Factors differentiating the level of crop insurance in Polish farms in relation to level of subsidies

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„…why farmers do not contract crop insurance policies as much as they should when considering the risk they face?”
[Bougherara 2016]

POLAND:

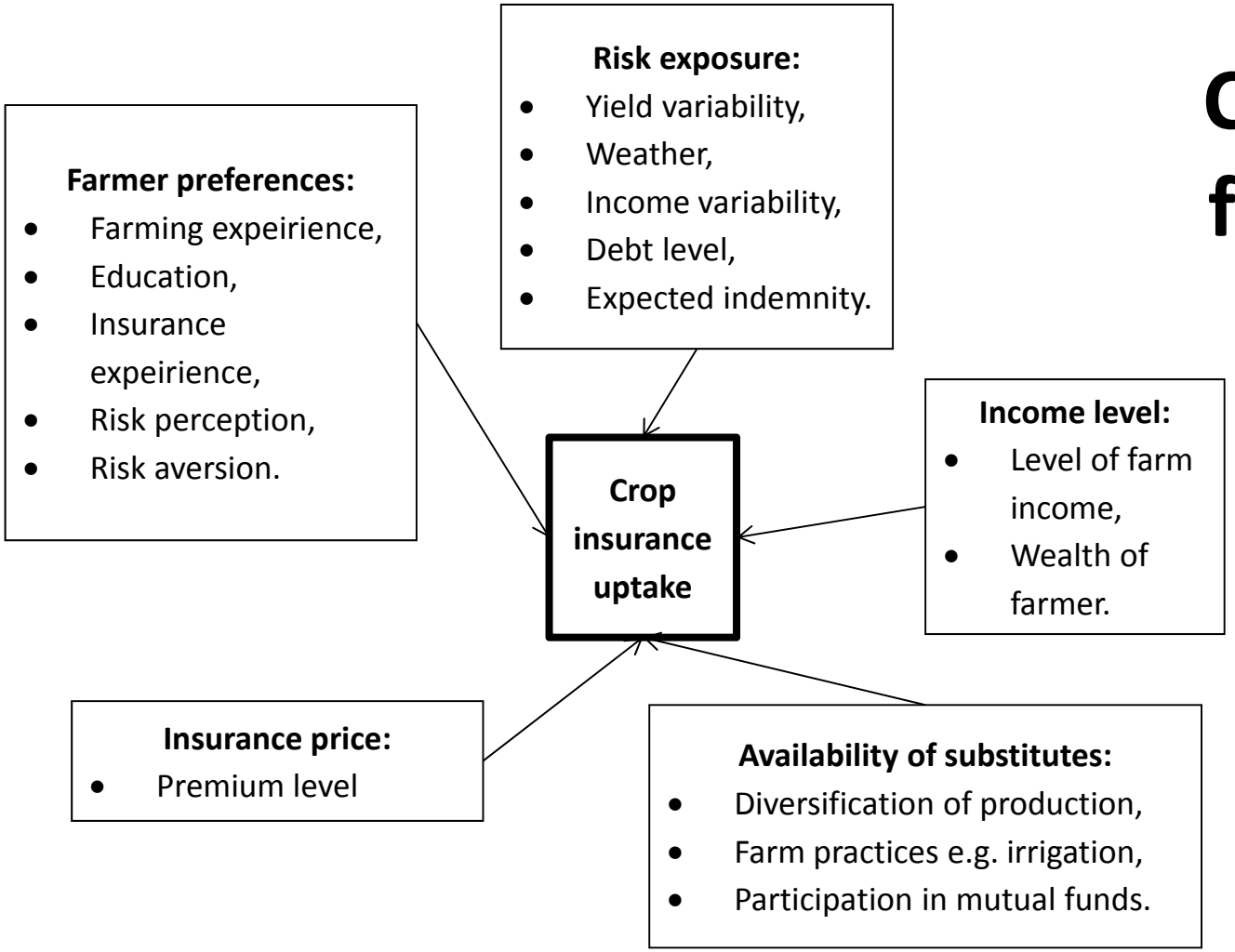
legal obligation of insuring 50% of area, but only…

- 10,3% of insured farms,
- 23,88 % of insured area.

