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Sustainable Farming Systems in the New Member States

Summary Report

Francisco Cáceres Clavero, José Carlos Cruz Gómez, Rosana García Collado, Encarnación Serrano Jaén, Silvia Aguilar Montilla, Saulė Augaitytė, Blanca Lucena Cobos, Miguel Ángel Méndez Rodríguez, Trinidad Manrique Gordillo, Teresa Parra Heras, Adriana Cristoiu

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Disclaimer

All results, conclusions and views expressed are those of the research team alone and do not necessarily represent the views of the European Commission.

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EXECUTIVE SUMMARY

Two main developments created the need for this study, namely the reform of the Common Agricultural Policy (CAP) in 2003 and the accession to the EU of ten new Member States (EU–10) in May 2004. Both these developments occurred against the background of a sharper focus on sustainable development under the Gothenburg strategy. At the same time, the accession of ten new Member States in 2004 increased the interest amongst policymakers and the research community in assessing the potential impact of implementation of the 2003 CAP reform on agriculture, its sustainability and farm populations in these countries.

Against this background, in 2005 the European Commission's Joint Research Centre-Institute for Prospective Technological Studies commissioned a study ("Sustainable Farming Systems in the New Member States") from *Empresa de Desarrollo Agrario y Pesquero S.A.,* the Prospective Studies Department of the Junta de Andalucía (regional government of Andalucía, Spain). The general aim of the study was to gather updated empirical information regarding the sustainability of agriculture in the EU–10 context. In particular, the study aimed to address the sustainability of farming systems in selected new Member States (the Czech Republic and Lithuania), to improve the understanding of the determinants for adopting sustainable farming practices in that specific context and to investigate the potential impact of implementing the 2003 CAP reform, in particular on farming income.

Identification and characterisation of sustainable farming systems

The unit of analysis is the *regional farming system,* i.e. *a group of farms situated in a specific (homogeneous) territory/region with similar land use, production patterns and farming practices.* Homogeneous regions were identified by applying five criteria (land use, agro–climatic conditions, livestock density and production, farming structure and demographic characteristics). Each criterion is made up of several variables calculated using data available from the Local Administrative Units level (LAU1). First variables were calculated for each LAU1 and then an average value was obtained for each criterion. LAU1 regions were then grouped together into broader homogenous areas, with similar characteristics based on the five criteria specified above. Finally, farming systems were associated with each of these broad territories and the match was validated by local national experts. Czech farming systems were labelled on the basis of their characteristic crop and the prevailing agricultural orientation on the territory concerned (based on the statistics for 2003). In Lithuania, apart from the prevailing production profile, the labels of the six farming systems also reflect other characteristics of the territory concerned (such as its marginal suitability for agricultural production, the presence of large urban areas or the intermediate values for most variables used to characterise the systems). Inter–country comparisons of the farming systems have to be treated with caution, as differences in the data available from the two countries influenced the selection of variables used.

This study follows the positive approach to analysis of farming sustainability, namely *ranking farming systems and exploring their characteristics* rather than attempting to define what a sustainable farming system is. The general approach consists of ranking the farming systems of a given country on a sustainability index. The sustainability index combines three partial indices covering different dimensions of sustainability (economic, social and environmental). To calculate the partial indices, the most appropriate variables were identified within the limitations of the data available in each country.

The sustainability assessment points to two conclusions. First, it is possible to identify and show differences between farming systems in terms of sustainability. The approach chosen allows a better understanding of which component of sustainability (economic, social or environmental) influences the 'overall' sustainability index of any given farming system most. Second, the transparency and traceability of this method make it possible to identify the variables and farming systems which may need closer monitoring and targeted intervention to help improve sustainability. The results of the sustainability assessment are particularly valuable for proposing methodological improvements and provide a benchmark for future studies related to this topic and for the level of analysis. Nevertheless, the results reported here should be treated with caution because they are influenced by the researchers' choices and by the data which were available at the time when this study was carried out.

