and promote the work required to ensure real expansion.

To conclude, it is important to stress that agricultural insurance is an effective, modern instrument that can help to achieve such important objectives as maintaining farmers' living standards and promoting the economic development of the countryside. Insurance systems are a valid means of protecting the agricultural sector, hence the importance of setting up international working parties to pool experience and thereby help to enhance and perfect insurance systems in every country.

C.3. Agricultural Insurance Programmes: Challenges and Lessons Learned

by Jerry R. Skees,*
H.B. Price Professor, University of Kentucky, United States**

Government-subsidised agricultural insurance is costly, complex and leads to potentially significant inefficiencies. If efficiency is a performance goal, there are no successful experiences with government supported farm-level crop insurance in the world. The challenge in many countries is how to offer affordable and workable crop insurance. A large part of that challenge includes the quest on how to best use government versus the private sector when attempting to start a government-supported agricultural insurance programme. My experience with and concerns about the United States risk management programmes have led me to pursue that quest for a number of years. In the following pages, I share my experiences and concerns as well as offer some prescriptions for fixing the problems that have plagued public crop insurance programmes the world over.

Performance goals and background

As an economist, a primary evaluation criterion will be efficient allocation of society's resources. This performance criterion is generally not a dominant goal for policy makers. Rent-seekers – those who seek to change the rules in a political economy so that they can obtain income streams from government – dominate policy decision processes. Efficiency is rarely on the agenda of special interest groups. The politics of special interests generally demand that government systems be designed to transfer as many dollars as possible to constituents who will play a significant role in helping re-elect politicians. Even among enlightened farm leaders in the United States, the politics of special interests circumvent economic logic. Farm leaders must often keep a vocal minority satisfied at the expense of the system as a whole.

The programme in the United States is complex and heavily subsidised, qualities that serve to enhance rent-seeking activity on the part of special interests. The United States has a long-standing crop insurance programme that has undergone significant changes in recent years. In May 2000, Congress was finishing major legislation that will increase subsidies provided to both farmers and private insurance companies in the United States. How the United States arrived at this point is complex and beyond the scope of this paper. In short, however, traditional agricultural subsidies have undergone a transformation that has been largely driven by international trade agreements. Although recent legislation (the 1996 Farm Bill) has removed traditional price and income support mechanisms, the crop insurance programme has grown from one that insured only losses due to shortfalls in crop yields to one that now insures losses in gross revenue (price times yield). It would seem that the traditional interests that once lobbied hard to keep price and income subsidies have turned their attention to insurance programmes.

* This contribution was presented in *Session* 4.A: *Insurance systems*.

** A previous version of this paper was presented at the *International Workshop on Insurance for Agribusiness*, 10-11 December 1999 in Piracicaba, Brazil. The assistance provided by Aleta Botts is gratefully acknowledged.

To be clear, the expected budget for crop insurance in 1999 would have farmers paying about 27% of the cost of all United States risk management programmes. Taxpayer costs are expected at 73% or about USD 2.4 billion.[1] The recently passed legislation in Congress will increase these expected costs by more than USD 1 billion for 2001. Expanded programmes and crops will account for much of this. However, the course is set for farmers to pay only about 20% of the total cost of the programme. It is doubtful that many countries in the world can afford such a programme and for this reason alone, one must be careful in attempting to use the United States crop insurance programme as a model. In addition, it should be remembered that the programme has undergone significant growing pains since 1981 when subsidies for crop insurance were introduced. With nearly 20 years of public-private experience many of the complex issues and problems of underwriting and rating have been addressed. Still, the actuarial performance of the crop insurance programme is not the same in every state. Some states have excellent experience and sound insurance offerings; others have very poor actuarial experience and questionable insurance offerings. One lesson to be gleaned from this experience is that it is risky to use the same national policy framework throughout a nation as large and diverse as the United States.

While regional differences make insurance even more difficult, it is not simple under any circumstances. Well-functioning banking and legal systems are prerequisites to an effective insurance sector in order to assure that contracts are enforceable. Like many contractual arrangements, effective insurance requires that those writing insurance contracts know nearly as much about the business as do the individuals buying the contracts. These principles are even more fundamental for farm-level multiple peril crop yield insurance. Yield risks are also different than many insurable risks in that weather conditions that hurt crop yields tend to harm a great number of individuals at the same time. These correlated risks can be used to justify government intervention, although capital market developments of recent years are reducing the importance of this argument.

Despite the challenges and problems with previous experience, effective risk-sharing markets are desirable for a market-oriented economy. Natural disasters causing crop losses can seriously disrupt the agricultural economy. When considering more market-oriented risk-sharing arrangements, a number of questions must be addressed. What are some basic principles of insurance? Why might such risk-sharing markets be desirable for society? What might happen to the agricultural development process when effective crop yield insurance is provided?

What are some basic principles to be followed when offering insurance?

Before embarking on the economic logic of why insurance is desirable, it is important to review some basic principles to be followed when offering insurance. Hazell's review (1992) of world crop insurance leads him to the following set of recommendations:

- Insurers must be financially responsible for their own affairs and should be separated from the Ministry of Agriculture.
- Insurance should only cover insurable risks and not risks created by poor management.
- Deductibles and co-payments must be used so that the insured shares in losses.
- Care should be taken in providing incentives for an insurer to spread risks.
- Insurance participation should be voluntary.
- Average yields should not be used as the basis for individual coverage.
- Proper incentives must be in place to control administrative costs.

Rejda (1995) takes a more traditional approach to the required conditions for a risk to be insurable:

"***There must be a large number of exposure units.***" Pooling involves the grouping of a large number of roughly homogeneous, independent exposure units so that the law of large numbers can provide an accurate prediction of average future losses. If a classification system cannot be found that results in relatively homogenous risk exposure units, adverse selection will result and only the higher risk members of the classification will participate in the pool.

"***Accidental and unintentional loss.***" Losses must occur as a result of chance – an "act of God" rather than an "act of management". If, as a result of purchasing insurance, management decisions are made that significantly alter the probability of loss and/or the extent of loss, moral hazard will exist. Moral hazard occurs when those insured change their behaviour after they purchase insurance. The behavioural change increases the likelihood that policy-holders will collect insurance indemnities and ultimately results in prohibitively high insurance premiums.

"***Determinable and measurable loss.***" Loss must be determinable and measurable within an acceptable level of reliability. "This means the loss must be definite as to cause, time, place, and amount."

"***No catastrophic loss.***" If losses are positively correlated across insurance units (*i.e.* the underlying risk is systemic) the law of large numbers does not apply. Annual losses for the insurance pool will be extremely variable. The loss in any given year may be large enough to threaten the solvency of the insurance pool. Two techniques for insuring correlated losses are reinsurance and geographical spreading so that catastrophe insurance exposure is limited in any given geographical market.

"***Calculable chance of loss.***" To develop a premium rate, one must be able to estimate both average frequency and average severity of loss. Low probability, high consequence catastrophic risks present serious challenges in premium rate-making.

"***Economically feasible premium.***" Premiums must be affordable. The chance of loss must be in a range that does not result in extremely high premiums. At some high level of probability the loss becomes a standard business expense instead of a risk to be transferred. While the chance of loss must not be too high, the potential for loss must be economically significant. Otherwise there will be no demand.

As will be more fully developed below, much of the risk facing crop yields is not independent risk. Thus, crop yield insurance should be uninsurable according to traditional views of insurance. Natural disaster risks are not independent. These correlated risks cause most societies to make heavy use of government assistance. Insuring risks that are correlated requires careful consideration. This is the core for understanding my recommendations on how a country might proceed should a crop yield insurance programme be implemented.

The role of risk-sharing in agricultural development

Since the future cannot be predicted with accuracy, risk must be considered in decision-making processes in farming. There are many important events farm decision makers cannot predict: the weather, commodity output and prices, input costs, interest rates, government policy and regulations. The variation of these events can wreck havoc on the economic outcome. Risks make it difficult to make rational long-term economic decisions. It cannot be eliminated and can retard development if there are no effective mechanisms to manage it.

Farm managers have many means for coping with risk. Diversification in enterprise mix or the use of family labour for both on and off-farm jobs is a common and dominant choice. This diversification does not come without a cost. The benefits of specialisation in production are well-documented in economics (Debreu, 1959). When farmers diversify they give up the higher expected income that would come with specialisation to reduce the variation in income. In effect, this can be thought of as an insurance premium. Another means of managing risk involves use of credit reserves. If the firm decides to limit the use of credit below a level that may be optimal, the opportunity to borrow funds will remain open in case of a major disaster. Again, there is an opportunity cost associated with maintaining a credit reserve for major disasters.

When farmers do not have the means to manage catastrophic risk from natural disasters, these risks will be internalised somewhere in the system. In many cases, adjustments must be made in the banking sector. When bankers recognise that loan defaults are tied to natural disasters they will either ration credit or build in a credit premium to cover these risks (*i.e.* charge higher interest rates). Agricultural risks are an impediment to fully developed financial markets in many developing countries. Access to affordable credit can be extremely important for development. With affordable credit, farmers can

adopt new technologies and take the additional risk associated with improving farming systems. If farmers had access to credit they could manage agricultural risk better; if bankers did not have to worry about loan defaults from agricultural risks they would provide more access to credit.

When there are no mechanisms for risk transfer from major natural disasters, economists consider the financial markets to be incomplete. In short, there are additional services that might be desirable that are not being offered in the market. Effective risk-sharing markets for natural disaster risks are largely lacking the world over. If such markets existed, one might expect the following: more access to affordable credit; more rapid adoption of new technologies; more specialisation in production; and, a more adaptive and flexible agricultural sector.

Most economists agree that using insurance allows decision makers to engage in new production activities with benefits for the entire economy (Arrow, 1964, 1996). However, great care must be taken. Farmers must pay something approaching the actuarially fair premium for the risk protection and the market contract must be structured so that it cannot be abused. These two conditions are fundamental to a sustained risk sharing programme and to one that results in welfare gains to society. If farmers are given risk protection via various subsidies, significant inefficiencies will follow. If the contract is subject to abuse, the losses must be added to future premiums and soon there will be no private interest in either purchasing or supplying insurance. Even with subsidies, the lower risk farmers may view the insurance as too costly after the full effect of abuse creates higher insurance rates for the non-abusers.

With traditional insurance, pooling independent loss events creates a mean loss for the pool that has a variance that is less than the mean of the individual variances. This result is derived from the classic statistical property of the law of large numbers – the variance of the one aggregate number is lower than the variance of many numbers that sum together to make the one number. Thus society benefits from pooling independent risks since the risk faced by the pool is less than the pre-aggregated sum of individual risks (Priest, 1996). In short, insurance markets reduce the risk faced by society and thus the aggregate cost of managing risk.

The multiple risk crop insurance programmes in the United States[2]

A number of countries around the world offer multiple risk crop yield insurance on individual farm yields. Very few are made with no government involvement. In the United States, multiple risk crop insurance is designed to cover a wide array of acts of nature, including hail, drought, excess moisture, plant disease, insects and wind. The intent is to insure only acts of nature and not bad management. Policyholders must follow generally accepted farming practices. While this provision is in place to reduce the impact of moral hazard, it is difficult to enforce. As noted previously, moral hazard is the changed behaviour of the insured after they purchase insurance – the behavioural change increases their risk beyond the initial design and rating of the insurance contract. In the United States, indemnities in the multiple peril crop insurance programme are paid for yield shortfalls below the farm's trigger yield per planted acre, for special adjustments for poor quality, for prevented planting, and in some cases, for replanting costs.

In an attempt to control for adverse selection, contracts for annual crops in the United States, such as corn, must be purchased no later than approximately six weeks prior to planting. Contracts for perennial crops, such as apples, must be purchased in the fall of the year before the crop is harvested. These dates are set to reduce the possibility that farmers will purchase insurance only when the probability or magnitude a potential loss is greater than normal. Such selection based on the current year's growing conditions is known as intertemporal adverse selection.

A payable loss occurs if the realised yield is less than the trigger yield, also referred to as the yield guarantee. Payable losses (in bushels, hundred weight, tonnes, etc.) on a crop for an insurance unit are calculated as:

- Payable losses = Trigger yield – Realised yield.
- If Trigger yield < Realised yield, Payable losses = 0.

Trigger yield is based upon the coverage (in percentage terms) chosen and the insurance yield. Specifically,

- Trigger yield = Coverage * Insurance yield.

