PRODUCTION AND PRICE RISK IN LITHUANIAN CROP FARMING

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The aim and tasks

- The aim - to identify the patterns of production and price risk in Lithuanian crops farming.
- Tasks:

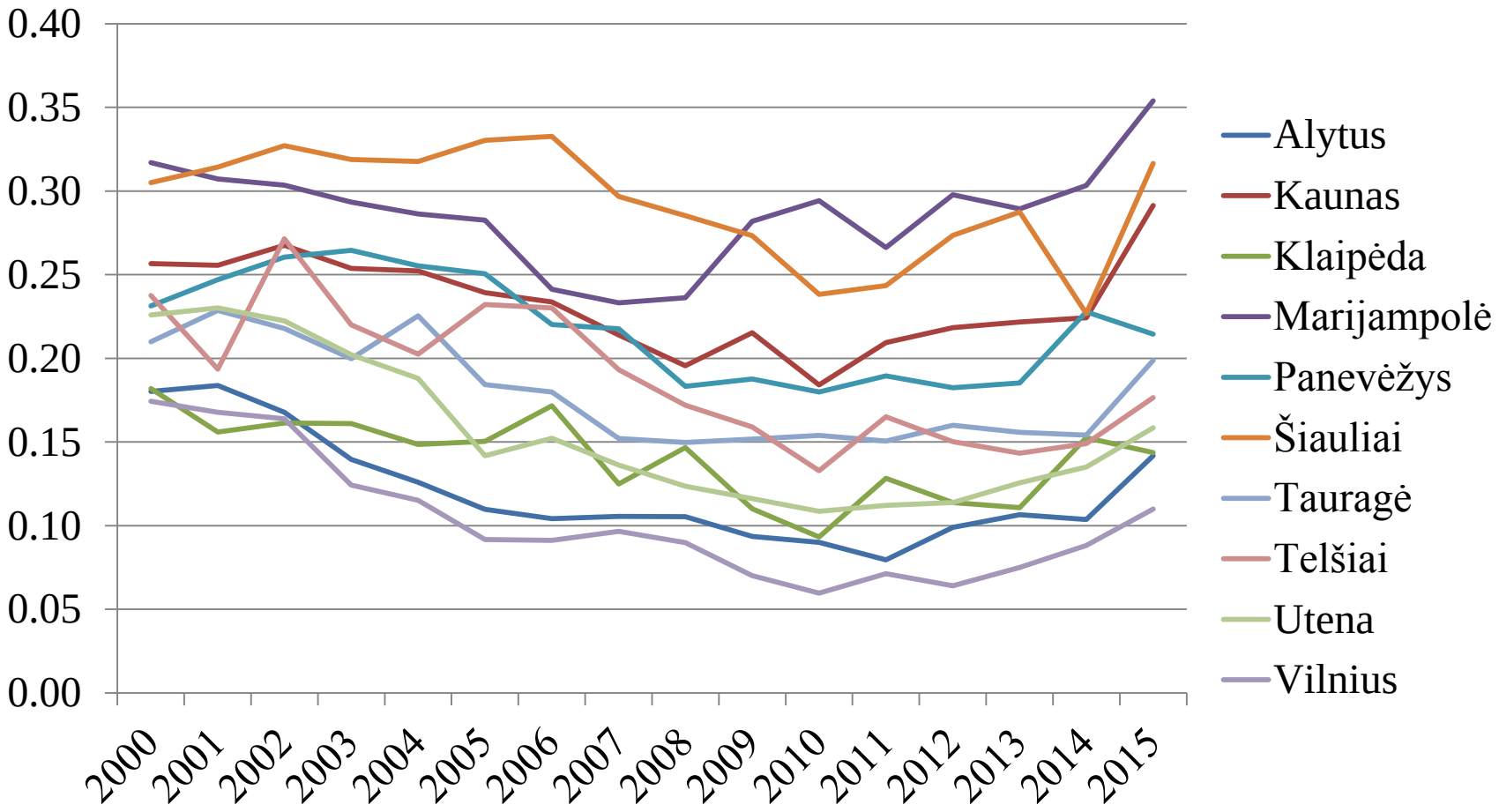
  to define the methods for the analysis of insurance premium and changes in the revenue;

  – to describe the main spatial and temporal trends in Lithuanian crop farming;
  – to estimate the insurance premia for main crops and regions;
  – to analyse factors influencing revenue change.

