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Risk Management in Agriculture in Australia

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Abstract

RISK MANAGEMENT IN AGRICULTURE IN AUSTRALIA

by

Shingo KIMURA and Jesús ANTÓN*

This report analyzes the agricultural risk management system in Australia, applying a holistic approach that considers the interactions between all sources of risk, farmers' strategies and policies. The policy analysis is structured around three layers of risk that require a differentiated policy response: normal (frequent) risks that should be retained by the farmer, marketable intermediate risks that can be transferred through market tools, and catastrophic risk that requires government assistance. The main focus of risk management policy in Australia is drought risk and this paper assesses the objective and instruments of the country's national drought policy framework.

JEL: Q18

Keywords: Agricultural policy, risk management, catastrophic risk, drought policy, climate change, bio-security, cost sharing, index insurance.

* OECD Trade and Agriculture Directorate.

FOREWORD

The OECD project on risk management policy in agriculture (www.oecd.org/agriculture/policies/risk) developed the framework and methods originally published in *Risk Management in Agriculture: a Holistic Approach* (OECD, 2009). These were then applied to the analysis of the risk management policies of five countries: Australia, Canada, Netherlands, New Zealand and Spain.

All five country studies which resulted from this project followed the same process of preparation. The key inputs to these reports were: responses by governments to a detailed questionnaire prepared by the OECD Secretariat; a background report drafted by a national expert; an OECD Secretariat visit to the country with the participation of national and international experts; and a report on the country visit by an international expert.

The OECD Secretariat would like to highly acknowledge financial, information and organisational assistance of the Department of Agriculture, Fisheries and Forestry of the Australian Government (DAFF) in preparation of this and other components of the project.

This project was led by Jesús Antón. The authors of this report are Shingo Kimura and Jesús Antón. The experts preparing the background report and the visit report for this study were Bill Malcolm from the University of Melbourne and Federica Angelucci from FAO (Italy). Statistical assistance was provided by Christine Le Thi. Editorial work was done by Michèle Patterson. The authors would also like to acknowledge the useful comments and discussions with several OECD colleagues.

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Abbreviations

ABARE – BRS	Australian Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences
AHA	Animal Health Australia
BOM	Bureau of Metrology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
EADRA	Emergency Animal Disease Response Agreement
EPPRD	Emergency Plant Pest Response Deed
EC	Exceptional Circumstances
ECIRS	Exceptional Circumstances Interest Rate Subsidy
ECRP	Exceptional Circumstances Relief Payment
NDP	National Drought Policy
NDRRA	Natural Disaster Relief and Recovery Arrangements
NSW	New South Wales
PHA	Plant Health Australia
SA	South Australia
WA	Western Australia

PART I.

RISKS, STRATEGIES AND POLICIES IN AUSTRALIA

1. An assesment of agricultural risk in Australia: three layers of agricultural risk

The principal advantage of farmers in Australia over those in other countries is the large area of agricultural land per head of population. Six per cent, or 46 million hectares, of the total land area in Australia is suitable for extensive crops, pastures, and intensive and irrigated agriculture and horticulture activities. This is a substantial area of arable land for agriculture and horticulture for a small population. However, the soil generally lacks a natural supply of nutrients necessary for plants, has little organic matter, and poor structure. A further 363 million hectares (47% of total land area) of the country's total 770 million hectares is used for agriculture that does not require cultivation. The remaining 40% of land has little agricultural use. Where the rainfall is less than 250 mm in the south or less than 350 mm in the north, the land cannot grow crops or introduce pastures. About 419 million hectares has such low and variable rainfall and poor soils that cropping or pasture improvement is not suitable for sustainable production. In these areas, low intensity pastoralism is the only potential agricultural use of land.

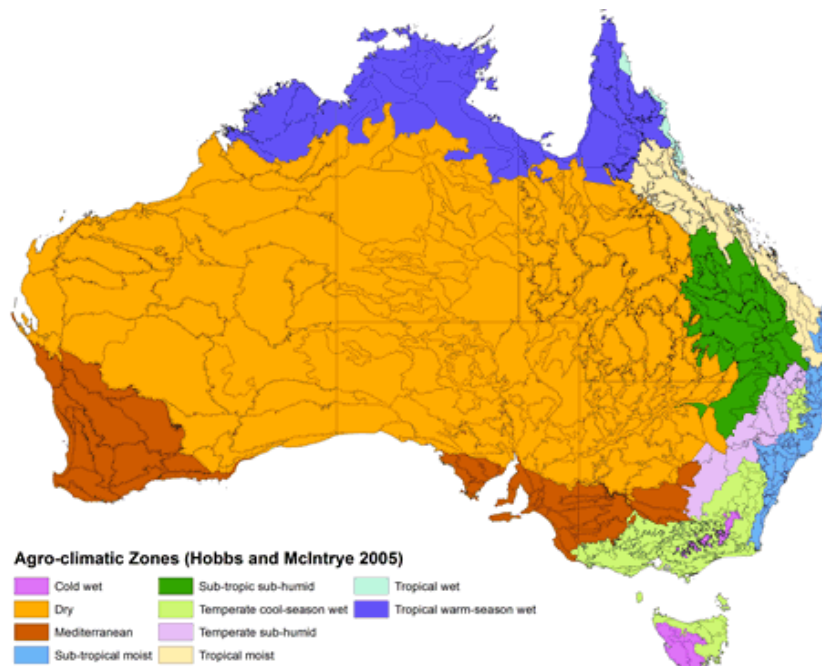
Agricultural climate condition

The key feature of the natural environment that affects farming in Australia is rain during the growing season. Rain varies greatly from one year to the next, and thus the supply of water for irrigation from rain that runs off the land and into catchments and underground is limited and highly variable. The amount of rainfall also varies greatly across Australia. The monsoon areas of the tropical north have summer maximum rainfalls and the temperate south-west and south-east have winter maximum rainfall. Eighty per cent of the land receives less than 600 mm of rain per year, and 50% of the land receives less than 300 mm of rain each year. The dry centre receives less than 200 mm of rain each year. South, between the dry centre and the coastal regions, annual rainfall is 200- 400 mm on average. Figure 1 presents the agricultural climate zones in Australia.

It is often argued that the frequency and severity of droughts in Australia has increased due to climate change. The application of IPCC ARD models shows that about 50% of the rainfall decrease in South Western Australia since the late 1960's is likely due to increases in greenhouse gases (Cai and Cowan, 2006). The historical record indicates that the percentage of area having exceptionally low rainfall between 2002-2007 is higher than the average of the last 16 and 108 years in all regions (Table 1). However, it also

shows that the percentage area with exceptionally low rainfall in the last 16 years is lower than the average of the last 108 years, except for Victoria and Tasmania and Southwest WA. The projection made by BOM and CSIRO in 2008 shows that the areal extent and frequency of exceptionally hot years has increased over recent decades and that this trend is expected to continue. The trend in exceptionally low rainfalls years is dependent on the period, but in some regions it is expected that the exceptionally low soil moisture years will increase over the next decades.

Figure 1. Agricultural climate zoning in Australia



Source : Hobbs and. McIntyre (2005)

Table 1. Average percentage area having exceptionally low rainfall
Per cent of total area in region

	1900-2008	1993-2008	2002-2007
Queensland	5.5	3.9	7.5
New South Wales	5.5	5.0	10.7
Victoria and Tasmania	5.5	7.0	14.1
South Australia	5.5	3.4	5.4
Northwest Australia	5.6	2.4	5.6
Murray-Darling Basin	5.5	4.8	11.4
Southwest WA	5.5	9.0	10.6
Australia	5.5	3.1	5.1

Source : Productivity Commission (2009).

Market conditions

Since the majority of agricultural commodities are exported to international markets, output price risks are based mainly on the international price and exchange rate. Australia has a long history, until deregulation in recent decades, of using marketing boards for export and domestic marketing of major commodities (Box 1). Marketing boards pool the price risk and usually offer a single price for all participating farmers. Under this type of scheme, the fluctuation of the international price and exchange rates are mitigated through the pooling mechanism, but farmers do not have access to other price risk management instruments. Recent deregulations in commodity marketing arrangements have made it possible, and necessary, for farmers to manage price risk themselves.

Box 1. Evolution of Commodity Marketing Boards in Australia

Historically, the Australian government facilitated the system of pooling price risk through marketing boards to reduce the producer's exposure to volatile commodity prices. Federal and state powers were required to enact and enforce regulatory regimes that made it possible to raise commodity specific levies and operate two-price schemes to equalize or stabilize prices and incomes, and buffer fund and buffer stock schemes. Notable examples are the Australian Wheat Board and the Dairy and Dried fruit two-price marketing schemes. The Australian Wool Board ran a reserve price, later buffer stock, scheme for wool from the early 1970s to 1989. State based marketing boards also had a single desk marketing arrangement in domestic and/or export marketing for barley, sorghum, maize, oats, oilseeds, lupins and rice. During the 1990's and early 2000's, almost all the marketing board schemes at both the national and state/territory government levels were abolished, except for the wheat export marketing arrangement.

The Australian Wheat Board maintained compulsory acquisition powers for wheat with a guaranteed producer prices until 1989 when the domestic marketing of wheat is deregulated. In 1999, the Australian Wheat Board was privatized but maintained its exclusive power of wheat export marketing. The single desk scheme for the remaining bulk wheat exports was abolished and replaced by the Wheat Accreditation Scheme in 2008, which requires bulk wheat exporters to be accredited by an Australian government agency (Wheat Exports Australia). As of March 2010, 29 organizations have been accredited to export bulk wheat and the share of Australian Wheat Board in wheat export has declined to 27% in 2009 (Productivity Commission ,2010).

Types of farming

Australia's small, medium-sized and large farm businesses produce for both small domestic markets and large export markets (Box 2). There are farmers in every state: 40 000 in NSW (30%), 32 000 in Victoria (25%), 27 000 in Queensland (20%), 14 000 in SA (11%), 12 000 in WA (9%), 3 800 in Tasmania (3%), 380 in the Northern Territory (0.3%). Cereals are grown in the southern mainland States. Mixed sheep-cereal farms are in NSW, Victoria, SA and WA. Beef is produced in all states, although mainly in NSW, Victoria and Queensland. Sheep meat is produced in Victoria, NSW and WA. The majority of dairy farms are in Victoria and Tasmania, with others in south-east SA, the southern Riverina of NSW and Queensland and WA. Queensland has the most vegetable producers, though significant vegetable production takes place in every state. The sugar industry is in Queensland and NSW Wales. Cotton is grown in NSW and Queensland. Apple, peach and pear producers are mostly in NSW and Victoria, as are nearly all citrus growers. Grape-growers for wine are everywhere. Northern Australia has beef and irrigated horticulture businesses. Irrigated agriculture accounts for three-quarters of water used in Australia, such as cotton, fruit and vegetables, grapes, sugar, rice, dairy, pastures for intensive livestock and some irrigated cereals. The Murray-Darling Basin accounts for two-thirds of the irrigated land in Australia.

Farming in Australia is mainly mixed farming. Crop receipts for mixed enterprise wool producers make up 50-60% of total income. Crop farmers grow a range of crops and often run livestock as well. Around 60% of Australian wool production is produced from mixed enterprise farms where annual wool sales generate 10-20% of total revenue (ABARE, 2006).

Box 2. Farm size in Australia

Australia's agricultural sector is comprised mostly of family operated farms, with very few public or large family farm companies. Nearly 70% of all holdings operate as sole operators, 30% are run as family partnerships, and about 7% operate as family companies or trusts. A small proportion of companies are large farm businesses owned by non-farmers. Farm businesses are in the majority medium-sized and involve a capital investment of AUD 3-6 million. The total capital of a farm business is the value of all assets used in the business: the land, animals, machinery, equipment, vehicles, tools, buildings, stocks of fertilizer, chemicals, feed on hand, and cash and other accumulated savings that are part of the business.

The "very large-scale commercial family farms" and "significantly above-average commercial family farms" make up 20% of the total number of farms. These farms contribute 80% of annual total value of agricultural output. Another indicator of the distribution of relative shares of total farm production is that the largest 10% of farm businesses account for 50% of total farm output. Small to medium-sized commercial businesses owned by a family make up 80% of all farms and contribute 20% of the annual total value of agricultural output. The medium-sized operations have a total capital invested of AUD 2-4 million. Another measure of the relative contribution of farms to total output is that 50% of farms contribute 10% of the total output. Operators of the small farms may also earn income from other sources to complement farm income. On average, people involved in small to medium-sized farm businesses earn substantial proportions (30-40%) of their total income from off-farm sources. This income comes from investments off the farm or work by family members off the farm.

Perceived risk in agriculture

Given the climate characteristics of Australia, yield risk is usually the predominant source of risks in agriculture. Yield risk derives from the variability of seasonal weather conditions, especially rainfall prior to the start of the growing season for crops and pastures and spring rains, in the Mediterranean climate regions of south eastern and south western Australia and the temperate climate regions of eastern Australia. Other yield risk includes natural disasters (e.g. flood and bushfire), animal or plant disease outbreak, and hail and frost risk. Hail and frost may cause catastrophic damage to crops, but private insurance markets are well developed due to the less systemic nature of these risks. For dryland farmers, weather and yield risks are foremost in their planning; the many other risks are significant but secondary. Farmers using irrigation face the risk of receiving highly variable and sometimes very low allocations of water for irrigation. A study by Nguyen *et al.* (2005) indicates that the most important risks perceived by land extensive farmers in SA and Queensland are climatic variability, followed by financial risk, marketing risk and government policy change.

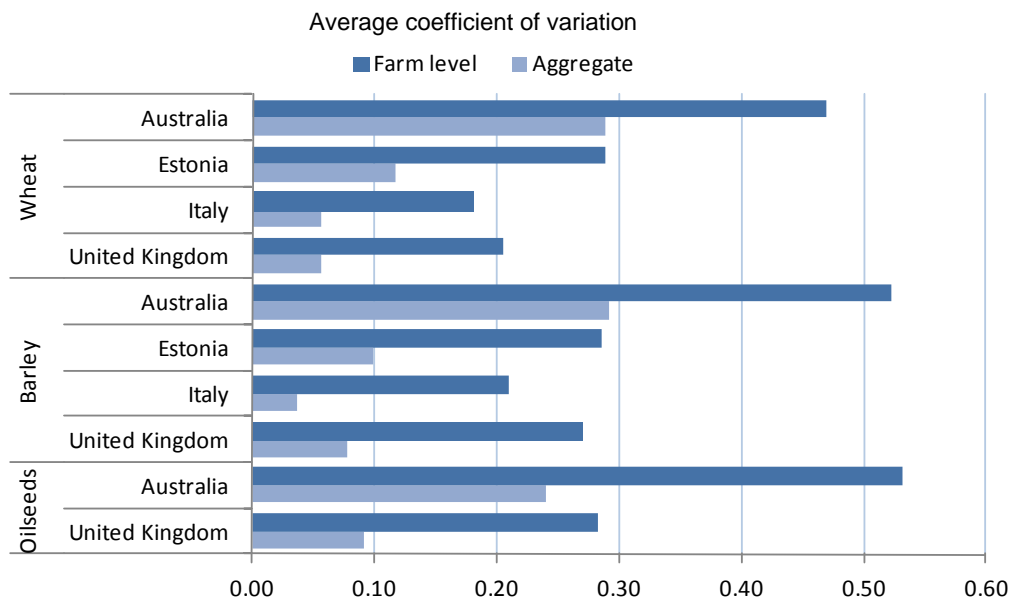
Price related risks are also perceived to be important in Australia where the majority of products are exported to international markets. Risks that derive from the export commodity markets that Australian farmers face include price volatility, exchange rate fluctuations and market access risk. Financial risk – the gearing ratios of farm firms – exacerbates the business risks of yield, price, disease and pest outbreaks.

Quantitative assessment of agricultural risk: mixed farm in Australia

This section quantitatively assesses the characteristics of risk faced by extensive mixed farms (broadacre farms) in Australia that jointly produce a range of crop and livestock commodities. The longitudinal data of 185 extensive mixed farms is taken from ABARE's broadacre farm survey between 2001 and 2007. The analysis of farm level data from seven countries, including Australia, is presented in OECD (2010b) and the complementary room document which discusses the methodology used for data processing. This analysis and the figures in this section are based on the assessment of variability in the seven-year history of data at the individual farm level.

