Perception of Innovative Crop Insurance in Australia

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Abstract

Worldwide, extreme climate risks cause stakeholders in food supply chains to search for new risk management tools. In Australia, recently so-called crop yield simulation insurance has been introduced based on an integrated agrometeorological simulation model. Current uptake is relatively low, possibly because Australian farmers perceive commodity price risk as more important than climate risk. Also, they perceive risk management tools such as water management and diversification as more important than buying crop insurance. Still, opportunities seem to exist for new insurance products, such as crop yield simulation insurance, as indicated by farmers' interest into such products. Outcomes are useful in worldwide discussions on risk management opportunities in dryland agriculture.

Key words: *Crop yield simulation; Yield insurance; Wheat farmers; Personal interviews*

1 Introduction

Wheat is Australia's most important crop; in 2005-2006, farmers harvested 25.7 million tons which is 4.14 % of the world production (Australian Bureau of Statistics, 2008; International Grains Council, 2009). Crop yields and the amount of rainfall within a given region are highly correlated (Malcolm et al., 1996). In fact, Australia is the second driest continent after Antarctica with average (mean) annual rainfall below 600 millimeters per year over 80 percent of the continent, and below 300 millimeters over 50 percent (Australian Bureau of Statistics, 2008). Droughts are inevitable, frequent and often severe events of the Australian agriculture. For example, the droughts in 1982-1983 and 1993-1994 were each responsible for a drop of about 20 percent in the net value of agricultural production, amounting to a fall of about $4 billion (in 1994 Australian dollars) in annual national income (Malcolm et al., 1996).

Insurance can assist in managing these losses, and crop insurance is especially designed to cover the losses arising from perils beyond the control of growers (Roberts, 2005). Varangis et al. (2002) argue that there is a need for yield insurance. Unfortunately, traditional crop insurances seem no longer sufficient. Both correlation of crop risks and asymmetric information problems are likely to make risk pooling, which is essential for any successful insurance program, ineffective. As a result, the latest innovative crop insurances attempt to overcome the traditional problems of agricultural insurance, such as moral hazard, adverse selection, high transaction costs, and most importantly, the problem of systemic climatic risks (Kang, 2007). New types of insurance have been developed during the last 2 decades. More specifically, much attention has been paid to the design and introduction of derivative

insurance products based on among others area yields and rainfall indices (Miranda and Glauber, 1997). Although successful in a number of regions around the world, derivatives also seem to face some problems, from which basis risk and availability of adequate data seem to be the major ones.

In Australia, relatively little traditional and derivative insurance is going on, partly because of the extreme weather conditions and because of governments not subsidizing insurance products, in contrast to e.g. US governments. Recently, however, an innovative insurance scheme based on simulated crop yields was introduced, fully run by private companies. This "crop yield simulation insurance" uses simulated crop yields to calculate claims. More specifically, simulated yield values must show a reduction from the forecast value produced at the start of the season to the value produced at the end of the season. Actual indemnities to the farmer depend on (i) evidence of actual loss of yield on property insured, confirmed by an agronomist; and (ii) the residual value of the crop after correcting for the insured field perils. Although the policy design looks quit promising, farmers' participation is still relatively low.

If farmers do not trade away part of their risks, they cannot move closer to the point of expected profit maximization. The result is less desirable allocation of resources (Myers, 1988) and a likely decrease of the overall efficiency in resource use (Hardaker et al., 1997; Rejda, 1998). Also, farms' and, ultimately, farm villages' resilience is likely to decrease (Meuwissen et al., 2001). In this framework this study focuses on the opportunities of innovative crop insurance in Australia. More specifically, the objectives of the study are to elicit Australian farmers' perceptions on (i) current risk management tools available, and (ii) crop simulation insurance products. Data are gathered through personal interviews with farmers in key wheat-growing areas of Australia.

