

# Willingness to pay for agricultural crop insurance

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## Abstract

*Approach to agriculture risk management has extended in the EU and the possibilities of public support for yield risk management have increased. Crop insurance products are supported in EU's Common Agricultural policy (CAP). The problem in policymaking is finding the balance between crop insurance supply and demand, because adequate data on farm-specific yield density functions are rarely available. We used a choice experiment (CE) to evaluate the willingness of farmers to buy crop insurance products. Demand for crop insurances was revealed, but we found that farmers anchor their willingness to pay for crop insurances to the price levels introduced.*

**Keywords:** Crop insurance; Choice experiment; split sample

## Introduction

In the EU member states, the main practices in preparing for crop damage include various types of joint funds for farmers and state compensation for crop damage paid on an *ad hoc* basis. These types of *ad hoc* compensation payments for crop damage amount to an average of about €920 million per year (Bielza Diaz-Caneja et al., 2009). Despite the missing crop insurance culture the markets for crop insurance are developing in the EU. One of the incentives is that the EU is paying increasing attention to agriculture risk management (Meuwissen et al., 2013). For example premium subsidies could be as large as 65% of premiums faced by the farmer (EU, 2013). Insurance companies in the EU are now interested in the market potential and plausible premium levels for crop insurance. Government officials are struggling with the estimations of the subsidies needed and taxes collected under insurance schemes composed by insurance companies. We conducted a choice experiment on crop insurances in Finland, and this study aims to contribute to the crop insurance markets by investigating: (1) the general willingness of farmers to purchase hypothetical and currently non-existent crop insurance; (2) effect of insurance attributes like cover and scale in willingness to pay; (3) stability of underlying preferences.

## Data and methods

The choice experiment survey was conducted in 2012. The survey was sent to total of 5,000 farmers in Finland, and it included questions about the farmers' risk preferences and attitudes towards private and public crop insurance products.

In constructing the choice experiment designs we considered how the selection of the insurance premium range affects the willingness to pay (WTP) when respondents are evaluating a hypothetical product. The existing literature indicates that there are multiple ways to carry out the price differentiation among hypothetical products. Ladenburg and Olsen (2008) used an "Instruction Choice Set" (ICS) with a split sample approach to test whether varying the example choice set shown before the actual choice set cause a starting point bias when the attribute level range did not vary across respondents. Mørkbak et al. (2010) used the split sample approach in the context of meat products. Their approach was based on changes in only the maximum level of the cost attribute between the sample splits. We applied the approach of Kragt (2012), who used completely different cost vectors with split data when studying how preferences for catchment management vary. In the questionnaire, respondents were shown six crop insurance product cards. On every choice card there were two different crop insurance products with varying attributes. Farmers were asked to choose the most

suitable crop insurance product for them. Respondents could also choose an out option, i.e. not purchase crop insurance at all (Table 1).

**Table 1. Choice card and attribute ranges.**

<b>INSURANCE CARD 1</b>	<b>Insurance 1</b>	<b>Insurance 2</b>	<b>No buy</b>	<b>Range</b>
Insurance premium €/hectare	12	16	<b>I would not purchase insurance</b>	low: 4, 8 and 12 €/ha high: 16, 24 and 32 €/ha whole: 4 – 32 €/ha
Deductible	20%	20%		10, 20 and 30 %
Insurance type	Yield index insurance, farm inspection is not needed.	Farm yield insurance, inspection of loss at the farm is needed.		yield index farm yield
Expected compensation €/hectare	300	600		100 €/ha 300 €/ha 600 €/ha
MY CHOICE	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>

To enable testing of the impact of differentiated price regimes, three choice experiment designs (low, high and whole) were created using efficient design. Efficiency was defined for multinomial logit model. All designs contained 42 choice cards which were grouped into 7 blocks.