Determinants for adopting sustainable farming practices: the case of organic farming

This part of the study is limited to organic farming, one of the possible sets of sustainable practices, and looks at the factors that influence farmers'/managers' decision whether or not to adopt this farming practice. Owing to the lack of detailed background information at local level about the social and environmental aspects, the analysis focuses mainly on the economic aspects of adoption. It is based on data collected from a field survey carried out in the two countries in August 2005. The interviews covered 62 Czech farmers (30 organic and 32 non–organic) and 89 Lithuanian farmers (23 organic and 66 non–organic).

Overall, the results of the field survey indicate that the main determinants for adopting organic farming in the two countries relate to farmers' environmental and/or food concerns and to the intrinsic characteristics of the farm (i.e. suitable farm size and type of production) meeting the certification standards required for converting to organic.

In the Czech Republic, the main barriers to adoption of organic farming are unsuitable farm characteristics, while in Lithuania they are related to poor market accessibility. 'Unsuitable farm characteristics' means differences between the existing and organic production technology (such as technical equipment, insufficient labour available, inadequate stock of machinery, etc.). Where these differences would require substantial changes in order to meet the requirements of the organic certification procedure (e.g. change of technology or taking on extra labour), farmers' propensity to adopt organic farming is low. In Lithuania, the market accessibility barrier takes the form of underdeveloped channels for marketing organic produce.

Further work is needed to fine–tune the approach, particularly by using a statistically representative sample (possibly using panel data from the same group of farms) to incorporate social and environmental aspects into the analysis. Another aspect to be investigated is the effect that potential ending of the payments for organic farming would have on the longer term continuity of this practice.

Prospects for agricultural income under policy scenarios

The last part of the study looks at the potential impact of selected policy instruments on agricultural income. Three policy scenarios are defined: (i) 'No–Accession', which builds on the hypothesis of what would have happened if the two countries had not joined the EU and, hence, the pre–accession agricultural policy and instruments had continued; (ii) 'Business as usual' ('Baseline'), which considers the developments in national agricultural policy up to 2005 — including EU accession and implementation of the 2003 CAP reform — and the most likely developments by 2013, as indicated in the relevant official documents; and (iii) 'Environmental CAP', which assumes greater policy support to encourage adoption of environmentally friendly farming practices (only support for organic farming is considered) and increase production of energy crops (only rape seed is considered). Three policy instruments available under the 2003 CAP reform are included in simulations: (a) single farm payments (SFP), (b) support for organic farming and (c) payments for energy crops. Gross farm income is used as a proxy for the economic sustainability dimension. Finally, three alternative managerial decisions which a '2003 farmer' would contemplate, given the policy scenarios and instruments mentioned above, are assumed, namely (1) continue as a non–organic farm, (2) convert to organic farming or (3) allocate part of the land farmed to cultivating rape seed.

A standard (non–organic) holding for each farming system is defined using the 2001–2003 average FADN data. This '2003 average holding' is then projected to 2013 by adjusting its main variables (i.e. output, intermediate consumption, subsidies and taxes). The scenario simulations use a static 'what if' approach to explore the consequences for the gross farm income of each of the farming systems in 2013, given the managerial choices taken in the initial period ('2003'). The simulations are based on an accountancy approach, looking at the income transfers generated under each policy instrument considered. This amount varies, depending on the structure of the enterprises in each farming system and the managerial choice considered.

The results show that adoption of the CAP (selected instruments) would substantially increase the average gross farm income in both countries by 2013. Differences in the structure of the enterprises making up each standard holding lead to different amounts of the corresponding policy support and thus generate large differences in farm performance. The results show that the average gross income in 2013 would be higher when converting to organic farming (in Lithuania) or introducing energy crops (in the Czech Republic).