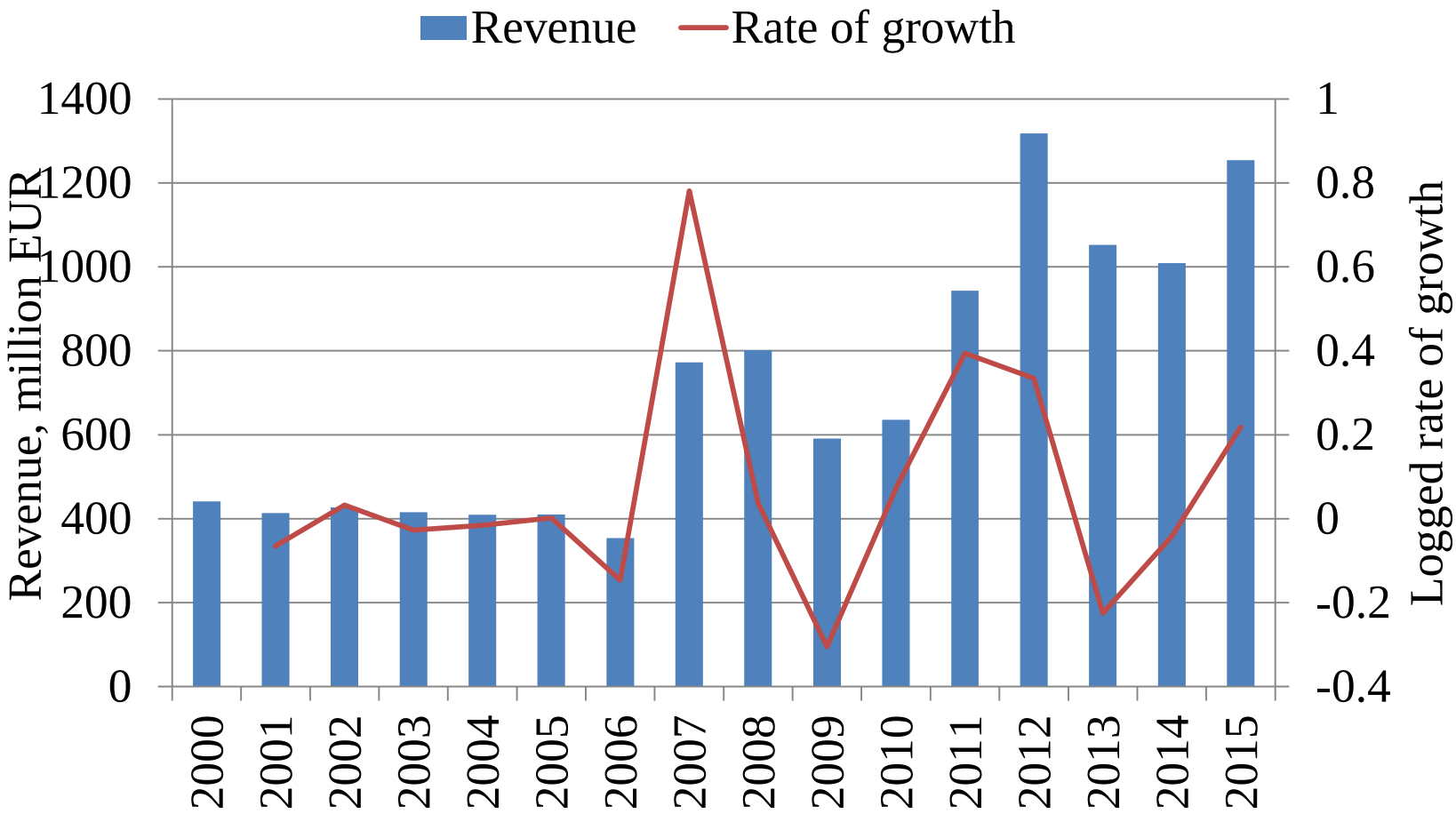
Methods and data used

- Methods:
  - LMA is applied for analysis of trends in yields and prices.
  - Insurance premia are modelled by fitting statistical distributions via the Maximum Likelihood.
  - The changes in revenue are decomposed by means of LMDI.
- Data:
  - The research covers years 2000-2015.
  - The analysis is carried out at the county level and covers 10 counties.
  - The data come from Statistics Lithuania (2016).