2 Crop yield simulation insurance compared with conventional and index insurance

The key principles of conventional insurance are that as a farmer you pay a premium and you receive an indemnity after an insured loss occurs (after loss adjustment and correction for deductibles, if any). If provided, conventional insurance seems to be a relatively popular risk management instrument. It however faces several difficulties, such as with *asymmetric information*. If a pool consists of large numbers of independent risks, the party who pools the risk may be able to estimate average losses and so the amount of money (e.g. an insurance premium) needed for dealing with these losses. Asymmetric information between the risk-sharing parties (such as between insurer and insured), however, can lead to established premiums being insufficient to cover the losses (Harrington and Niehaus, 1999). Asymmetric information includes moral hazard and adverse selection. In insurance, adverse selection means that exposure units most at risk buy more insurance than others but the extent to which this happens is not known a priori to the insurer. With moral hazard, insured entities change their behavior after having bought insurance in a manner not predicted by the insurer (e.g. by becoming more careless) (Arrow, 1996). Another difficulty relates to *systemic risks*. Pooling independent risks reduces the variance of losses. But if systemic (i.e. positively

correlated) risks are pooled, the variance of losses decreases less. In pooling completely systemic risks, variance does not decrease at all (Harrington and Niehaus, 1999). Risks that are completely systemic, such as prices and interest rates, generally cannot be commercially insured but can be efficiently dealt with on exchange markets, e.g. by use of futures. Risks that are not completely independent nor completely systemic, the so-called 'in-between risks', (Skees and Barnett, 1999) are more problematical. Examples include droughts affecting crop yields over a substantial area and widespread epidemics of livestock diseases. Organizations that pool such risks face higher costs of pooling because of the need to hold substantial reserves in case systemic events occur (Doherty, 1997).

In contrast to conventional insurance, index-based products are financial instruments that make payments based on realizations of an underlying index relative to a pre-specified threshold (Barnett et al., 2008). The underlying index is a transparent and objectively measured random variable. Examples include area average crop yields, area average crop revenues, cumulative rainfall, cumulative temperature, flood levels, sustained wind speeds, and Richter-scale measures. Some highly standardized index-based products are actively traded in secondary markets. However they are mostly customized to fit the specific risk management needs of the purchaser. Index-insurance schemes have a number of advantages, but also disadvantages, relative to conventional insurance. These are summarised in Table 1.

Crop simulation insurance, such as the one provided in Australia, is a product that is somewhat in between conventional insurance and index-based insurance. For instance, payments are triggered "off-farm", i.e. by a simulation model, comparable to index schemes. Loss adjustment on the other hand is done on farm, as with conventional insurance. Pros and cons are listed in Table 1 as well.

Table 1. Pros and cons of various types of insurance.

	Conventional yield insurance	**Index insurance**[1]	**Crop yield simulation insurance**
Pros	- Applicable to a wider range of situations than index insurance, as it can cover all risks where losses are involved. - Actuarial procedures for indemnity-based schemes are well established and thus schemes should be easy to run. - As claims are paid by assessing losses directly, there is no issue of basis risk.	- No problem of moral hazard as the behaviour of the client does not influence the pay-out. - No problem of adverse selection as pay-out is independent of losses. - No need to assess claims so lower transaction/overhead costs. - Pay-outs can be rapid because claims are verified easily through the index rather than assessment of losses. - Policies can be sold as standard packages.	- Lower transaction costs and less problems of asymmetric information compared to conventional insurance because of use of simulation model - Less basis risk in triggering payments compared to index insurance because of ability to capture local heterogeneity
Cons	- Moral hazard is an issue unless there are deductions built into the premium for risk reduction. - Adverse selection can occur with voluntary schemes, in particular if there is asymmetric information and the client knows more about their risk than the insurer. - Transaction costs and overheads are high because of the need to assess losses. - The loss assessment process can be time-consuming, leading to slower pay-out of indemnities. - Difficulties to deal with systemic risks	- Basis risk, where correlation between payouts and losses breaks down and payment occurs without losses, or *vice versa.* - Historical data needed to create the index, but this may not be an accurate predictor of future conditions. - Needs a relatively homogenous area to ensure that losses correlate to the index. - Relatively difficult to understand, therefore low uptake[2]	- Need for continuously updating integrated agro-meteorological simulation models - Slower pay-outs than with index-insurance because of required farm visit - Relatively new product, therefore not much experience