The main merit of this study lies in its approach to identifying and assembling regional farming systems. The complexity of the concept of agricultural sustainability and of the decision–making process at farm level call for further fine–tuning of the indicators, improvements in multi–criteria assessment (e.g. weights for constructing aggregated indicators) and involvement of a spectrum of experts and stakeholders to avoid subjectivity before putting forward results. In addition, the institutional dimension of sustainability will have to be considered in future studies. The conceptual framework and methodology are general enough to be easily applied in any other country or region. This in–depth but transparent approach offers valuable insights at a time of growing interest in supporting the moves towards sustainable agriculture in the European Union.

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LIST OF ABBREVIATIONS

AHF	Agriculture, Hunting and Forestry
CAP	Common Agricultural Policy
CM	Crops–Marginal system
COM	Crops–Oriented Maize system
COSB	Crops–Oriented Sugar beet system
CO	Crops–Oriented system
CZK	Czech crowns currency
ESU	Economic Size Unit
FADN	Farm Accountancy Data Network
FSSI	Farming System Synthetic Index
GDP	Gross Domestic Product
GFI	Gross Farm Income
GVA	Gross Value Added
Ha	Hectare
IC	Intermediate Consumption
I	Intermediate system
LFA	Less Favoured Areas
LTS	Litas, Lithuanian currency
LU	Livestock Unit
LM	Livestock–Marginal system
LO	Livestock–Oriented system
LAU1	Local Administrative Units
M	Million
MOG	Mixed–Oriented Grassland system
MOP	Mixed–Oriented Potatoes system
EU–N10	New Member States (EU Enlargement of May 2004)
SFP	Single Farm Payments
ST	Subsidies and Taxes
TO	Total Output value
UO	Urban Oriented system
UAA	Utilised Agricultural Area

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1 INTRODUCTION

This report summarises the results of the study ('Sustainable Farming Systems in the New Member States', contract no. 22477-2004-11 F1ED SEV ES) commissioned from Empresa Pública Desarrollo Agrario y Pesquero S.A., the Prospective Studies Department of Junta de Andalucía (regional government of Andalucía, Spain). The objective of the study is to gather empirical updated information regarding the sustainability of agriculture in the selected new Member States (the Czech Republic and Lithuania), particularly to describe the sustainability of farming systems, to improve the understanding of the determinants of adopting sustainable farming practices in that specific context, and to investigate the potential impact of implementing the 2003 CAP reform in particular on farming income.

The originality of the study rests in the methodological approach to assemble regional farming systems, which allows assessing agricultural sustainability within territorial contexts. The conceptual framework and methodology are general enough to be easily applied in any other country or region. The in–depth but transparent analysis provides results that can be valuable at a time of growing interest in supporting the move towards sustainable agriculture in the European Union.

Overall, the main merits of this study consist in the methodology developed for the assessment of sustainability at the farming systems level, the rich empirical information regarding the factors that trigger the decision to adopt organic farming (one of the set of sustainable farming practices), as well as the detailed accountancy–based information regarding the characteristics of organic farming in the context of the new Member States considered here, and the interlinked effect between farmer's own preferences and policy instruments introduced under the 2003 CAP reform. The results reported here are more valuable for the illustrating the methodologies developed here rather than for being used as direct input in a policy decision. The complexity of the concept of agricultural sustainability and of the decision–making at the farm level call for further refinements of the methodologies developed here before putting forward such results. Above all the institutional dimension of sustainability has to be included in future studies given the particularities of the institutional context of the agricultural sector in the new Member States.

This report is structured as follows. Section 2 summarises the main characteristics of the methodology used to identify and assess the farming systems along the three dimensions of sustainability (economic, social and environmental). Section 3 presents the results of the empirical investigation of the determinants of adopting organic farming and some general structural and social aspects of organic production in the countries and farming systems considered. Section 4 includes the results of analysing the impact of selected agricultural policy instruments introduced under 2003 CAP reform on farming income. Conclusions are provided at the end of each Section.