Aim of the study

Identification of determinants influencing Polish farmers decisions on insuring crops taking into account the subsidies to production value ratio

Conceptual framework



Field of observation and data

Data: FADN individual farm records (2004-2013)

- Farm characteristics data (2013),
- Use of FADN typology:
  - Econimic size, Type of farming, FADN Region,
- Granivores and horticulture farms excluded,
- Farms < 8 th. EUR SO - excluded
- Yield and input data (2004-2013) – min. 4 observations,
- Sample size: 5,202 farms (2013),
- Population size: 193,733 farms (2013) 4,267 th ha.

Data processing in Polish FADN

Source: **Najważniejsze informacje niezbędne do interpretacji wyników Polskiego FADN (**2017-01-11)
Opracowali: R.Płonka, A. Smolik, I.Cholewa, M.Bocian, E.Juchnowska, D.Osuch.

Methodology

$$\ln\left(\frac{P(Y_i=1)}{1-P(Y_i=1)}\right)=\alpha+\beta_1 x_{1i}+\cdots+\beta_k x_{ki}$$

where:

Y_i - variable of purchasing crop insurance: 0 – not purchased, 1 – purchased,

α - intercept

$x_{1i},\ldots, x_{ki}$ - values of the independent variables for the *i-th* farm,

$\beta_1,\ldots,\beta_k$ - values of the coefficients for the respective independent variables.

The Horvitz-Thompson estimator was used to include information on number of farms represented by every farm in the sample.

*Model estimation was performed in **R environment** with Tomas Lumley „survey" package*

Polish FADN, stratified sampling

Dimensions:

1. Region: 4 levels
2. Economic size: 6 levels
3. Farming type: 13 levels

Theoretical number of strata: 4*6*13=312

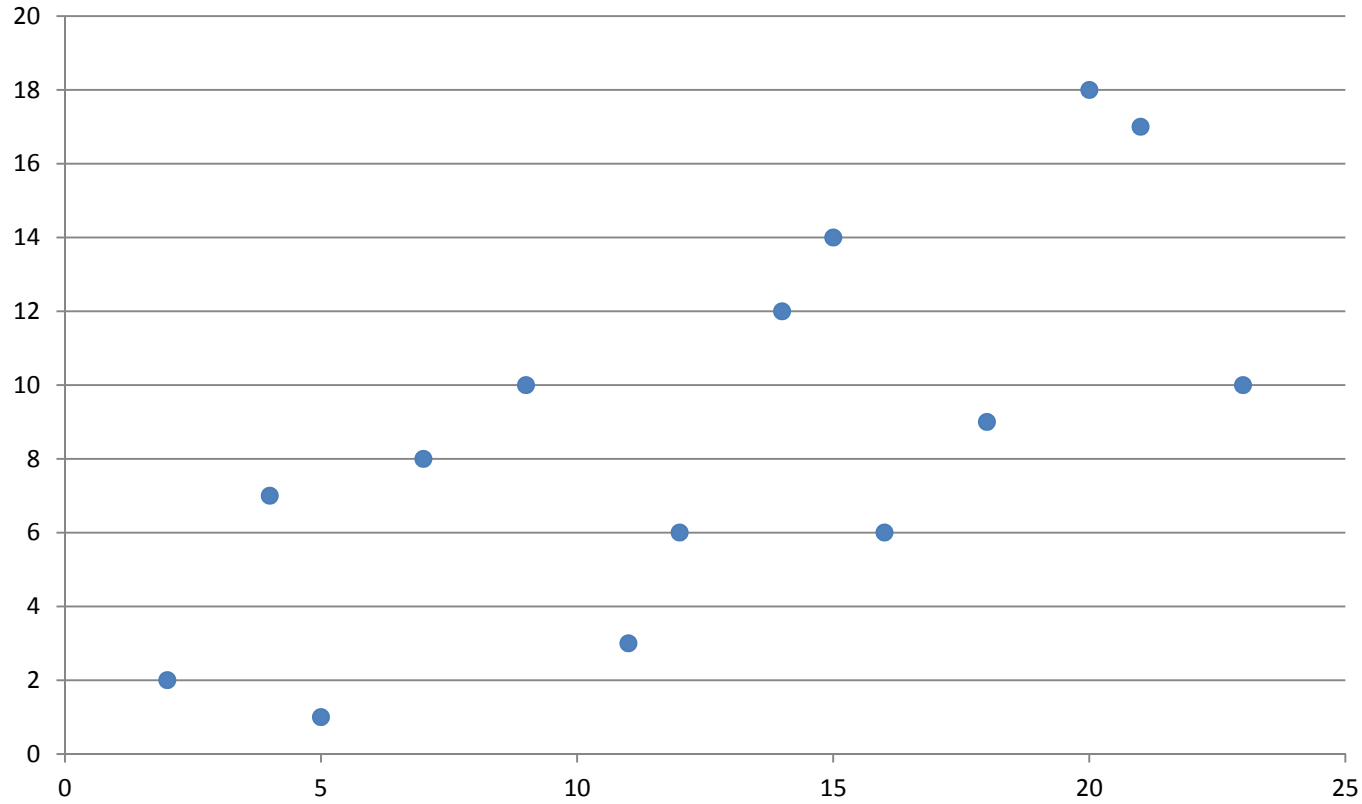
Optimum allocation (Neyman's method):