Table 1 illustrates that all three types of insurance have some potential problems. As a result, various authors propose combinations of products. For instance, to "combine the best of conventional and index insurance", Skees et al. (2006) suggested to develop "*blended products*" in which (i) the systemic risk is covered by index-products deployed by governments, reinsurers or banks; and (ii) the idiosyncratic part of risk is covered by conventional insurance products sold by local companies. The index-based livestock

insurance in Mongolia, covering herders when livestock losses at the regional scale exceed a certain trigger point, is an example of such a blended product (Skees et al., 2008). As crop simulation insurance is a relatively new product, no such experience does yet exist.

3 Materials and methods

In the period November 2009 up to February 2010 a structured survey is undertaken in the form of personal interviews[1]. The issues addressed in the survey are the following: structural characteristics of the farms, currently used on-farm and risk sharing management tools, general knowledge and potential up-take of agronomy based insurance products, and a number of personal questions. Farmers' perception of risk, risk management strategies and crop simulation insurance products is measured on Likert-scales ranging from 1 to 5. Criteria farmers apply when buying insurance were ranked from 1 (most important) to 12 (least important). Farmers are selected from the New South Wales and Queensland wheat-growing areas. Interviews took place during harvest and holiday periods. They took about 30 minutes, including an insurance broker's explanation about the crop yield simulation product.

4 Preliminary results

From the various sources of risk, Australian farmers perceive commodity price risks as the major source of risk (Table 2). This reflects the Australian non-protected market circumstances. Natural hazards such as droughts, pests and flooding are perceived as secondly most important source of risk. "Man-made hazards" such as vandalism and pollution are perceived as relatively not important.

1. As interviews are currently still going on, results in this paper reflect only part of the data (n=15). The total number of interviews is expected to be around 40.

Table 2. Perceived importance of risk factors, measured on a scale from 1 (very little) to 5 (very much), preliminary results (n=15).

	Mean	SD	Rank
Commodity prices	4.67	0.62	1
Drought	4.20	0.86	2
Pests	3.07	1.03	3
Flooding	2.73	1.54	4
Hail	2.60	0.98	5
Soil compaction	2.47	1.25	6
Nutrient deficiency	2.33	1.23	7
Frost	2.13	1.12	8
Poor education & training of workers	2.07	1.38	9
Fungi	1.80	1.20	10
Bacteria	1.73	0.96	11
Viruses	1.67	1.11	12
Over-application of herbicides	1.60	1.18	13
Fire	1.33	0.82	14
Vandalism	1.27	0.88	15
Pollution (air, soil)	1.20	0.86	16
Other	1.00	1.77	17
Dryland salinity	0.80	0.56	18

A number of risk management strategies are used to deal with the types of risks as described in Table 2. Before going into these details, farmers were first asked to review various criteria perceived to be relevant when buying crop insurance. These are types of perils covered, trust in the company and adequate advice, perceived "value for money", and ease of understanding the product (Table 3). All in all, however, crop insurance is not very popular as it ranks 7th out of 14 risk management strategies (Table 4). The risk management strategy perceived to be the most important is water management. On-farm and off-farm diversification, and applying latest technologies also score relatively high. From the various types of insurance schemes, i.e. property, personal and crop insurance, interestingly, property insurance scores highest, i.e. even higher than personal insurance.

Table 3. Important factors when deciding to buy crop insurance, ranked from 1 (highest importance) to 12 (lowest importance), preliminary results (n=15).