Specialisation of counties (HHI), 2000-2015



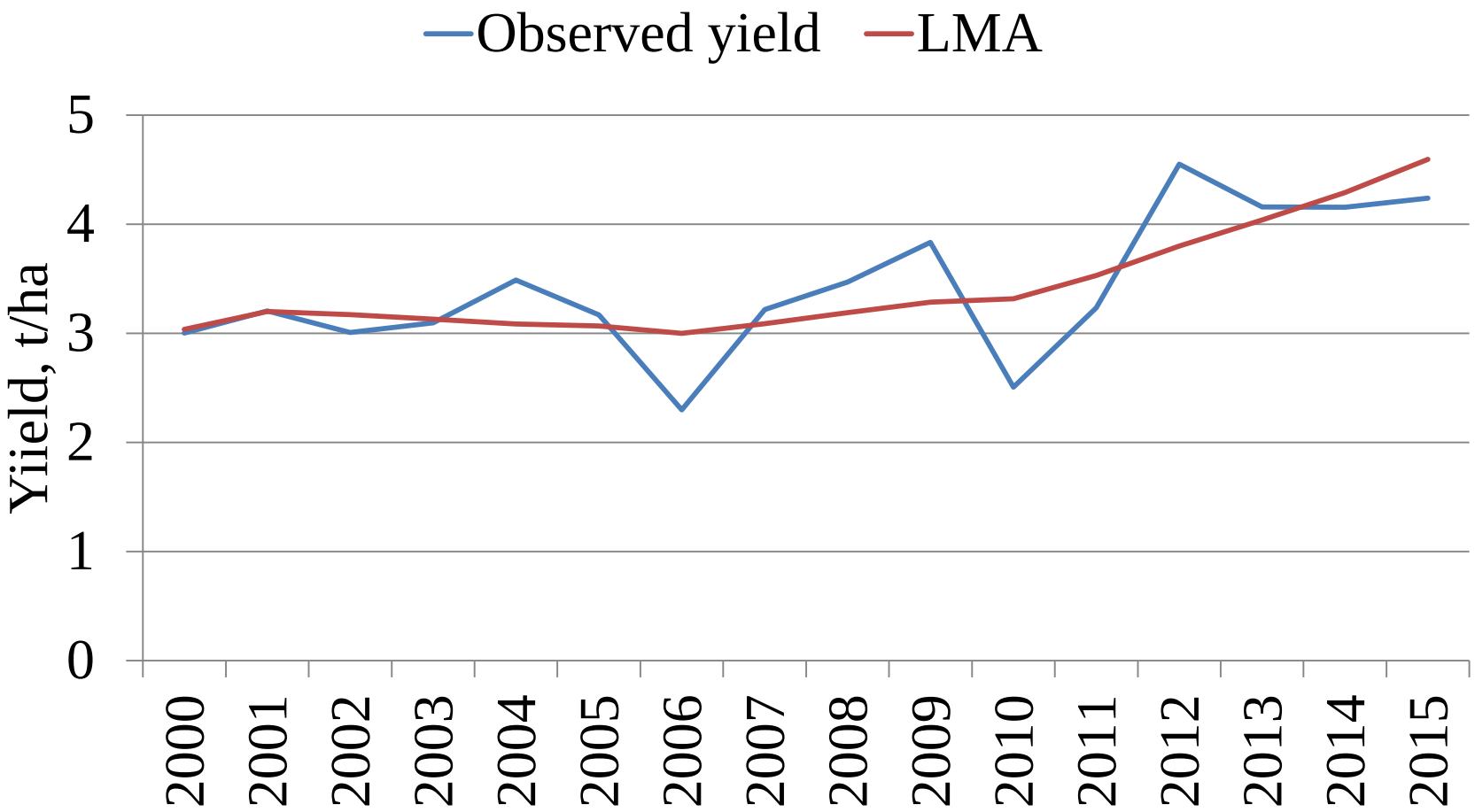
Total crop revenue in Lithuania, 2000-2015



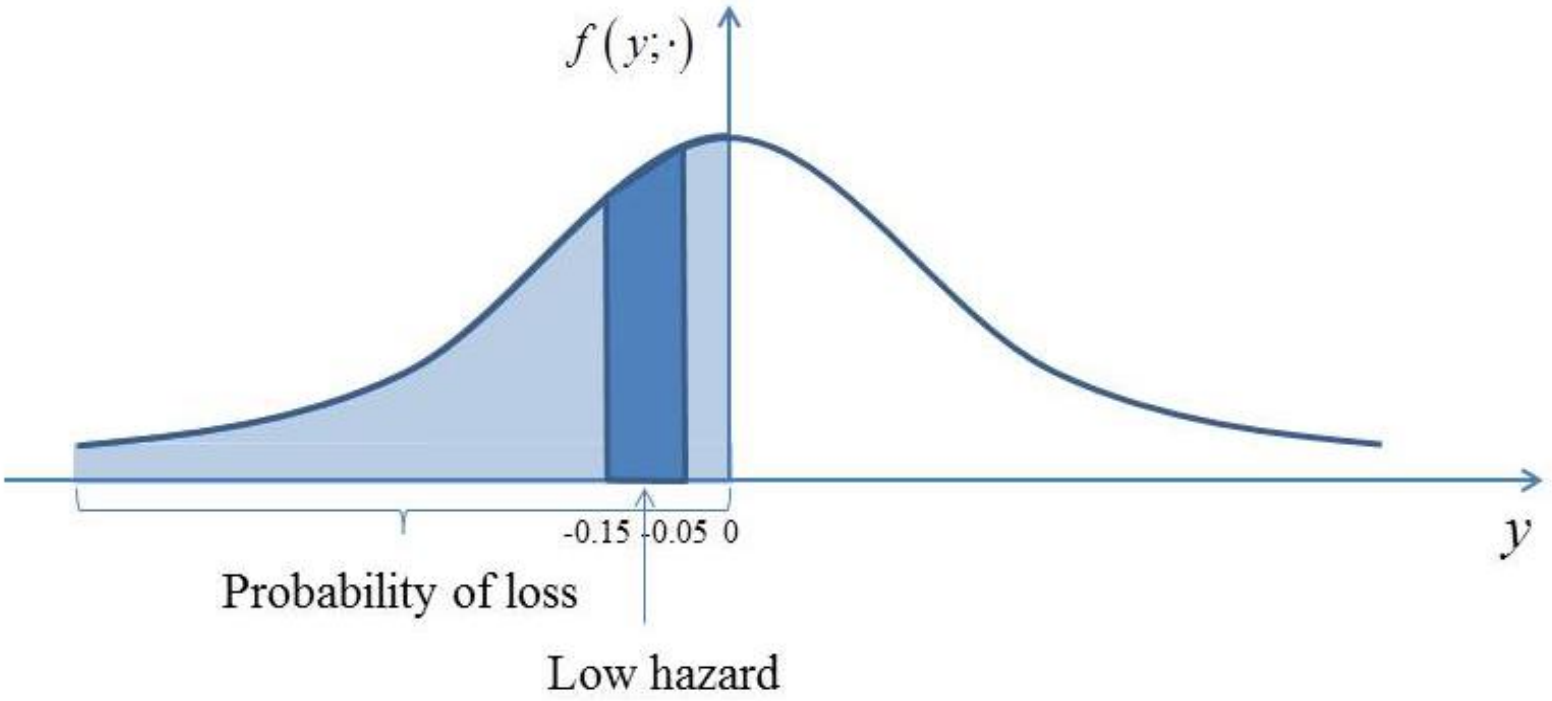
The changes in crop revenue across different crops, 2000-2015