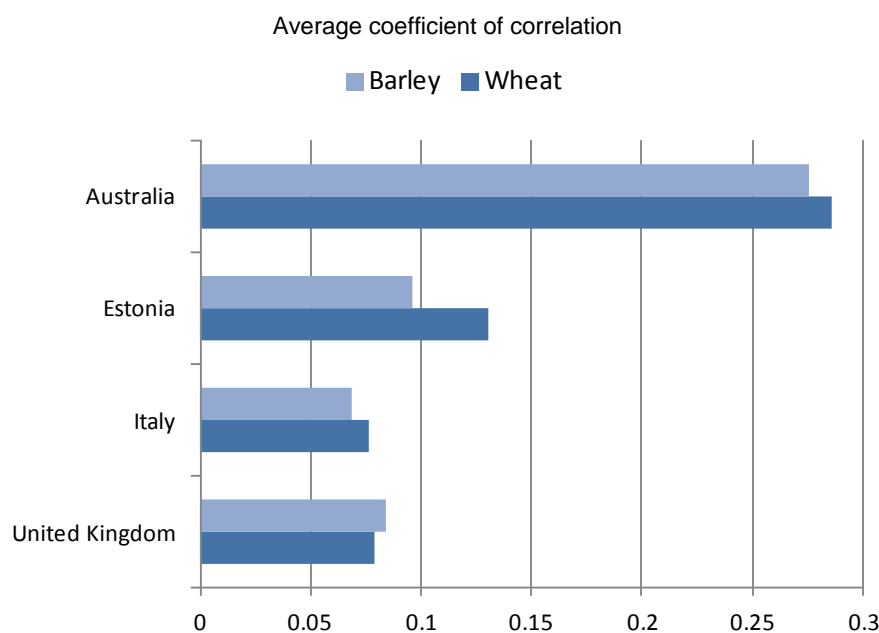
Figure 2 compares the average farm-level and aggregated variability of crop yields (wheat, barley and oilseeds) between Australia and three countries in Europe. The average coefficients of crop yields in Australia are much larger than those in European countries for all three crops. The characteristics of farming in Australia, which suffers more from variable rainfall and other climatic conditions, expose Australian farmers more to yield risk compared to those in European countries.

Figure 2. Variability of crop yields: Australia and other countries



Source: OECD (2010b).

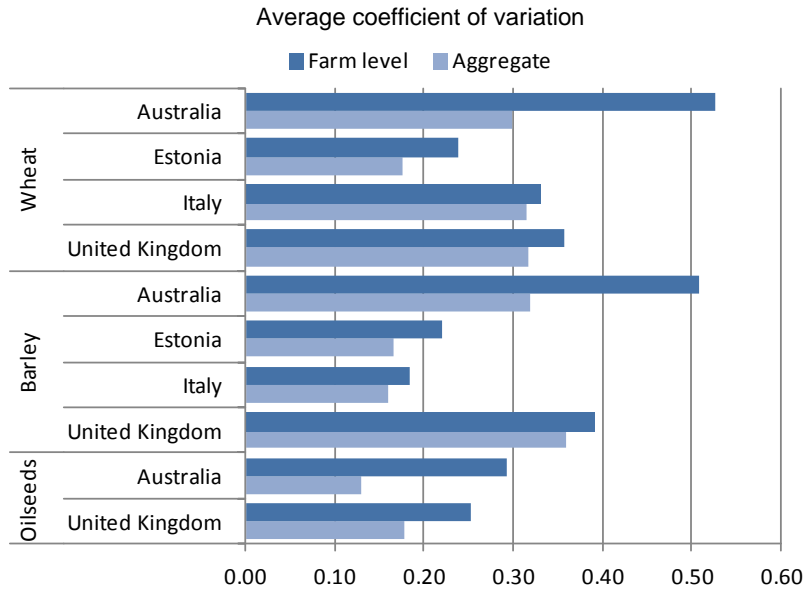
Another important characteristic of yield risk in Australia is its systemic nature. Figure 3 compares the average coefficient of correlation of crop yield across farms between Australia and three countries in Europe. If the yield risk is systemic (highly correlated across farms), farmers face similar yield shocks. The data shows that Australian farmers are exposed to much more systemic yield risk than farmers in these three European countries because Australia suffers from catastrophic events, in particular drought, more frequently, which affects farms in many different locations simultaneously. In the European countries, yield risk is found to be more location/farm specific so that farmers face less systemic yield risk.

Figure 3. Correlation of yield across farm: Australia and other countries

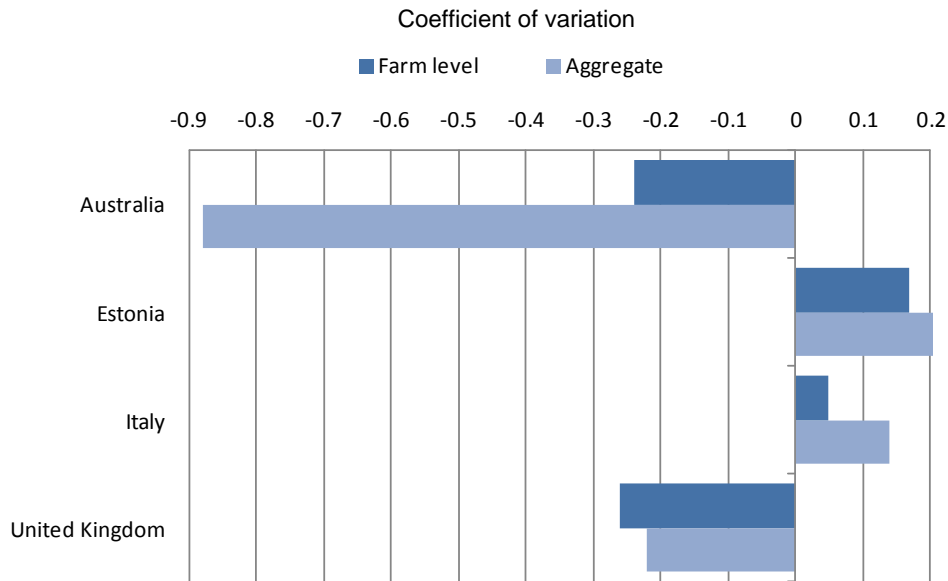
Source: OECD (2010b).

Figure 4 presents the average *price coefficient of variation* for wheat, barley and oilseeds. In comparison with the European countries, the Australian mixed crop farm faces higher price risks. Unlike three countries in Europe, where cereal price intervention systems exist for wheat and barley and the proportion of export in crop production is low, Australian farms are more exposed to price fluctuation in international markets. Moreover, the average price coefficients of variation are found to be less than the yield coefficient of variation except for wheat, which is consistent with the risk perception of farms that yield risk dominates other risks.

It is well known that farmers are taking advantage of negative price-yield correlation to stabilize income. The data shows that the average price-yield correlation of wheat is negative at both aggregate and farm level in Australia (Figure 5). In particular, the negative price-yield correlation of the aggregate data is very high. In Australia, the more systemic nature of yield risk makes the supply of wheat more variable than in other countries. Given that Australia is a large producer of wheat, an increase in yield is more likely to be associated with lower price at the aggregate level. However, the extent of negative price-yield correlation at the farm level is comparable with other countries. The large difference between aggregate and farm-level price-yield correlation may be a reflection of the farmer's personal risk management strategy, such as storage and forward contract. Nonetheless, the data shows that more than 70% of wheat farms have a negative correlation of yield and price. It is clear that many wheat farmers in Australia benefit from the negative correlation between price and yield as a natural stabilizer of income.

Figure 4. Variability of crop prices: Australia and other countries

Source: OECD (2010b).

Figure 5. Correlation of wheat price and yield: Australia and others

Source: OECD (2010b).

Overall, farm risk has distinguishing features in Australia. Yield risk is higher and more systemic here than in other countries; price risk is higher due to the exposure to world markets and exchange rate variability; and negative price yield correlations at the farm level are comparable with other countries. These specific characteristics of yield risk in Australia have significant implications for good risk management policy that are not always applicable to other countries.

Information and communication on risk and risk management

Information about the risks in agriculture in Australia is available from numerous sources. These include state/territory government departments involved with agriculture and agricultural research, development and extension; federal agencies such as the BOM, ABARE-BRS, BRS, CSIRO, DAFF, the Rural Research and Development Corporations and industry organizations (Box 3). These organizations investigate and disseminate information on risks from climate and weather variability that cause yield and price volatility. Commercial firms also provide price information and weather information. Biosecurity risk receives high priority in government agencies.

Access to climate information is a key to taking the necessary risk reducing/mitigation measures. White (2001) reports that between 30% to 50% of farmers take account of seasonal climate forecasts when making farm management decisions. Richies *et al.* (2004) investigated the use of seasonal climate forecasting in decisions taken on areas to plant irrigated cotton in the northern Murray Darling Basin. They found that minimising risk by adjusting planting areas in response to seasonal forecasts improved the activity's gross margins.

Box 3. Sources of information on agricultural risks in Australia

The Bureau of Meteorology (BOM) is a government agency that provides several thousand products in several delivery media free-of-charge for most of the products. BOM provides more a specialized product for primary producers, known as SILO, which includes climate data, drought indices, weather forecast, warnings, observations, Numerical Weather prediction output from computer models, and satellite and radar image (<http://www.bom.gov.au/silo/>)

Geoscience Australia is a prescribed agency that undertakes a range of scientific activities, including natural hazard risk and impact analysis (e.g. flood, bushfire and earthquake). It also provides hazard maps and information on frequencies of landslides and earthquakes.

Emergency Management Australia (EMA) is located within the Attorney Generals Department. EMA covers all kinds of hazards and pursues a cooperative relationship with state and territory governments and other Australian government agencies. EMA provides information in all stages of emergency management such as prevention, preparation, response and recovery.

ABARE-BRS – the professionally independent research bureau within DAFF – provides market information (e.g. exchange rate, interest rates, market indices and commodity prices) on a daily basis in addition to monthly or yearly statistical data; conducts a wide range of research programs on topics such as climate change, and water and land management; and produces tools, models, data and metadata to help agricultural, fisheries and forestry industries make decisions (e.g. rainfall to pasture growth outlook tool).

Industry Organizations such as the National Farmers Federation, State Farmers associations and sector organizations (e.g. Meat and Livestock Australia) offer more specialised market information (e.g. weekly price report, information on export market) as well as production advice exclusively to its members.

Research and Development Corporations (RDCs) conduct mainly applied research projects and provide extension services. The R&D projects include the adaptation to climate change and the improvement of water use efficiency.

CSIRO is the government's national science organisation that conducts studies in many fields of science. CSIRO undertakes various research projects related to agricultural risk management such as climate change, farm management, soil management, and the development of new crops varieties.

For animal and plant disease, The Australian Quarantine and Inspection Service (AQIS), a statutory authority located within DAFF, provides information on quarantine records, and distribution and abundance of potential disease. For the emergency response to a disease outbreak, Bio-SIRT (Biosecurity Surveillance Incident Response and Tracing) has been developed to enable information, such as the location of disease detection, to be quickly exchanged between jurisdictions to facilitate a coordinated response with national consistency in recording, reporting and managing emergency incidents.

2. Risk management strategies and policies in Australia

Table 2 is a summary of the risk management instruments and strategies that have special importance in Australia. The strategies are classified in the table according to two criteria following the framework in OECD (2009): whether it reduces the probability of occurrence (risk reduction), the magnitude of the damage (risk mitigation) or the impact on consumption (risk coping), and whether its main action takes place at farm household / community level, through markets or through government measures. The strategies and instruments in the table do not pretend to be exhaustive, but just to highlight the strategies that have special relevance in the country. This will allow comparisons to be made with the main strategies used in other countries.

The mapping between these strategies and the risks that have been defined in the previous section are specific to the risk and institutional environment of each country. There are risks that, because of their catastrophic nature (low probability but high damage), are difficult to manage at the farm level or through market instruments, and for which government policies typically play an important role. There are risks that are more “normal” (low probability and low damage) that are typically managed at the farm business or household level, without significant involvement of markets or government. Finally, there are risks with medium probability and medium damage that are more appropriate for risk transactions through market instruments.

This chapter successively analyses the strategies that take place at the household level, the market strategies and the government measures that deal with catastrophic risk. In practice there are government measures that have direct implications for the three layers of risk, normal, marketable and catastrophic, and they are discussed in conjunction with the corresponding farm household, market and catastrophic risk strategies. The last subsection of this chapter is dedicated to an overview of government measures which are listed in Table 10. The classification of measures follows the criteria based on policy implementation and policy objectives, and the discussion is intended to clarify how the different policy measures fit within the different risk layers. The boundaries between different risk layers are, in practice, endogenous to the specific risk and policy environment.

Table 2. Risk management strategies having special importance in Australia

	Farm household	Market	Government
Risk reduction	<ul style="list-style-type: none"> Adoption of water conservation farming technique Irrigation Training 		<ul style="list-style-type: none"> Water rights trading Bio-security border measures Training programmes
Risk mitigation	<ul style="list-style-type: none"> Financial management Crops/livestock diversification Stock management Off-farm employment and investment 	<ul style="list-style-type: none"> Price hedging through forward contracting and futures markets Exchange rate hedging 	<ul style="list-style-type: none"> Farm Management Deposit Scheme Emergency response to animal/plant disease outbreak EC interest rate subsidy (ECIRS)
Risk coping	<ul style="list-style-type: none"> Cost reduction through minimising other expenses 		<ul style="list-style-type: none"> EC relief payments (ECRP) National Disaster Relief and Recovery Arrangement

Farm household strategies

According to a survey by the Queensland Department of Primary Industry on drought management strategies, farmers undertake many steps to manage the risks they face (Table 3). Across farm sectors, saving farm maintenance and operating expenses are widely adopted drought management strategies. In addition, a wide range of financial management strategies are adopted, such as cutting down personal expenses and using cash reserves. The survey indicates the importance of having high equity and reserves of liquid assets, as well as diversified income sources in order to cope with drought risks. There are also sector specific drought risk management strategies. While making an early decision on planting and planting different types of crops are the main strategies for crop farms, stock management of livestock and fodder is the key strategy for the livestock sector. In particular, conserving fodder in times of surplus to use in times of shortage is a fundamental strategy in extensive livestock production. The following section examines on-farm risk management strategy through more specific types of farming in Australia.

Table 3. Implementation of drought management strategies in Queensland by industry

	Percentage of farms			
	Extensive livestock	Intensive livestock	Cropping	Horticulture
Livestock strategies				
Sold stock earlier than otherwise	89.1	68.9	48.9	15.1
Put stock on agistment	30.3	16.4	12.0	4.1
Used fodder that had been stored	65.0	75.4	48.9	12.3
Purchased extra feed	79.4	73.8	32.6	11.0
Plant industry strategies				
Made an early decision not to plant a crop	17.2	34.4	59.8	34.2
Planted a different type of crop to normal	9.1	29.5	46.7	21.9
Purchased additional water allocation	3.1	8.2	3.3	12.3
General strategies				
Used climate forecast	48.1	47.5	54.3	52.1
Reduced the workforce	25.0	34.4	46.7	60.3
Cut down on farm maintenance	62.2	68.9	63.0	50.7
Minimized other farm operating expenses	78.4	80.3	89.1	84.9
Extra off-farm work	35.3	26.2	46.7	37.0
Accessed FMDs	15.6	11.5	21.7	8.2
Used other cash reserves	63.4	57.4	62.0	57.5
Sold farm assets	15.6	23.0	26.1	19.2
Sold off-farm assets	12.2	11.5	23.9	16.4
Took out new loans/ increase overdraft	46.9	37.7	57.6	45.2
Reduced debt	30.0	29.5	33.7	31.5
Cut down personal spending	85.0	83.6	88.0	76.7

Source: Queensland Department of Primary Industry (2004).

Off-farm income is earned mainly from off-farm wages, and salary and investment incomes have increased in real terms over the past 40 years. Payments from government have also increased. On average, off farm income represents over 30% of total farm income (ABARE 2006). Broadacre farmers with off-farm wages increased from 25% in 1977-78 to 45% in 2007-08. For dairy farmers, the percentage receiving off-farm wages increased from 26% in 1977-78 to 35% in 2007-08.

Extensive mixed farm (broadacre farm)

Broadacre crop farms grow mainly cereals, oil seeds and grain legumes, almost all of which is dryland production based on expected seasonal rainfall. Crops are usually sown in moist soils following the first rains in the autumn for winter spring crops, and spring and summer rains for summer-autumn crops. Increasingly, there is a tendency for growers of cereal crops to sow a proportion of their total crop area at the preferred time in expectation that the rains will arrive, even if the rains have not yet started. During the growing season, nitrogen fertilizer is used in a strategic manner, again depending on the timing of rains and yield potential of the crop at critical stages of the life of the crop. To maximize available soil moisture and nutrition available to crops, minimum tillage has become the dominant method, and growers focus on managing ground cover pre-sowing and weed control in crops.

A diversification strategy is integral to the crop farm systems. First, livestock are integral to many cropping systems as they utilize crop residues and graze the areas of crop farms that are not cropped in any given year (because of the need to have a break and sometimes to allow for fallow periods so as to replenish soil fertility (e.g. several years for a pasture legume). Second, diversification in continuous cropping systems is unavoidable because of the need to have disease break crops after a series of cereal crops. Thus a mix of cereals, oil seed and grain legume crops are grown in any cropping system in any year. Diversification, even within specialized cropping systems, has the effect of exposing the business to a range of crop markets and prices, and to crop and livestock markets and prices.

Table 4 presents the average coefficient of variation of per hectare return for each diversified production at the farm level. The farmer can benefit from diversification as long as the coefficient of correlation of returns across crops is less than one. Table 5 shows the correlation matrix of per hectare return across crops and each production element. It is clear from these tables that a farmer can gain advantages from diversifying production. The variability of per hectare return of crop production is lower than that of wheat, barley and oilseed production. Moreover, since the data shows the negative correlations between crop and livestock, the potential for diversification between crops and livestock is particularly important in Australia. The coefficient of variation of per hectare output is significantly lower than the coefficient of variation of both crop and livestock outputs, indicating that in fact producers are benefiting from production diversification between crop and livestock sectors.