	Rank (mean)	SD
Types of perils covered by the insurance	3.00	2.59
Trust in broker or intermediary for good advice	3.67	2.38
Perceived "value for money"	4.13	2.44
Ease of understanding coverage and simple underwriting process	5.80	3.16
Simplicity of the insurance product	5.87	3.62
Premium rate below 5% of insured value	6.13	3.27
Time needed for loss settlement	7.13	2.26
Security and trust of the insurance company	7.13	3.94
Loyalty to the insurance provider or broker	7.60	1.88
Availability of information about the insurance product	7.73	2.25
Weather predictions for the upcoming season	8.53	2.92
Compulsory because of financing arrangement	11.27	1.33

Table 4. Perceived importance of risk management strategies, measured on a scale from 1 (very little) to 5 (very much), preliminary results (n=15).

	Mean	SD	Rank
Water management	4.80	0.41	1
Growing other crops besides wheat	4.73	0.59	2
Off-farm investment	4.33	0.81	3
Using the latest technologies	4.33	0.72	4
Property insurance	4.27	0.59	5
Personal insurance	4.20	1.15	6
Crop insurance	3.93	0.88	7
Forward contracts	3.93	0.88	8
Holding financial reserves	3.73	0.79	9
Working together with other farmers	3.60	1.18	10
Producing at lowest possible cost	3.33	1.44	11
Other sources of income	2.73	1.28	12
Trading on futures markets	1.87	1.25	13
Other	1.60	2.35	14

Focussing on the crop yield simulation insurance reveals that, despite explanations given before the interview, farmers seem to perceive the product as relatively complex as indicated by the high percentages of scores in the ranges of “1” to “3” for the questions on product understanding [Table 5]. Still, the concept of the product seems to be perceived as relatively appealing as indicated by the high interest to follow monthly yield simulations via internet (>75%), as well as the interest for further product information (>75%).

Table 5. Perception of crop yield simulation insurance, measured on a scale from 1 (completely disagree) to 5 (completely agree), preliminary results (n=15).

	Detailed scores (%)					Overall	
	1	2	3	4	5	Mean	SD
I understand the total concept of crop insurance based on simulated yields	0	13	40	40	6	3.40	0.83
I trust the validity of simulated yields	0	26	53	20	0	2.93	0.70
I understand how the premium level is calculated	13	20	33	33	0	2.87	1.06
I understand how the loss adjustment is carried out	0	13	46	40	0	3.27	0.70
A product reducing income volatility is worth 5% of the insured value	6	13	46	33	0	3.07	0.88
I trust the competence of the company providing this product	0	6	40	40	13	3.60	0.83
I would like to follow the monthly yield simulations via internet	0	0	20	46	33	4.13	0.74
I was given negative information about this product	0	93	6	0	0	1.13	0.52
I would like to know more about this product	0	0	20	53	26	4.07	0.70

5 Conclusions and outlook

This paper studies farmers' perceptions of a new type of insurance covering weather risks in Australia. The insurance uses a crop simulation model to trigger payments and, partially, to assess losses. The concept is likely to face less problems of asymmetric information than conventional yield insurance. Also, crop yield simulation model has less problems of basis risk than index insurance. However, despite these advantages, the concept faces difficulties as the product is perceived as relatively complex and farmers do not always trust the validity of the simulated yields.

Future opportunities for crop yield simulation insurance may exist in combining the yield coverage with commodity price risk. The latter was perceived as even more important than climate risk. Also, opportunities may be found in developing so-called "blended products" in which governments use crop simulation outcomes for (re)insuring the catastrophic part of risks, while local insurers design conventional products for the idiosyncratic part of risks. Outcomes are useful in current discussions on designing new risk management instruments for dryland agriculture as a response to increasingly extreme weather circumstances.

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[1]Derived from among others Skees et al., 1999; Miranda and Vedenov, 2001; Skees et al., 2006; and Agelucci, 2008.

[2]Especially in developing countries. Discontinued pilot programs can be found in Ethiopia, Morocco and Malawi. Complexity of products was not the only reason for discontinuation.