Crop	Revenue, million EUR				Structure of revenue, %			
	2000	2007	2015	Annual rate of growth, %	2000	2007	2015	Rate of change, p.p.
Winter wheat	121.8	213.0	523.5	9.9	27.6	27.6	41.7	14.1
Winter triticale	8.2	30.9	47.0	12.6	1.9	4.0	3.7	1.9
Winter rye	29.6	25.3	12.2	-2.4	6.7	3.3	1.0	-5.7
Winter barley	0.3	7.0	2.2	10.8	0.1	0.9	0.2	0.1
Spring wheat	26.7	44.3	177.4	18.0	6.0	5.7	14.1	8.1
Spring barley	94.3	179.6	114.7	2.6	21.4	23.2	9.1	-12.2
Spring triticale	5.1	4.4	11.1	10.7	1.2	0.6	0.9	-0.3
Oats	5.8	17.7	19.8	8.2	1.3	2.3	1.6	0.3
Buckwheat	3.5	5.5	15.2	12.3	0.8	0.7	1.2	0.4
Mixed cereals	1.4	7.8	5.1	9.7	0.3	1.0	0.4	0.1
Maize	1.0	4.7	8.1	24.8	0.2	0.6	0.6	0.4
Legumes	10.2	8.6	91.4	12.7	2.3	1.1	7.3	5.0
Winter rape	2.2	39.1	147.9	25.9	0.5	5.1	11.8	11.3
Spring rape	12.7	46.9	26.8	14.2	2.9	6.1	2.1	-0.7
Potatoes	118.2	137.7	52.3	-4.2	26.8	17.8	4.2	-22.6
Total	441.0	772.5	1254.4					

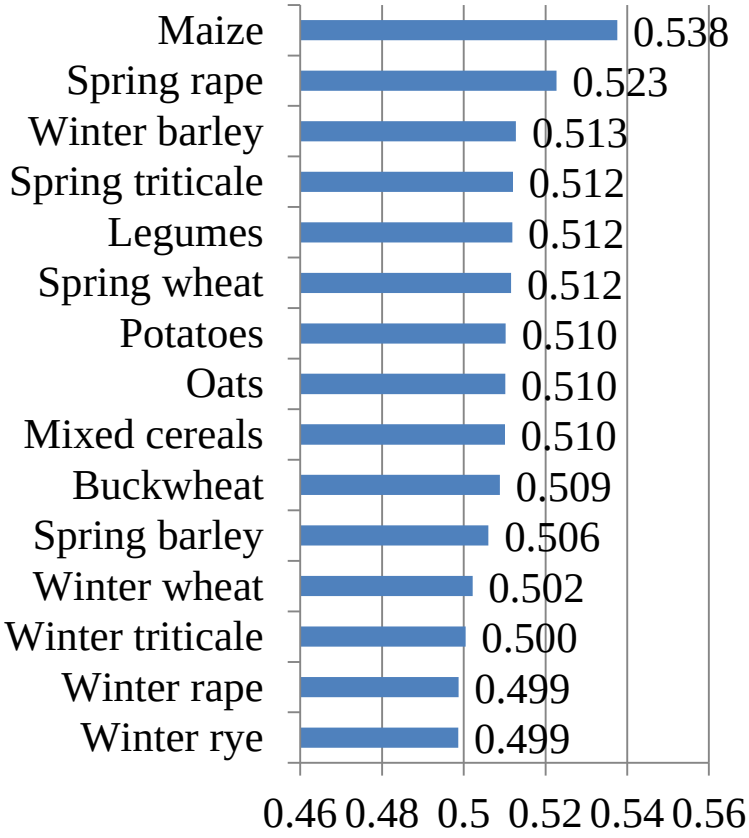
The yield of winter wheat in Alytus county, 2000-2015