The insurance yield is an estimate of the long-run average yield based upon the actual production history (APH) for the insurance unit. A farm may have several insurance units. Coverage, as the term is used in crop insurance, is 100% minus the deductible percentage. Coverage typically ranges from 50% to 75% of the expected yield in 5% increments. The Crop Insurance Reform Act of 1994 authorised the Federal Crop Insurance Corporation (FCIC) to offer coverage up to 85% in certain circumstances.

The farmer selects an indemnity price that is less than or equal to FCIC's estimate (made prior to planting and sales closing) of the market price at harvest. The payable loss is converted into dollars as follows:

- Payable loss = Trigger yield – Realised yield
  unless Realised yield > Trigger yield, then Payable loss = 0.
- Indemnity = Payable loss * Indemnity price.

Protection, or insurable liability, the amount per acre that the insurance contract would pay if the realised yield were zero (*i.e.* a 100% loss) is:

- Protection = Insurance yield * Coverage * Indemnity price.

The gross insurance premium is calculated as:

- Gross insurance premium = Gross premium rate * Protection.

The gross premium rate increases at an ever greater rate as coverage rises. The farmer's premium is calculated as:

- Farmer premium = Gross insurance premium – Government subsidy.

The following example illustrates how these equations convert into the US programme. Consider a farmer who has a 100 bushel APH yield (*i.e.* the average of the previous ten years equals 100 bushels per acre). If this farmer selects 75% coverage, there will be a crop insurance payment any time the realised yield drops below the trigger yield of 75 bushels (100 × .75). If the realised yield was 50 bushels, payments would be made on 25 bushels (trigger yield – realised yield). The 25 bushels would be multiplied by the indemnity price established at the beginning of the year. For example, if that value is USD 2, the crop insurance payment on the 25 bushel loss would be USD 50 per acre. If the realised yield were zero, then the full protection (liability) value would be paid (75 bushels × USD 2 or USD 150 per acre). Recall that the protection level is used to calculate the gross insurance premium. Thus, the gross premium rate is USD 10/USD 100 of protection or a rate of 10%. The gross premium would equal USD 15 per acre (USD 150 × 10%). Any subsidy would be subtracted from the gross premium to obtain the farmer premium. For example, if the premium subsidy was 30%, then the farmer would pay USD 10 per acre (USD 15 – [USD 15 × 30%]).

Consider the extent of information requirements needed to monitor and deliver an effective multiple peril crop insurance programme. The insurer must know the following for each individual insured unit:

The insurance yield. Estimating the expected yield on any farm unit is a daunting task. For most multiple peril insurance, estimating expected yields is the primary (if not the only) mechanism for classification of risk. Using simple averages of 4-10 years of records may give a crude estimate, but since the farmer supplies the information there are many opportunities to "fix" the numbers. Mistakes can be made in either direction since the sequence of weather events in the recent past will have a large influence on the 4-10 years of yields. These mistakes lead to adverse selection where only those farmers who believe they are getting a fair or better than fair offer will chose to participate. Farmers who think the insurance yield is too low will not participate.

The realised yield/loss adjustments. Estimating realised yields to determine losses is also complicated and can be expensive. Most farmers do not like the idea of having someone come to their farm to determine the realised yield. Estimating losses is not a precise science either. As the word estimate implies, there will nearly always be measurement error. Extra investments are required to

minimise that error. When there are widespread losses, a very large workforce of trained individuals who can determine crop losses may be needed. Many systems rely on farmers to report their realised yields and back this up with spot checks and penalties for false reports. Such systems can result in claims that are not warranted.

The gross premium rate. Calculating premium rates can be the most complex aspect of insurance. While most types of insurance can use experience-based rating, crop yield insurance rates require more complex underwriting systems. One would ideally like to know the yield distribution for each individual farm. If one has trouble estimating the expected yield, it is even more troublesome to estimate the higher moments of the distribution (variance and skewness). Further, simply knowing the yield distribution for a well-classified group of farmers may not be enough. Extra losses (beyond those represented by the yield distribution) can occur due to moral hazard. Further, there may be classification problems that lead to adverse selection.

More on conceptual issues for government supported agricultural insurance

Operating an insurance programme requires discipline in following basic insurance principles. Barnett and Coble (1999) provide an excellent document for understanding these principles of crop insurance. When insurance is made universally available, as it is with a government crop or income insurance programme, it is difficult to practice discipline. Political pressures prevail.

In North America, it has become difficult to know if the insurance programmes are designed to help farmers manage risk or if they are made available under the guise of "market mechanisms" simply to provide a new mechanism to subsidise farms. Any government insurance programme must be considered within the broader political economy of the country. This complicates any discussion about agricultural insurance provided by governments. Rent seekers who previously had access to subsidies via price and income support programmes have focused their attention on obtaining rent from risk management and insurance programmes. The principles of insurance have become less important than designing a programme that is favourable to the largest number of stakeholders.

Even in the absence of political economy considerations, insuring multiple risks for crop yields is more complex than most types of insurance. A requirement for effective contracts is that both parties must have similar information. However, information asymmetries prevail for farm-level crop insurance programmes. Adverse selection and moral hazard are common problems due to the imbalanced information. Numerous articles discuss adverse selection and moral hazard (Skees and Reed, 1986; Goodwin and Smith, 1995; Shavell, 1979; Knight and Coble, 1997). Problems with adverse selection and moral hazard motivated work on area yield insurance in the United States (Miranda, 1991; Skees, Black and Barnett, 1997; Glauber, Harwood and Skees, 1993; Mahul, 1999). Area yield insurance pays for crop shortfalls over a defined area. Farm yields are not used. Therefore, farmers have incentives to continue to produce even when yields are poor. There is no incentive to "lose the crop". Monitoring needs and transaction costs are much lower. The obvious problem is that an individual can have a loss and not get paid if the area yield does not trigger a payment. Nonetheless, since lower deductibles are possible, it is possible for some individual farmers to obtain better risk protection from area yields than from individual crop insurance with higher deductibles (Miranda, 1991).

For farm-level insurance, significant investments in monitoring and acquiring information must occur to control adverse selection and moral hazard problems. Since it is costly to monitor and deliver these programmes, cost of delivery for government-supported multiple peril crop insurance programmes has been subsidised. Hazell (1992) documents how extensive these costs have been for a number of countries.

To control adverse selection and moral hazard, insurance contracts generally use either high deductibles or co-payments. High deductibles mean that the value being insured is less than the expected value. For example, if a 25% deductible is used to insure average crop yields, then yields must drop below 25% of the average before payments begin. Deductibles protect against misclassification and adverse selection. Co-payments mean that the insured will share in the losses and they also protect against moral hazard. Indemnities are paid at some fraction of the economic value of the loss.

When the government is running the insurance programme, political pressures can undermine the soundness of the insurance. Such pressures can be a major problem when operating a government insurance programme as they soften many aspects that make good business sense and which control abuse. Both the United States and Canada have also had a tendency to undercut their crop insurance programmes by providing *ad hoc* and free disaster assistance (see Skees, 1999*b* for a review of the US experience).

Beyond the challenge of controlling for adverse selection and moral hazard, there is another reason that is commonly cited for why private markets cannot deliver multiple peril crop insurance. Crop disasters are generally widespread creating correlated losses – a large number of farmers suffer losses at the same time (Jaffee and Russell, 1997; Miranda and Glauber, 1997; Skees and Barnett, 1999). Insurance works best when losses are independent. Since private companies deliver and share in the risk of crop and revenue insurance, there is a special reinsurance agreement between the private companies selling the federally subsidised crop insurance and the government. Keep in mind that the companies must offer without exception federally subsidised insurance to all farmers. Though the government has tried to price the most serious abusers, political pressures have prevailed and many of those attempts have been reversed. Therefore, the special risk-sharing agreement allows companies to pick and choose the risks they wish to retain and the risks they wish to pass on to the government. In addition, since the risks being insured are correlated or systemic risks, there are special arrangements in the reinsurance agreement that limit the losses for the companies. One key part of the agreement is that the government pays for all losses beyond a certain point. In the US case, the government takes on all losses when the ratio of indemnities over premiums exceeds 500%.

Clearly price risks are not independent. Futures markets are used to hedge price risk for most major agricultural commodities in the United States. Insurance contracts work best for independent risk. Futures contracts work best for correlated risk (Miranda and Glauber, 1997; Skees and Barnett, 1999). If countries are to consider insuring income, they must understand that price risks are largely correlated and that government-supported income insurance may crowd out the development of private futures markets. By the same token, many of the price and income support programmes used in developed countries retard the development of futures exchange markets. One can argue that this is a reason such exchanges have not developed in Europe.

Performance of multiple risk crop insurance

Multiple peril crop insurance around the world has been faced with many problems. Governments subsidise these programmes to a great extent. If one were running a private insurance performance, the average payouts (indemnities plus administrative costs) would have to be below average premiums collected. Hazell (1992) puts this into a ratio that must be less than one to have a sustainable insurance company:

$(A + I)/P < 1$ where A = average administrative costs;
I = average indemnities paid; and
P = average premiums paid.

Hazell goes on to report experience with crop insurance programmes in five countries. The ratio exceeds 2 in every case. As can be seen in the table below, two extremes are noteworthy: the loss ratio (indemnities/premiums) in Brazil was very high while the administrative cost was relatively low; and, in Japan for the period 1985-89, the loss ratio was barely below 1 (.99), while the administrative costs exceeded premiums by 3.57! In short, it required a very high investment to obtain the needed information in order to maintain a loss ratio below 1.

Numerous studies document performance of the US programmes (Skees, 1999*b*; Glauber, Harwood and Skees, 1993; Goodwin and Smith, 1995; Knight and Coble, 1997; various General Accounting Office reports). Until recently, the US multiple peril crop insurance programme had significant actuarial problems. For example, from 1984-93 the ratio of indemnities divided by unsubsidised premiums was 1.4. To be actuarially sound the loss ratio should equal 1.0. Thus, the average premium rates used

Financial performance of crop insurance schemes in five countries

	Period	Indemnities/premiums	Administration costs/ premiums	(Indemnities + administration costs)/ premiums
Brazil[1]	1975-81	4.29	0.28	4.57
Costa Rica[1]	1970-89	2.26	0.54	2.80
Japan[1]	1985-89	0.99	3.57	4.56
Mexico[1]	1980-89	3.18	0.47	3.65
USA[1]	1980-89	1.87	0.55	2.42
USA[2]	1999 (*expected*)	2.71	0.96	3.68

1. *Source* : Hazell, 1992.
2. *Source* : Skees, 1999*b*.

from 1984-93 were at least 40% too low. Of course, these problems could have been caused by underwriting problems, created when adverse selection and moral hazard are present, rather than low premium rates. In 1994, Congress largely abandoned the goal of actuarial soundness by developing a new standard. The target for the programme is a loss ratio of 1.075.

An unpublished United States Department of Agriculture (USDA) study suggests that the expected loss ratio is now about 1.08, although national averages mask problems that exist in certain regions. The performance of the programme is still very poor in the South and in the Southwest, particularly Texas. The confusion created by examining aggregate loss ratios is pervasive. Significant problems and inequities remain as some individuals continue to abuse the multiple peril crop insurance programme. Simply adding subsidies does not fix these problems.

To be fair, recent national experience of the programme has been very good. In the past five years, the national loss ratio has exceeded 1.0 in only one year. Still, weather in the last five years has been mild compared with the previous decade. In addition, the new revenue insurance products have really not been tested yet since the United States has not experienced a major within-year downturn in the price used for these products.

The United States crop insurance programme has subsidies that are structured as follows:

- Premium subsidies (averaging about 42% of the gross insurance premium).
- Administrative subsidies (24.5% of gross insurance premium given to insurance companies who sell and service crop insurance).
- Risk-sharing subsidies between the private companies and the government (averaging about 10-15% of the gross insurance premium).
- Unintended subsidies in excess losses (since the US crop insurance programme has not been actuarially sound, the government now targets a loss ratio of about 1.075).

In 1999, farmers in the United States paid about USD 915 million in premiums and the expected indemnity payments (assuming a loss ratio of 1.075) were about USD 2.5 billion. All administrative costs (expense reimbursements, risk sharing returns and USDA administrative costs) were nearly equal to what farmers paid in premiums (about USD 882 million). Thus, even by design, the current programme has a Hazell ratio of approximately 3.68. Returning to the Hazell table, there is no crop insurance programme where subsidies do not exceed the amount paid by farmers by at least double. This is a very costly system to transfer income. Even under very generous assumptions about the benefits of risk sharing, it is unlikely that the general welfare of society is improved enough to offset this level of subsidy.