Table 4. Variability of per hectare return

Average coefficient of variation across farms

Crop production	0.80
Wheat	0.47
Barley	0.54
Oilseed	0.46
Livestock production	0.51
Total output	0.33

Source: TAD/CA/APM/WP(2009)30/FIN.

Table 5. Correlation of per hectare revenue

Average coefficient of correlation across farms

	Wheat	Barley	Oilseeds	Crop production	Livestock production
Wheat	1	0.28	0.15	0.86	-0.05
Barley		1	0.37	0.67	-0.01
Oilseeds			1	0.61	-0.02
Crop production				1	-0.05
Livestock production					1

Source: TAD/CA/APM/WP(2009)30/FIN.

Cotton

In recent years, the major risk cotton growers have confronted has been the availability of water. This has led to a more opportunistic approach in cotton production, with diversification to other dryland cropping activities as part of the whole farm system. Cotton is completely exposed to export markets and because of the exposure to exchange rate risks, there is a greater tradition of using futures pricing instruments than is the case in any other activity. Whereas a small proportion of cereal growers use forward pricing methods, the majority of cotton growers actively manage price risk exposure using forward and futures pricing instruments. A high percentage of the annual harvest is covered using forward pricing instruments.

Wool and prime lamb

Wool production takes place in the pastoral zone of Australia where there are no other production alternatives. It also takes place in more-reliable rainfall areas, such as the wheat-sheep zone, as well as in high rainfall areas in conjunction with cropping, prime lamb and beef production. There are no activity diversification options in the pastoral areas and risk is managed mainly by choice of stocking rate and off farm investment. In the more-reliable and higher rainfall areas, wool production occurs mostly in mixed farming systems, with the wool activity a relatively low variable cost operation compared with cropping. The wool activity complements cropping activities and represents a diversified stream of income. Despite a general move towards finer wool production, poor wool prices over the past 15 years has seen a marked decline in sheep for wool and a move towards prime lamb production, both from fine wool sheep such as Merinos and increasingly from prime lamb breeds.

Around 90% of the wool is exported. A wool futures market exists, but there is little activity. Few wool growers use futures and forward pricing instruments and 85% of the wool is sold at auction, with around 15% sold by private contracts. Wool growers commonly obtain an advance on their production and the traders do the risk management.

Beef

There are two types of beef production: the northern beef industry of the pastoral areas in northern Australia where beef is the sole activity on extremely large properties and with large herds, and the southern beef industry where beef is mostly produced in small herds as part of a mixed farming system. These two different types of production systems have quite different risk profiles. The northern beef producers produce mainly for export, traditionally for the manufacturing beef trade and includes a growing export trade of live animals. The southern beef producers are mostly mixed farming systems for reasons of complementarity and income diversification, although large specialist systems also exist. Specialist beef producers are more likely to have established relationships with others actors along the production and marketing chains: backgrounders preparing young stock for entry to feedlots, feedlots and processors and, sometimes, large supermarket outlets. Historically, several beef futures contracts have been offered at various times, and each time they have closed for lack of trading activity. Exchange rate risks remain one of the major risks for beef producers.

Dairy

Dairy production is present in all states, although it is concentrated in the higher rainfall areas of Victoria and Tasmania, with irrigated dairying in drier areas and local dairy activity close to most major capital cities in other states. With few exceptions, dairy farming is a single activity business. However, systems vary considerably in type and productivity depending on the climate and growing season characteristics of the area where the dairy farm is located and the skills of the operator. The majority of production is for export markets. Production for higher priced domestic consumption markets requires year-round farm production systems. The main production risks for dairy farmers is feed supply and costs. Dairy systems are predominantly based on pasture, with animal feed demand matched closely to expected home grown feed supply supplemented by substantial (40% or more) use of purchased feed. Increasingly, fodder crops and partial/total mixed ration systems are used to gain greater control over the variability of feed supply resulting from highly variable rainfall. Milk is sold to farmer-owned processing co-operatives, and then exported or sold to private processors for the domestic market.

Horticulture

Pome fruit, citrus and vegetable production is in most cases irrigated and increasingly variable water supplies and water costs are the major production risks to be managed, along with pest and disease risks. Integrated pest management techniques are common. Increasingly, growers purchase water on an annual basis to supplement shortfalls in annual allocations of water from growers' permanent water rights. Forward purchasing arrangements to secure the required water are becoming standard components of risk management. Tree, crop and vegetable producers grow a number of crops to diversify income throughout the year and to utilize complementarities of labour and capital arising from different seasonal timing of production. The larger producers use forward contracts

with processors and, for fresh produce, forward contracting with large supermarkets is standard practice.

Table 6. Summary of household risk management strategy by industry

	Major risk	Diversification strategy	Production management	Price risk management
Extensive mixed farm (Broadacre farm)	Rainfall, output price	Production diversification and off-farm income diversification	Conservation of soil moisture	Storage, forward contract and price pooling
Cotton	Rainfall, output price, exchange rate	Production diversification	Water management	Futures and forward contract
Wool and lamb	Output price, exchange rate	Production diversification and off-farm investment	Stocking rate management	Spot market trading
Beef	Output price, exchange rate		Stocking rate management	Forward contract
Dairy	Input cost	Specialization	Feed production and storage	Price pooling through co-operatives
Horticulture	Plant disease, irrigation water	Production diversification	Pest management	Forward contract

Government measures to support farm household strategies

Tax policy

Across farm sectors, maintaining an appropriate level of cash reserve is important to smooth income and prepare for income loss. The Australian government provides tax incentives to retain a certain cash reserve. The Farm Management Deposits (FMD) scheme allows farmers to deposit up to AUD 400 000 of income earned that is then excluded from taxable income until it is withdrawn from the FMD if kept for at least 12 months. Eligible farmers in Exceptional Circumstance declared area may access their FMD within 12 months while retaining the tax benefits.

FMDs defer and save tax, and aim to provide a means to reduce inequity that may derive from highly fluctuating incomes and progressive income tax schedules, thereby achieving the increased self-reliance. FMDs are not available to companies and trusts. As at March 2010, aggregate FMD holdings totalled over AUD 2.4 billion. The number of holders has been stable since June 2002, with an average of around 40 000 holders, although a slight decline has been noticeable since 2006, reflecting the effects of the recent prolonged drought. The ABARE farm survey results in 2006 indicated that a significant number of farms had multiple FMD holders and that overall around 30 000 farms had FMDs (DAFF 2006). The average trend of FMD amounts has been upwards since the inception of the scheme, peaking at an average of AUD 70 000 per holding in June 2008.

In addition to the FMD scheme, primary producers can also use a tax averaging scheme that allows their current taxable income to be assessed at the tax rate applicable to their average income in the current year and the four preceding years. Under this scheme,

a farmers pay lower taxes when they have higher taxable income than the average of previous five years, but a higher tax is imposed when the taxable income is lower than the average of the previous five years. This scheme also has the effect of smoothing income by avoiding a higher tax rate that would be applicable in high income years.

Development of water markets

Variable rainfall and the frequent risk of drought make efficient water management a key risk management strategy for Australian farmers.² Although only 0.5% of total farm land was irrigated in Australia in 2004-05, irrigation for agriculture and horticulture expanded along the inland waterways that have highly variable annual flows. The states own water storage facilities on rivers, and issue licenses for irrigation water from bores or rivers. Water for irrigation is distributed to farmers from facilities owned by either the state, or by state-owned or private irrigation companies.

In response to problems that include inefficient water use, increasing salinity or insufficient water flows from the natural environment, water policy reform has been pursued through the National Water Initiative, an inter-governmental agreement. The commitments of this initiative include the introduction of registers for water rights, standards for water accounting, and the expansion of water trading. Water trading is the process of buying, selling, leasing or otherwise exchanging water access entitlements (permanent trade) or water allocations (temporary trade).³ The water markets for irrigation allow farmers, and the public, to compete to obtain water for alternative uses, including environmental uses. The aim is to ensure that irrigation schemes operate more effectively and that farmers, by paying the market price for water, are forced to use water as efficiently as other potential buyers and competing users of water.⁴ Buying and selling water on the market enables irrigation water to move from less valuable to more valuable uses.

Water markets contribute to a producer's drought risk management in multiple ways. First, water markets provide an incentive for farmers to use water more efficiently, depending on climate conditions. Producers can purchase water allocations in wet periods at low prices and expand farming operations, while selling their water allocations at high prices and reduce the size of their operation. Second, selling permanent water entitlements can mitigate the adverse impact of droughts on farm income. The asset value of water entitlement is, by nature, counter-cyclical with the availability of water.

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2. OECD (2010) analyses the sustainable management of water resources in agriculture. The development of water markets in Australia is discussed in one of the background documents for this report (Parker and Speed, 2010).
 3. The initial allocation of water entitlement is offered to the land owners within the irrigation district, in many cases, based on the previous irrigation permission or licence. It is often argued that water entitlements are over allocated relative to the availability of water. In many cases, less water is allocated to the owner of water entitlement in dry seasons. For example, the announced allocation by the Murray River System in 2007-08 was 43% of the entitlements.
 4. The level of permanent trade out of the irrigation district in Victoria is currently limited to 4% of the total water entitlement annually.

Training and R&D

Adopting an appropriate farm management practice and the technology to reduce and mitigate risks is at the core of farm households' risk management strategy. For example, the use of production techniques to conserve water use allows a farmer to mitigate the adverse effects of droughts. Having a financial management strategy to prepare for future risks also contributes to smooth income and consumption. In Australia, the impact of climate change on the farming environment (such as rain fall pattern) is increasing the need for farmers to adjust their farm management practice to the new farming environment. In order to assist the farmer's adjustment, the government offers training opportunities and funds relevant R&D projects. Australia's Farming Future Program is a policy package that tries to equip primary producers to adapt and adjust to the impacts of climate change mainly through training, management advice and R&D funding. State/territory governments also implement various training programs that intend to facilitate the adjustment to climate change.

"Farm Ready Reimbursement Grants" part of the Australia's Farming Future (AFF) package were announced in July 2008 and provides two types of training grants. The first covers the cost to attend approved courses for individual producers (e.g. understanding the implication of climate variability, and change and integration of new techniques for sustainable production as a result of climate change). "Farm Ready Industry Grants" are designated for industry and community groups to develop strategies to improve industry self-reliance and preparedness to adapt to climate change. Another training grant is offered through the Climate Change Adjustment Program in the AFF package. This grant allows farmers to assess their business and financial position, and to prepare a climate change action plan. An additional grant may be available for obtaining advice or training activities. Outside the AFF package, farmers also have access to the Rural Financial Counselling Service in which private, rural financial counsellors provide advisory services. This can include helping clients to identify financial and business options, negotiate with lenders, and identify training needs.

In addition to the training and the professional advisory service, farmers in an EC declared area may be eligible for the Professional Advice and Planning Grants (PAPG) to cope with risks. PAPG allows farmers to obtain professional advice in drought management and recovery (e.g. advice on farm viability and development of farm business plan). Since the introduction of PAPG in October 2006, 12 810 grants have been issued (until 31 March 2010).

The AFF package includes funding for R&D activity. The Climate Change Research Program funds large scale collaborative research projects that involve a variety of organizations (e.g. private research organizations, industry groups, universities and state/territory governments). Research focuses on reducing greenhouse pollution, improving soil management and climate change adaptation, and involves projects that provide practical management solutions to farmers and industries. Farmers also fund R&D activity through 15 research and development corporations through commodity specific levy charges (Box 4).

Box 4. The levy system in Australia

Australia has a levy system in which the farmer contributes to funds that respond to a problem or opportunity requiring collective industry funding such as R&D, marketing promotion and animal/plant health programs. The levy also funds the management of wheat export marketing arrangements through Wheat Export Australia. The industry organization proposes the purpose and the level of levy via discussions with their members, but the Australian government approves the proposal according to the Levy Principles and Levy Guidelines as set by the government. The Australian government also provides services to collect levies, usually at the first selling point, and to pool and disburse the resources. In some cases, the Australian Government matches certain research and development expenditures up to the limit of levy receipts. The levy is charged on most agricultural products, including dairy, grains, horticulture, and livestock commodities, wine/grapes, sugar, forestry products, and farmer prawns.

Risk market instruments

Crop Insurance

Most farmers use crop and livestock insurance, asset and third party liability insurance. Insuring vulnerable crops against hail damage is routine for most crop farms. Insuring farm assets, including animals, against loss by fire is widespread amongst farmers. Insurance against frost damage is available for horticultural crops. Crop insurance against the risk of loss by hail, fire, and frost amounts to around AUD 7-10 billion worth of crops insured each year, with a total premium around AUD 200 million, spread amongst 6-7 insurers. Around 85% of this exposure is then reinsured with reinsurers.

Multi-peril crop insurance opportunities are not available in Australia. However, a number of industry groups have called for government support for multi-peril crop insurance. A number of feasibility studies have been conducted by the Governments or researchers in the past 25 years. They often conclude that multi-peril crop insurance would not be commercially viable without government support (e.g. Government of Western Australia 2009). An Ernst & Young study on the feasibility of multi-peril crop insurance found that only 18% of farm businesses were likely to subscribe to insurance at viable premium levels (Ernst & Young 2000). In the mid-1980s, Patrick (1988) found willingness to pay for crop yield insurance (area or proportion of expected total yield), for a majority of the wheat growers he surveyed in the Victorian Mallee was at, or above, the actuarial cost for crop insurance by wheat growers. Administrative costs mean that the required premium was greater than the actuarial cost. Patrick (1988) found that premiums could be 50% above estimated actuarial costs.

Price hedging through futures market and forward contracting

Under the commodity marketing board arrangement, designated marketers such as the Australian Wheat Board made extensive use of futures and option contracts on commodity price and exchange rates. However, the fully deregulated grain market has seen grain marketing opportunities and methods increase markedly. Wheat growers have many choices: they can sell directly to a large number of export buyers or into private co-operative pools. Grain can be sold directly to end users, increasingly making use of established relationships and forward contracting. On-farm storage to allow selling throughout the year has increased. This enables growers to hedge by selling through time and into several markets. Use of futures pricing methods is increasing, mainly in the form of over-the-counter products provided by financial institutions. Futures and options

products are available, based on the Australian futures exchange or the Chicago futures exchange (Table 7). The potential of options to manage price risk is increasingly being recognized, although only limited (mostly large) growers currently make use of them.

Futures markets for trading futures contracts in wool and wheat are available at the Sydney Futures Exchange. Historically, there have been futures markets for lamb and beef cattle. Wheat futures are also traded using the Chicago futures exchange. Interest rate and exchange rate futures also exist in the market. Little use is made of commodity futures trading instruments due partly to its inability to cover the individual basis risk. Instead, the main users of futures markets are commodity marketers. Table 7 summarizes the main futures markets used by Australian commodity marketers by commodity. The use of international futures markets, such as Chicago Board of Trade, has the advantage of high liquidity of trade, but the participants suffer from higher basis risk than when trading on the Australian futures market. Over the past two decades, several futures contracts (e.g. lamb, cattle) have ceased in the Australian futures market because of lack of trade.

Table 7. Main futures markets used by Australian marketers

	Major risk	Diversification strategy	Production management	Price risk management
Extensive mixed farm (Broadacre farm)	Rainfall, output price	Production diversification and off-farm income diversification	Conservation of soil moisture	Storage, forward contract and price pooling
Cotton	Rainfall, output price, exchange rate	Production diversification	Water management	Futures and forward contract
Wool and lamb	Output price, exchange rate	Production diversification and off-farm investment	Stocking rate management	Spot market trading
Beef	Output price, exchange rate		Stocking rate management	Forward contract
Dairy	Input cost	Specialization	Feed production and storage	Price pooling through co-operatives
Horticulture	Plant disease, irrigation water	Production diversification	Pest management	Forward contract

Source : DAFF.

Forward contracting of sales is common in large, intensive horticultural and animal activities. Forward purchase agreements for feed inputs are widely used in dairying and intensive animal activities such as pig, egg and broiler production. The major proportion of all milk produced in Australia is processed and sold by farmer-owned dairy processing co-operatives. These co-operatives supply inputs, including credit, and are eligible for some concessionary taxation treatments of aspects of their business operations. Also, numerous small farmer co-operatives exist for marketing of grains, wool, lambs, and for purchasing inputs. After the deregulation of commodity markets, a wide range of commercial marketers started to offer various forward contracts (Table 8). Commercial banks have become a major provider of forward contracts for agricultural commodities. In order to reduce the transaction costs associated with forward contracts, Meat and Livestock Australia has prepared a standard form of forward contract, with trading terms and conditions between cattle producers and marketers, although the use of the forward contract is limited to cattle producers.

Table 8. Key providers of forward contract

Commodity	Key providers
Cotton	Integrated ginnners/marketers Large multinational marketers Small specialist marketers
Grains	Australian Wheat Board Integrated bulk handlers/marketers Large multinational grain marketers Domestic marketers Banks
Sugar	Queensland Sugar Limited Millers
Wool	Wool brokers Banks

Source : DAFF

Cotton growers are the most prominent users of futures to manage price risk (Ada *et al.*, 2007). Less than 5% of woolgrowers use wool futures. Around 20% of wheat growers use market price risk management techniques such as futures contracts, options, and over the counter products like swaps. Deane and Malcolm (2007) reported that around 10% of the annual wool production is sold using forward contracts or with some other form of price protection, with 85 to 90% of wool continuing to be sold at auction each year. According to ABARE (2006), the top 25% wool producers in terms of financial performance dedicate 8% of their annual wool production to price risk management, while for the remaining 75% of farms, only 4% of their production is subject to price risk management. Lubulwa *et al.* (1997) found that 2-3% of woolgrowers used futures.