$$n_h = n \frac{N_h \sigma_h}{\sum_{k=1}^{L} N_k \sigma_k}$$

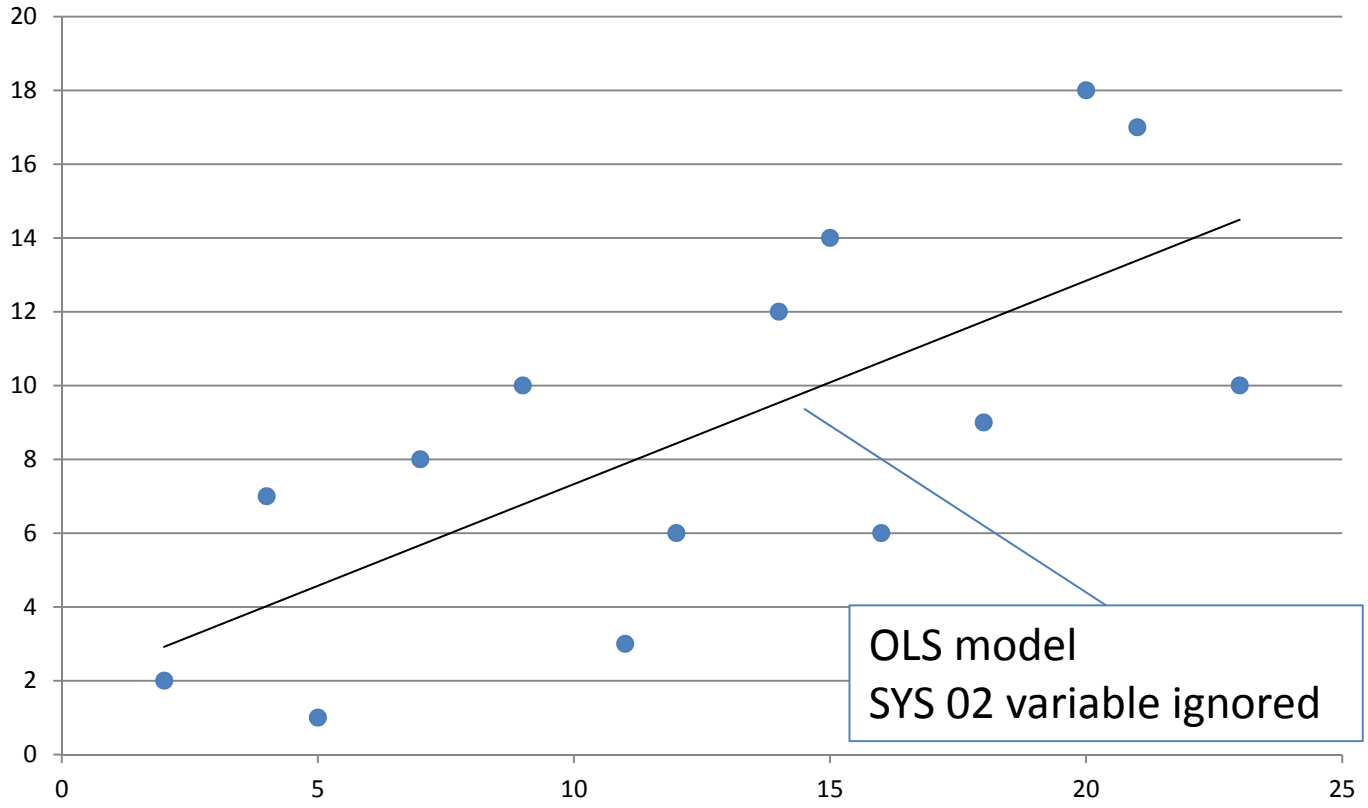
where: n_h – sample size in strata h, n – total sample size,