2 SUSTAINABILITY DIMENSIONS AT THE FARMING SYSTEM LEVEL

2.1. Introduction

With the aim to carry out a detailed study, putting the main effort on collecting relevant and detailed information to reflect the specific local context, this study focuses on only two of the new Member States (EU–N10), the Czech Republic and Lithuania. Both countries selected, although acknowledging their different historical and development contexts that influence their agricultural particularities, are taken as representative for two main geographical areas of the EU–N10, Lithuania for the Baltic countries and the Czech Republic for the Central and Eastern countries. The choice of these two countries as case studies is also justified by the desire to look in more detail at agricultural sectors that can illustrate two extremes of the agricultural transition path. Each of the two countries is seen as representative either of a context where agriculture has a high importance in the national economy but with a low agricultural dynamism (i.e. a so–called ‘type A’ agricultural context, here illustrated by the Lithuanian case), or of a context where agriculture has a low weight in the national economy but a high agricultural dynamism (‘type B’ agriculture, illustrated here by the Czech case).

The characteristics considered to differentiate the two types of agriculture include (1) *share of agriculture in Gross Domestic Production (GDP)* (2.9 % in Lithuania, 1.2 % in the Czech Republic); (2) *share of agricultural area in total national area* (38.4 % in Lithuania, 46.3 % in Czech Republic); (3) *agriculture gross value added at basic price*s (Lithuania €311m; Czech Republic €929m); (4) *share of agricultural employment* (18.6 % in Lithuania, 4.9 % in Czech Republic); (5) *share of food and agricultural products exports in total exports* (7.6 % in Lithuania, 2.4 % in the Czech Republic); (6) *external trade balance in food and agricultural products* (€-61m in Lithuania, €-902m in Czech Republic); (7) *share of organic area in total Utilised Agricultural Area (UAA)* (0.3 % in Lithuania, 5.1 % in Czech Republic); (8) *labour productivity* (as Gross Values Added/employee: €1,174 in Lithuania; €4,004 in Czech Republic); and (9) *land productivity* (as GVA/ha is €89 in Lithuania and €254 in Czech Republic). All figures above are for the year 2002.

The investigation of sustainability dimensions at the farming system level in the context of this study implied two main steps, namely (1) identification and definition of regional farming systems and (2) specification of the sustainability dimensions at the farming system level. For each step, a specific methodology had to be defined using mainly statistical information available from rather high disaggregated territorial unit in each country (Local Administrative Unit, LAU1)[1]. The sections below summarise the main characteristics of the methodologies applied at each stage, and the results in the two countries.

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[1] See Annex 1 for the relationship between LAU1 and administrative territories in the two countries.

2.2. Identification of regional farming systems

2.2.1 Methodological approach

The approach used to identify and characterise farming systems is based on the concept of *territory–linked farming system*. This approach is justified as obviously agriculture happens in close link with the natural environment and it is composed by different agro–ecosystems located in specific territories. Farming practices and land use in each holding are determined by physical, geological, climatic, topographic and structural factors of the territory where the farm is situated. Therefore, the unit of analysis is the farming system defined as *a group of farms situated in a specific territory with similar land use and farming practices determined by environmental and socio–economic characteristics of the territory and of the historical period.*

Given the selected unit of analysis, homogeneous territories (or regions) have to be first identified to which farming systems are then attached. The approach used relies on using available statistical data from a rather disaggregated territorial unit (LAU1, ca. 1,000 km^2 in each country considered here). The LAU1 level is selected under the assumption that agriculture developed within this territorial space followed rather similar patterns, under the influence of similar socio–economic conditions and natural environment. The identification of homogeneous territories (regions) relies on the use of five criteria (land use, agro–climatic conditions, livestock density and production, farming structure and demographic characteristics. The selection and use of these criteria allows taking into account various aspects of the farming systems rather than being limited exclusively to their agronomic aspects.[2] The LAU1 regions are then grouped into broader areas having internal homogenous characteristics according to the five criteria specified above. The farming systems are associated with each of these broad areas and their location validated using input from local experts.