In addition to the costly subsidies for crop insurance in the United States, the government continues to provide *ad hoc* disaster payments when there are serious crop losses, most recently providing USD 2.25 billion for the 1998 crop year and USD 1.2 billion for the 1999 crop year. There has been a long history in the United States of providing both subsidised crop insurance and *ad hoc* disaster payments, costing the US taxpayers in excess of USD 2 billion per year over the last ten years. Providing

subsidies in crop insurance has not resulted in participation levels that are adequate to satisfy policy makers when there is a natural disaster. Attempts to increase participation have created problems in offering a programme that is actuarially sound. This vicious cycle has been a major part of the agricultural policy scene since the early 1980s.

The complexity of the crop insurance programmes increases the difficulty of considering reforms and represents a classic political economy problem. They have, along with the reinsurance arrangements, become so complex that they are difficult to understand. The number of stakeholders having an interest in maintaining the crop insurance programme continues to grow, for in addition to the farmers and the private companies, lenders and agribusinesses also have an interest now.

A major objective in using the private sector to deliver federal crop insurance was to allow for more innovation. However, when private companies do not bear the full responsibility for the risk there is a problem. Companies can be very creative in designing products that will increase sales when they do not have to take the full responsibility for the increased risk. There have been some painful reminders of this in the United States in 1999 with the new revenue insurance products that were largely developed by private companies. For example, mistakes were made in the revenue insurance offering for durum wheat. The expected price offered in the contract was much higher than the actual expected market price. Farmers were buying this contract very aggressively and many were changing their planting intentions based on the favourable offer. The USDA attempted to pull the contract from the market and the matter is now in the hands of the courts. The initial ruling was against the USDA, meaning that the original contract must be honoured. Similar concerns have been raised about revenue insurance for cotton and rice in the southern United States.

Since companies can put the government at increased risk when designing new products, government oversight is needed. However, government oversight also slows the innovation process and can constrain creativity. Further, since subsidies are involved, any new products that are developed by a private company must be made universally available. This certainly gives the wrong incentives for creativity. Thus, while the concept of having the private sector deliver federally subsidised crop insurance is sound, and they are likely doing a better job of servicing customers than a government delivery system, the current US model is flawed. The quest for better mechanisms to mix government and markets in providing subsidised insurance continues.

How do crop and revenue insurance programmes influence production decisions?

The subsidy structure of the US programme is inequitable, and it creates incentives to take on more risk and plant more. Farmers who have the highest risk obtain the greatest income transfers. By the same token, regions that are the most risky also receive the most income transfers. Premium subsidies are set as a percentage of the unsubsidised premiums. Thus, those farmers/regions facing the highest relative risk should be faced with significantly higher unsubsidised premiums. For the higher coverage levels in the United States, the premium subsidy now exceeds 50%. Consider two farmers who are neighbours. One farmer is high risk and is quoted an unsubsidised premium of USD 20 per USD 100 of liability. The other farmer is low risk and has an unsubsidised premium of USD 10. The subsidy equals USD 10 for the high risk farmer and USD 5 for the low risk farmer. Even more troublesome, farm yields that are proven (*i.e.* the APH yield), stay with the farmer and not the parcel of land that was used to prove the yield. Therefore, it is quite possible to prove a yield with the better soils on the farm and then switch the insurance to some poorer land. As will be discussed below, this dynamic sends signals to farmers to grow more on marginal land.

Thus far the reader should understand the following:

- Offering agricultural insurance is complex under any circumstance – adding the government in the mix increases the complexity.
- Income insurance programmes have become the new mechanism for transferring subsidies in North America – still they have not solved the problem of sustained downturns in commodity prices.
- The US model of using the private sector to deliver subsidised agricultural insurance has limitations.

- Even with heavy subsidies on crop insurance, farmer participation is still not high enough to prevent the government from giving free disaster aid.
- Despite improved actuarial performance in the aggregate, actuarial problems still plague the programme in many regions of the United States.
- Those farmers/regions that are most at risk gain the most from subsidised insurance in North America.

Regardless of these problems, there are good economic arguments for the necessity of government help in the formation of risk-sharing markets. This is a matter of how much and how the assistance should be structured. The current level of subsidies and the subsidy structure limit the economic efficiency gains that can be made from such government involvement in the United States. When decision makers must pay for risk protection, at least what they expect to get back over the long term, then the risk will be internalised into the decision processes. When they pay less than they will get back in indemnities because of heavy insurance subsidies, society is paying decision makers to take on additional risk. The resources used in taking on those additional risks really cost the economy much more than just the income transfer imbedded in the subsidy. The additional cost becomes the inefficiency created by the subsidy.

Insurance subsidies create incentives for farmers to restructure their operation to produce roughly the same level of risk that existed before the subsidy. This is particularly true when decision makers fully recognise the value of the subsidy. The most common response may be to borrow more and expand production either into the riskier part of the farm or into new and more risky farms. The risk subsidy makes society neither more efficient nor more equitable. Farmers are at just as much risk as they were previously and the subsidy has been bid into asset values to create barriers to entry for new farmers.

A number of economists are raising questions about crop and income insurance programmes and the extent to which they influence production decisions (Turvey, 1992; Spriggs and Nelson, 1997; Chen and Meilke, 1996; Skees, 1999*b*; Goodwin and Smith, 1995; Keeton, Skees and Long, 1999; and Young *et al.*, 1999). Even in the absence of subsidies, theory tells us that insurance should influence production decisions. In particular, farmers can gain by specialisation since they no longer have the same needs to diversify. With subsidies, the effects on production decisions can be significant.

Consider the subsidies in place in the 1999 crop and revenue insurance programmes. By summing up the total expected premium subsidies for all insurance programmes and dividing that by the expected revenue, one can obtain a measure that is equivalent to a price increase. This was done for all crop reporting districts (CRD) in the United States for the major crops: corn, wheat, soybeans, cotton, grain sorghum, and barley. Some CRDs had very high ratios. For example, in some of the riskiest regions, the insurance transfers averaged more than 20% of the expected gross revenue (expected market prices times expected yield).

Again, keep in mind that the very structure of the subsidy gives more transfers to the highest risk farmers within a county, the highest risk parcels on a farm, and the highest risk regions. In modelling these effects, Keeton, Skees and Long (1999) estimate that cropland use for the top six crops in the United States may be as much as 15% greater than it would be without crop insurance subsidies. Cropland use includes the United States acreage retirement programmes such as the conservation reserve programme. Considering a conservative price response that accompanies the additional planted acres, it is possible that many of the most productive farms actually have lower incomes even when they use subsidised crop insurance than they would without the subsidised crop insurance programmes. In short, the loss in income from lower prices is greater for many farmers than the income gained from the crop insurance subsidy.

Available international capital for agricultural insurance

As the United States continues to increase the subsidies available to farmers and insurance companies, the US dominance of international risk sharing for agricultural insurance will increase. There are only a few major reinsurance companies in the world. The US share of the agricultural market is very dominant in the portfolio of these companies. Now the European Union is considering introducing

similar risk management subsidies to support farmers. Even the market oriented reinsurance companies are now calling for subsidies for crop insurance. Many of these companies are based in Europe and they are now pointing to the United States as being ahead of Europe in subsidising risk management.

Reinsurance is meant to work well by pooling risk around the world and spreading that risk to make what risks that are generally not diversifiable, diversifiable. In an ideal world, reinsurers could provide needed capital to offset systemic agricultural risk for major crop disaster for many countries around the world, both small and large. It is likely that the subsidies and the sophisticated methods of underwriting and understanding risk in the developed countries, result in less interest in providing reinsurance services to developing countries. I am concerned that the increased risk management subsidies in the developed countries will crowd out interest in providing reinsurance services for developing countries. This is an issue OECD should be concerned with as well. Developing countries need these services and small country states likely need them much more. Small countries that have a single crop produced in a concentrated geographic area have considerable systemic risk. New innovations are desperately needed to help these countries share that risk with the rest of the world. Unfortunately, as long as developed countries offer lucrative opportunities for reinsurance companies with added subsidies, it is not likely that such innovation will come from the private market.

Moving to more privatisation for risk management

If governments want farmers to use market-based risk management, they must consider ways to facilitate these markets. Two markets merit special attention: the price markets and crop insurance markets. Markets that help in managing price risk include the futures exchange markets and forward pricing markets established by agribusinesses. While futures exchange markets will not work for every commodity, these markets offer promise. In many developed countries, futures markets have not evolved because government programmes have crowded out the interest in and development of these markets.

For multiple peril crop insurance, three aspects of potential market failure must be addressed:

- government crowding out market development;
- the high costs of monitoring to control for the asymmetric information that causes adverse selection and moral hazard; and
- the high degree of correlated (systemic) risks that may prevent private companies from offering multiple peril crop insurance.

Putting a basic structure in place to create futures exchange markets and to address some of the problems with offering multiple peril crop insurance could go a long way to facilitating more market-based risk-sharing in developed countries. The government may still be needed. To the extent that efficiency is important, there should be better ways to use the government than have been tried up to now. If the focus were on making risk management products available at a premium that would roughly equal the expected indemnities payments, there would be efficiency gains. For this reason, the government may be needed to lower the transaction costs of certain types of insurance. Paying some level of delivery cost and monitoring to control for adverse selection and moral hazard may be needed.

In spite of the challenge of managing systemic risks, market mechanisms have emerged in the last ten years. Skees (1999*c*) reviews a number of new initiatives in the capital markets that are designed to "securitise" insurance. If insurance companies are able to protect against hurricanes and earthquakes, why can they not protect against widespread crop losses? Skees and Barnett (1999) investigate use of government-based area yield insurance as a means of protecting against systemic risk for crop insurers. If the government was selling only low-level put options on area yields (*e.g.* a state yield), there would be less government oversight needed since private companies would have proper incentives to design new products that would be covered by area yield contracts and the futures markets. Some regulatory changes would be needed in most countries before such concepts can be tried.

In the fall of 1999, I was involved in a World Bank activity to advise the government of Argentina.[3] A new model for combining initiatives of the government and private companies was developed with the Ministry of Agriculture. The primary objective of the government was to offer some level of disaster

assistance in the most efficient manner possible. Further, the desire was to offer something that would be clear, well-defined and done in a fashion that facilitated market developments. The government also wanted to limit its cost. In my view, these were precisely the right questions and focus. This was the chance to lay out some alternatives that would use the government to handle systemic risk and the market to handle independent risk. Since the government is going to provide some level of aid, it is important that they do so in the most transparent fashion possible. Transparency is critical in minimising rent-seeking behaviour (Dixit, 1996).

Our proposal involved using area yield estimates as the unit for establishing disaster payments. The area would be defined by Argentine departments (a geographic division that is roughly equivalent to counties in the United States). To avoid the problem of favouring high risk regions we recommended that frequency be used as the mechanism for declaring disaster. After adjusting the 25 years of data that were available by crop and department, we developed a cumulative distribution function (CDF) for these data. Using these CDFs, we could then identify the yield level that represented a 1 in 7, 1 in 10, or 1 in 20 years events.

We modelled each level to develop cost estimates for the government and to determine the risk profile. Using frequency as the means for determining the trigger yield is superior to using percentage of the average since it treats everyone more equally when making free payments. This should be significantly less distorting than using a percentage of the average to make the payment. For example, 90% of average may be a 1 in 3 year event for the high risk department and 1 in 10 year for the low risk department. Thus, all farmers should expect to receive roughly the same transfer when triggering based on frequency. If the government provided this type of *ex ante* aid, our analysis clearly demonstrated that most of the systemic risk would disappear. Thus, private companies could more easily offer individual insurance that would be packaged with the government policy. These private wrap-around policies would still require great care as the problems of moral hazard and adverse selection remain.

Conclusions

There is little doubt that mistakes of the past will continue to haunt governments attempting to initiate crop insurance programmes. Of significant concern is that many governments will look to the United States' system for solutions. This model is not a good one to replicate in other countries as the programme has become very expensive and is distorting markets. There are more efficient ways to transfer subsidies than through risk management programmes. Further, the current structure of subsidies in the United States, and most countries around the world who have subsidised crop insurance, favours the highest risk farmers and the highest risk regions. This issue will demand more attention in the future as the World Trade Organisation re-evaluates the extent to which risk management programmes add to production.