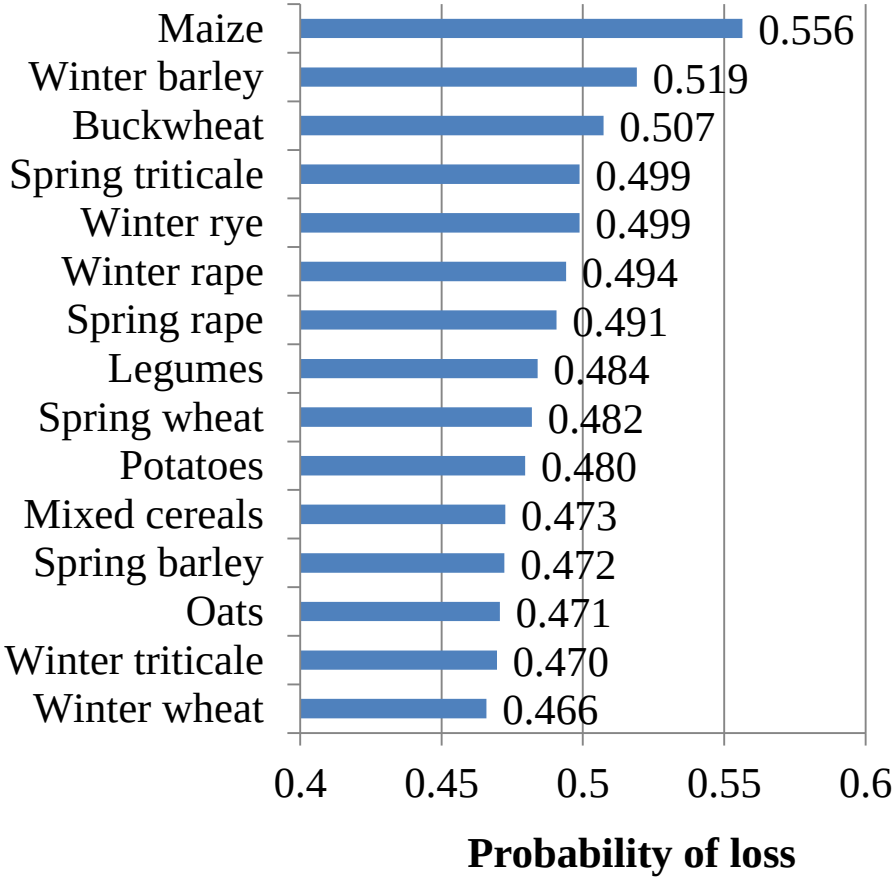
The measures of production risk



Probability of loss for different crops (averages across counties)