Three alternative approaches for delimiting the farming systems were then considered, as it was thought they would be complementary to each other and the results will be aggregated and represented in a single map of regional farming systems. The three approaches were:

- classification and grouping of LAU1 based on the available information by statistical methods (cluster analysis);
- identification, delimitation and general characterisation based on local expert knowledge (mainly gathering input based on a written questionnaire through consulting specialised national institutes);

[2] At the same time, it is difficult to accede to statistics from such a disaggregated level as this information is often not available outside the region of origin (i.e. EUROSTAT does not currently cover this territorial level), it is scattered, of very different nature and the result of different methodologies. This difficulty appears to be even greater when one tries to access the same information in different countries. Taking into account all these challenges it results almost impossible to dispose of exactly the same information from different countries. The main merit of these descriptors (criteria and component variables) is their use for grouping the similar LAU1 units in agricultural terms to delimit and characterise the systems for each country.

– identification and delimitation of agricultural systems based on own observation and experience in recognising the similarities and disparities of considered criteria for the different LAU1. The aim in this case was to try to group the LAUs into areas having internally homogenous characteristics according to the five criteria specified above.[3]

The final decision was to rely on technical criteria and on the experience of research team of the project, taking into account the five criteria mentioned above. The results and feedback obtained through the other two approaches (statistical analysis and consultation of experts) were taken into consideration and integrated. Inter–country comparisons of the farming systems have to be treated with care given that, although the criteria applied are the same, the lack of the same statistical data from the LAU1 level in both countries has lead to the use of different associated variables.

Following this approach, eleven farming systems are identified in the two countries. Czech farming systems identified are labelled according to the prevalence of the 'differentiating crop' (maize, sugar beet, potatoes, grassland) and the general orientation of the agricultural production (based on the statistics for the year 2003) in the associated territory: *Crops–Oriented Sugar beet*, *Crops–Oriented Maize*, *Mixed–Oriented Grassland*, *Livestock–Oriented* and *Mixed–Oriented Potatoes*).

In Lithuania, apart from the prevailing production profile, labels of the systems also reflect other characteristics of the associated territory (such as the marginal suitability to agricultural production, presence of important urban centres that shape production specialisation, or the intermediate position of the values of the variables). The six farming systems identified in Lithuania are: *Livestock–Oriented*, *Crops–Oriented*, *Crops–Marginal*, *Livestock–Marginal*, *Urban–Oriented* and *Intermediate* (see Table 1 and Table 2 below).

2.2.2 The Czech Republic

The geographical situation and agro–climatic conditions in the Czech Republic depict a typical pattern of Central European agriculture, where arable crops (mainly cereals), permanent grasslands and livestock represent the principal agricultural enterprises and the main uses of the agricultural land. Livestock represents 48.7 % of the total production, prevailing milk production (19.6 %) and pig livestock (14.8 %). Of the total crop production the main crops are wheat (12.5 %), barley (6.5 %), oilseeds (6 %) and potatoes (4.5 %). Cereals are cultivated in all agricultural regions, although crops like sugar beet, potatoes, grass and maize can be considered as distinctive crops of each production area.

[3] First, efforts have been made to classify automatically the LAUs based on statistical methods (cluster analysis) in both countries but the results achieved were not satisfactory. Particularly, it was difficult to explain satisfactorily the clusters of territorial units obtained, and moreover, the groupings obtained were problematic in terms of excessive geographical dispersion. Second, questionnaires were elaborated and distributed via e-mail to selected national experts in both countries. No complete answers were received, although in some cases, graphic information for territorial demarcation of the systems was provided.