The search for improved models for mixing government and markets to improve risk-sharing mechanisms will continue. This paper offers one such model that has promise for using the government to provide disaster aid without undue distributions to market innovations and with fewer distortions to markets. By using frequencies to identify when a disaster occurs, high-risk regions would no longer be favoured as they are with so many of the current programmes. More fundamentally, the models that offer the most promise, in my view, would have the government either offering free disaster aid for area yields or selling these as put options. In either case, the government would be providing the capital for the catastrophic or systemic risk. Private companies could then wrap individual insurance products around these area yield contracts. There are a number of modifications that can be made on the basic design presented here.

NOTES

1. These expectations are based on a loss ratio of 1.075 (the expected number). The loss ratio in 1999 was less than 1.
2. See Skees, Black, and Barnett (1997) for a more complete review of the alternative crop insurance programme in the United States – the Group Risk Plan. See also Skees (1999*a*) for a review of the revenue insurance products being offered in North America.
3. Details of our recommendations can be found in the World Bank report: *Risk Analysis and Development of Agricultural and Livestock Insurance in Argentina: Part* B. *Modelling and Evaluation of Alternatives*, World Bank Project ARG/94/018/B/01/99, prepared by AgriRisk Services Pty Ltd. (Australia), Agricultural Risk Management Consulting Inc. (United States), and Cazenave and Associates (Argentina), September 1999.

D. AGRICULTURAL, FISCAL AND SOCIAL SAFETY NETS

D.1. Canadian Agricultural Safety Nets Performance, 1998 and 1999

by
*Tom Richardson**
Agriculture and Agri-Food
Canada

Introduction

There is continuing debate in Canada, as in most OECD countries, on what the objectives of agricultural safety nets should be. At the 1998 annual meeting of Federal-Provincial Ministers of Agriculture it was agreed to describe the objective as being one of encouraging "risk management" by producers and to include "income stabilisation".

The majority of governments would have settled for "risk management" only, but a significant minority took the position that "income stabilisation" was just as important. No government defended the objective of "income support", although this does not mean that this issue is absent from the debate. Indeed, income support is considered as very important by many producers as well as some farm organisations, particularly in situations where the following examples can be cited: high subsidies in other countries contributing towards low incomes in Canada; manipulation of high input prices by agrifood corporations; less than competitive food processors; and, consumers who should be paying more for their food (the so-called "cheap food policy").

Underlying this debate is the ever present anxiety associated with the ongoing productivity gains in primary agriculture – lower real prices, larger farms, pressure on smaller farms to either cease their activities or to expand, and the pressures in rural areas where a declining farm population can have profound effects on the survival of towns and basic services such as schools, hospitals, etc. This latter effect is most prominent in remote areas. In many parts of Canada there is population growth in areas within 75-100 kilometres of major cities, but the opposite is more often the case further afield.

While a safety net objective focussed on risk management and income stabilisation would seem relatively progressive and would imply modest support levels, there is always the test of actual governmental behaviour when a major global downturn occurs; this occurred in late 1998 and 1999 when hog and cereal prices plummeted and oilseed and cereal prices remained low throughout 1999. Governments responded in a way that mostly reflected their stated objectives but with significant exceptions and under considerable stress. In addition, a fourth objective crept back into the debate, that of "adjustment". This refers to the idea that safety nets or related programmes may be used to help families leave agriculture entirely, to completely change their farm operation, or to find alternative work in their region.

Before looking at the collective government response to low prices in 1998 and 1999, we will examine what has driven the development of Canadian safety nets in the last 10-20 years and how this has affected the design of programmes. Table A1 of the annex to this section shows the size and importance of agriculture in the Canadian and provincial economies.

* This contribution was presented in *Session* 4.B: *Agricultural, fiscal and social safety nets.*

Drivers of safety nets

Weather

Climate plays a major role in Canada (late springs, early frosts). This and the large dryland areas of the Prairies, which are subject to periodic drought, have lead to a well developed but subsidised Crop Insurance programme. This programme has been operational for over 40 years with precursor programmes in place prior to its introduction. Crop Insurance is administratively expensive, particularly as concerns the many smaller production bases of new crops and special varieties. A number of provinces are exploring how income-based disaster programmes may replace or better complement the need for Crop Insurance. Other approaches are also being tried, demonstrating that weather will continue to be a strong factor in the design of such programmes.

Federal-provincial joint jurisdiction/sub-national flexibility

Under the Canadian constitution, agriculture is a concurrent jurisdiction with both the federal and provincial governments able to introduce safety net programmes. This places a premium on co-ordination and shared approaches. It also means that flexibility to respond to differing provincial objectives must be accommodated in the development of any national approach. A further consequence is the experimentation with new programming that takes place at the provincial level. The most recent example of this was the introduction in Alberta, British Columbia and Prince Edward Island of an income-based disaster programme based on the rules of Paragraph 7 of Annex 2 of the Uruguay Round Agreement on Agriculture (see Part I, section on government intervention and Table A8 in the annex to this section). This model was subsequently adopted nationally following the hog and grain price collapse in late 1998.

Equity

Unlike the United States, where safety nets have focussed almost exclusively on crops (mostly grains and oilseeds), Canada has evolved its approach to treat all production equally. (The supply managed commodities are the exception.) It is interesting to note that the United States and Canada have taken different paths in spite of similar geography and production patterns. There was a period in the 1980s when Canadian support was heavily weighted to grains and oilseeds, although this would be difficult for governments to repeat today. In any case, the result has been the development of programmes which are "whole farm", *i.e.* all production on the farm is treated in the same manner. In the NISA (Net Income Stabilisation Account) programme, introduced in 1990, a producer sets aside up to 3% of his gross revenues per year and this is matched by governments. This individualised savings account can then be used by farmers to make withdrawals in low income years. All commodity organisations in Canada have agreed to participate in this programme, the exception being those related to cattle in two provinces and supply managed commodities.

The control of NISA by producers is an indirect result of equity. As governments cannot respond fairly to every situation faced by a producer, control is given to the individual producer. The more recent income-based disaster programme, the Agricultural Income Disaster Assistance (AIDA) programme, includes all production. While some efforts continue to be made to design programmes that benefit one or another commodity, the collectivity has difficulty today in accepting any type of specific commodity support.

Budget pressures

All provinces and the Federal government moved in the 1990s to balanced budgets. As a consequence, agriculture, and all sectors of the economy and society in general, suffered severe reductions which considerably lowered safety nets. While the low prices of 1998 and 1999 lead to significant reinstatement of financial support, the increase was still well below that of 10-15 years ago. With the funding of health care being a national priority, it is not likely that safety nets will receive further substantial increases, even if low prices continue or major weather disasters occur in the next few years.

Several smaller provinces have seen their agricultural budgets reduced to a bare minimum. Only safety nets have been kept in order to maintain the 60:40 cost-shared approach, which has also meant that ongoing income support as a permanent objective continues to be under increasing pressure.

Canada/US trade and US trade action

Canada exports significant volumes of cattle, hogs, grains, oilseeds and horticultural products to the United States. Successful countervail in the mid-1980s of the federal-provincial hog price support programme had a fundamental effect on the thinking of Ministers, officials and especially industry. There have been numerous countervail, anti dumping and punitive border closings in the last 15 years based on sanitary and phytosanitary standards. Most were unsuccessful but the defence was costly and the potential major cost implications of an unsuccessful defence were such that everyone paid attention. There has been strong interest in the "green" programmes under Annex 2 of the Uruguay Round Agreement on Agriculture, or "generally available" programmes under the World Trade Organisation (WTO) Agreement on Subsidies and Countervailing Measures as applied by the United States Department of Commerce. As a result, there are only a limited number of price-based programmes remaining in Canada and, for the most part, these are available to all producers and types of production.

Export orientation

Fifty per cent of Canada's primary agricultural production is exported. This is not out of line with other national resource commodities such as forest products, minerals, and oil and gas. While Canada has always been a trading nation, the North American Free Trade Agreement and the WTO Uruguay Round have had a considerable impact on Canadians – it is now commonly understood (but not always accepted) that Canada must be competitive and that the country must export in order to raise the standard of living. It is contended (although difficult to prove) that this evolution makes it increasingly difficult for agriculture stakeholders to obtain the support of the Canadian population to embrace either income support or high and continued levels of income stabilisation, as was done in the period 1986 to 1993 when grains and oilseeds prices were low. The situation may well be different in countries where a higher percentage of production is traded internally.

Cumulative impact of the drivers

The following set of directions and principles constitute the cumulative effect of the various drivers described above:

- a focus on risk management and income stabilisation, and a movement away from permanent income support;
- a movement towards income based "whole farm" programmes rather than commodity-based price supports;
- voluntary programmes, which are producer controlled where possible;
- programmes which are production and market neutral;
- cost-shared by federal and provincial governments and producers; and
- provincial flexibility in a national framework.

Programmes and their costs

Prior to 1998, federal and provincial governments were spending just over CAD 1 billion on safety nets for an industry with gross revenues of CAD 30 billion. With the low prices of 1998 and 1999, and the addition of AIDA, costs have risen to over CAD 1.8 billion. Federal funding for AIDA was limited to two years – the 1998 and 1999 tax years. In July 2000, a three-year agreement on safety net programmes was signed that includes a new, ongoing disaster programme, the Canadian Farm Income Program (CFIP). The projected costs for major components of the safety nets are presented in the table below.

Safety net costs, 2000-2001
CAD Million

Programmes	Federal	Provincial	Producers
Core programmes	**260**	**100**	**275**
NISA	230	190	180
Crop insurance	215	210	–
Companion programmes			
Sub-total	705	500	455
Disaster programme (AIDA)	435	290	
Total	1 140	790	455

Source: Agriculture and Agri-Food Canada.

Programme performance: 1998 and 1999

All governments adopted between end of 1998 and 1999 the income-based disaster programme (AIDA). With the phase out of national price support programmes by 1995, NISA became the only programme available to carry a major downturn. In political terms, this was not judged to be adequate for at least two reasons. First, the sharp drop in hog prices in late 1998 left many hog producers in a negative margin situation. The hog industry had only joined NISA in 1994. Many producers had not taken full advantage of NISA nor had many built up sufficient NISA reserves. Secondly, the situation of grains producers was more complex. They had joined the programme in 1990 so had sufficient time to build up reserves. Analysis of the data revealed, however, that roughly 30% of the NISA account balances were zero or close to zero, while many of the rest were sufficient to manage a 1 to 3 year downturn. Table A2 of the annex to this section shows the distribution of accounts for Saskatchewan, the central Prairie province most affected by the low grain prices and where participation in NISA has been the highest. The reasons for this distributional behaviour are discussed below. Suffice to say that these two irrefutable pieces of data encouraged governments to adopt one national income-based disaster programme identical to that already introduced in three provinces. The introduction by the United States in the fall of 1998 of a large increase in support to grain producers, who were already receiving a much higher support level than in Canada (Figure A1 of the annex to this section), also played an important role.

The design of AIDA is based on Paragraph 7 of Annex 2 of the Uruguay Round Agreement on Agriculture. As implemented in Canada, the previous three year average margin is calculated. This margin is measured as revenues less "variable" costs, thus measuring returns to labour, land and capital. Seventy per cent of this margin is determined and compared to the margin of the current year. Payments cover the shortfall. This margin was judged to be the most appropriate way to treat all farms fairly.

The programme was introduced in 1998 and is delivered on the basis of farm tax returns (which also serve as the basis for the delivery of NISA). Delivery has proven difficult, however, because farms in Canada are permitted to file on a cash basis, whereas inventory information is required in order to obtain a better estimate of current year's income. As a result, many producers simply do not keep good records, which results in administrative delays and higher processing costs.

How did these programmes (NISA and AIDA) stabilise incomes in 1998? Table A3 of the annex to this section shows how each programme, and the two in combination, affected producers' current year income compared to their five year average. Although not all producers showed a substantial improvement, the results were acceptable to the majority.

Many, although not all, stakeholders would agree that the income stabilisation objective was met for 1998. However, as grains and oilseeds prices continued to decrease through 1999, the demand for income support continued. The stress was most intense in the eastern prairies (Saskatchewan and Manitoba) where the transportation subsidy (the "Crow") was eliminated in the 1995 budget reforms.

Table A4 of the annex to this section shows the decline in margins of smaller grain farms located in this region that were not able to adjust from wheat to other types of production, while larger farms were able to adjust in order to maintain their margins. In addition, a percentage of these smaller farms had little or no off-farm income due to lifestyle, reductions in government services, or to rationalisation and restructuring of agribusiness services – the main off-farm employment opportunities. While these smaller farms received disaster payments commensurate with their farm size, many had withdrawn their modest NISA accounts yearly (there is a minimum income trigger) so that they had a very limited NISA reserve to draw on.