N_h – population size in strata h, σ_h – standard deviation i strata h, L – number of strata.

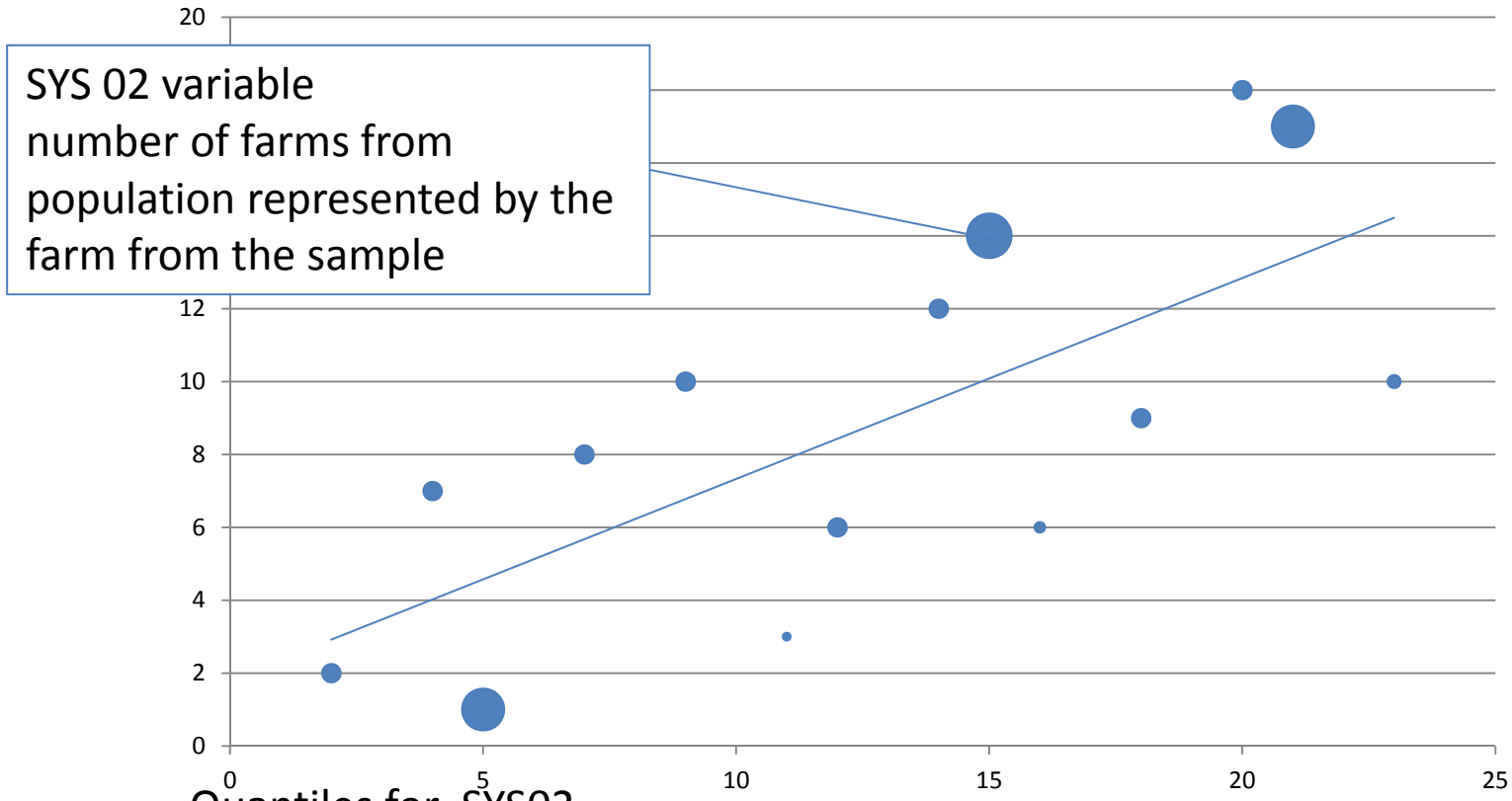
Horvitz Thompson estimator - explained



Horvitz Thompson estimator - explained



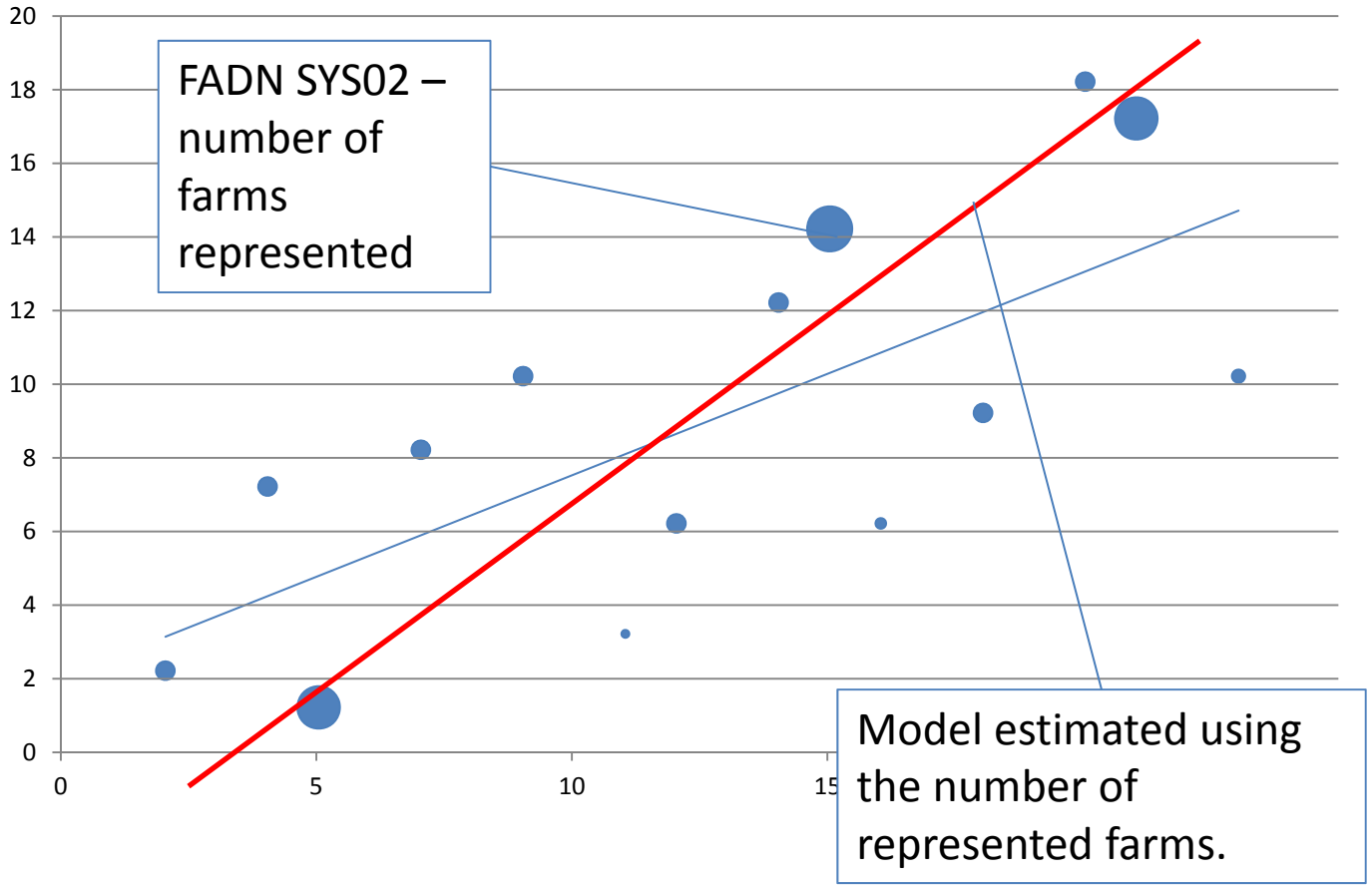
Horvitz Thompson estimator - explained



Quantiles for SYS02

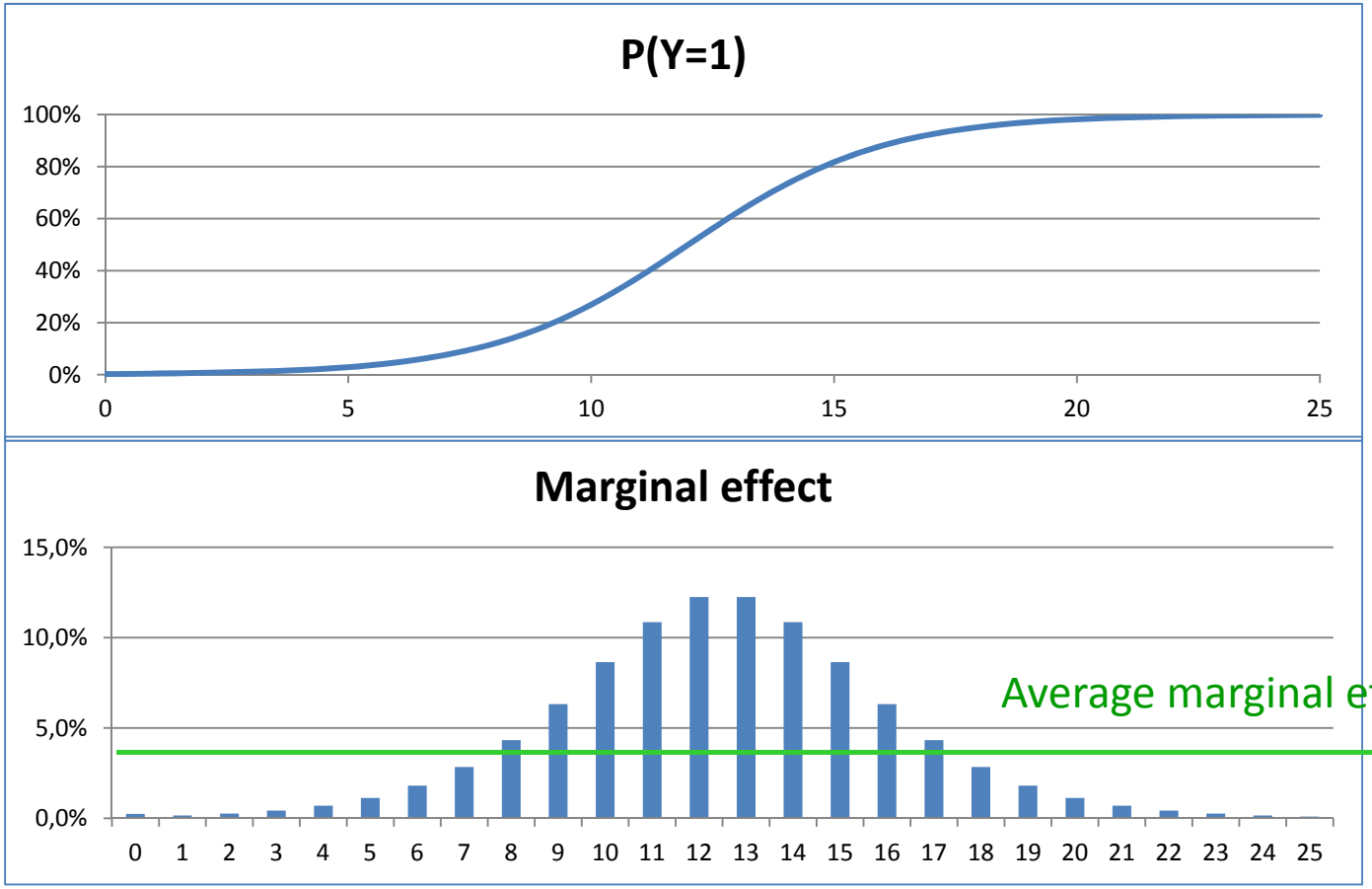
0%	25%	50%	75%	100%
1.00	14.66	30.07	69.51	1323.00

Horvitz Thompson estimator - explained



Average marginal effect - example