The information available for districts has been aggregated in systems, obtaining the average values provided in Table 1. The characterisation of the Czech systems identified is then carried out based on the main descriptors (criteria and associated variables) used for their identification. Related to crops area reported, owing to the homogenous distribution of cereals across the country, four crops have been selected as 'identifying' crops of farming systems, namely maize, sugar–beet, potatoes and mountainous grassland. Area percentages reported in the table below are related to each of these crops, and not the total crop (e.g. in *Crops–Oriented Sugar beet* system, area cultivated with maize represents 1.34 % of the total area of profiling crops (i.e. maize, sugar beet, potatoes and mountainous grassland)). In order to describe the productive capacity of the soils, only potatoes and wheat yields have been considered. These crops have been selected because of their prevalence in the Czech agricultural land use.

Table 1 Main variables used to characterise the Czech farming systems (average values)

DESCRIPTORS: Criteria and associated variables		FARMING SYSTEMS: CROPS–ORIENTED SUGAR BEET	CROPS–ORIENTED MAIZE	MIXED–ORIENTED GRASSLAND	LIVESTOCK–ORIENTED	MIXED–ORIENTED POTATOES
Criterion 1: Land use						
Total area (ha)*		2,825,299	389,599	1,602,914	1,146,903	1,922,037
System agricultural land (ha)*		1,703,520	263,468	650,862	670,257	991,772
System agricultural land/ Total agricultural land of Czech Republic (%)*		39.80	6.16	15.21	15.66	23.17
System agricultural land/Total system area (%)*		60.30	67.63	40.60	58.44	51.60
Arable land/agricultural land (%)*		80.67	84.83	47.11	74.72	68.28
Grasslands/agricultural land (%)*		11.93	4.05	45.29	22.22	27.66
Gardens/agricultural land (%)*		4.41	2.28	4.61	2.80	3.15
Production area (crop area / total area of maize, sugar beet, potatoes and mountainous grassland)*	Maize (%)	1.34	70.94	0.02	0.00	0.00
	Sugar–beet (%)	75.09	19.87	9.40	5.04	10.10
	Potatoes (%)	20.99	9.19	56.99	87.89	85.19
	Mountain grassland (%)	2.57	0.00	33.38	7.07	4.71
Share of farms in the whole number of farms*[a]	Crop–oriented (%)[(a)]	36.31	59.40	20.68	17.01	20,83
	Livestock–oriented (%)	17.27	7.18	19.28	27.42	25,59
	Mixed–oriented (%)	46.42	33.42	60.04	55.57	53.57
Total area of organic crop/agricultural land of system (%) ****		1.86	1.90	16.70	1.41	10.28
Criterion 2: Agro–climatic conditions						
Total LFA/Agricultural land (%) **		15.32	0.62	64.03	66.92	65.70
LFA–Mountain/ Agricultural land (%)		2.54	0.38	35.39	18.07	6.69
LFA–Specific/ Agricultural land (%)		3.11	0.24	19.52	0.00	6.73
LFA–Others/ Agricultural land (%)		9.67	0.00	9.13	48.85	52.28
Yields of main crops**	Wheat (t/ha)	4.65	4.09	3.79	3.87	3.92
	Potatoes (t/ha)	20.60	25.62	22.44	20.47	20.60
Criterion 3: Livestock density						
Livestock unit density (only ruminants) per 100 ha***	LU/100 ha of Agricultural land	21.76	12.50	25.63	40.61	30.74
	LU/100 ha of grasslands	224.42	446.89	55.62	195.94	120.21
Criterion 4: Property and holding size						
Share of agricultural	Legal entities (%)	70.30	79.87	62.66	77.24	72.56