Under intense pressure, the Federal government and the provinces of Saskatchewan and Manitoba made available a one-time decoupled payment of CAD 400 million, the cost being shared 60:40. The payment was made to all crop producers based on historical production and was capped at a relatively low level (CAD 125 000 maximum sales representing about the average farm size; maximum payment of about CAD 10 000).

In the course of this process, there was discussion about whether governments should institute a transition programme to help smaller producers either adjust their operations or retrain for alternative employment. No programming or policy decision was made, but governments and industry continue to debate this issue. Modest transition programmes have been instituted in the past (in the early 1970s, the late 1980s and early 1990s), but concerns of "destroying the family farm" and the potential impact on more remote rural communities are shared by many stakeholders.

Economic impact

The above suggests that safety net programmes are stabilising income for most farms. A secondary question is whether this is being done in an economically efficient way. Producer Support Estimates (PSE) show that support for wheat in the United States is significantly higher than in Canada, and yet grain producers in the Northern Plains states adjacent to the Canadian border continue their demands for additional support (Figure A1). From an economic theory perspective, it is understood that it is quite difficult to prevent capitalisation of subsidies into land and other capital resources. In this situation, there is evidence of differential land prices across the 49th parallel. Current indications are that land values in Saskatchewan are less than one half the value of land in Montana. The situation with Manitoba and North Dakota is less dramatic with the differential being about 25%. Indeed, in 1999 land prices in Saskatchewan declined while elsewhere in Canada prices rose. This is modest evidence that Canada's safety nets are providing effective income support while not impeding adjustment to reflect changing market conditions.

A related issue is the principle of production and market neutrality called for in programmes falling within the federal-provincial safety net framework agreement. The relative shift in the price of grains compared to oilseeds (which decreased only as of 1999) led to a massive shift in production away from wheat to canola and special crops. Of course, with all prices down in 1999, options were limited. Nevertheless, the 1998 evidence makes a strong case that Canadian safety nets are not preventing production shifts, diversification or perhaps other risk mitigation strategies (Table A5 of the annex to this section).

This evidence is basic to maintaining a consensus among stakeholders that effective stabilisation can be provided during severe downturns while not distorting the incentive and ability of producers to evolve their operations to changing conditions. It, or elaborations of it, can be used to make the case that modest income support programming, as defined in Paragraph 7 of Annex 2 of the Uruguay Round Agreement on Agriculture is meeting the intent of the Green Box (see Part I, section on government intervention for explanations on the Green Box).

In summary, it is contended that the continuation of NISA and AIDA along with Crop Insurance provided reasonable income stabilisation in 1998 (and is expected to do so for 1999) without major economic distortions. These measures were not deemed sufficient, however, to respond to the adjustment faced by smaller grain farms in the eastern Prairies, for whom income support was put in place as a one-time measure. While there were alternative suggestions, such as transition programming, skills retraining, etc., such adjustment measures were not adopted.

Future policy challenges

The results described above have been presented in a reasonably positive manner. There is not, however, any certainty or consensus amongst industry and governments that the current safety net framework will meet all needs over the next three years.

On an international level, "low" grain prices will probably continue. In fact, current prices may be close to the long term trend line, despite evidence that current prices are largely driven by four or five excellent world-wide harvests.

In an important presentation to the House Standing Committee on Agriculture two leading agricultural economists from the University of Saskatchewan, Drs. Hartley Furtan and Richard Grey, painted a pessimistic picture of the long-term future of exporting grain from the Canadian Prairies. Among other points, they recommended that governments clearly state whether their objective is income support, minimal stabilisation and/or adjustment. In their view, the outcome for rural Saskatchewan will be quite different depending on the policy approach taken.

This is not the only challenge to Canadian primary agriculture. There is a rapid industrialisation of hog production and expansion in all major producing provinces coupled with an increasingly world scale processing industry, all of which are placing tremendous pressure on the smaller, old technology-based operations. The horticulture industry is also changing in shape and size (greenhouses in particular) as is the production of a variety of special crops. This increasing rate of change is disturbing to some and a benefit to others. What are the issues for Canada?

One possibility being debated is the stabilisation period as defined in Paragraph 7 of Annex 2 of the Uruguay Round Agreement on Agriculture: it should be either the previous three years or the middle three of the last five (labelled the "Olympic" average in Canada). National farm organisations contend that to deal with the longer downturns that occur in grains, a longer or more selective stabilisation period is both appropriate and needed. Should a different base be adopted, would one still see the production and marketing shifts seen in 1998? In other words, would one still have a non trade distorting regime?

The alternative, in the opinion of the major farm organisations, is to "meet the competition" with Canada moving towards massive income support based on historical production, as permitted under Paragraph 6 of the same Annex 2. This is the route the United States has followed. Producers in Canada have questioned the trade neutrality of Paragraph 6 by the United States in view of the size of their programmes; this is also true of the European Union which supports similar measures. Canada has also questioned whether the effects of capitalisation negate any real income support or stabilisation? In essence, is there an acceptable path based on a modified Paragraph 7 approach that could be combined with a limitation on the use of Paragraph 6 (or equivalent Blue Box* approach)?

A second approach proposed is for Canada to consider a pro-active use of other paragraphs in Annex 2 of the Uruguay Round Agreement on Agriculture related to adjustment, be it regional, structural or producer age related. These types of support would be trade-neutral as well as exempt from countervail – an important consideration for Canada given its export orientation and the value of the United States market.

The Federal Minister has raised this issue and, based on the responses received, is likely to continue to do so. Such a strategy could involve farmers staying in agriculture, staying in the rural community or leaving. Is there evidence of social, economic and political success in the use of these paragraphs in other OECD countries?

Thirdly, within the Canadian framework of safety nets – AIDA, NISA, Crop Insurance and companion programmes – there is room for further improvement. There are a number of questions as to how the programmes complement each other and work together. This will be pursued in the latter half of 2000.

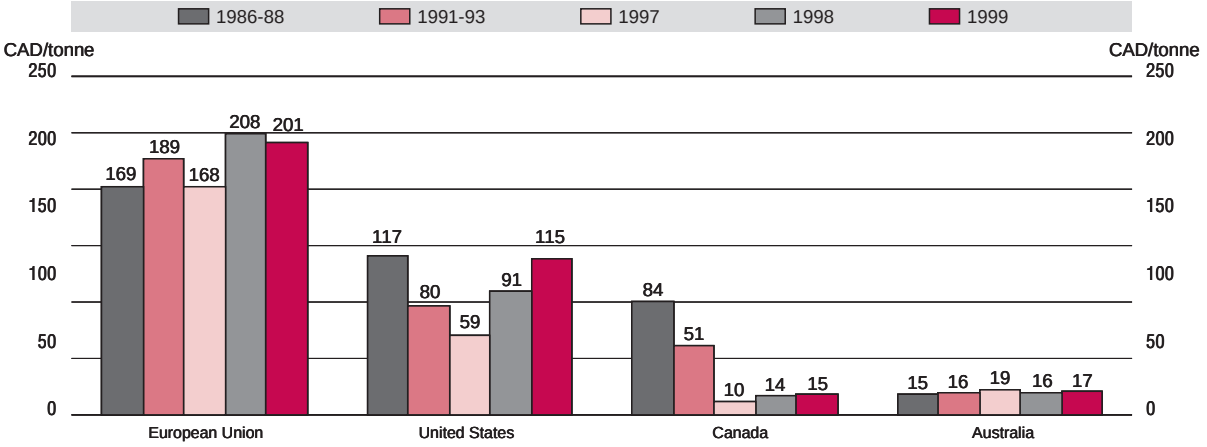
Finally, Canada has identified rural renewal as a key commitment as it provides for alternative employment, infrastructure redevelopment and a more orderly evolution of the farming economy while minimising disruption to the rural community.

* The Blue Box includes payments under production-limiting programmes that are exempted from the commitment to reduce domestic support.

Annex

TABLES AND FIGURE

Figure A1. **Unit Producer Support Estimate for wheat in Australia, Canada, the United States and the European Union**



Source: OECD, PSE database.

Table A1. **Importance of primary agriculture**

Province	Provincial GDP in % of total GDP[1]	Agricultural GDP in % of total GDP	Number of farms[2]	Total sales (Million CAD)	Percentage of total sales[3]					
					Grains and oilseeds	Cattle	Hogs	Horticulture	Supply management	Other
British Columbia	12.0	1.1	11 035	1 860	1.9	15.1	2.1	19.3	35.2	26.4
Alberta	12.2	3.5	55 570	6 285	30.6	47.6	5.5	1.0	8.0	7.3
Saskatchewan	3.1	8.4	60 735	4 753	71.8	17.5	2.9	0.1	3.5	4.2
Manitoba	3.2	3.2	22 700	2 803	43.2	16.0	16.8	1.2	9.8	13.0
Ontario	42.3	1.1	51 540	6 739	17.4	13.2	9.0	10.8	29.6	19.9
Quebec	21.1	1.5	29 395	4 537	8.4	8.0	17.5	7.7	44.2	14.2
New Brunswick	1.9	1.1	1 920	370	0.6	8.1	6.3	7.4	33.9	43.7
Nova Scotia	2.2	1.1	2 310	383	0.2	8.8	7.2	17.4	43.0	23.4
Prince Edward Island	0.3	4.6	1 680	351	1.5	8.4	6.4	4.3	16.3	63.1
Newfoundland	1.2	0.4	285	82	0.0	1.9	1.7	6.3	72.4	17.9
Canada	**1.0**	**1.8**	**237 170**	**28 162**	**0.3**	**0.2**	**0.1**	**0.1**	**0.2**	**0.1**

1. 1999 GDP.
2. 1997 taxfiler data.
3. 1999 sales data from Statistics Canada.

Source: Agriculture and Agri-Food Canada.

Table A2. **NISA fund balances as a percentage of five-year average gross margin, Saskatchewan, 1998**

Sales class	Negative margin	0%-20%	20%-40%	40%-60%	60%-80%	80%-100%	100% and over	**Total**	Under 60%	Over 60%
	Number of participants								Percentage	
CAD 0-CAD 24 999	2 326	6 023	1 617	1 411	1 214	4 250	13	**16 854**	67.5	32.5
CAD 25 000-CAD 49 999	733	3 684	1 089	1 006	957	3 554	5	**11 028**	59.0	41.0
CAD 50 000-CAD 99 999	414	4 049	1 284	1 141	1 294	4 671	6	**12 859**	53.6	46.4
CAD 100 000 and over	287	4 230	1 759	1 500	1 727	6 604	4	**16 111**	48.3	51.7
Total	3 760	17 986	5 749	5 058	5 192	19 079	28	**56 852**	57.3	42.7

NISA: Net Income Stabilisation Account.
Source: Agriculture and Agri-Food Canada.

Table A3. **1998 margins versus the 5 year average margin for NISA and AIDA participants in Saskatchewan**

1998 stabilisation year

	Margin		AIDA[2]		Potential NISA[1]		AIDA[2] + Potential NISA[1]		Withdrawal NISA[1]		AIDA[2] + Withdrawal NISA[1]	
	Participants											
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Did not apply for AIDA												
100 % or more	18 824	54	–		26 958	77	–		20 976	60	–	
70% to 100%	4 320	12	–		1 787	5	–		3 950	11	–	
40% to 70%	3 078	9	–		1 071	3	–		2 525	7	–	
0% to 40%	3 782	11	–		1 883	5	–		3 077	9	–	
Negative	4 905	14	–		3 210	9	–		4 381	13	–	
Applied for AIDA but did not receive a payment												
100 % or more	8 480	55	–		12 730	83	–		10 259	67	–	
70% to 100%	2 609	17	–		918	6	–		2 081	14	–	
40% to 70%	1 766	11	–		472	3	–		1 146	7	–	
0% to 40%	1 180	8	–		446	3	–		797	5	–	
Negative	1 376	9	–		845	5	–		1 128	7	–	
Received an AIDA payment												
100 % or more	2 761	29	4 760	49	6 388	66	**7 669**	**79**	3 965	41	6 002	62
70% to 100%	1 689	17	1 789	19	982	10	**688**	**7**	1 711	18	1 375	14
40% to 70%	1 767	18	1 284	13	671	7	**462**	**5**	1 373	14	909	9
0% to 40%	1 651	17	908	9	717	7	**384**	**4**	1 212	13	639	7
Negative	1 793	19	920	10	903	9	**458**	**5**	1 400	14	736	8

NISA: Net Income Stabilisation Account.
AIDA: Agricultural Income Disaster Assistance.
1. Includes deemed.
2. Includes those not in NISA.
Source: Agriculture and Agri-Food Canada.