based on the normal distribution

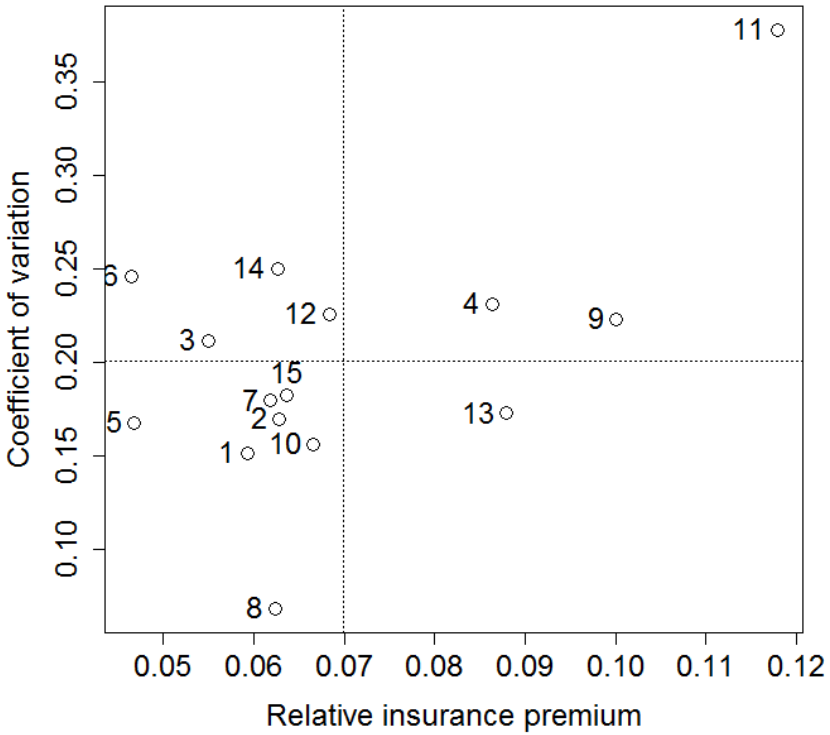


based on the logistic distribution

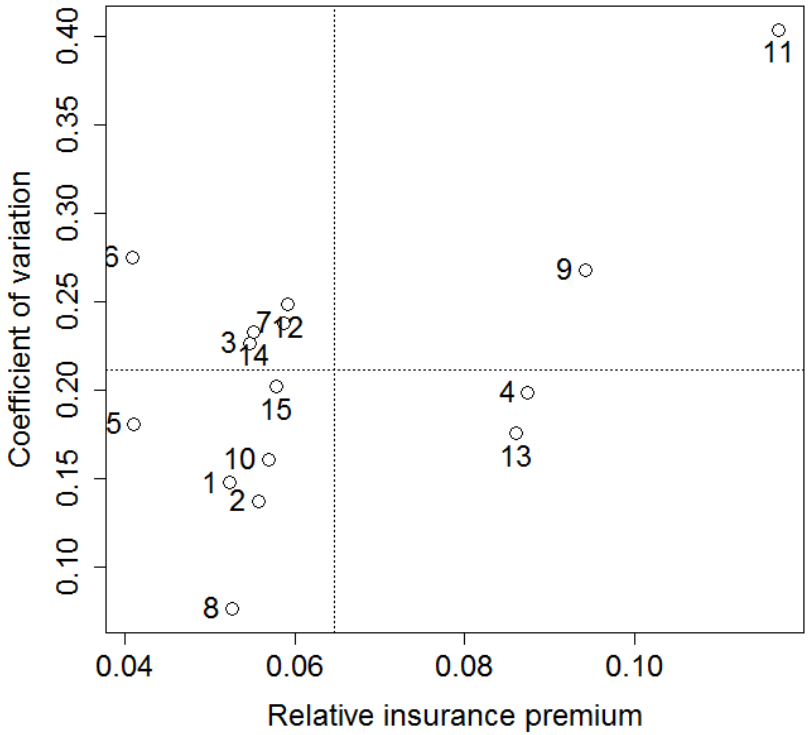
Average relative risk premia

	Normal distribution	Logistic distribution
Winter wheat	0.059	0.052
Winter triticale	0.063	0.056
Winter rye	0.055	0.055
Winter barley	0.086	0.087
Spring wheat	0.047	0.041
Spring barley	0.046	0.041
Spring triticale	0.062	0.059
Oats	0.062	0.053
Buckwheat	0.100	0.094
Mixed cereals	0.067	0.057
Maize	0.118	0.117
Legumes	0.068	0.059
Winter rape	0.088	0.086
Spring rape	0.063	0.055
Potatoes	0.064	0.058