DESCRIPTORS: Criteria and associated variables		FARMING SYSTEMS				
		CROPS–ORIENTED SUGAR BEET	CROPS–ORIENTED MAIZE	MIXED–ORIENTED GRASSLAND	LIVESTOCK–ORIENTED	MIXED–ORIENTED POTATOES
land /Total Agricultural land by legal form of the system*	Individual farms (%)	27.32	17.11	36.18	19.54	26.47
	Other (%)	2.38	3.02	1.16	3.23	0.97
Number of farms by legal form within the system	Legal entities	1,225	235	448	500	619
	Individual farms	17,391	8,386	10,133	9,054	8,496
Farms with average size <10 ha within the system	Number	10,864	7,574	7,550	5,899	4,857
	%	63.76	90.98	75.52	68.78	58.20
Farms with average size 10-<50 ha within the system	Number	3,582	400	1,601	1,716	2,171
	%	21.02	4.80	16.01	20.01	26.02
Farms with average size 50-<100 ha within the system	Number	757	111	242	340	427
	%	4.44	1.33	2.42	3.96	5.12
Farms with average size >100 ha within the system	Number	1,835	240	605	622	890
	%	10.77	2.88	6.05	7.25	10.67
Criterion 5: Population characteristics						
Employees in agriculture, hunting and forestry (AHF)/Total employees* (%)		3.36	8.48	3.48	9.27	5.44
Gross wage per employee in AHF* (€/month)[1]		371.87	356.12	363.12	363.50	372.80
Gross wage per employee in AHF/Total economic activitites (%)*		72.29	75.97	78.08	80.91	78.10

Notes: (a) To be assigned to a particular specialisation (crop, livestock, mixed), farm revenue from this specialisation had to be at least 2/3 of total agricultural revenue. Farms with specific specialisations account for a small proportion of farms.
1 Euro = 32.41 CZK (Average as at 31 December 2003. See: OJ C 1, 6.1.2004. Available from: http://europa.eu.int/abc/doc/off/bull/en/200312/p000559.htm.

Sources: Compiled by the authors using data from:
* Czech Statistical Office (2003); www.czo.cz.
** Research Institute of Agricultural Economics (VUZE), (2003).
*** Centre for environment and land assessment (Ekotoxa) (2003); http://www.ekotoxa.cz/.
**** Ministry of Agriculture of Czech Republic (2004).

In terms of *land use* criterion, *Crops–Oriented Sugar beet* system is the most extended, occupying 2,825,299 ha, of which 60.3 % is agricultural land. At the other extreme, *Crops–Oriented Maize* system is the less extended occupying only 389,599 ha of which 67.6 % agricultural land. The share of arable land of the total agricultural land is the highest in the *Crops–Oriented Maize* system (84.8 % and the lowest in *Mixed–Oriented Grassland* system (47.1 %). Other categories of agricultural land use reach maximum values in the case of *Mixed–Oriented Grassland* (45.3 % grassland, 4.6 % gardens).

The corresponding shares of land under the four 'identifying' crops are noticeable. Of the total land associated with maize, sugar beet, potatoes and mountainous grassland, 75 % is cultivated with sugar beet in *Crops–Oriented Sugar beet* system, 71 % with maize in *Crops–Oriented Maize,* 85 % with potatoes in *Mixed–Oriented Potatoes* system. Area under potatoes is also important in the other two remaining systems: 88 % in *Livestock–Oriented* system and 57 % in *Mixed–Oriented Grassland* so that a choice had to be made when deciding their label.

The choice implied taking into account other characteristics when labelling these systems (such as importance of livestock production for the first system and the presence of mountainous grassland areas for the latter). Finally, the share of land under organic farming in total agricultural area is the highest in *Mixed–Oriented Grassland Mixed–Oriented* system (17 %), followed by *Mixed–Oriented* system (10 %), while in each of the other systems the corresponding shares are under 2 %.