Table A4. **Average NISA gross margin by farm typology, Eastern Saskatchewan, 1994-98**

Farm typology	Number of participants	Average gross margin (CAD)[1]				
		1994	1995	1996	1997	1998
Hobby farms	254	9 259	10 374	6 860	5 639	1 446
Pension farms	1 274	30 644	32 804	28 702	28 309	23 425
Lifestyle farms	44	8 976	12 003	6 316	8 212	3 313
Low income farms	497	14 955	14 870	10 195	12 673	6 870
Limited opportunity farms	500	15 190	15 637	13 565	12 955	9 807
Transition farms	1 161	27 233	28 623	24 589	26 844	22 628
Large farms	1 932	50 947	56 523	56 261	58 938	53 345
Very large farms	103	122 804	139 833	136 594	134 575	137 793
All	5 765	34 607	37 641	34 996	36 345	31 605

NISA: Net Income Stabilisation Account.
1. Gross margin includes family labour.
Source: Agriculture and Agri-Food Canada

Table A5. **Production shifts, Saskatchewan, 1997, 1998, 1999**

Commodities	Values					
	1997		1998		1999	
	sales	price/unit	sales	price/unit	sales	price/unit
	('000 tonnes)	CAD	('000 tonnes)	CAD	('000 tonnes)	CAD
Wheat (excl. Durum)	11 033	135.09	7 280	113.46	6 540	111.07
Durum	3 678	150.46	3 347	155.67	3 236	115.61
Canola	2 415	370.11	3 066	375.34	2 727	283.75
Peas	812	190.19	1 126	157.10	1 239	137.25
Lentils	322	283.67	353	329.70	470	370.71
Mustard seed	181	393.73	191	309.18	164	434.08
Canary seed	134	311.95	131	267.58	146	237.06
Cattle (carcass weight equivalent)	7 887	79.59	8 359	79.67	7 649	81.67
Calves (carcass weight equivalent)	1 643	109.70	1 554	123.82	1 580	130.43
Hogs (carcass weight equivalent)	2 170	85.74	2 574	53.93	2 454	55.89
	Annual change in sales					
	% change 1997/98		% change 1998/99		% change 1997/99	
Wheat (excl. Durum)	–34		–10		–41	
Durum	–9		–3		–12	
Canola	27		–11		13	
Peas	39		10		53	
Lentils	9		33		46	
Mustard seed	6		–14		–9	
Canary seed	–3		11		8	
Cattle	6		–8		–3	
Calves	–5		2		–4	
Hogs	19		–5		13	

Source: Agriculture and Agri-Food Canada.

D.2. An Overview of Income Risk Management Practice and Policies in Australia

by
Rural Policy and Communications Division
Agriculture, Fisheries and Forestry Australia (AFFA)*

Introduction

The purpose of this paper is to outline the policy approach to income risk management in the Australian agricultural sector and to briefly describe the Australian commercial approaches and government programmes relevant to this subject.

The Australian farming environment is characterised by a climate of low and unreliable rainfall, few naturally good soils and an agricultural sector that is export focused, with farm income linked closely to prices on often volatile world markets. These three factors combined means that Australian agriculture is arguably subject to far higher levels of income risk than equivalent producers in Europe or North America. Despite this, Australian agriculture has survived and prospered using a market based approach, by focusing on clear market price signals, productivity increases based on technical developments and the structural adjustment of farm resources where necessary.

This section provides an overview of Australian agriculture and the policy environment in which it exists. The Australian approach to income risk management in Australian agriculture is then described. The four main types of risk and the policy response to each are examined in turn. The individual responsibility of farm managers for planning and managing for risk in their own enterprises is also discussed. Comments are also provided on the relationship between income risk management and the welfare safety net available to all Australians.

Overview of Australian agriculture

Australian agricultural industries cover about 60% of the land mass and contribute 3% of Australian Gross Domestic Product. Australian agriculture is a vital sector occupying a significant place in global rural trade. Wool, beef, wheat, cotton and sugar exports are particularly important components of the AUD 22.5 billion total value of Australian rural exports.

In 1998/99, of the 144 860 agricultural establishments employing 394 000 people, only 0.4% were corporately owned. Both the number of farm businesses and the number of people employed on farm have been steadily declining over the last ten years in response to adjustment pressures. However, there are strong indications that total employment in the agricultural sector is increasing because of the greater use of contract services and technical advisers to supplement the declining on-farm labour force.

For Australia, the gross value of agricultural production is AUD 28.8 billion which represents a farm cash income (average per farm) of AUD 43 570 in 1998/99. These figures have been relatively stable over the last few years, after a period of greater volatility from the 1970s to the early 1990s (ABARE, 2000).

* This contribution was presented by Craig Burns, Permanent Delegation of Australia to OECD, in *Session* 4.B: *Agricultural, fiscal and social safety-nets*.

Despite the relative stability of the aggregate performance, considerable variability exists within its component elements. This component variability is associated with the different commodity focus, climatic circumstances and environmental challenges facing individual farm enterprises and, as a consequence, farm incomes demonstrate considerable variability between regions and between years.

As a major agricultural exporter, Australia is directly affected by developments in world agricultural markets and the impact of policies of other countries which have a distortionary effect on agricultural trade and production. It is recognised that Australian exporters continue to face significant barriers in other countries and competition from subsidised products. While on-going reforms have achieved some notable improvements for agricultural trade, international markets remain highly distorted and this factor adds an additional element to the risk profile of Australian agriculture.

The Australian fiscal environment

The overall fiscal environment needs to be recognised as having a major impact on the profitability for all businesses, including agriculture. The current Australian Government has pursued a budget surplus to reduce government debt and this has contributed to low inflation and interest rates. Lower interest rates through the late 1990s have helped produce a more competitive Australian dollar, making exports more attractive. For farmers and other businesses carrying debt, lower interest rates improve their ability to service their debts and to meet general business and living costs. This has been particularly important for the most profitable third of farmers who tend to be highly geared (that is, carry a high debt to equity ratio) and carry 70% of the sector's debt.

To increase competition and reduce costs for Australians, including rural industries and rural and remote communities, Australia has enacted a National Competition Policy. This policy aims to create incentives for improved economic performance by increasing competition for goods and services. The Australian Government provides some specific arrangements for primary producers to address the period inequity problems with the tax system which reduces the variability of taxation liability from year to year, rebates for limited remote areas, and incentives for resource management.

Australia has also effected a programme of taxation reform, including a broad based consumption tax to replace a raft of indirect taxes. The aim is to give Australia a fairer tax system that provides further incentives to work, save and invest, as well as improve the capacity of Australian businesses to compete internationally.

General rural policies and programmes

The challenge for Australian agricultural policy is to facilitate the competitive, profitable and sustainable development of self reliant agricultural industries, capable of responding to the opportunities afforded by a market driven trading system. Australian agricultural policy includes few elements specifically focused on the management of risk. However, a number of programmes which principally focus on other objectives have secondary effects relevant to the management of risk by primary producers.

In September 1997, the Australian Government announced an integrated rural policy package titled Agriculture – Advancing Australia (AAA). The AAA package was subsequently extended in the 2000 budget. This package is a positive and integrated approach by the Government to help the farm sector and rural and regional communities successfully adapt to change. Its foundation is based on a commitment to work with the people of rural and regional Australia to overcome the many challenges facing rural industries and communities and secure the profitability, sustainability and competitiveness of the farm sector. Substantial opportunities for growth and development are emerging for Australia's rural industries.

The AAA package has four key objectives:

- to help individual farm businesses profit from change;
- to ensure that the farm sector has access to an adequate welfare safety net;
- to provide positive incentives for ongoing farm adjustment; and
- to encourage social and economic development in rural areas.

Australia also has a suite of agricultural and environmental policies to ensure effective and sustainable management of its natural resource base. These policies recognise that there is a role for Government to address market failures through, for example, the provision of resource information. The Government is working in concert with industry and the community to disseminate information on best practice land and water management and to address the adverse off-site impacts of agricultural activities and the under-supply of attributes such as ecological functions and habitat provision.

Australian approach to income risk management

Australian agricultural policy has been subjected to a programme of reform in recent decades which has seen movements towards a more market oriented sector and greater industry self-reliance. Prior to these reform processes, Australian agriculture was characterised by government supported underwriting schemes, buffer stock schemes and input subsidies. These have been dismantled as part of the reform agenda. Australia has also played a leading role in negotiations to achieve a more open world trading regime for agricultural products.

Along with these reform processes, Australian rural policy authorities have supported individual decision making by agricultural producers, including their assuming the major responsibility for their own risk management. In most cases, this is achieved through individual farmer action, but there are cases where it is achieved through co-operative action by industry groupings of producers.

Current government involvement in agricultural income risk management focuses on the following classes of activities:

- the provision of a legal and institutional framework for commercial measures;
- intervention in the case of market failure; and
- provision of a welfare safety net.

The Australian policy approach to risk management has both a short term and a long term focus. It is an underlying objective of policy that the Australian rural sector should be responsive to the market realities for the commodities. The structure and production patterns of the sector should be responsive to these fundamental influences. As such, the policies relating to income risk must be considered in this context. The policies do not exist to support farm incomes at levels above those which are consistent with the long term economic conditions or for other social purposes.

In order to achieve a policy environment which encourages farm decision making consistent with this objective, policies and approaches are considered in both the short term and the long term perspective, as follows:

- the short term perspective focuses on responses addressing variability and fluctuations in annual income or over a run of seasons; and
- the long term perspective focuses on the adjustment of production patterns and resource use away from activities or commodities which are unable to adapt to the income risk conditions to earn a suitable return in the long term for the labour and capital employed in production.

The following discussion is structured to reflect the types of risks identified in Part I. The generalised Australian approach to types of risk and the policy responses associated with them are described in the following paragraphs.

Production risk

The Australian production environment experiences large variation from a range of sources including weather phenomena, such as drought, storm and flooding, disease outbreaks and damage, from mice and insect plagues. This category of risk is arguably the most important of the four risk categories in the Australian situation. While some other parts of the world may have more variable rainfall patterns than Australia, the mean values of Australian rainfall are generally lower, leading to situations where the probability of falling below the rainfall threshold for production failure is greater. Of particular note are large scale regional drought events of several years duration often related to the El Nino phenomenon.

In the short term, individual producers generally bear the risks associated with these. Governments may provide disaster relief in extreme cases which are considered to be beyond the scope of normal individual risk management. In addition, government agencies provide meteorological forecasts and are developing long range forecasts which provide reliable planning information for decision makers to make management decisions about activities in the season ahead.

Specific policy responses to production risk include the following programmes.

The Farm Management Deposits (FMD) scheme offers primary producers a tool to manage financial risk and reduce the variability of post-tax income, by enabling producers to set aside pre-tax income from years of good cash flow, deferring the payment of tax on these amounts and drawing down on deposits in years when additional cash flow is needed. As the Australian taxation system for individuals features progressing marginal tax rates, this results in a more even distribution of taxation liability between periods. In the past, deposits of this nature were managed by a government agency. FMDs are a tax-linked fully commercial product, offered by banks and other financial institutions which meet the Government's prudential requirements for deposit taking institutions. Many producers incorporate the use of FMDs into their risk management strategies, particularly to provide funds to reduce the effect of years when production risk from extreme climatic events, such as drought, reduces their business incomes.

Exceptional Circumstances Assistance is the Commonwealth Government's main vehicle for providing assistance directly to farmers in a region or industry that is experiencing a severe downturn due to a rare and severe event. The rationale for providing this support is to ensure that farmers with long term prospects for viability will not be forced to leave the land due to short-term adverse events that are beyond their control.

Exceptional circumstances are rare and severe events that are outside those that a farmer could normally be expected to manage under responsible farm management strategies. Specifically, they are events that occur on average once every 20 to 25 years and have an impact on income for a prolonged period (*i.e.* greater than 12 months). The event:

- must result in a severe downturn in farm income over a prolonged period of time;
- cannot be planned for or managed as part of farmers' normal risk management strategies; and
- must be a discrete event which is not part of long-term structural adjustment or of normal fluctuations in commodity prices.

Climate Research and Long Term Weather Forecasting are essential baseline activities for improving the production management decisions in Australian primary industries. These government services provide information and forecasts that enable managers to manage their production processes, reducing the variability of outcomes and thus of income risk. Research to date indicates that reliable forecasting tools based on appropriate climatic leading indicators are achievable. Principal agencies involved in this research are the Bureau of Meteorology and the Division of Atmospheric Physics of the Commonwealth Scientific and Industrial Research Organisation (CSIRO). A number of other agencies including State Governments and universities are involved in operationalising these forecasts as practical decision support tools for farmers.