Catastrophic risk management

In Australia, most government measures that deal with risk management are focused on management of catastrophic risks: natural disasters and animal/plant diseases. There are two main policy frameworks that manage weather related risks: the National Disaster Relief and Recovery Arrangement (NDRRA) and the National Drought Policy (NDP). The former provides *ad hoc* type *ex post* assistance for communities and individuals to deals with most types of catastrophic climate risks except for drought. The latter is specifically addressed through drought risk management, which originally was considered as one of the natural disasters covered by NDRRA. More frequent, damaging and longstanding droughts have led to the creation of a separated National Drought Policy framework (NDP) in 1992 (Box 5). In addition, Bio-Security Partnership Arrangement provides the public-private partnership arrangement to share the risk of animal/plant disease outbreak among the stake holders.

Box 5. Development of drought policy in Australia

The last three major droughts experienced by farmers in Australia occurred in the early 1980s, the early to mid-1990s and in the early 2000s. Each of these droughts cost the economy about 1% of Gross Domestic Product (Burdon, 1995, Commonwealth Government Drought Panel Review Report, 2004). The 1990s and 2000s droughts cost taxpayers half to one billion current dollars in direct assistance given to farmers. From 1971 to 1989 public assistance to droughts occurred under the auspices of the National Disaster Relief Arrangements (NDRRA). The assistance to the 1982-83 drought in Australia was a series of *ad hoc* measures under NDRRA scheme. The main focus of assistance was concessional loans, freight subsidies and subsidies for fodder. In addition, state/territory governments gave their own drought assistance, including concessional loans and transport subsidies.

The National Drought Policy (NDP)

In 1989, the Commonwealth and the States reached an in-principle agreement on a drought policy that would be separated from the NDRRA, recognizing that drought assistance should be considered in a wider context than that of temporary relief. Based on a government drought policy review undertaken by an independent policy review taskforce, the *National Drought Policy* (NDP) was agreed to in 1992. The NDP recognized that droughts were a natural phenomenon that could be expected to happen reasonably often and introduced an *ex-ante* rule-based policy framework. Consequently, exceptional circumstances (EC) in a geographical area were defined as rare and severe, occurring on average once every 20 to 25 years, lasting for more than 12 months, and affecting the incomes of a significant proportion of farm businesses in an area. EC provisions under the NDP were designed to operate in association with the Rural Adjustment Scheme (RAS). They triggered a maximum subsidy of 100% interest on new and existing loans for viable farms suffering from severe financial difficulties. Moreover, it introduced the Farm Household Support Scheme for non-viable farms with support equivalent to the economy wide Jobsearch allowance. In 1994, the Australian Government introduced the Drought Relief Payment to provide income support to both viable and non-viable farmers experiencing a temporary loss of income.

The review of NDP in 1997

In 1997, the Australian Government announced the abolishment of the Rural Adjustment Scheme and released an integrated rural policy package called Agriculture - Advancing Australia (AAA) based on the 1997 drought policy review. The AAA retained the EC system with some revisions. EC Interest Rate subsidy reduced the maximum rate of subsidy to 50% and Exceptional Circumstances Relief Payment was introduced, replacing the previous Drought Relief Payment. Exceptional Circumstances (EC) in 1997 brought other risks into consideration - pests, disease, frosts, and water logging became part of the EC evaluation. In the AAA package, exceptional circumstances were defined as being beyond the scope of normal risk management in which the government should provide assistance. In 1999, the Commonwealth and states agreed: 1) the event, or events, must be rare and severe; 2) the effects of the event, or events, must result in a severe downturn in farm income over a prolonged period; and 3) the event must not be predictable or part of a process of structural adjustment. This new criteria places greater emphasis on how farm income is affected.

NDP reviewed in response to drought in the 2000's

The drought in the early 2000's raised the concern of eligibility of farms located on the edge of EC declared areas. EC support became available to those farmers who could prove they had been affected by the EC event, even if their farm was not entirely inside the EC declared area. Moreover, the Interim Income Support scheme was introduced so that farmers could access income support before a formal EC declaration was made if the EC application satisfied a *prima facie* case against the EC criteria.

In 2005, the Australian government introduced a new Drought Package for farmers continuing to face the effects of drought. The new drought assistance included: 1) an increase in the Exceptional Circumstances Interest Rate Subsidies from 50% to 80% for farm businesses in their second and subsequent years of an EC declaration; 2) a doubling of the off-farm assets threshold; 3) the introduction of a AUD 10 000 annual offset against the income support test to assist with the increased need for farming families to seek off-farm work; and 4) an automatic, streamlined reassessment process for those EC-declared areas nearing the end of their second year of assistance. The Australian government subsequently introduced an expanded drought assistance package in September 2007. The expanded package included: 1) an increase to the off-farm income exemption for ECRP applicants from AUD 10 000 to AUD 20 000; 2) an increase to the off-farm assets limit, for access to ECIRS, from AUD 473 000 to AUD 750 000; 3) immediate access to the AUD 5 500 professional advice and planning grants for farmers in EC-declared areas; 4) an expansion of the program to include agricultural dependent small businesses reliant on the farm sector for business turnover, 5) an EC exit package of up to AUD 150 000 for farmers who have decided to leave the land and some other additional measures.

Natural Disaster Relief and Recovery Arrangements (NDRRA)

Federal, state and local government agencies combine to administer disaster relief, depending to some extent on the nature and area of the disaster (Box 6). The Natural Disaster Relief and Recovery Arrangements (NDRRA) covers specifically bushfire, earthquake, flood, storm, storm surge, cyclone, landslide, tsunami, meteorite strike and tornado, but not drought, frost, human or animal epidemic. It is an arrangement under which the Commonwealth (federal government) partially reimburses state expenditures in relation with natural disasters. The NDRRA is automatically triggered when state/territory expenditures on an event exceeds AUD 240 000. The federal government makes annual provisions for funds covering disaster aid, and reimburses between 50% and 75% of State/territory governments costs for eligible measures classified under categories A to D. Under the NDRRA, relief or recovery aid applies only to compensate damage or distress arising as a direct result of a natural disaster. It does not provide compensation for losses and farmers are generally not eligible for support if insurance can cover the loss. The NDRRA is a policy framework under which State governments develop their own programmes and measures, make the assessment of circumstances and trigger assistance. The federal government only provides partial reimbursement of measures that fall under the designated categories.

Box 6. Incidence of natural disaster and droughts in Australia

Under the national disaster relief definition, a natural disaster is defined as “a serious disruption to a community or region caused by the impact of a naturally occurring rapid onset event that threatens or causes death, injury or damage to property or the environment and which requires significant and coordinated multi-agency and community response.” A “serious disruption” can be caused by any one of, or a combination of, the following natural events: bushfire; earthquake; flood; storm; cyclone; storm surge; landslide; tsunami; meteorite strike; or tornado. In Australia, the following are not considered to be natural disasters under the official definition; “ordinary” drought, frost, heat wave, epidemic and events where human activity is a significant contributing cause of the problem, such as poor environmental planning, commercial developments, personal intervention (other than arson) or accident.

Natural disasters in Australia that particularly caused serious damage include: Tropical Cyclone Mahina (1899), Black Friday bushfires (1939), Floods in New South Wales (1955), Black Tuesday bushfires(1967), Tropical Cyclone Tracy Darwin(1974), Floods in south-east Queensland (1974), Ash Wednesday bushfires(1983), Newcastle earthquake (1989), Thredbo landslide (1997) in New South Wales, Sydney hailstorm (1999), Canberra bushfires (2003), Cyclone Larry (2006), Cyclone Larry, Far North Queensland (2006), Storms and floods in the Hunter and central coast regions of New South Wales (2007), Victorian Black Saturday bushfires (2009).

Drought was considered to be one of the natural disasters covered by NDRRA before the NDP was agreed in 1992. The NDP recognized that drought was a natural phenomenon that can be expected to happen reasonably often. The Bureau of Meteorology defines a drought as being when rainfall for a region has been at or below the level of the lowest 10% of rainfalls known in history for a period of three or more months. Over the past hundred years, there have been major droughts in the eastern states of Australia: 1838-40, 1864-66, 1880-86, 1895-1903, 1911-16, 1939-45, 1963-68, 1972-73, 1982-83, 1991-95, and 2002-to date. In recent decades, each major drought has cost federal and state/territory governments more than AUD 1 billion in payments to farmers, plus the cost to the GDP of foregone production, estimated to be over 1% of GDP growth in the recent major droughts.

Assistance under category A may include emergency food, clothing or temporary accommodation, repair or replacement of essential items of furniture and personal effects and essential repairs, demolition or rebuilding to restore housing to a habitable condition. None of these measures is specific to agriculture. However, category B measures include assistance specifically for primary producers to alleviate the financial burden of costs incurred by primary producers, non-profit organizations or individuals as a direct result of

a natural disaster. This may include a scheme of loan assistance at a concessional interest rate, freight and interest rate subsidies, all of which are available to primary producers. The interest rate subsidy is provided to eligible primary producers to cover new loans. The freight subsidy covers up to 50% of the cost of transporting livestock, fodder and farm building, fencing or machinery as a direct result of a natural disaster. The State prepares these subsidy schemes and assesses the eligibility of the applicant.

Measures under categories C and D are available only for “severe events” designated as eligible by the Federal Minister. Category C covers a community recovery package to support the recovery of regions, communities or sectors severely affected by a natural disaster. This package includes one off grants of up to AUD 10 000 to eligible primary producers for the clean-up and immediate restoration costs without assessment of damage, and an additional one-off grant of up to AUD 15 000 with an assessment of damage and longer-term viability. In addition, loans to primary producers are available at concessional interest rates. Loans are made by the State to a primary producer whose assets (including fodder) have been damaged significantly by a natural disaster and the borrower has no reasonable prospect of obtaining commercial finance but has a reasonable prospect of long-term viability for the business. Category D is for exceptional measures taken by the Minister.

National Drought Policy

The *National Drought Policy (NDP)* is a Commonwealth (federal) policy, in terms of its design and decision making, and in terms of its funding. This contrasts with the NDRRA which is driven by decisions at the State/territory level, and framed by a co-financing arrangement. The objectives of the NDP are: 1) encourage primary producers and other sections of rural Australia to adopt self-reliant approaches for managing climate variability; 2) maintain and protect Australia’s agricultural and environmental resource base during periods of extreme stress; and 3) ensure early recovery of agricultural and rural industries that are consistent with long-term sustainable levels. Providing short-term assistance to long-term viable producers is the key operational policy objective of NDP. The policy support becomes available in a region only after the government declaration of Exceptional Circumstance (EC). These are defined as “rare and severe events outside those a farmer could normally be expected to manage using responsible farm management strategies”. Three operational criteria are used to determine an EC:

- must be rare, that is it must not have occurred more than once on average in every 20 to 25 years;
- must result in a rare and severe downturn in farm income over a prolonged period of time (e.g. greater than 12 months);
- must be a single event that is not part of long-term structural adjustment processes or of normal fluctuations in commodity prices.

These operational criteria are assessed, within the context of local practices, on the basis of meteorological conditions, crop yield, pasture and stock conditions, water supplies, and farm income levels. Once an area is declared EC, three main programmes are made available to farmers: the EC Relief Payment, the EC Interest Rate Subsidy and the EC Exit package.

The *EC Relief Payment (ECRP)* covers the necessary day-to-day living expenses of farm households suffering from extremely low incomes due to EC events, with payments equivalent to the unemployment allowance for the non-farm sectors (Newstart allowance).

However, special asset and income test requirements are applied under the ECRP scheme. In particular, assets essential to the running of the farm business are excluded from the asset test, which allows farmers with high valued farm assets access to ECRP (Table 9). The government agency that administers social security services (Centrelink) provides up to AUD 424 per fortnight for the farmer and partner while the area is EC declared (equates to AUD 848 combined per fortnight for a partnered couple).⁵ In 2008-09, approximately 24 500 farm households received ECRP payments, totalling AUD 339 million. In June 2008, the *Transitional Income Support* program was introduced as part of the Australia's Farming Future policy package, replacing the Farm Help income support program. This program allows farmers outside an EC declared area to have access to short-term income support, and advice and training opportunities. Although special eligibility criteria are applied to the Transitional Income Support, it includes the asset test including farm asset, whereas ECRP does not impose any limit on farm asset. The farm asset test requirement makes it difficult for most farmers to be eligible for this program.

Table 9. Comparison of eligibility criteria of Newstart, ECRP and Transitional Income Support

	Newstart	ECRP	Transitional income support
Mutual responsibility	Must be unemployed	Must be a full-time farmer in EC area	Must be a full-time farmer
	Activity test - must look for job and/or undertake training or an approved activity	Activity test: none	
Income test	Where claimant earns above AUD 62 per fortnight or their partner earns above AUD 769 per fortnight, payments are reduced	Same as Newstart income test but additional AUD 20 000 off-farm wage and salary income per annum per couple exempted, proceeds from forced disposal of livestock are exempt	Farming families estimated total income for the next 12 months less than AUD 41 054 (same as personal income test of Newstart)
Asset test	Must have combined asset under AUD 252 000. Principal home and superannuation are not included	No total asset limit. Off-farm asset limit of AUD 252 000. Principal home, life insurance, superannuation of farmer are not included	Net asset less than AUD 1.5 million / liquid assets including FMD less than AUD 20 000

1. The difference of eligibility is not exhaustive in the table.

Source: DAFF.

The *EC Interest Rate Subsidy (ECIRS)* aims to support the long-term viable enterprise suffering from financial difficulty due to EC event. Both farm business and farm dependent rural small business in EC declared area are eligible to apply for ECIRS. It covers up to 50% of the interest payable on all loans (excluding recent property purchases) in the first year and up to 80% in subsequent years. The eligibility criteria for this scheme includes: 1) an off-farm asset test of AUD 750 000, excluding FMD deposit, bona fide insurance and superannuation (pension); 2) farmers must contribute at least 75% of their labour to the enterprise under normal circumstance; 3) they must have derived at least 50% of their income from farming, and 4) the farm business must be located in an EC declared area. Since the eligibility for ECRP and ECIRS are not mutually exclusive, a farmer can have an access to both ECRP and ECIRS at the same time. The ECIRS

5. The rates are as of October 2010.

payment is limited to AUD 100 000 per 12-month period, with cumulative support capped at AUD 500 000 over five years.

EC Exit Package is designed to assist non-viable farms to leave the sector. It consists of an Exit Grant, which provides a taxable one-off payment of up to AUD 150 000, an Advice and Retraining Grant (a further AUD 10 000 available for advice and retraining) and a Relocation Grant (up to AUD 10 000 for relocation expenses). A farmer receiving an exit package must declare that he will not return to the agricultural sector within five years. As of 5 December 2008, only 98 applicants received the package out of 469 claims. Of those who received exit assistance, 64 also received either ECIRS or ECRP before leaving the industry. The exit package is hardly used partly because it imposed more restrictive criteria with an asset test of AUD 350 000. Additionally, other payments such as ECIRS are more attractive in terms of eligibility and the potential amount of the subsidy. Farmers may have an incentive to remain in the sector and receive other types of government support.

A few other programs are also available. For example, under the *Small Business Income Support* scheme, agricultural dependent small business operators can apply for both the EC relief payment and the EC interest rate subsidy. *Professional advice and planning grants* are available for farm business located in EC declared areas, and provide up to AUD 5 500 for drought affected farm businesses to have access to professional business and financial planning advice.

Animal and plant disease

Catastrophic damage caused by animal or plant diseases is not considered as a natural disaster or exceptional circumstance. Although the Australian government (AQIS) is solely responsible for the import quarantine, it takes a public-private partnership approach for the domestic quarantine measures called “bio-security partnership arrangement” (Box 7). The national and state governments and industry organizations jointly established the non-profit public companies (Animal Health Australia and Plant Health Australia) that help coordinate national animal and plant health programs affecting the domestic quarantine measures, such as surveillance, emergency response to disease outbreak and disease risk mitigation.

Box 7. Bio-security partnership arrangement in Australia

Outbreak of contagious animal/plant disease can cause a catastrophic damage to livestock and horticultural production. Australia takes a partnership approach to manage animal/plant disease risk, where the Australian government, regional government and industry organization jointly prepare the risk management policy and share its cost subject to legally binding contract between them. Initially, it was the agreement between national and regional government on sharing the cost of emergency response to animal/plant disease (“Commonwealth/States Cost Sharing Agreement”). However, the agreement was expanded to include industry organizations to share the cost of emergency response and prepare the response plan to disease outbreak (Emergency Animal Disease Response Agreement (EADRA) and Emergency Plant Pest Response Deed (EPPRD)) with more variety of diseases in coverage. Animal Health Australia (AHA) and Plant Health Australia (PHA) were jointly established by the national, state and industry organization as non-profit public companies that administer the emergency response program and other related programs (e.g. animal disease surveillance).