A total of 1,170 survey forms were returned. After missing responses were removed from the dataset to enable panel data format, there were 5,790 completed insurance choices from 965 farmers. The data was analyzed with Mixed logit models (ML). ML model allows random taste variation, an unrestricted substitution pattern and correlation in unobserved factors over time. This allows us to estimate the mean coefficients and standard deviations of the random parameters, representing unobserved heterogeneity among farmers (Train, 2003). Implicit prices and their confidence intervals for different datas were derived in this study by a method proposed by Krinsky and Robb (1986) with 5,000 replications.

## Results

When the premium of insurance was €4/ha in the LOW premium regime, 57% of the insurance products were chosen. Doubling of the premium from €4 to €8/ha appears to have no effect on the crop insurance demand at all. At the premium of €8/ha, 56% of the insurance products were chosen. Furthermore, in the high premium regime (HIGH), no major difference in the amount of insurance cards chosen was observed between insurance valued at €16 and €24/ha.

Surprisingly, smaller number of contracts were chosen at the premium of €12/ha in the LOW premium regime compared to €16/ha (50% of insurance cards chosen) and €24/ha (43%

of the insurance cards chosen) in the HIGH premium regime, given that the other attributes of the insurance products were identical. These results are similar to those obtained by Kragt (2013) and strongly imply that underlying preferences were not initially well formed and stable over the premium information fed to the farmers. To further study this anchoring effect, we calculated implicit prices for crop insurance in different price regimes.

Parameter estimates are presented in Table 2. All the coefficients of insurance attributes had the expected signs. The premium and deductible had a negative effect on the utility of the farmer, while the expected compensation, i.e. the scale of the insurance, had a positive effect on the utility of the farmer. The coefficients for the “farm insurance” type were negative and significant, indicating that the farmers preferred index insurance over farm-specific insurance. In all the models, the random parameter estimates were significant, indicating heterogeneity towards all attributes. An alternative specific constant (ASC) was specified for the no insurance choice.

**Table 2. Results of the mixed logit model for three price regimes and for pooled data (SE in parentheses).**

	Low prices (LOW)	High prices (HIGH)	Whole price range (WHOLE)	Pooled data (POOLED)
<b>Choice experiment attributes</b>				
Price	-.35954*** (.03886)	-.13633*** (.01879)	-.19021*** (.02262)	-.18766*** (.01283)
Deductible	-6.70466*** (.98711)	-2.47832*** (.87832)	-1.31144 (.85863)	-2.98530*** (.49176)
Scale	.00724*** (.00064)	.00545*** (.00055)	.00662*** (.00062)	.00629*** (.00032)
Farm insurance	-.66119*** (.17743)	-.89358*** (.21102)	-.35314* (.18912)	-.57271*** (.10285)
<b>Random parameter estimates</b>				
Price	.64264*** (.08304)	.20532*** (.04202)	.34189*** (.04672)	.32659*** (.02805)
Deductible	4.57751*** (.43604)	3.97410*** (.54132)	5.29935*** (.55251)	4.57789*** (.26503)
Scale	.00563*** (.00074)	.00446*** (.00068)	.00453*** (.00066)	.00465*** (.00040)
Farm insurance	2.36580*** (.39813)	3.00912*** (.41623)	2.60364*** (.39204)	2.47462*** (.22264)
<b>Socioeconomic variables</b>				
Age	-.01452 (.02205)	-.06341*** (.02215)	-.05497** (.02710)	-.04279*** (.01302)
Cultivated area	.02242*** (.00708)	-.00786 (.00650)	.02154*** (.00720)	.01323*** (.00386)
Education	2.51843** (1.06343)	-.48747 (.96204)	.64494 (1.18779)	1.09346* (.58830)
ASC <sup>1</sup>	6.22668*** (1.45063)	-1.34668 (1.33443)	.54709 (1.57907)	1.52704* (.78495)
Log-likelihood	-1268	-1186	-1191	-3694
N	1998	1884	1908	5790
McFadden R <sup>2</sup>	.4221363	.4268307	.4318613	.4192961
AIC	2561	2397	2406	7412

<sup>1</sup>Alternative specific constant refers to no insurance choice \*\*\*( $P < 0.001$ ), \*\*( $P < 0.01$ ), \*( $P < 0.05$ )