Relative insurance premium and its spatial variation



based on the normal distribution



based on the logistic distribution

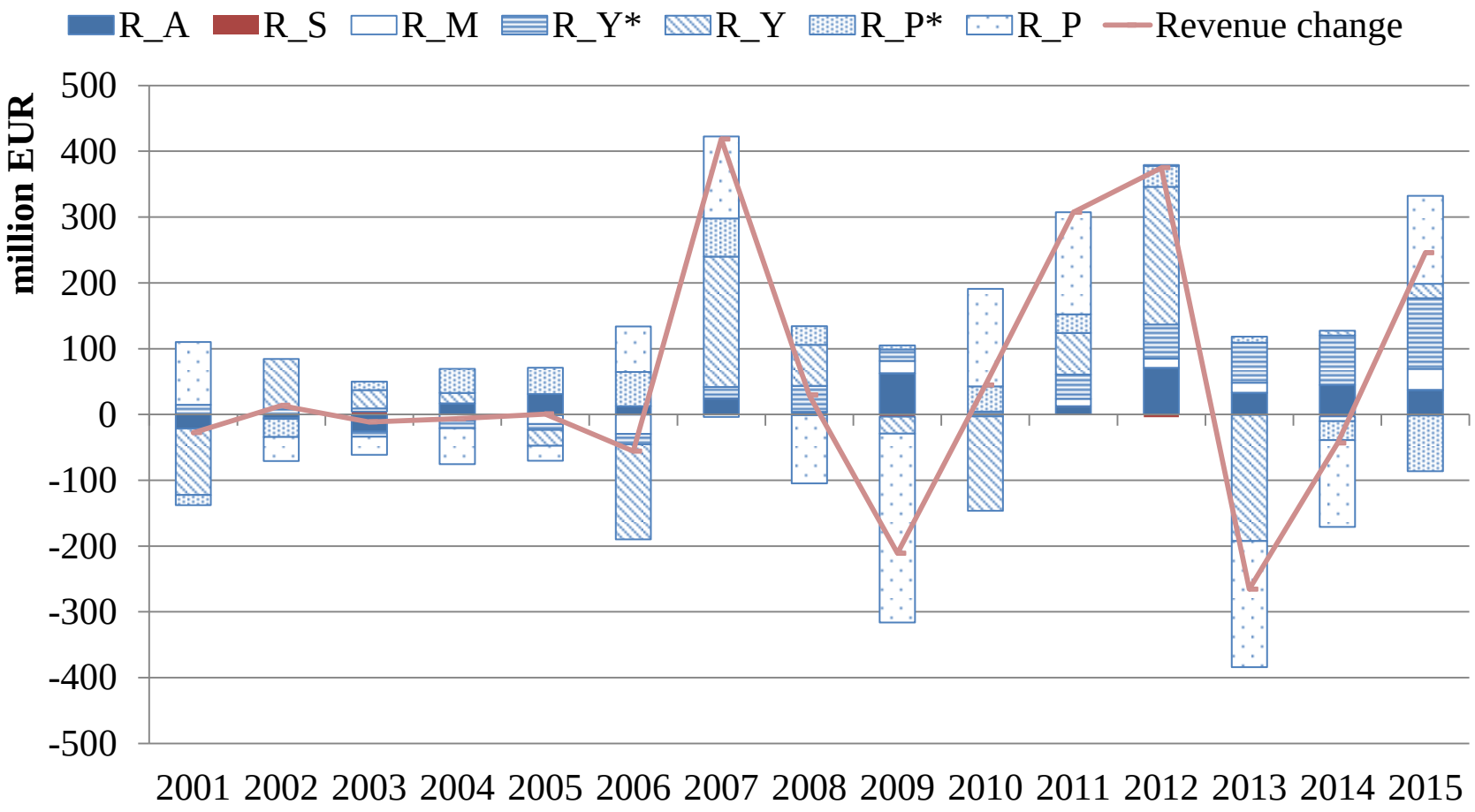
The relationship between AAI and production risk across the selected crops

Crop	Trend	Crop	Trend
Winter wheat	-0.017	Winter rye	0.001
Winter triticale	-0.023	Spring triticale	0.009
Winter barley	-0.059	Oats	0.002
Spring wheat	-0.018	Mixed cereals	0.006
Spring barley	-0.043	Legumes	0.006
Buckwheat	-0.014	Potatoes	0.015
Maize	-0.109		
Winter rape	-0.033		
Spring rape	-0.028		

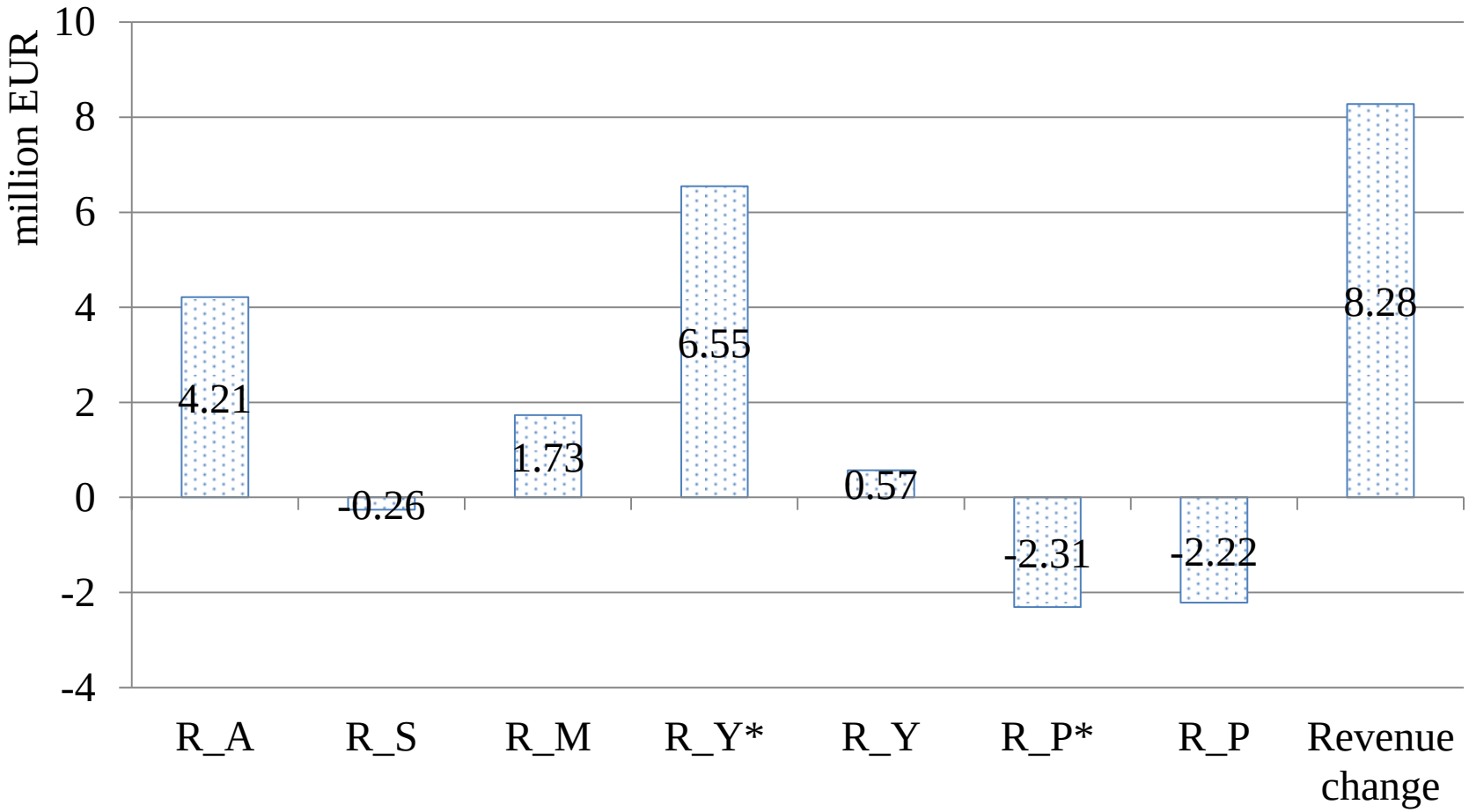
Absolute decomposition of changes in the crop revenue (million EUR), 2000-2015