The Bio-security partnership arrangement includes the compensation scheme for animals and plants destroyed in the process of emergency responses to diseases. The initial valuation of the property is made at the time the disease is detected at the farm, but also compensates the difference between the first evaluation and the market value when the quarantine measure applied to the farm is lifted. The cost of compensation is shared between the governments and affected industries. To be eligible for compensation, the farmer must prepare an explicit risk management plan to reduce the disease risk and report the potential disease outbreak within 24 hours of its detection. The strength and weakness of the bio-security partnership approach is discussed in the following chapter.

Overview of government risk management measures and the definition of risk layers

Overall, the Australian risk management system is based on the self-reliance principle of risk management by farmers and the government provision of support under exceptional circumstances. The majority of government programs assist farmers to prepare for droughts and climate change through training programs, tax incentives to maintain cash reserves, and R&D. On the other hand, the EC programme is supposed to be a safety net that supports viable farms suffering from exceptional circumstance. However, the eligibility criteria have been relaxed and expenditure increased in recent years. Little or no support is provided to risk management markets, such as insurance and futures markets. Price pooling systems through marketing boards are abolished, which has increased the farmer's responsibility to manage price risk.

In terms of risk layers, a relatively large layer of catastrophic risk is defined due partly to the dominance of drought risk and to the policy focus on drought risk management. The principle of self-reliance in risk management has expanded the normal risk layer. As a result, the market risk layer is defined relatively narrowly. Part II will analyze the governance structure of Australia's catastrophic risk management policy. In particular, the analysis focuses on whether the Australian system avoids asymmetric information problems (e.g. moral hazard and adverse selection) and serves its policy objective in the most efficient and effective way, considering other available policy options.

No clear boundary exists between the different layers of risk in Australia. In particular, the marketable risk layer is not clearly defined and relatively few risk market instruments are available, except for price hedging through futures or contracts. As indicated by the objective of the National Drought Policy in its approach to climatic variability, the basic concept of risk management is that individual farmers take individual responsibility to manage risks when it is within their control. Catastrophic risk is considered to be beyond the control of individual producers, but despite the existing rules defining the scope of such risk, its boundaries have been blurred by the increasing frequency to declare EC situations.

Table 10. Government measure related to risk management in Australia

	Market creation	Modifying market incentives	Risk reduction and mitigation (income smoothing)	Coping with risk (consumption smoothing)
Ex ante	<ul style="list-style-type: none"> • Development and of futures exchange market • Development of water markets 	<ul style="list-style-type: none"> • Farm Management Deposit scheme 	<ul style="list-style-type: none"> • Tax averaging system • Bio-security measures 	
			<ul style="list-style-type: none"> • Training (Farm Ready Programme) • Farm management advice (Climate Change Adjustment Programme) • Climate Change Research Programme. 	Climate change adjustment (Australia's farming future)
Ex post - triggered ex post		<ul style="list-style-type: none"> • R&D by levy organization • Emergency response to animal / plant disease outbreak • Transportation subsidy 	<ul style="list-style-type: none"> • Professional advice and planning grants • Transitional income support 	
			<ul style="list-style-type: none"> • EC interest rate subsidy 	National Drought Policy
- decided ex post			<ul style="list-style-type: none"> • EC relief payments • EC Exit subsidy 	
				<ul style="list-style-type: none"> • Natural Disaster Relief and Recovery Arrangements

Catastrophic risk

Drought was removed from the NDRRA partly because they continue over a longer period whilst other natural disasters are of a short-term nature, and partly to get away from the *ad hoc* nature of responses by the NDRRA. NDP requires a frequency of no more than once every 20 to 25 years, but the duration and geographical extent of EC declarations has increased during the last decade. Both governance (see next chapter) and climate factors may contribute to this. The question is raised that “climate change” may be affecting the viability of the drought policy framework. Climate change may be challenging the capacity of policy to distinguish between a risk that needs to be managed or mitigated and a change that requires structural adjustment and adaptation. But institutions and governance may also affect the capacity of policy to discriminate and move the boundary of catastrophic risk towards risks that would be considered as a normal or market risk.

Marketable risk

Marketable risks are those that are transferred or pooled through risk markets. Australian farmers use risk market instruments to a limited extent. Although the Australian farmer widely insures specific peril yield risks, such as hail, frost and fire risk, the insurance markets do not offer multi-peril crop insurance. The market transfer of price risk is observed through forward contracts and futures exchange.

Normal risk

There is a wide range of normal risks that are retained by farmers. Price risk may be partly managed through risk market instruments, but many farmers, in particular livestock enterprises, use stock management strategies. The diversification of agricultural production and income source are also important ways of pooling risk privately. Institutional risks include interest rate and policy risk (taxation and regulatory) in addition to local and global economic conditions.

Part II.

Main Issues of the Risk Management System in Australia

3. Adjusting objectives and instruments in drought risk management policy

The Australian government conducted reviews of the national drought policy in 1997 and 2004. It was agreed by Ministers in 2008 that the approaches to drought and Exceptional Circumstances were no longer the most appropriate in the context of a changing climate; they therefore launched a national review process. The review consisted of three separate assessments: an economic assessment of drought support measures by the Productivity Commission, an assessment by an expert panel on the social impact of droughts on farm families and rural communities, and a climatic assessment by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Meteorology. All three reviews were completed in 2009. The main points of the assessments in these three reports are summarized in Box 8. The present study does not attempt to replicate or question the conclusions of this far-reaching exercise, which is an impressive example of good information gathering for policy making.

**Box 8. The review on the national drought policy:
some conclusions from the three assessment reports**

Scientific assessment on the impacts of climate change, by BOM and CSIRO

- 1) The climatic projection indicates more EC declarations would be likely over the large areas due to higher temperature and, for some regions, more frequent periods of exceptionally low rainfall.
- 2) The current EC trigger, one in 20-25 years based on historical records, is not appropriate under a changing climate.
- 3) Farmers and their suppliers need user-friendly, reliable and up-to-date location specific information on historical climatic conditions and future climate variability.

Social impact assessment by Expert Social Panel

- 1) EC policy arrangements are the subject of either strong support or dissatisfaction, depending on eligibility or for a range of other reasons. The EC declaration process is undoubtedly causing stress among the people in the implementation of different approaches between and across state jurisdictions, in meeting complex criteria and in completing complex paperwork. "Future policy should seek to move people towards an acceptance that future dryness will occur and is not a crisis' and that there is a need for plan for dryness.
- 2) Dryness negatively impacts on the ability of members of a rural community to work together for the benefit of the whole community, eroding the capacity of people to engage in community projects or voluntary work. The dryness also impacts on farm families through separation and isolation. Human support service can perform a vital role in the long-term sustainability of rural communities. Education and training must be available in rural areas based on sound adult learning principles.
- 3) The government should move away from short-term crisis response approach to facilitating the social wellbeing of farm families, rural businesses and communities to improve their capacity to live with dryness, recognising the fact that Australia will face periods of prolonged dryness in the future. "Future policy should be focused on investment and planning".

Economic assessment by the Productivity Commission

1) In 2007-08, 23% of the farms in Australia received drought assistance, totalling over AUD one billion, with some on income support continuously since 2002. However, most farmers in drought declared areas manage without drought assistance. From 2002-03 to 2007-08, on average about 70% of dairy and broadacre farms in drought area received no drought assistance.

2) EC declarations and related drought assistance programs do not help farmers improve their self-reliance, preparedness and climate change management. Specifically: a) ECIRS and state-based transactions subsidies are ineffective, can perversely encourage poor management practice and should be terminated. b) ECRPs are limited to those in drought –declared areas, ignoring hardship elsewhere or for other reasons. They should be replaced with income support for all households in hardship regardless of location or cause. c) The EC declaration process is inequitable and unnecessary. It should not be extended to new areas. Current declarations should lapse as soon as practicable.

3) Government needs to commit to a long term reform path that recognises that the primary responsibility for managing risk, including from climate variability and change, rests with farmers. Therefore, a) R&D, extension, professional advice and training to improve farmers' business management skills and build self-reliance warrant significant government funding. b) FMDs have encouraged farmers to save and to be more self-reliant, and should be retained. c) policies related to water, natural resource management, and climate change are often at cross-purposes and need to be better coordinated and integrated.

More recently, on 5 May 2010, the Australian Government, in partnership with the Western Australian Government, announced a pilot of drought reform measures in part of Western Australia. The pilot will test a package of new measures developed in response to the national review of drought policy. The measures are designed to move from a crisis management approach to risk management. The aim is to better support farmers, their families and rural communities in preparing for future challenges, rather than waiting until they are in crisis to offer assistance. The pilot will be in place from 1 July 2010 to 30 June 2011 (Box 9). The pilot will be reviewed in 2011 to inform ongoing work on national drought policy reform.

Box 9. Pilot of drought reform measures in Western Australia

The Australian Government, in partnership with the Western Australian Government, is conducting a pilot of drought reform measures in part of Western Australia from 1 July 2010 to 30 June 2011. The pilot will test a package of new measures developed in response to the national review of drought policy. The pilot measures are designed to move from a crisis management approach to risk management, meaning that they are focusing more on assisting farmers to prepare for the impacts of drought, reduced water availability and a changing climate rather than mitigate the financial impacts on farmers by adverse climatic events. Interest rate concession was not included in the program and the support triggering process of government declaration of exceptional circumstance was not adopted. EC policy framework is maintained outside the pilot region during the pilot period.

Farm Planning: Up to AUD 7 500 for farmers to undertake training to develop or update a strategic plan for their farm business. The plan will identify priority activities to help improve the management and preparedness of the farm business to respond to future challenges.

Building Farm Businesses: Grants of up to AUD 60 000 in two components. *Business Adaptation Grants*—up to AUD 40 000 for eligible activities identified in the strategic plan that help farm businesses prepare for the impacts of drought, reduced water availability and a changing climate. *Landcare Adaptation Grants*—up to AUD 20 000 for eligible activities identified in the strategic plan with a natural resource management focus and having a broader public benefit.

Stronger Rural Communities: Grants are available to local government authorities and community organisations to fund projects that build the resilience of rural communities and help them to manage hardship resulting from an agricultural downturn.

Farm Social Support: Support for a better coordinated social support network to meet the mental health, counselling and other social needs of farming families and rural communities.

Farm Family Support: Income support for farmers facing financial hardship, allowing them to meet basic household expenses.

Farm Exit Support: Grants of up to AUD 170 000 to support farmers who decide to sell their farm, including for retraining and relocation expenses.

Beyond Farming: Beyond Farming puts current farmers in touch with former farmers to talk about opportunities outside of farming and to talk to someone who has been in the same position about the options for themselves and their families if selling the farm business or retiring.

This section focuses on four specific aspects of the NDP: the EC declaration system, the income risk management dimension, the crowding out effects and the implications for structural adjustment.

Is EC declaration system sustainable and efficient?

Exceptional Circumstances would be declared when the combined impact on farmers of the core criteria (meteorological, agronomic, water, environment, farm income and scale) constitutes a rare and “severe occurrence.” Meteorological conditions and a once every 20 to 25-year frequency would be the threshold or primary conditions. The threshold frequency is interpreted by the BOM&CSIRO (2008) report as a 5% probability of occurrence in each year according to the historical distribution over the last decades (a hundred years series is used). The report concludes that, on average, weather was exceptionally hot in 10-12% of the area every year in the last four decades, but is most likely to be in 60-80% of the territory in the next three decades. The report also concludes that according to rainfall data in one of the scenarios, EC declarations would be triggered about twice as often and over twice the area in all regions. There is strong evidence that climate change is having an impact on higher temperatures and lower rainfall in Australia, and therefore historical data does not currently allow for accurate discrimination between extreme and normal drought events. The NDP was designed to be triggered only under exceptional circumstances, but the frequency and area of EC declarations have increased in recent years. The BOM & CSIRO report identifies the need for research to improve existing information for all agents, including government and farmers. This scientific information could be used to refine the criteria for EC declaration, adjusting historical distributions with current knowledge on trends in temperature and rainfall.

Information gaps and climate change are not the only factors that have caused an increase of EC declarations. The declaration process is subject to governance and institutions. In the case of the NDP in Australia, the state and territory governments are responsible for compiling and submitting EC applications to the Australian Government based on concerns raised by a local community or industry body. To assist in developing an accurate and effective assessment of an EC application, the National Agricultural Monitoring System (NAMS) was created by BRS. It generates standard reports that contain relevant data agreed to by stakeholders for EC application.⁶ These standard reports are based on historical data that arguably overestimates the exceptionality of current temperatures and rainfall. Once an EC application is lodged, the Australian Government undertakes a *prima facie* assessment and the Australian Government

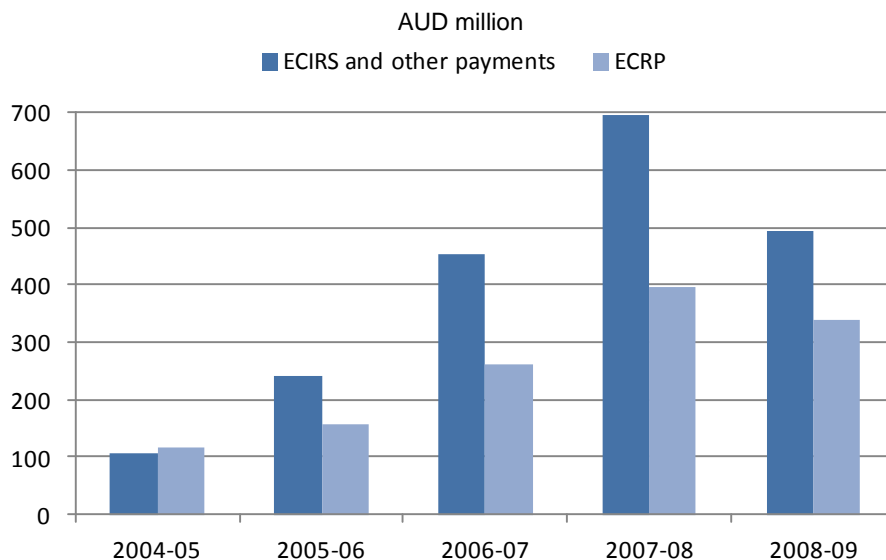
6. The NAMS system is currently suspended due to the disagreement of financial contribution by stake holders

Minister for Agriculture, Fisheries and Forestry refers the application to the National Rural Advisory Council (NRAC) for assessment. The NRAC is composed of up to eight members including a chair person, one Australian Government representative, one State/Territory Government representative, a representative from the National Farmers Federation and agricultural producers who have expertise in economics, financial administration, sustainable agriculture, regional development and farm management/training.

Upon referral, the Australian Government may enable *prima facie* payments (interim income support) while NRAC assesses an application. This support is available for up to six months while the application is processed, regardless of whether the application is eventually assessed as meeting the EC criteria. If the application is successful and EC is declared, eligible farmers and small business operators in the declared EC area will have full access to EC assistance, including its the EC Interest Rate Subsidies (ECIRS), EC Relief Payments (ECRP) and EC Exit Package. EC assistance is typically available for up to two years and may be extended if ongoing EC assistance is warranted by continued poor season conditions. Figure 6 shows the evolution of budgetary expenditure for EC programs between 2002-03 and 2008-09, with a peak of AUD 1.1 billion in 2007-08. The percentage of agricultural land declared as EC was more than 40% in all five years between 2003 and 2007 (Figure 7).

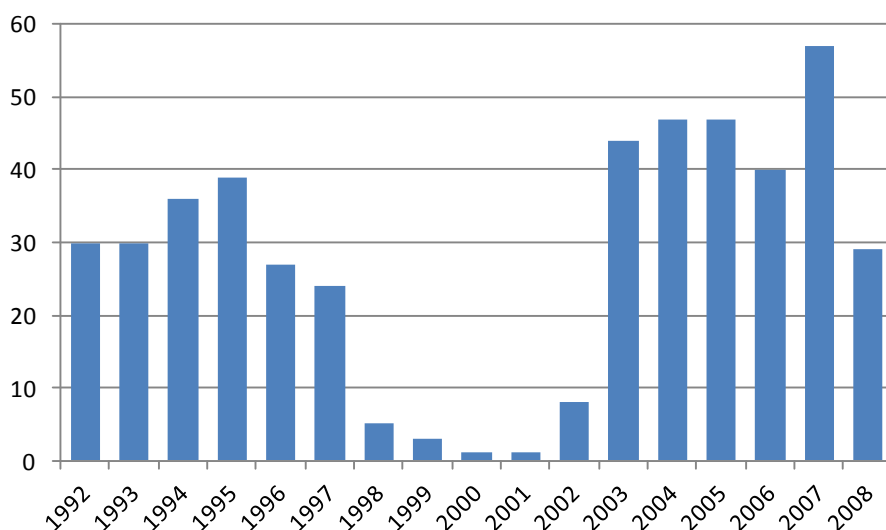
The scientific report from BOM and CSIRO highlights the information gaps about the distribution of temperature, rainfall and moisture. This cognitive failure contributes to create an asymmetric information situation in the declaration process. It is well known that asymmetric information often leads to moral hazard problems. In the case of the EC program, the principal is the Australian government and the NRAC that have imperfect information about the exceptionality of the drought, and the agents are the state/territory governments that apply and make a case for the EC declaration. Farmers who receive EC payments are also agents with respect to its state government which has only imperfect information on the social and economic impacts of a given circumstance.

Figure 6. Evolution of EC payments



Source: DAFF.

Figure 7. Percentage of agricultural land EC declared, 1992-2008



Source : Productivity Commission (2009).