Implicit prices (IP) are the marginal rates of substitution between price and product attributes. These reveal how willing farmers are to trade one attribute for another given that the bundle of these attributes gives constant utility. The IP for deductible describes farmers' preferences towards 10 per cent point changes in the deductible. Large negative values imply that farmers are willing to transfer their risks to insurance companies. The greater the risks carried by farmers are, the less willing they are to pay for insurance. The 10% share of the yield variation obtained median IP of -€1.60 /ha/year. Farmers' median WTP for 100 Euro increase in expected compensation (=scale) per hectare is estimated at €3.5 /ha/year Euros.

The effect of price anchoring was found with *scale* attribute. In LOW premium range farmers consider an increase of some €2.02 /ha/year in the insurance premium and €100/ha/year in the scale (indemnity payment) as indifferent. The value ranged between farmers from 1.63 to 2.54. Farmers' preferences were on a completely different scale in the HIGH price regime. The scale IP was estimated on average to be as large as €3.99 /ha/year and to range from 2.98 to 5.49. The effect of price anchoring was not found with *deductible* attribute. Increasing deductible by 10% reduces farmers' WTP -€1.87 /ha/year in the LOW price regime and -€1.80 /ha/year in HIGH price regime. Thus, farmers do not put greater value on yield risks when they were shown yield insurances with higher prices compared to the situation with lower prices, *ceteris paribus* (other attributes as fixed).

**Table 3. Median implicit price (IP) estimates of choice experiment attributes for LOW and HIGH regimes.**

€/ha/year	Low premium (LOW)	High premium (HIGH)	Average change % in IP (Low premiums to high premiums)
Deductible (10%)	-1.87 (-2.39 to -1.40)	-1.80 (-2.94 to -.63)	3 %
Scale (100€/ha)	2.02 (.016 to .025)	3.99 (.030 to .055)	97 %
Farm insurance	-1.83 (-2.87 to -0.87)	-6.55(-11.12 to -3.30)	-257 %

Confidence intervals in parentheses based on the 2.5<sup>th</sup> and 97.5<sup>th</sup> percentiles of the simulated IP distribution.

Both deductible and scale have a major effect on the willingness of farmers to pay for crop insurance (Table 4). While the 30% deductible level is currently the only plausible option in the EU, a 30% deductible and €100/ha scale insurance were described in this study as examples. The estimated mean WTP of Finnish farmers for this type of insurance are €3.8/ha/year in the WHOLE dataset. It is notable that the willingness of farmers to pay for crop insurance is sensitive to the price information given. For example, there was a €-4.0 /ha/year WTP for the example insurance if farmers were presented with insurance premiums changing in LOW regime. However, example insurance obtained a WTP of €19.9/ha/year when farmers were presented with insurance premiums varying in HIGH regime.

**Table 4. Farmers' willingness to pay €/ha/year for crop insurance in Finland.**

	Low premiums (LOW)			High premiums (HIGH)			Whole premium range (WHOLE)		
	Expected compensation (€/ha)								
	100	300	500	100	300	500	100	300	500
<b>Deductible</b>									
<b>10 %</b>	-0.3	3.7	7.8	23.5	31.5	39.4	5.2	12.2	19.1
<b>20 %</b>	-2.2	1.9	5.9	21.7	29.7	37.6	4.5	11.5	18.4
<b>30 %</b>	-4.0	0.0	4.0	19.9	27.9	35.8	3.8	10.8	17.7

## Discussion

Our results show that farmers are willing to buy crop insurance products. Farmers' median WTP for crop insurance with scale of 100 Euros and deductible of 30% is estimated as €3.8 per hectare per year. Both deductible and scale have a major and effect on the willingness of farmers to pay for crop insurance.

The results revealed that farmers' initial preferences regarding crop insurance attributes are not established. Instead, farmers easily anchored their WTP for crop insurances according to the premium levels offered by the insurance companies. Thus, the markets that are starting to emerge will be dominated by the knowledge of premium setting. This is important because crop insurances will be heavily subsidized by the government.

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