In addition to the short term responses to income variability, a longer term focus is also needed to restructure agricultural industries so as to achieve higher returns and manageable risk levels. In the long term, individuals are encouraged to relocate the resources tied up in non-viable enterprises to other enterprise types through adopting different products or technologies, or by relocation to other geographic areas where a viable enterprise might be developed.

Industry and government also provide joint funding for research and development activities on a range of subjects to reduce production risks. This activity covers a wide range of scientific and economic inquiries of relevance to agricultural production and marketing.

Ecological risks

These risks are associated with pollution, climate change and natural resources. In Australia, the progressive decline in water quality and the degradation of land resources, particularly through salinity, is a growing problem in specific regions. The effects of these are generally slow and progressive, rather than acute and quick acting.

In the short term, individual producers plan and manage their production activities to minimise the impacts of these changes. As these effects are generally slow and progressive in their impact, producers may adopt a strategy of progressive revegetation of vulnerable areas and capital works such as the construction of drainage ditches or banks to control water flow, or laser levelling of irrigation fields.

In the longer term, individuals may plan to change the nature of their enterprises in line with projected changes in climate or their resource base. In many areas, landholders may act co-operatively, such as in Landcare groups, or sometimes in conjunction with other concerned citizens to undertake land remediation activities such as large scale tree planting or capital works on a catchment basis. Governments also are responding with research into changes in the climate and the resource base, plus monitoring and remediation techniques.

In the future, with the anticipated continuation of land and water degradation, significant actions may be required involving engineering works, restrictions on undesirable farming practices or in extreme cases, the relocation of farming populations from areas which cannot be reclaimed for viable production pursuits. Such actions would be undertaken in close consultation with affected individuals, industry bodies and regional authorities.

Market risk

This type of risk is associated with input and output price variability. Australian agriculture faces high levels of risk of this nature because of its openness to international market conditions and prices, which themselves are made more variable as a result of domestic market insulation practices by other major producers.

In the short term, individual producers can make decisions about the nature and timing of production and marketing activities. These may result in spreading production across a range of markets, both spatially and temporally. Alternatively, managers may utilise risk management instruments such as forward selling, futures contracts or insurance to increase the certainty to price outcomes. An active futures market exists in Australia for many commodities and many producers use futures contracts as a risk management tool. However, the insurance market provides only limited opportunities for risk management, as available contracts only cover a relatively restricted range of risks, generally flood, fire and hail.

Some industries have chosen to operate co-operative marketing arrangements. One approach is the pooling of products and another is single desk marketing. While the latter approach incorporates some element of risk management, it is more likely explained as a seller's response to market structure issues related to balancing the power of buyers in a concentrated market. These arrangements do not, however, contain any subsidised underwriting provisions, with any short term variability covered from internal funds.

Government involvement in market risk management focuses on longer term issues such as setting the broader economic policy environment and the legal and institutional framework within which commercial and industry risk management arrangements operate. In recent years, changes in these areas have focused on the creation of an open, market-based economy with as little government intervention in the business decision making of industry and individual producers as possible. As a consequence of these changes, the management of most types of risk is now being handled by individual farm managers using the services of an increasingly sophisticated commercial risk management market.

Research aimed at the development of a multi-risk insurance scheme is being supported by the Australian Government. The Australian insurance market does not currently offer insurance cover for many categories of risk facing primary producers. While there has been interest in multi-peril risk instrument, it has not proved feasible to date to offer one at a price which would be attractive to primary producers. The availability of such an insurance contract from a range of commercial insurers could add significantly to the ability of primary producers to manage income risks associated with their businesses. In 1999, funding was provided for actuarial research into the practicality of offering a scheme of insurance against multiple risks facing primary producers. This work has not yet been finalised.

Regulatory or institutional risks

These risks relate to institutional changes such as changes in government intervention in agriculture, changes in food safety requirements and environmental regulations. An example of institutional risk is the changes currently occurring in the Australian taxation system. On 1 July 2000, a broad-based goods and services tax will replace or modify a number of existing income tax and sales tax measures. In addition, a major review of business taxation arrangements is being conducted which is expected change a number of business arrangements for farmers and other businesses.

In the Australian situation, there is an active and ongoing liaison between farmer organisations, industry and government to manage institutional risk. Most issues are managed in a manner which attempts to balance the interests of the parties involved. In some cases, the resolution may include some form of compensation provided by the benefiting parties to the disadvantaged, which may include in some cases a publicly funded component. This is particularly applicable where institutional reform is necessary in the interests of the society as a whole and where losses are incurred by particular groups in the process. An example of this process is the arrangements made for the testing of Australian cattle herds in recent years to detect and eliminate bovine tuberculosis and brucellosis. The disease-free status brings benefits to Australian beef industry, especially in international trade. In order to achieve this desirable objective, the testing programme and compensation for the slaughter of infected animals was funded by government. It should, however, be noted that while such arrangements are possible in domestic cases, the impact of institutional risk arising from outside Australia is not as easily managed as that arising from within the nation.

Supporting farm-level management of risk

Australian income risk policy places considerable responsibility on individual managers for the planning and implementation of risk management strategies and activities relating to their individual farm business. Support for this focuses on education and training activities, applicable to all four types of risk.

The extension and economics officers of the agriculture agencies of Australian State/Territory Governments, plus industry bodies, universities and colleges, have provided a range of education and training options for Australian farmers over many years to assist them acquire and use suitable risk planning and management skills.

The strategies which might be included under this approach include:

- diversification strategies (on-farm and off-farm);
- benchmarking (including risk/return tradeoffs);
- understanding the concept of probability and its use;
- understanding and using climate forecasts;
- assessing the risk characteristics of production alternatives;
- activity planning and cash flow planning using different scenarios;
- the use of futures hedging and other risk management instruments; and
- the use of climatic and technical information in planning for risk.

Many Australian farmers are generally risk averse and conservative in making farm production decisions. Studies by ABARE (ABARE, 2000) show that Australian broadacre farmers are adopting greater levels of enterprise diversification as demonstrated by increasing values of the diversification index for surveyed Australian broadacre cropping farms. This indicates that a greater range of alternative enterprises are being adopted on their farms in response to economic pressures.

Other programmes with risk policy implications

All Australian citizens are covered by a social security welfare net which provides assistance to individuals and families for specific welfare related purposes and also in circumstances where they can no longer provide the basic necessities of life. Such assistance is not specific to primary producers and is available to all people in the nation. In general, different conditions of access to such benefits are applied to persons employed for wages and to self-employed persons with significant assets. Farmers usually hold significant assets and thus are included in the self employed category and their access to such assistance is more restricted than is the case for employees who are normally employed for wages. These social security benefits are only available in cases of extreme hardship by farm families and are not available as a tool to manage normal income risk.

One programme which currently addresses this objective is the Retirement Assistance for Farmers Scheme (RAFS). This scheme is targeted at older farmers who wish to transfer their farm to a younger family member and retire on the old age pension but are ineligible to do so under the rules relating to asset disposal. Under RAFS, special provisions are in place to enable the retiring farmer to receive the pension whilst transferring the farm to a younger family member.

For those families considering leaving farming, the Farm Family Restart Scheme (FFRS) provides support to low income farmers experiencing hardship, who are unable to borrow further against their assets and who are not ready to adjust out of farming. FFRS provides farming families with income support for up to 12 months, limited access to professional advice to plan their future – whether this be on or off the farm – as well as providing a one-off re-establishment grant for those who decide to leave farming.

Education and Training Programmes have been developed which raise awareness by farmers and rural communities of the nature and extent of the changes that they must make and that encourage them to acquire the skills and information necessary to manage those changes. These are generally broader in concept than the specific risk management training activities discussed in earlier paragraphs. Programmes emphasise that farmers and communities are responsible for the management of their own affairs and must implement practices that are self reliant, ecologically sustainable and economically viable. As a consequence, farmers are improving their management and financial skills and adopting new technologies and innovative practices. They are becoming more flexible and better able to adapt to changing market conditions. Productivity is increasing, management of the natural resource base is improving, and linkages with other sectors are being strengthened. Programmes of particular relevance include the FarmBis programme which focuses on farmer management skills and Property Management Planning (PMP) which focuses on strategic planning skills of farm families.

Summary and conclusion

In line with its general approach to farm policy, the Australian approach to income risk management focuses on the individual responsibility of farm managers for planning and managing to ameliorate the risks facing their business, using appropriate risk management instruments.

Government involvement focuses on providing the appropriate economic management settings for the economy as a whole, plus providing the institutional and legal framework for individual, commercial and industry actions. Governments also are involved in the provision of public goods such as long term weather forecasts and research into climate matters and risk management tools. There is also a significant commitment to education and training, particularly focused on the acquisition of planning and

management skills by farm managers. While not primarily targeted at risk management outcomes, some taxation arrangements and structural adjustment policies have implications for the incidence of problems associated with low incomes in years of low commodity prices or production.

Risk management policies and instruments are seen in Australia as tools for farm managers to use in a market oriented farm sector. It is not appropriate for such tools to be used as a means of financially supporting non-viable producers or farm communities lacking long term prospects for their product or industry. Where governments pursue such outcomes for legitimate social or political reasons, the policy instruments chosen should directly address the desired outcomes, rather than the inappropriate and indirect use of income risk policies.

In cases of disaster causing extreme hardship, the Australian Government provides relief through Exceptional Circumstances Assistance. In addition, a social security safety net is available for all citizens who are unable to provide the basic necessities of life. This safety net is not a specific income risk tool, rather it represents a social overhead, similar in nature to the provision of basic schools and medical services.

BIBLIOGRAPHY

ABARE (2000),
Proceedings of the National Outlook Conference, Canberra, 29 February-2 March.

Agriculture Canada (1989),
Growing Together: A Vision for Canada's Agri-food Industry, Proceedings from a National Agri-Food Policy Conference on Safety Nets, December, Ottawa, Canada.

Ahsan, S.M., A.G. Ali and N.J. Kurian (1982),
"Toward a Theory of Agricultural Insurance", *American Journal of Agricultural Economics*, Vol. 64, pp. 520-529.

Anderson R.W. and J.P. Danthine (1980),
"Hedging and Joint Production: Theory and Illustrations", *Journal of Finance*, Vol. 35, pp. 487-498.

Arrow, K.J. (1964),
"The Role of Securities in the Optimal Allocation of Risk Bearing", *Review of Economic Studies*, Vol. 31 pp. 91-96.

Arrow, K.J. (1996),
"The Theory of Risk-Bearing: Small and Great Risks", *Journal of Risk and Uncertainty*, Vol. 12, pp. 103-111.

Ashkenas, R., D. Ulrich, T. Jick and S. Kerr (1995),
The Boundaryless Organisation – Breaking the Chains of Organisational Structure, Jossey-Bass.

Barnett, B.J. and K.H. Coble (1999),
"Understanding Crop Insurance Principles: A Primer for Farm Leaders", Mississippi State University Research Report No. 209, Starkville, Mississippi.

Boehlje, M., L. Schrader and J. Akridge (1998),
"Observations on formation of food supply chains", *Proceedings of the Third International Conference on Chain Management in Agribusiness and the Food Industry*, Wageningen Agricultural University, Netherlands, May, pp. 393-403.

Burgaz, F. (1995),
"Las politicas de ayudas a las catástrofes agrícolas y a los seguros agrarios en la Union Europea", *Revista Española de Economía Agraria*, Vol. 174(4).

Burgaz, F. (1997),
"La agricultura protegida contra las inundaciones", *Vida Rural*, Vol. 57, pp. 21-23.

Burgaz, F. and M. Perez-Morals (1996),
1902-1992, *Noventa anos de seguros agrarios en España*, Ministerio de Agricultura, Pesca y Alimentación, Madrid.

Chambers, R.G. (1989),
"Insurability and Moral Hazard in Agricultural Insurance Markets", *American Journal of Agricultural Economics*, Vol. 71, pp. 604-616.

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

Coble, K., T.O. Knight, R.D. Pope and J.R. Williams (1997),
"An Expected Indemnity Approach to the Measurement of Moral Hazard in Crop Insurance", *American Journal of Agricultural Economics*, Vol. 79, pp. 216-226.

Cordier, J. (2000),
Required Vertical Coordination and Derived Risk Management, paper presented at the Xth Congress of the International Food and Agribusiness Management Association, Chicago, 26-28 June.