Effect	2000-2006	2006-2015	2000-2015
ΔR_A – area sown	6.6	282.4	289.0
ΔR_S – spatial distribution	3.8	-8.3	-4.5
ΔR_M – crop mix	-48.0	78.9	30.8
ΔR_{Y^*} – yield trend	-22.3	411.1	388.8
ΔR_Y – deviation from yield trend	-149.0	201.3	52.2
ΔR_{P^*} – price trend	98.6	86.2	184.8
ΔR_P – deviation from price trend	23.3	-150.9	-127.7
Total	-87.1	900.5	813.5

Chain-liked additive decomposition of the crop revenue, 2000-2015



Decomposition of the average annual change in crop revenue based on the stochastic trend



Region-wise decomposition of changes in crop revenue, 2000-2015

	Alytus	Kaunas	Klaipėda	Marijampolė	Panevėžys	Šiauliai	Tauragė	Telšiai	Utena	Vilnius
D_A	1.1	6.4	1.3	5.0	5.7	8.8	1.4	1.3	1.0	1.8
D_S	-0.8	1.4	-0.9	-0.5	1.7	1.9	-1.8	0.8	-0.8	-0.7
D_M	-1.4	-0.3	-1.7	0.7	0.5	2.5	-0.9	-0.9	-0.9	-1.9
D_{Y*}	0.5	8.8	1.0	5.4	5.6	9.7	1.5	1.1	1.6	1.7
D_Y	-0.1	-1.9	-1.4	-2.3	0.3	-1.3	-0.9	0.0	-0.3	0.3
D_{P*}	2.0	7.4	2.7	5.6	6.2	10.1	2.6	2.2	1.6	3.3
D_P	0.2	-0.2	1.0	0.6	-1.1	-1.0	0.6	0.6	0.4	0.9
$D = R_T / R_0$	1.5	21.5	1.9	14.4	18.8	30.8	2.5	5.1	2.6	5.4

Conclusions (1)

- Application of the Herfindahl-Hirschman index suggested that Lithuanian counties increased the diversity of crop-mixes during 2000-2010, whereas the specialisation increased afterwards and exceeded the level of 2000 in 2015 in many counties.
- The highest probabilities of yield loss were observed for maize, winter barley, and spring triticale. These crops require introduction of improved varieties in order to weather the Lithuanian climate.
- Index decomposition analysis suggested that the effects of the area sown, the yield trend, and the price trend were the most important in driving the crop revenue up during 2000-2015. However, different patterns can be observed for the sub-periods of 2000-2006 and 2006-2015.

Conclusions (2)

- Crop-wise analysis implied that winter wheat, spring wheat, winter rape, and spring rape offered the most important contributions the change in the total crop revenue.
- Region-wise analysis also enabled to identify regions that were most important in driving the total crop revenue up.
- Incentives and support for crop insurance can be adjusted across the regions (and crops) in order to tackle the most problematic issues.

Conclusions (3)

As regards the research methodology, further improvements can be made into different directions:

- the data set can be improved in order to reflect the selling prices more accurately.
- different statistical distributions can be applied to improve the accuracy of the modelling of the insurance premia.
- the index decomposition analysis can consider different factors and decomposition principles.

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