In the principal-agent relationship between the national and state/territory government in the EC declaration process, it is the state/territory government (agent) that applies for EC, making the case that a specific drought incident qualifies for the EC criteria. The state/territory government does not bear any significant cost in this process: NAMS reduces the transactions costs of gathering information and producing a report, and the federal Australian Government funds 100% of the EC Relief Payment, EC Exit Package and PAPG, as well as 90% of EC Interest Rate Subsidies. The state governments contribute 10% of EC Interest Rate Subsidies and provide a range of complementary drought assistance measures⁷. In this framework, the agent (state/territory government) has strong incentives to apply for EC declaration because it will get most of the credit from the citizens and bear little of the costs. The principal (the Australian government) bears the burden of the budgetary costs of a potential EC declaration, but given the NRAC procedures, the principal has hardly any means to compare information and apply strict criteria to the EC declaration. The action by the agent (state/territory government) is not expected to be Pareto-optimal because state/territory governments do not have financial incentive to refrain from EC declaration. Since the Australian government has difficulty in assessing the local incidence of drought, the principal (Australian government) observes the imperfect signal of the action taken by the agents (state/territory government and producers).

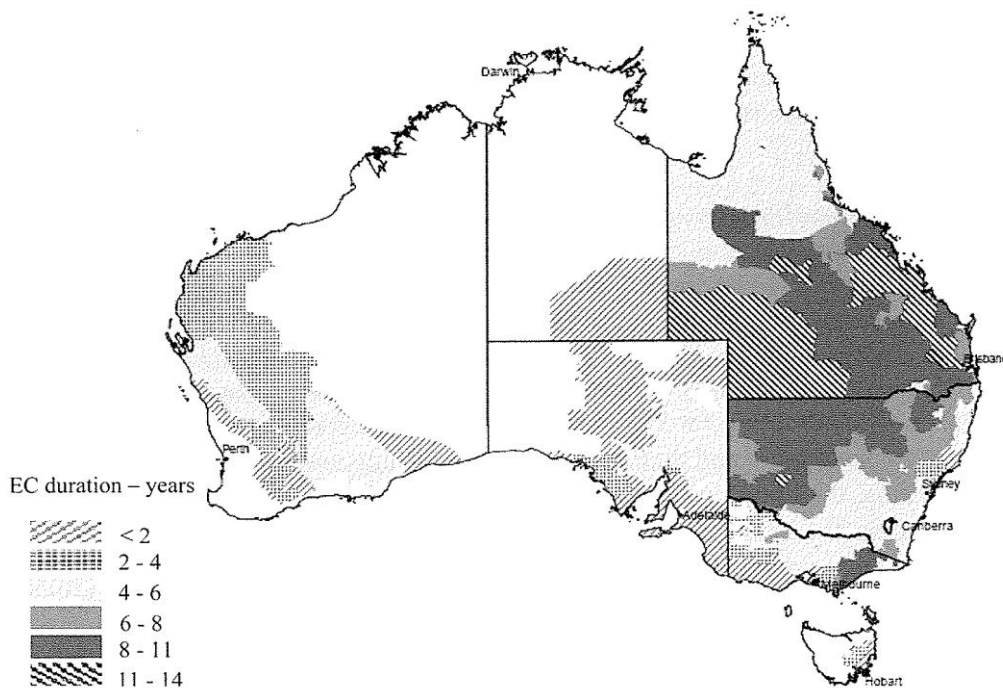
This potential moral hazard behaviour could also contribute to the frequency of EC declarations. Despite the stated criteria of EC declaration that the event has to be rare that

7. Australia is organized as a federation of states and territories, with federal, state and territory governments, and a third level of local government. Under the Constitution, the federal government has the taxing powers: it raises income and disburses it to the states via an agreed formula so that the states can meet their constitutional responsibilities for such things as health, education, and transport. The state and the federal governments meet in the Council of Australian Governments (COAG) and related committees, such as the Primary Industries Ministerial Council and the Primary Industries Standing Committee and various sub-committees, to deal co-operatively with issues relating to agriculture, such as drought policy, water policy, rural research, and bio-security.

is it must not have occurred more than once on average in every 20 to 25 years, EC has been declared in wide area of Australia. After 2003, the percentage of land EC declared has been close 50% of total land in Australia (Figure 8). Many of Australia’s agricultural producing regions in Queensland, NSW and Victoria have endured consecutive drought years, with little or no opportunity for production systems to recover. Subsequently, a number of areas have been EC declared for at least eight years since the introduction of the NDP.

The governance of drought in Australia contrasts with that of the Bio-security partnership arrangement scheme that has devices to reduce the moral hazard problem. Under this scheme, which is further discussed in Chapter 4, the participating stake holders, including both national and state/territory governments, share the cost of the emergency response program based on the specified formula that intends to equate the benefit received and the cost it incurs.

Figure 8. Duration of EC declarations, 1992-2008



^a Includes only declarations based on a drought event (irrespective of industry).

Data source: BRS (2009 unpublished).

Is the EC triggering mechanism contributing to the effectiveness of ECRP as a social assistance program?

The EC Relief Payment (ECRP) is designed to support viable farmers experiencing a financial hardship due to the adverse effect of drought. The program is designed in line with the parameter of Australia’s general social security system (Centrelink programs and Newstart unemployment benefits) to provide a basic safety net. However, it applies more

favourable criteria on asset, activity and income tests, considering the specificity of farming operation (e.g. large asset position, difficulty to engage in off-farm employment, supposed viability of the farm and need to keep activities in the farm). However, the ECRP is not applied to farmers outside the EC declared area. Although drought is one of the major sources of risk, farmers are exposed to other risks that have severe adverse effects on farm income and that can be more relevant than drought for some farms or areas. ECRP is supposed to be a social program that should target individual low income situations. A payment triggered exclusively by income risk – without a prerequisite of drought EC declaration – could be more targeted to low income risk of all farmers. On the other hand, such an income based payment may increase the chance of unviable farmers receiving support if the income and asset criteria are less restrictive. The role of the payment should be limited to a social safety net.

This section summarizes the analysis of ECRP using micro data and simulation models (OECD, 2010b). The effect of ECRP on farm welfare, income variability, minimum income and diversification is compared with that of two alternative payments: the payment that is triggered solely by income risk and the lump sum payment. Table 11 presents the effects of an additional one AUD subsidy per hectare through three different payments: a representation of current ECPR triggered by a systemic yield shock and an income test, a hypothetical “income based payment” that is triggered only by individual income tests regardless of EC declarations and a lump sum transfer for all farmers. ECRP and the alternative income based payment achieve higher welfare than a lump sum payment through higher level of expected income and lower income variability. They are also more effective in reducing income risk. However, the income based payment has a higher welfare impact than ECRP both in terms of increasing in the level of income and reducing the income variability. This is because the payment is better targeted to income than the ECRP, which is not triggered unless a drought condition is declared. The income risk originates from risks other than drought, such as other weather events and price or cost risk.

Slightly negative impacts on the diversification index were found for the three payments, indicating some crowding out of on-farm risk management strategies. The lump sum payment has the least crowding-out effect, presumably because a systemic yield shock is more difficult to manage through crop diversification. The payments triggered by a systemic yield shock may be more complementary with a crop diversification strategy. A clear difference is found between the payments in the effects on minimum income level. The alternative income based payment has the highest impact on the minimum income, which is the most reasonable target of social programs. On the other hand, the simulation indicates ECRP has a negative impact on the minimum income because the incident of minimum income does not qualify for EC condition and the crowding-out effect of crop diversification reduces the minimum income. The payment triggered by a specific risk shock such as ECRP may not function well as a safety net.

Overall, payments targeted to income are more effective in reducing income risk than are lump sum types of payment. In Australia, the payment triggered by a systemic yield shock may have an advantage in minimizing the impact of the crowding-out effect of a diversification strategy. However, the role of ECRP as a safety net is questionable because farmers may suffer from other risks than drought, and these could be more damaging in terms of risk for those farmers with very low incomes. This program should be available to the farmers outside the EC declared area. In fact, the farmer outside the EC declared area can have an access to the Transitional Income Support program. The total net asset test of AUD 1.5 million is widely perceived to be very restrictive for most of the farmers. Given that the new program is replacing the ECRP, the income and asset test criteria should be reviewed accordingly so that it functions as a social safety net. The Productivity Commission (2009) proposes an income support scheme which has total net asset cap of AUD 2 million tapering to AUD 3 million. The pilot income support program implemented in WA sets the total net asset limit of AUD 2 million. The eligibility criteria should be determined based on the assessment of the pilot program.

Table 11. Comparison of the impacts of ECRP and alternative payments

Impact of additional one AUD per hectare

	Certainty equivalent income (change in AUD)			CV of income (change in percentage)	Minimum income	Diversification index (Initial=100)
	Overall change	Contributing factors				
		Change in mean	Change in variability			
ECRP	1.22	1.17	0.050	-0.67	-0.28	-0.24
Income-based payment	1.26	1.20	0.052	-0.64	7.47	-0.35
Lump sum payment	1.01	1.01	-0.003	-0.59	0.97	-0.01

* The simulation increased ECRP by AUD 1 per hectare from the current level. Alternative income payment and lump sum payment equivalent to AUD one per hectare are introduced in addition to current level of ECIRS and ECRP.

Does NDP crowd out farmer's own risk management strategy?

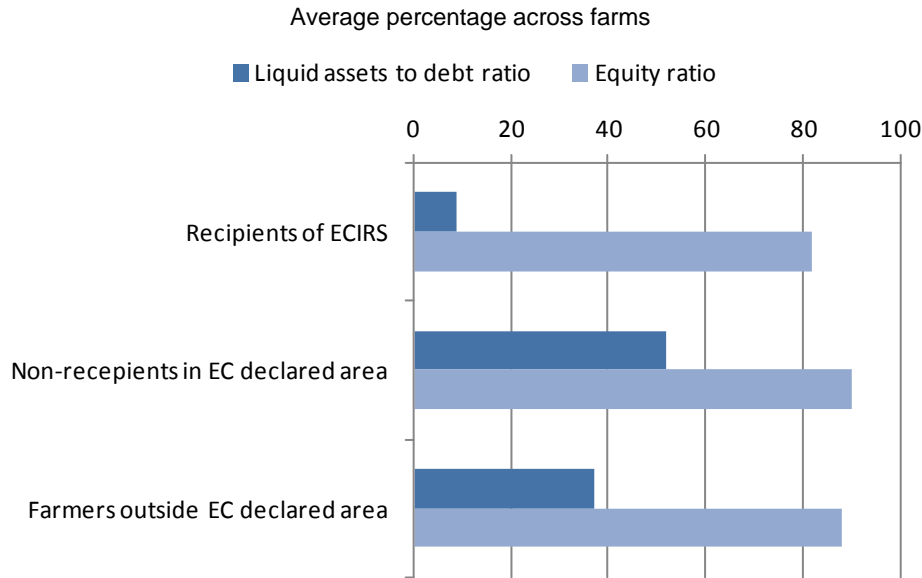
Crowding out of on-farm risk management strategy by EC programs

The observation of risk management strategies in the previous section indicates that the farmer can potentially take a number of risk reducing or mitigation strategies to manage drought risk (e.g. adopting specific production practice, financial management and stock management). However, the producer's own risk management strategy and government policies are interlinked. The effectiveness of government policy may be reduced if it crowds out the producer's own risk management strategy. The results from micro data and modelling analysis in OECD (2010b). leave little room for doubt about the crowding-out effects of all risk management government policies. All the policies analyzed create an incentive for farmers to use less on farm or market risk management strategies or instruments. There is some evidence that this is the case with the NDP measures.

The survey in Queensland indicates that maintaining an appropriate level of equity is a widely adopted financial management strategy to mitigate the adverse impacts of drought (Table 3). The Australian government provides tax incentives (e.g. FMD) to smooth income through savings. ECIRS can cover up to AUD 100 000 of the interest rate

repayment for both existing and new debts per year, which creates incentives for farmers in EC declared areas to increase their debt load, leading to a lower level of equity. The data shows that ECIRS recipients have a higher dependence on debt, as indicated by the lower liquid assets to debt ratio and equity ratio in Figure 9.

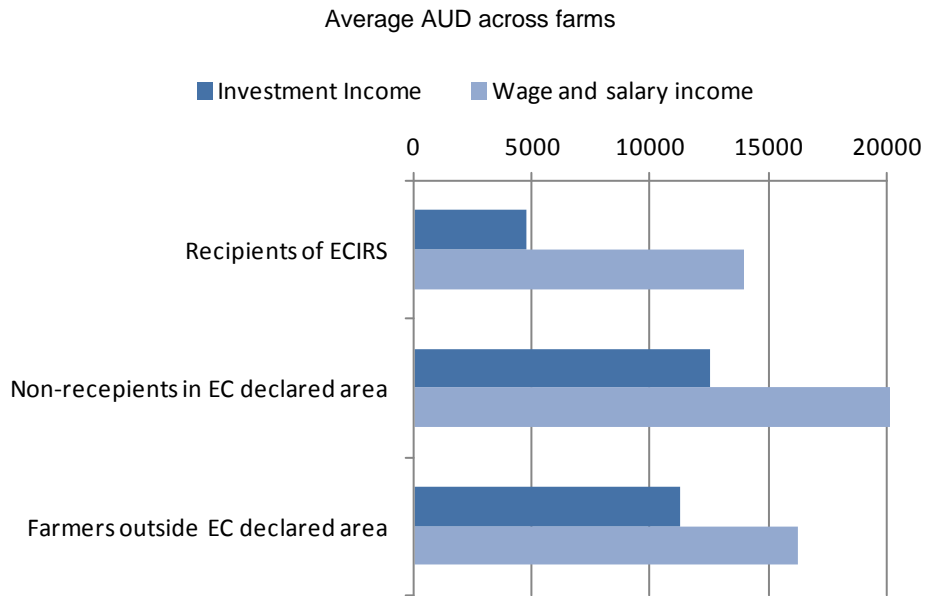
Figure 9. Comparison of financial position, 2002-03 to 2007-08



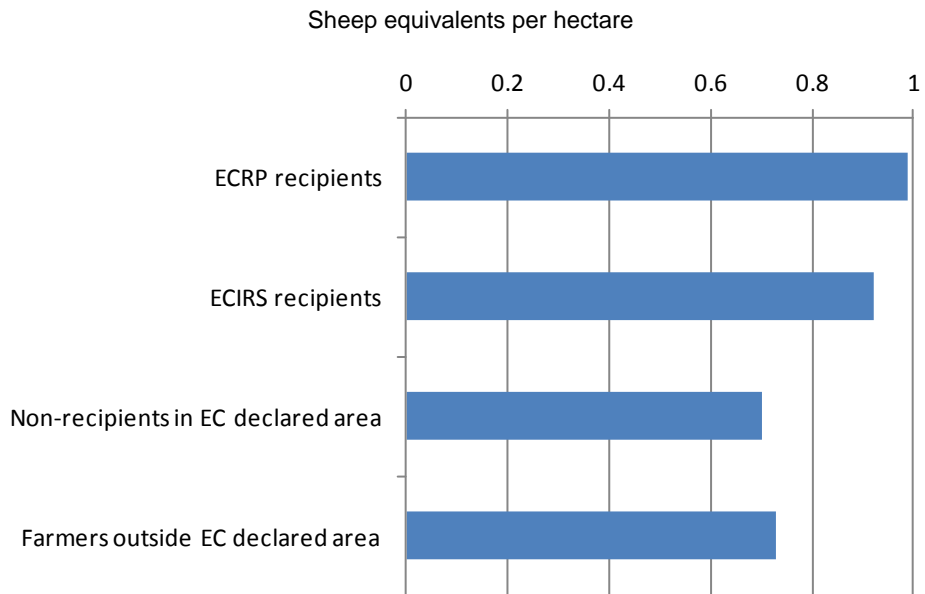
Source: Productivity Commission (2009) taken from ABARE.

ECIRS may also reduce the incentive to diversify income sources because having a cash income from investment or off-farm employment may reduce the probability of accessing to ECIRS. In fact, the average off-farm investment income, and wage and salary income of ECIRS recipients between 2002-03 and 2007-08, are lower than those of non-recipients in EC declared area and farmers outside EC declared area (Figure 10).

Third, as described above, farmers can adopt specific production practices to mitigate the adverse effects of drought. In particular, effective stock management of both animal and fodder is important for the extensive livestock farmer (e.g. storing the fodder through lower stocking density during wet periods and using during dry periods, and selling animal stock before the drought season). The survey in Queensland indicates that the majority of farms implement strategies to sell animal stocks earlier than expected and use reserved fodders to mitigate the effects of drought (Table 3). However, EC recipients tend to have a higher stocking rate than do non-recipients (Figure 11). It is also found that EC recipients had higher fodder expenditure per animal between 2002-03 and 2007-08 (Productivity Commission 2009). Livestock farmers in EC declared area may have an incentive not to reduce the stocking rate to mitigate drought risk and depend on the purchased fodder. Maintaining a higher stocking rate increases the expected income, but it comes with more risk in drought condition. Despite the policy objective, EC payments may allow livestock farmers to take more risks in their production decisions.

Figure 10. Comparison of annual off-farm income, 2002-03 to 2007-08

Source : Productivity Commission (2009) taken from ABARE.