$$\ln\left(\frac{P(Y_i=1)}{1-P(Y_i=1)}\right)=-6+0.5x$$



Considered determinants

- location of the farm in one of FADN regions,
- farmers age [years],
- value of agricultural production [th. PLN]
- soil quality index (within the range 0.05-1.95),
- intensity of production, inputs for crop production per ha [PLN/ha AL]
- losses of yields experienced in last 9 years (2004-12) defined as at least 40% drop below farm average for at least one of the main crops [0/1],
- receiving at least once indemnity in the 9 years period (2004-2012) [0/1],
- level of farm income [th. PLN],
- ratio debts/value of the farm,
- Arrow-Pratt absolute risk aversion coefficient,
- **subsidy rate [operational subsidies/production value].**

Model results - POLAND

Variables	Estimate	Stand. error	p.value	Average marginal effects p.p.
(Intercept)	-2,7055	0,3667	0,000	0,00
Wielkopolska i Śląsk	0,5924	0,1178	0,000	10,52
Mazowsze i Podlasie	-0,9186	0,1486	0,000	-10,94
Małopolska i Pogórze	-0,5317	0,185	0,004	-7,09
losses of yields experienced	0,5702	0,0984	0,000	8,23
soil quality index	0,6788	0,1493	0,000	10,37
intensity of production [th.PLN/ha]	0,2198	0,0747	0,003	3,05
farm income [th. PLN]	-0,0017	0,0007	0,020	-0,02
farmers age [years]	-0,0077	0,0045	0,087	-0,10
debts/value of the farm	1,1035	0,5121	0,031	18,12
receiving at least once indemnity	1,1853	0,1999	0,000	19,71
Arrow-Pratt abs.risk aversion coefficient	0,1455	0,1266	0,250	1,99
agricultural production value [th.PLN]	0,0021	0,0004	0,000	0,03
subsidy rate (oper.subsidy/prod.value)	0,3897	0,2256	0,084	5,62