Debreu, G. (1959),
Theory of Value: An Axiomatic Analysis of Economic Equilibrium, Wiley, New York.

Dehn, J. and C.L. Gilbert (1999),
Commodity Price Volatility, Economic Growth and Poverty, University of Oxford, Centre for the Study of African Economics.

Dixit, A. (1996),
The Making of Economic Policy: A Transaction-Cost Politics Perspective, Cambridge, MA, The MIT Press.

Economic and Social Committee (1993),
Common System of Agricultural Insurance, brochure published by the European Communities, Economic and Social Committee, Brussels.

Fortez del Rey, V. (2000),
El sistema de seguros agrarios combinados español. Situación actual, International Seminar on Systems of Protection against Agricultural Risk in the 21st Century, Madrid, 2-4 June 1999.

Gabriel, S.C. and C.B. Baker (1980),
"Concepts of Business and Financial Risk", *American Journal of Agricultural Economics*, Vol. 62, pp. 560-564.

Glauber, J.W., J.L. Harwood and J.R. Skees (1993),
"An Alternative for Reducing Federal Crop Insurance Program Losses", *Agricultural Economic Report*, Vol. 668, United States Department of Agriculture, Washington, DC.

Glauber, J.W. and M.J. Miranda (1994),
"Providing catastrophic yield protection through a targeted revenue program" in D.L. Hueth and W.H. Furtan (eds.), *Economics of Agricultural Crop Insurance: Theory and Evidence*, Kluwer, Dordrecht, Netherlands.

Goodwin, B.K. (1994),
"Premium Rate Determination in the Federal Crop Insurance Program: What Do Averages Have to Say About Risk?", *Journal of Agriculture and Resource Economics*, Vol. 19, pp. 382-395.

Goodwin, B.K. and V.H. Smith (1995),
The Economics of Crop Insurance and Disaster Aid, American Enterprise Institute Press, Washington, DC.

Hardaker, J., R. Huirne and J. Anderson (1997),
Coping with risk in agriculture, Cab International, Wallingford, United Kingdom.

Harwood, J., R. Heifner, K. Coble, R. Dismukes and S. Evans (1994),
"Streamlining Farm Policy: The Revenue Guarantee Approach", *Agricultural Outlook*, Economic Research Service, United States Department of Agriculture, Washington, DC.

Harwood, J., R. Heifner, K. Coble and J. Perry (1996),
"Strategies for a New Risk Management Environment", *Agricultural Outlook*, Economic Research Service, United States Department of Agriculture, Washington, DC.

Harwood, J., R. Heifner, K. Coble, J. Perry and A. Somwaru (1999),
"Managing Risk in Farming: Concepts, Research, and Analysis", *Agricultural Economic Report*, Vol. 774, United States Department of Agriculture, Washington, DC.

Hazell, P.B.R. (1992),
"The Appropriate Role of Agricultural Insurance in Developing Countries", *Journal of International Development*, Vol. 4, pp. 567-581.

Hueth, B. and E. Ligon (1999),
"Agricultural Supply Response under Contract", *American Journal of Agricultural Economics*, Vol. 81, pp. 610-615.

Hull, J. (1989), *Options, Futures and other Derivative Securities*, Prentice-Hall, Englewood Cliffs.

Kaine, G., J. Lees and J. Sandall (1994),
Planning and Performance: An exploration of farm Business strategy and perceptions of control, Armidale NSW: The Rural Development Centre, University of New England.

Keeton, K., J. Skees and J. Long (1999),
The Potential Influence of Risk Management Programs on Cropping Decisions, selected paper at the American Agricultural Economics Association meetings, 8-11 August, Nashville, Tennessee.

Knight, T.O. and K.H. Coble (1997),
"Survey of US Multiple Peril Crop Insurance Literature Since 1980", *Review of Agricultural Economics*, Vol. 19, pp. 128-157.

Jaffee, D.W. and T. Russell (1997),
"Catastrophe Insurance, Capital Markets, and Uninsurable Risks", *Journal of Risk and Insurance*, Vol. 64, pp. 205-30.

Just, R.E. and L. Calvin (1993),
Moral Hazard in US Crop Insurance: An Empirical Investigation, unpublished manuscript, College Park, University of Maryland, College of Agriculture and Natural Resources.

Leuthold, R.M., J.C. Junkus and J.E. Cordier (1992),
The Theory and Practice of Futures Markets, DC Heath, Lexington.

Mahé, L.P. and F. Ortalo-Magné (1998),
International co-operation in the regulation of food quality and safety attributes, OECD Workshop on Emerging Trade Issues in Agriculture, Paris, 26-27 October.

Mahul, O. (1999),
"Optimum Area Yield Crop Insurance", *American Journal of Agricultural Economics*, Vol. 81, pp. 75-82.

Makki, S.S. and A. Somwaru (2000),
Asymmetric Information in the Market for Yield and Revenue Insurance Products, unpublished manuscript, United States Department of Agriculture, Economic Research Service, Washington, DC.

Manfredo, M.R. and R.M. Leuthold (1998),
Agricultural Applications of Value-at-Risk Analysis: A *Perspective*, OFOR Paper, University of Illinois, Vol. 98(4).

Martin, P., M. Lubulwa, C. Riley and S. Helali (2000),
"Farm Performance – Managing Risks", *Proceedings of the National Outlook Conference*, Canberra, 29 February-2 March, pp. 41-62.

Martin, S. (1996),
"Risk Management Strategies in New Zealand Agriculture and Horticulture", *Review of Marketing and Agricultural Economics*, Vol. 64(1), pp. 31-44.

Martin, S. and F. McLeay (1998),
"The Diversity of Farmers' Risk Management Strategies in a Deregulated Environment", *Journal of Agricultural* Economics, Vol. 49(2), pp. 218-233.

McDermott, A.K. and N.M. Shadbolt (1998),
"Strategic alliances for competitive viability in New Zealand pastoral systems", *Proceedings of the Third International Conference on Chain Management in Agribusiness and the Food Industry*, Wageningen Agricultural University, Netherlands, pp. 587-596.

Ministerio de Agricultura, Pesca y Alimentación (1997),
Los seguros agrarios en el umbral del siglo XXI, paper from the National Conference on Agricultural Insurance, Madrid, 1-3 April.

Miranda, M.J. (1991),
"Area-Yield Crop Insurance Reconsidered", *American Journal of Agricultural Economics*, Vol. 73, pp. 233-242.

Miranda, M.J. and J.W. Glauber (1997),
"Systemic Risk, Reinsurance, and the Failure of Crop Insurance Markets", *American Journal of Agricultural Economics*, Vol. 79, pp. 206-215.

Mishra, P.K. (1996),
Agricultural Risk, Insurance and Income: A *Study of the Impact and Design of India's Comprehensive Crop Insurance Scheme*, Avebury, Aldershot, United Kingdom.

Montes de Oca and N.M. Shadbolt (2000),
"Vertical Co-ordination in the New Zealand Lamb Supply Chain: methods by which to better assess Risk-Return Profiles", *Proceedings of the Fourth International Conference on Chain Management In Agribusiness and the Food Industry*, Wageningen Agricultural University, Netherlands, pp. 303-312.

Newbery, D.M. and J.E. Stiglitz (1981),
The Theory of Commodity Price Stabilization, Clarendon Press, Oxford.

Palmer, C.M. (1996),
"Building effective alliances in the meat supply chain: lessons from the United Kingdom", *Supply Chain Management*, Vol. 1(3), pp. 9-11.

Priest, G.L. (1996),
"The Government, the Market, and the Problem of Catastrophic Loss", *Journal of Risk and Uncertainty*, Vol. 12, pp. 219-237.

Quiggin, J., G. Karagiannis and J. Stanton (1994),
"Crop Insurance and Crop Production: An Empirical Study of Moral Hazard and Adverse Selection", *Economics of Agricultural Crop Insurance*: *Theory and Evidence*, Darrell L. Hueth and William H. Furtan (eds.), Kluwer Academic Publishers, Norwell, MA, pp. 253-272.

Ray, P.K. (1980),
Agricultural Insurance: *Theory and Practice and Application to Developing Countries*, New York, Pergamon Press, second edition.

Rejda, G.E. (1995),
Principles of Risk Management and Insurance, New York: Harder Collins College Publishers.

Sarris, A.H. (1997),
"The Evolving Nature of International Price Instability in Cereals Markets", FAO *Commodities and Trade Division*, Report ESCP/No.4.

Shadbolt, N.M. and S.R. Carroll (1997),
"Adoption of Risk Management and Growth Strategies to Achieve Short and Long Term Viability for the Family Farm", *Proceedings of the* 11th *International Farm Management Congress*, Calgary, Canada, International Farm Management Association, pp. 611-621.

Shavell, S. (1979),
"On Moral Hazard and Insurance", *Quarterly Journal of Agricultural Economics*, Vol. 93, pp. 541-63.

Skees, J.R. (1999*a*),
"Opportunities for Improved Efficiency in Risk-Sharing Using Capital Markets", *American Journal of Agricultural Economics*, Vol. 81, pp. 1228-1223.

Skees, J.R. (1999*b*),
"Agricultural Risk Management or Income Enhancement?", *Regulation*, Vol. 22, pp. 35-43.

Skees, J.R. (1999*c*),
Policy Lessons of Income Insurance: Lessons Learned from the US and Canada, principle paper for the meeting of the European Association of Agricultural Economists, Warsaw, Poland, August.

Skees, J.R. and B.J. Barnett (1999),
"Conceptual and Practical Considerations for Sharing Catastrophic Risks", *Review of Agricultural Economics*, Vol. 21, pp. 424-441.

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*, Vol. 79, pp. 430-38.

Skees, J.R., J. Harwood, A. Somwaru and J. Perry (1998),
"The Potential for Revenue Insurance Policies in the South", *Journal of Agriculture and Applied Economics*, Vol. 30, pp. 47-61.

Skees, J.R. and M.R. Reed (1986),
"Rate Making for Farm-Level Crop Insurance: Implications for Adverse Selection", *American Journal of Agricultural Economics*, Vol. 68, pp. 653-59.

Spriggs, J. and T. Nelson (1997),
"Effects of Enhancing NISA on Income Stabilization and Support", *Canadian Journal of Agricultural Economics*, Vol. 45, pp. 123-129.

Sumpsi, J.M. (2000),
Hacia une actividad agraria menos incierta?, International Seminar on Systems of Protection against Agricultural Risk in the 21st Century, Madrid, 2-4 June 1999.

Turvey, C.G. (1992),
"An Economic Analysis of Alternative Farm Revenue Insurance Policies", *Canadian Journal of Agricultural Economics*, Vol. 40, pp. 403-426.

Turvey, C.G. and K. Chen (1994),
Canadian Safety Net Programs for Agriculture, paper presented at the annual meeting of the American Agricultural Economics Association, San Diego, California.

Tweeten, L. (1995),
"The twelve best reasons for commodity programs: why none stands scrutiny", *Choices*, 2nd Quarter.

US Department of Agriculture (1983),
Farm Income Protection Insurance: a Report to the United States Congress, Farm Income Protection Insurance Task Force, Washington, DC.

US General Accounting Office (1993),
Crop Insurance: Federal Program Faces Insurability and Design Problems, GAO/RCED-93-98, Washington, DC.

US General Accounting Office (1995),
Crop Insurance: Additional Actions Could Further Improve Program's Financial Condition, GAO/RCED-95-269, Washington, DC.

US General Accounting Office (1998),
Crop Revenue Insurance: Problems With New Plans Need to Be Addressed.

Wang, H.H., R.J. Hanson, R.J. Myers and R. Black (1998),
"The effects of crop yield insurance designs on farmer participation and welfare", *American Journal of Agricultural Economics*, Vol. 80, pp. 806-820.

Williams, J. and W. Schroder (2000),
Agricultural Price Risk Management, Oxford University Press, New York.

Wright, B.D. and J.A. Hewitt (1994),
"All Risk Crop Insurance: Lessons from Theory and Experience", *Economics of Agricultural Crop Insurance: Theory and Evidence*, Darrell L. Hueth and William H. Furtan (eds.), Kluwer Academic Publishers, Norwell MA, pp. 73-112.

Young, C.E., R.D. Schnept, J.R. Skees and W.W. Lin (1999),
Production and price impacts of US crop insurance subsidies: some preliminary results, paper presented at the Federal Forecasters Conference, Washington, DC, June.

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(51 2000 12 1 P) ISBN 92-64-18534-8 – No. 51425 2000