Figure 11. Stocking rate of EC recipients and non-recipients, 2002-03 to 2007-08

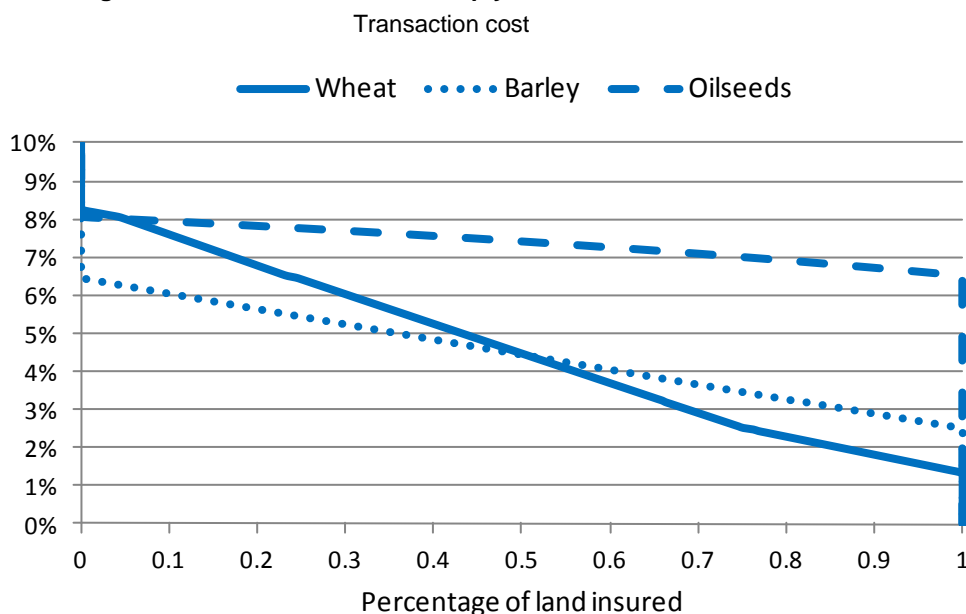
Source: Productivity Commission (2009) taken from ABARE.

Role of risk market instruments

The use of risk market instruments is, as stated above, relatively limited in Australia. In particular, the insurance products that allow yield risks to be insured are limited to single-peril insurance (e.g. hail and fire). Multi-peril crop yield insurance is not offered by the market and there are on-going arguments as to whether the government should support the implementation of multi-peril crop yield insurance. In principle, access to diverse risk management instruments is desirable, recognizing that the farmer has much better information on the nature of their risk environment than do researchers or governments, but the desirability of such a measure requires an in-depth cost benefit analysis. The Productivity Commission Report argues that the systemic nature and the asymmetry of information, and the existence of NDP policy can impede the development of drought insurance in Australia.

The microeconomic simulation in OECD (2010b) explored the viability of crop yield insurance in Australia as compared to other countries using farm level data.⁸ Figure 12 shows the proportion of the planted area of land which are insured by producers for each crop yield with different levels of transaction costs in Australia. The representative producer participates in the insurance market when the transaction costs of insurance are at around 8% of fair premiums, and he fully insures crop yield at less than 2% of cost. The simulation results in a narrow margin that implies the market would most likely not be able to offer crop yield insurance without a government subsidy.

Figure 12. Potential demand of crop yield insurance in Australia



8. The structure of stochastic modelling is described OECD (2010b) and the complementary room document [TAD/CA/APM/WP/RD(2009)14/REV1].

However, the microeconomic analysis shows some advantages for Australia as compared to other countries in the development of crop yield or drought insurance in Australia. First, yield risk is higher in Australia than in other countries, which leads to more demand of crop yield insurance at the same level of transaction cost. Second, the effect of crop yield insurance in stabilizing income may be reduced by crowding out effects of other strategies such as diversification. The simulation shows that the farmer may subscribe insurance to take more risks when the crop diversification strategy can be substituted with the crop yield insurance. However, Australian farmers are facing more systemic risk than those in other countries, making crop diversification less effective in reducing income risk. In this situation, reducing the cost of insurance premiums is more effective in reducing the variability of income due to the smaller crowding out effect of crop diversification strategies. Third, asymmetric information between the insurance provider and the farmer can be one of the major sources of high transaction costs; if the yield risk is systemic, there will be more potential to reduce high transaction costs by developing index insurance that covers risky events (e.g. the amount of rainfall) based on an index that is highly correlated with individual yield risk. The characteristics of yield risk in Australia shows that index insurance can be an attractive policy option to be explored for farmers and for re-insurers, and it can be implemented at a relatively lower cost. A possible role of government could be the development of appropriate databases and indicators so that farmers and insurers can explore possible indexes to reduce the asymmetry of information and the transaction costs of drought insurance. This potential in the context of climate change has been underlined by OECD (2009).

Although the high transaction cost is likely impeding the market from offering crop yield insurance in Australia, state tax on insurance premium is also effectively increasing the potential cost of crop yield insurance. In line with any insurance products, each state imposes stamp duty of 1% to 11% on the insurance premium (Table 12). In addition, if the insurance covers the fire risk, some states that are prone to bushfire impose additional fire service levy up to 58% to finance the cost of public fire service. Given the cost sensitivity of demand for crop yield insurance, the state tax on insurance can be an additional impediment on the development of insurance markets in Australia.

Table 12. State tax on insurance premium (2009)

Percentage of premium paid

	Stamp duty	Fire service levy
New South Wales	2.5	40
Queensland	7.5	0
Victoria	1	58
South Australia	11	0
Western Australia	10	0

Source: Agricola Crop Insurance.

Drought policy, adverse selection and structural adjustment

Adverse selection is also a representative economic problem caused by asymmetric information. More specifically, it occurs when the principal can observe the characteristics of the agent imperfectly. The issue is typically discussed in the context of insurance markets. If the insurance premium is determined at the average risk in the population, it would attract only the higher risk type and the system does not function

properly. The same can apply to some of EC programs. The main objective of EC programs, in particular ECIRS, is to help long-term viable farms to quickly recover from the short term adverse effect of drought. At the same time, the EC program assists non-viable farmers who leave the sector through the EC exit package, which consists of a one-off payment and training program. These two programs are intended to facilitate smooth structural adjustment by discriminating between viable farmers who will receive ECIRS (and maybe also ECRP) during the EC, and non-viable farmers who may have access to an Exit package. Discrimination is made through two different filters: an auto-selection by the farmers deciding to apply for one, another, or none of the programs, and the viability test by the government to give access to ECIRS.

The government has imperfect information to judge whether the individual farmer is viable in the long-run or not, which weakens the discrimination capacity of the viability test. This may create the adverse selection problem in which non-viable farms continue to be farmed and to receive the ECIRS instead of applying the EC exit package. This is the reason argued by the Productivity Commission against the use of the viability assessment to force structural adjustment, and in favour of providing grants for advice, training and information that would facilitate the farmers' auto-selection as viable or non-viable. However, this auto-selection is currently strongly influenced by the amount of support provided under the ECIRS program as compared to the Exit Package.

The decision making of viable and non-viable farms to continue farming or exit the sector can be illustrated by the simple pay-off matrix (Figure 13). Let us consider a farmer inside an EC declared area, for which the viability test fails to discriminate, and he is then eligible for either programme: the ECIRS or the exit package. If this farmer continues farming, he will be able to apply for ECIRS interest subsidies and get a pay-off that would be the sum of the present value of future farm income (F_{Iv} and F_{In} for viable and non-viable farms respectively) plus the interest rate subsidies (IS). On the other hand, if a farmer decides to leave the sector, his pay-off would be the opportunity cost of farming (OC , the present value of future income in the non-farm sector minus any exit adjustment costs) and the EC exit payment (EP). The government wants that only viable farmers continue farming and only non-viable farmers leave the sector. The incentive structure for this to happen requires:

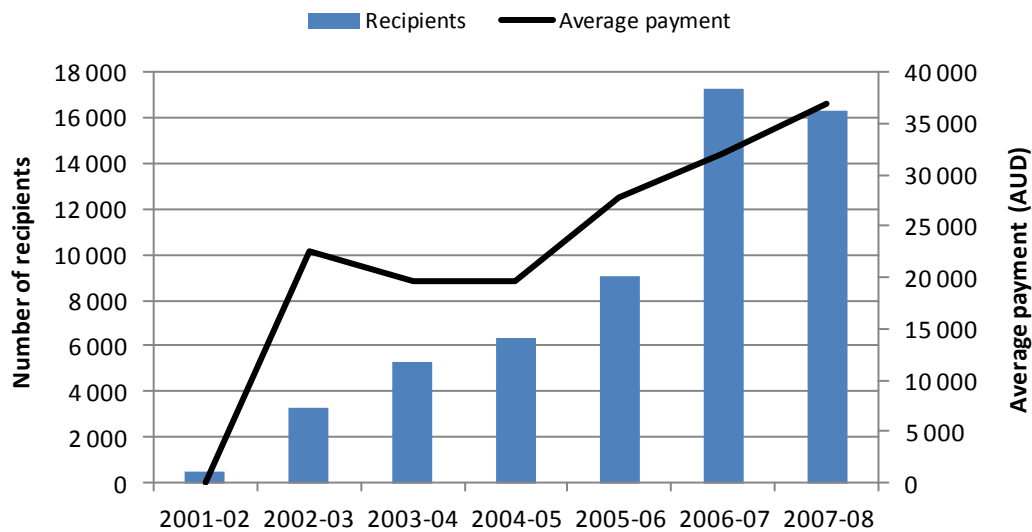
$$F_{Iv} + IS > OC + EP > F_{In} + IS \rightarrow F_{Iv} > OC + EP - IS > F_{In}$$

This condition depends on the specific returns of each viable (F_{Iv}) and non-viable (F_{In}) farm and the corresponding best alternative income opportunity (OC). The argument for supporting viable farms with IS is associated with a quick recovery objective that avoids viable farms leaving the sector due to liquidity constraints. The argument for supporting exit is to ensure that the adjustment costs of exiting do not impede a welfare enhancement adjustment of non-viable farms. In order for this condition to hold, the government has to carefully decide the level of EP and IS , depending on the values of F_{Iv} , F_{In} and OC . However, the government cannot observe these values and the farmer typically will have incentives to not reveal them. While setting a relatively high level of IS compared to EP risks to keep non-viable farmer in the sector, a relatively low level of IS as compared to EP may push viable farmers out of the sector. The government decision on the relative amount of these support measures needs to consider the probability of giving these wrong incentives.

Figure 13. Pay-off matrix of viable and non-viable farms

	Exit	Continue
Viable farms	OC + EP	Flv + IS
Non-viable farms	OC + EP	Fln + IS

The actual level of ECIRS is set well above the benefit of EC exit package. While ECIRS covers up to AUD 100 000 of interest payment (including existing debt) per year, EC exit payment provides one-off payment of up to AUD 150 000. The use of EC exit package is extremely limited (98 recipients between December 2007 and December 2008) compared to ECIRS (16 000 recipients in 2007-08). These figures imply that, despite its policy objective to ensure early recovery of viable-farms, non-viable farmers may be receiving the ECIRS; this may also retard the potential for structural adjustment in response to climate change. Aggregated ECIRS payments increased significantly in recent years to around AUD 604 million in 2007-08, where 16 000 recipients received AUD 37 000 on average (Figure 14).

Figure 14. Number of ECIRS recipients and average annual payments

Source: Productivity Commission (2009).

4. **Bio-security risk management: Public-private partnership approach**

Issues in bio-security risk management

Droughts and contagious animal/plant disease outbreaks are two major sources of catastrophic risk in Australia, but for which there is a clear difference. While drought is a natural hazard that producers cannot influence, the probability of its occurrence as well as the probability and damage of contagious animal/plant disease outbreaks depend, to a certain extent, on the stakeholder's risk management measures. For example, if a farmer does not adopt an appropriate risk reducing strategy (e.g. routine vaccination of animals), the probability of a disease outbreak may increase. If the government does not implement quarantine measures quickly enough after the initial detection of a disease, the consequent damage to other farms increases proportionately. Moreover, the cost of inappropriate risk management measures adopted in one livestock industry may not be limited to that specific industry, but may have wider consequences for the economy and society. For example, the outbreak of Foot and Mouth Disease (FMD) that infected all cloven-hoofed animals usually led to the restriction of exporting a wide range of livestock products by importing countries. The outbreak of highly pathogenic avian influenza has serious consequences on human health. In these situations, the individual farmer does not internalize the cost to other farms and beyond. This is called an externality in economics literature. The system of bio-security risk management has to be carefully designed so that it creates incentives for all the stakeholders to jointly take mutually benefitting risk management measures. In other words, the system must be incentive compatible to internalize the external cost of bio-security risk.

An effective containment of contagious disease requires emergency quarantine measures, such as destroying the infected animals/plants and imposing restrictions on animal/plant movements. For example, the World Animal Health Organization (OIE) recommends no more than 48 hours elapse between reporting and culling as good practice to control the highly pathogenic avian influenza. In order for governments to take the necessary quarantine measures quickly, the system needs to provide enough incentives for farmers to report the detection of potentially infected animals/plants to the relevant authority. Many OECD governments impose a legal obligation on farmers to report any suspicious case of disease/pest, and they often implement a compensation scheme for economic losses due to quarantine measures as an incentive to report cases and to accept quarantine measures. However, determining an appropriate level of compensation is a challenging issue because the government has limited information on the true costs of complying with reporting requirement for the farmers. While the low level of compensation does not incentivize farmer enough to report the disease detection, high level of compensation is likely to reduce the farmer's incentive to take an appropriate risk reducing strategy. The design of a compensation scheme must carefully take the issue of asymmetric information into consideration.

Together with domestic biosecurity measures, import quarantine measures are an integral part of the system of bio-security risk management. The import quarantine measures at the border affect the level of bio-security risk inside the border, which determines the cost of domestic quarantine measure. The administrative costs of import quarantine measures are paid by taxpayers, but it also affects the welfare of consumers who may not have access to imported products at a competitive price. Moreover, the cost of import quarantine measures also spills over to trade partners by restricting trade. The system of bio-security risk management needs to be designed in a holistic way so that it

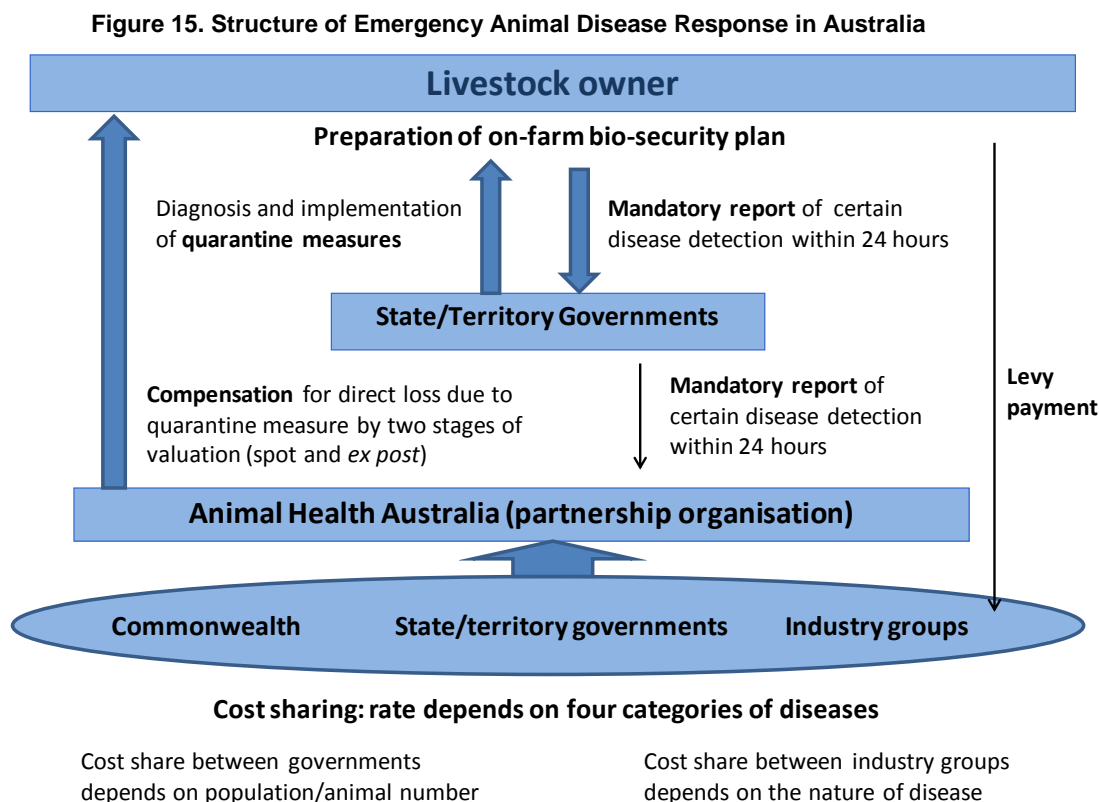
incorporates the interaction between domestic and border quarantine measures, and the costs associated with them. This chapter intends to identify the possible issues in biosecurity risk management and the characteristics of the desirable system to tackle these issues, taking an example of the bio-security measures in Australia.