Model results - estimates

subsidy rate quartiles

Variables oper.subsidy/prod.value	Quartile 1 <14,9%		Quartile 2 14,9-22,8%		Quartile 3 22,6-34,5%		Quartile 4 >34,5%	
(Intercept)	-3,0277	***	-3,5211	***	-1,5903	*	-3,4935	***
Wielkopolska i Śląsk	0,4193		0,2443		0,5321	*	1,0566	***
Mazowsze i Podlasie	-1,344	***	-1,4874	***	-0,9472	*	-0,1945	
Małopolska i Pogórze	-0,4222		-0,9955	*	-0,837	*	0,284	
losses of yields experienced [0/1]	0,8893	***	0,6233	**	0,3255	.	0,4035	*
soil quality index [0,05-1,95]	0,1033		1,0394	*	0,5434	.	0,8214	*
intensity of production [th.PLN/ha]	-0,1089		0,2781	.	0,3162	.	0,5553	*
farm income [th. PLN]	-0,0051	***	-0,0016		-0,0016		-0,0001	
farmers age [years]	0,0137		0,0001		-0,0126		-0,0097	
debts/value of the farm	0,5552		1,5233		1,875	.	-0,046	
receiving at least once indemnity [0/1]	0,9662	**	0,859	*	0,5041		2,2472	***
Arrow-Pratt abs.risk aversion coefficient	0,5401	.	0,3771		-0,2138		0,0788	
agricultural production value [th.PLN]	0,0035	***	0,002	*	0,0023	.	0,0028	*

Model results – Average Marginal Effects [p.p.] subsidy rate quartiles

Variables oper.subsidy/prod.value	Quartile 1 <14,9%	Quartile 2 14,9-22,8%	Quartile 3 22,6-34,5%	Quartile 4 >34,5%
Wielkopolska i Śląsk	-	-	**10,20**	**14,53**
Mazowsze i Podlasie	**-15,62**	**-18,25**	**-12,59**	-
Małopolska i Pogórze	-	**-13,90**	**-11,49**	-
losses of yields experienced [0/1]	**13.87**	**8.54**	4.66	**4.94**
soil quality index [0,05-1,95]	-	**15,54**	8,30	**11,51**
intensity of production [th.PLN/ha]	-	3,65	4,62	**7,34**
farm income [th. PLN]	**-0.07**	-	-	-
farmers age [years]	-	-	-	-
debts/value of the farm	-	-	34,14	-
receiving at least once indemnity [0/1]	**15,59**	**12,49**	-	**39,18**
Arrow-Pratt abs.risk aversion coefficient	-	-	-	-
agricultural production value [th.PLN]	**0.05**	**0.03**	0.03	**0.03**

p-value <0,05 p-value <0,1 „-” p-value >0,1

Conclusions

- probability of crop insurance is increased by:
  - receiving at least once indemnity
  - experiencing losses of yields
  - location of the farm in Wielkopolska and Śląsk,
  - Intensity of production, soil quality,
  - economic size of farm.

Conclusions

- probability of crop insurance is decreased by:
  - level of farm income,
  - location of the farm in Mazowsze i Podlasie, Małopolska i Pogórze,
- Subsidy rate – not significant at 0.05,
- however the higher subsidy rate, the lower effect of „crop lost experienced in the past”.

Conclusions

- Average uptake of insurance in Poland is still quite low,
- Although level of crop insurance in Poland is really low it seems that farmers behave rationally. They insure crops in cases when the possible loss could significantly endanger financial situation of farm.
- There is a need for effective policy instruments which might encourage farmers to join the system of crop insurance.

Thank you for attention!