Incentive to report disease outbreak and compensation to quarantine measures in Australia

It is important that biosecurity risk management system provides incentive for animal/plant owners to report quickly any potential case of disease/pest infection on their property and accept the subsequent quarantine measures. In Australia, the national and state/territory governments impose a legal requirement on all people to report contagious diseases in the national and state/territory lists immediately after they notice a suspicious case. Governments provide compensation for direct losses due to the quarantine measures taken under the Emergency Animal Disease Response Agreement (EADRA) and Emergency Plant Pest Response Deed (EPPRD) (Figure 15). All the participating parties, including governments, have the obligation of reporting emergency animal disease within 24 hours. The compensation payment is conditional on compliance with Acts or regulations related to the containment and eradication of an emergency animal disease, including the obligation to report certain diseases. EADRA covers only the direct costs that arise from the implementation of emergency response plans, and not the consequential losses, such as labour costs, during the non-production period.

Technical guidelines for the EADRP and EPPRD are documented in AUSVETPLAN and PLANTPLAN, respectively. The valuation of livestock is made based on the market value on 1) the date the owner reports the disease or suspicion of disease, 2) the date of detection of disease by inspector, and 3) the date of imposition of a quarantine order relating to the disease, whichever is the earlier. Since the valuation on these dates may already be affected by the adverse effect the disease outbreak has on the market price, a second “top-up” valuation is made on the date when the property where the livestock were located was allowed to be restocked. The payment may be provided on the difference between the first and second valuation.

However, it is difficult for the government to determine an appropriate level of compensation because it usually has limited information on the true opportunity cost for the farmer to report the suspicious case of disease and accept the quarantine measure, and the farmer would not reveal the true cost. The system of the compensation scheme must be designed therefore to reveal the hidden costs to the farmers. The cost sharing mechanism between the government and industry can contribute to mitigate the asymmetric information problem between the government and the farmers.



Incentive to take risk reducing strategy and cost sharing mechanism

While the compensation payment of the loss associated with quarantine measures incentivizes the animal/plant owner to report diseases, high level of compensation may reduce the incentive to take necessary *ex ante* risk reducing measures, eroding the efficiency of the whole bio-security risk management system. In Australia, the cost of compensation through bio-security partnership arrangements is partially contributed to by the participating industries for most diseases. The arrangement also requires farmers in participating industries to prepare an individual bio-security plan. The fact that the farmer must partially finance the cost of compensation generates an incentive for the farmer to reduce the risk of disease/pest outbreak. The cost sharing arrangement through negotiations between the stakeholders may be an effective way to maintain appropriate incentives; farmers report the suspicious case of disease/pest, while taking an adequate risk reducing measure.

The external cost of a disease/pest outbreak depends on the characteristics of the disease/pest. If the disease is not contagious and the adverse effect of its outbreak remains on a specific farm, there is little reason for the government to finance the cost of on-farm quarantine measures. On the other hand, if the disease/pest is highly contagious and affects other livestock species or even human health, then there is greater rationale for the government to fund the quarantine measure and the cost of compensation because of the high external costs of such an outbreak.

In Australia, the share of the compensation cost paid by each party depends on the type of diseases is an attempt to reflect the direct and indirect benefit for each party. For example, EADRA stipulates four categories of animal diseases and the share of the cost

contributed by the government and applicable industries. The diseases that seriously affect human health and/or the environment but which may only have minimal direct consequences to the livestock industry are defined as Category 1 diseases (e.g. rabies, Australian lyssaviruses). The biosecurity measures for diseases in this category are fully funded by governments. Category 2 diseases may have slightly lower national socio-economic consequences, but have significant public health and/or environmental consequences (e.g. BSE, brucellosis and foot-and-mouth disease). The government funds 80% of the cost of measures for Category 2 diseases, while the rest is funded by industries. Government and industry share the cost equally of Category 3 diseases, which have significant but generally moderate national socio-economic consequences, and minimal or no-effect on human health or the environment (e.g. African swine fever, avian influenza, bluetongue). Diseases that are not expected to significantly affect the national economy and for which its main effect is limited to the livestock industry are categorized as Category 4 diseases for which industry pays 80% of the cost (e.g. equine influenza, swine influenza and sheep scab). The initial costs for emergency responses is covered by governments, but the cost is calculated on each occasion and is partly covered by a contribution from the industry.

In addition to the proportion of cost shared between the governments and industry depending on the category of the disease, EADRA clarifies the specific formula on how the cost is shared within state governments and industries. The national and state/territory governments equally share the cost of an emergency disease response. However, the cost that each state shares depends on the disease under consideration. If the disease in Category 1 has significant human health consequences, then the cost is split according to the population in each state. In other cases, the cost share is based on the number of animals in each state. However, multi-species diseases require more complex calculations. Within the industry, the cost is shared according to the benefit that each industry receives from the emergency disease response. If the disease affects only one species, then this industry bears all the industry part of cost. If the disease affects more than one species, the share of cost contributed by each industry is determined by both the gross value of production and the importance of the specific disease for that industry. For example, the cost shares of emergency response to foot and mouth disease are 50% for cattle industry, 30% for sheep/goat industry and 20% for pig industry.

Import quarantine measures in the bio-security risk management system

The import quarantine measure is an integral part of the bio-security risk management system. The level of protection at the border affects the risk of introducing an exotic disease/pest into the country. Thus, the higher the import quarantine measure imposed at the border, the lower the cost of domestic quarantine measures required (e.g. *ex post* disease eradication). However, it is usually the case that the higher the import quarantine measure, the marginal effect of reducing risk per dollar decreases (diminishing marginal return). Moreover, the border measures may erode consumer welfare in the importing country as well as the producer welfare in the exporting country. Farmers usually have a strong incentive to demand high levels of import quarantine measure because it protects them from competition with trade partners and reduces the risk of disease outbreak on their farm. The level of import quarantine measure at the border should, in principle, be determined as part of a comprehensive bio-security management system, considering the overall efficiency and effectiveness of the system. It is not efficient to take decisions on import quarantine measures solely based on an import risk assessment, without

consideration of its interaction with other parts of the bio-security risk management system.

Setting an import quarantine measure that is consistent with a comprehensive bio-security risk management system requires the agreement on the Appropriate Level of Protection that governs the principles of the quarantine measures across commodities. Under the SPS agreement, each WTO member is entitled to set its Appropriate Level of Protection, taking into account the full range of national interest considerations. It requires the country to act consistently across different commodities and to adopt risk mitigation measures that are least trade restrictive. However, the Appropriate Level of Protection set by the countries are usually abstract and not operational. For example, Australia defines its own Appropriate Level of Protection as “providing a high level of sanitary and phytosanitary protection, aimed at reducing risk to a very low level, but not zero”. The independent review of Australia’s quarantine and biosecurity arrangements submitted in 2008 (*One Biosecurity: a working partnership*) recommends that the Minister determines what level of biosecurity risk is acceptably low and establish guidelines for biosecurity import risk analysis, recognizing the need to develop a seamless biosecurity system that fully involves all the appropriate players at the pre-border and post-border levels. In addition to multilateral harmonization of sanitary and phytosanitary protection throughout the WTO, Australia is pursuing bilateral and regional harmonization of food standards. The Australia-New Zealand Food Standard Code, which set common standards of food for the two countries (e.g. food labelling and maximum residue limit of chemicals) was agreed to in 1995. However, the import quarantine conditions in terms of animal or plant health are not common between these two countries.

Designing a comprehensive biosecurity risk management system needs to balance the complex cost and benefit of all stakeholders and provide appropriate incentives to avoid moral hazard behaviour (e.g. false reporting of disease outbreak and no on-farm risk reducing measures). This is outside the scope of the current work by OECD on risk management in agriculture, which does not investigate the external costs of risk beyond the farm. Additional work is required to identify the potential issues in biosecurity risk management and extract policy lessons.

PART III.

POLICY IMPLICATIONS

5. Policy recommendations and concluding remarks

The major challenge for risk policies in Australia is to refocus from mitigating financial impacts of short-term adverse climatic events to facilitating farmers' adaptation to changing climate. The climate projections predict that severe drought will become more frequent, which makes it more important to establish an efficient risk governance system able to discriminate between farmers and activities that are or are not sustainable under these new conditions. The current framework of drought risk management, in particular, the policies triggered by the government declaration of the Exceptional Circumstance (EC), is unlikely to be sustainable in the long run because it is triggered with increasing frequency. Under current provisions, the EC declaration threshold of one in 20-25 years event based on historical records is not being well respected. The interest rate concessions that are triggered by EC may impede farmers to adjust to the changing climate conditions and create incentives to depend on debt excessively. Government policies need to enhance farmer's capacity to manage pro-actively risks derived from all sources, including the changing climate conditions. The recommendations in this section suggest ways to address this policy challenge.

Policy recommendations for Australia

1. *Improve governance of the drought policy* to facilitate rather than hinder farmer's adaptation to the changing climate. The current EC policy framework sends wrong signals to farmers about their responsibility to manage risks and may impede necessary adjustments in the sector. A new policy framework should focus more on empowering farmers to adopt a variety of risk management strategies to facilitate adaptation to a changing climate, while providing a safety net for those who are unable to cope with the consequences of catastrophic events.
 - a. *Terminate government programs triggered by an Exceptional Circumstance declaration.* The National Drought Policy framework is triggered by the government declaration of Exceptional Circumstance which is based on the criteria of climatic conditions of one in 20-25 years. However, in some of the drought prone areas, EC has been declared continuously for more than eight years. The scientific assessment made by BOM and CSIRO predicts that more EC declarations are likely and over larger areas. In this situation, the triggering mechanism of EC policy is not a sustainable framework and, therefore, should be terminated.
 - b. *Promote a cost sharing arrangement in the drought policy framework between the national and state governments.* The triggering of EC policies are in most cases initiated by the local governments, but the cost of these policies is almost entirely

- financed by the national government. The latter has limited possibility to obtain sufficient information on local impacts of a catastrophic event. Due to this problem of asymmetric information, the EC declaration process creates incentives for stakeholders to exploit the system. The financial arrangement enhances incentives for state/territory governments to push for frequent EC declarations. The significance of this incentive is confirmed by the record of recent EC declarations. The experience of the Emergency Animal Disease Response in Australia shows that a cost-sharing mechanism between stakeholders can become a device to mitigate the moral hazard.
- c. *Abolish the interest rate subsidy.* The results obtained in this study show that ECIRS has a relatively strong crowding-out effect on other farm risk management strategies, such as maintaining an appropriate level of equity and off-farm income diversification. Despite the policy objective to assist the quick recovery of viable farms, non-viable farmers are more likely to depend on ECIRS. Interest subsidies on existing debt are not targeted to catastrophic drought risk needs, they create incentives to borrow and invest when drought is becoming more frequent, and they potentially impede farmers to adjust their production and risk management strategies to changing climate.
 - d. *Reorganize EC Relief Payments to a more targeted safety net payment.* Drought is not the only source of low income risk. There are other sources of risk that may be beyond farmer's capacity to cope. The microeconomic analysis shows that the more targeted the payment to income risk functions, the more effective it is as a safety net. The existing ECRP and Transitional Income Support programs should merge into a single income safety net program for farmers, maintaining its basic framework as a part of general social security system.
2. *Explore the possibility to develop insurance markets for drought risk.* Private insurance markets in Australia do not currently offer a multi-peril yield insurance or a index based insurance that cover drought risk. The assessment of farm risk indicates that yield risk is systemic in Australia, which makes insurance a more attractive instrument of farm risk management. The farm-level policy simulations show that crop yield insurance tends to be more effective in reducing income risk when the yield risk is more systemic. Moreover, systemic yield risk also reduces information asymmetries and potentially reduces administrative cost associated with loss adjustment in determining insurance indemnity because weather related indexes can be used for insurance or re-insurance. However, the experiences in other countries show that government commitment is likely to be necessary to start up crop insurance. Making insurance products available for farmers to protect them from catastrophic yield risk may allow governments to manage political pressure to cover catastrophic damage through ad-hoc payments or those triggered by *ex post* EC declarations in Australia. Developing insurance products for drought risk is a potential policy option to be considered as a part of a new drought policy package.
 - a. *Consider a feasibility study of developing commercially viable insurance products to cover drought risk.* Microeconomic simulation shows that potential demand for multi-peril crop yield insurance is high in Australia due to high yield variability and the systemic nature of yield risk. The feasibility study may include consultations with insurers and other stakeholders on the potential and appropriateness of creation of an information-sharing system on risks. The feasibility study should also identify other potential obstacles that exist in commercial crop insurance market such as state tax on insurance premium.

- b. *Consider the feasibility of index-based insurance.* The systemic nature of yield shocks in Australia, typically associated with a drought, makes it more feasible to introduce insurance that is indexed to rainfall because high correlation between rainfall in weather stations and farms (low basis risk). Development of index-based insurance is expected to cost much less than traditional crop yield insurance, which requires individual loss assessment. This instrument can be available for grazing industries. However index insurance requires information from an appropriate number of trustable weather stations. A feasibility study should explore the costs and benefits of developing such insurance products.
3. *Assist farmer's adaptation to climate change.* In some drought prone areas, farming may no longer be viable in the long term perspective. Climate change requires structural adjustments in the agricultural sector. New policy framework should allow the needed structural adjustment in the sector.
 - a. *Give increasing priority to gathering and analysing of data on risks related with climate change* in Australia, and to R&D projects in this area. Foster innovation and the diffusion of knowledge among farmers with the view of applying innovations at the farm level and facilitate adaptation to climate change.
 - b. The government may provide *information and training support to empower farmers to take active strategies for adapting to changing climate condition.* The pilot of the drought reform measure in Western Australia, focusing more on assisting farmers to prepare for the impacts of drought, reduced water availability and a changing climate, is a positive step toward this policy direction. If the evaluation of the results of this pilot policy is positive, the framework should be extended to other regions.
 - c. *Targeting an exit support program to non-viable farms is a major challenge* due to the lack of information to discriminate between viable and non-viable farmers. There is no evidence that current provisions to gather information and develop an individual business plan are effective. In the absence of this information, policies should avoid long run incentives to remain in the sector (such as EC Interest Rate Subsidy). The policy frame should be designed to help farmers to make their knowledgeable decision whether their farming business is viable or not in the future. The challenge is to create appropriate set of incentives that does not send a mixed signal to the farmer.

Policy lessons beyond Australia

4. *Establishing a good governance mechanism is a key factor of successful catastrophic risk management.* Making a credible contract agreement between the stakeholders can create incentives to reveal accurate information and mitigate the problems associated with information asymmetries. In particular, sharing program costs between stake holders can help to find an equilibrium of responsibilities and to ensure that no stakeholder exploit the system. Australia's cost-sharing approach in the emergency response plans to animal/plant disease is an example of such type of catastrophic risk governance.
5. *Catastrophic risk measures should be targeted to farmers in need.* Policies triggered by government declaration of catastrophic event in specific area is most likely untargeted because there is likely to be many farmers in that area that are not in need and farmers in other areas that are in need. The experience of Australia's NDP indicates that setting

stipulated criteria of catastrophic event becomes even more difficult when there is a structural change in climate pattern. Moreover, targeting income support associated with a single source of risk is most likely ineffective because farmer suffers from more varieties of risks. If the policy intends to provide an income safety net for the farmers, a payment more targeted to income risk is more effective.

6. Australia's approach to *link farm income support to the general social welfare system* with specific provisions for farmers has the advantage of ensuring equity between farm and non-farm sectors and assisting the needed structural change. In most countries, farmers are in general not eligible for social welfare payments due to the high value of their production assets. Australia's experience in applying different eligibility criteria for the asset test to farmers is a good example of this approach to include farmers in general social safety nets.
7. *Farm Management Deposit, which allows farmers to set aside the revenue from taxable income, provides incentive to save* and helps farmers manage normal fluctuation of income. This tax incentive mechanism is a good example of an instrument to manage normal risks, which does not crowd out other risk management strategies.

Annex A.

The OECD TEAM visit for the review of Australia

OECD Team	<p>OECD Staff Jesús ANTÓN Shingo KIMURA</p> <p>External experts Bill Malcolm (University of Melbourne, Australia), author of background report Federica Angelucci (FAO, Italy), author of visit report</p>
Main contact person in Canberra	David Cooper (DAFF), responsible for the questionnaire
Dates of visit	Canberra, Melbourne and Sydney, 7-11 December 2009
List of institutions and persons visited	<ul style="list-style-type: none"> • ABARE, Canberra • Biosecurity Security Group (Quarantine Operations, Import Risk Assessment, Emergency Response), DAFF, Canberra • Australia's Farming Future Program, DAFF, Canberra • EC (Assessments and Review, Program Implementation, DAFF, Canberra • Bureau of Rural Sciences, DAFF, Canberra • Land and Water Australia (Managing Climate Variability Program), Canberra • Australian Taxation Office, Canberra • Productivity Commission, Melbourne • Industry and Investment New South Wales (NSW State Government) - Climate Risk Management Program, Canberra • Victorian Department of Primary Industry, Melbourne • Australian Commonwealth Scientific and Research Organization (CSIRO), Canberra • Rural Industries Research and Development Corporation, Canberra • University of Melbourne Centre for Excellence in Risk Analysis, Melbourne • Australian Wool Exchange, Melbourne • Agricola Insurance, Canberra • National Farmers Federation, Canberra • Victorian Farmers Federation, Melbourne • Meat and Livestock Australia, Sydney • Market Check (Independent Commodity Specialist), Sydney

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