The *agro–climatic conditions* criterion contains variables related to the prevalence of Less Favourable Areas (LFA) in the territory associated with each system, as well as the land productivity of two selected crops (wheat and potatoes). The case of *Crops–Oriented Maize* system is noticeable as compared with the other Czech systems, its shares of LFA (total and by categories) in total agricultural area are small (under 1 %). The highest share of LFA land is reported for *Livestock–Oriented* (67 %) and *Mixed–Oriented Potatoes* systems. In *Mixed–Oriented Grassland* system, LFAs represent 64 % of total agricultural land, with important shares in each sub–category of LFA classification (35 % LFA mountainous, 20 % LFA specific and 9 % LFA other). As for land productivity, the highest wheat productions are reported for *Crops–Oriented Sugar beet* and *Crops–Oriented Maize* with an average of 4.7 t/ha and 4.1 t/ha, respectively.

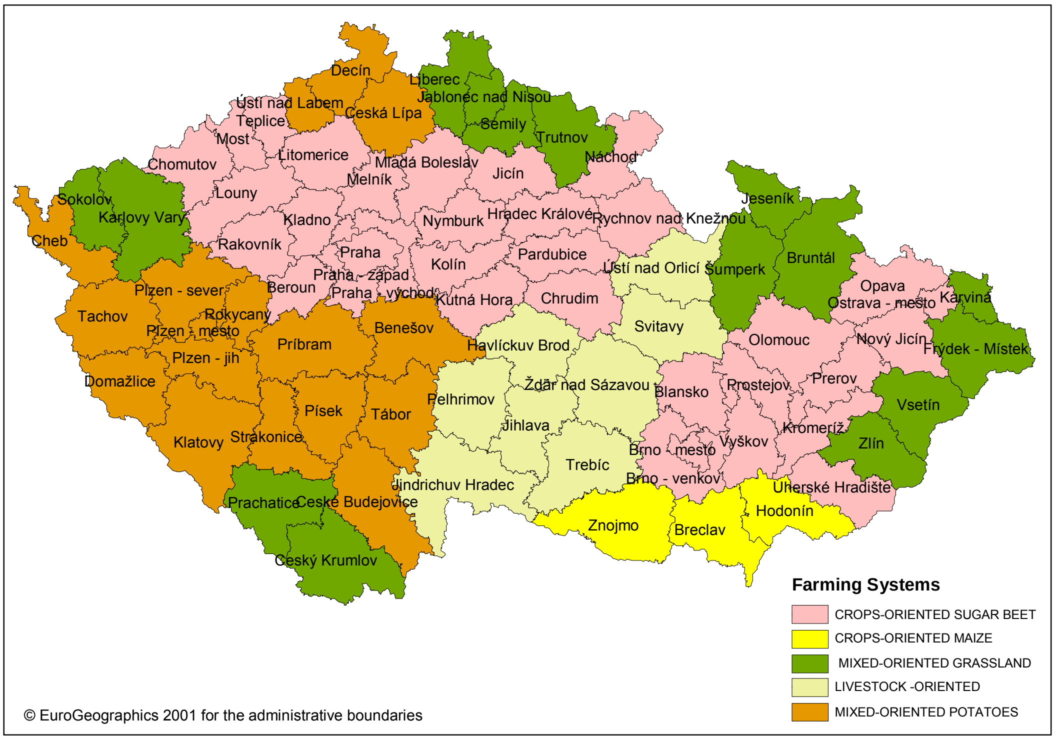
The *livestock density* criterion refers only to ruminants density in the territories associated with the five farming systems identified. The values are computed per 100 ha agricultural land (in order to grasp the overall presence of livestock in the give regions) as well as per 100 ha grassland (to relate it more closely with the pressure put on the local fodder resources). The herds size as well as the importance of grassland influence the values reported for each farming system. The highest average livestock density per agricultural land is observed for the *Livestock–Oriented* system (40.6 LU/100 ha agricultural land although only 196 LU/grassland). At the other extreme is *Crops–Oriented Maize* system with an average of 12.5 LU/100 ha agricultural land but 447 LU/100 ha grassland.

The fourth criterion refers to characteristics of *property and size of holdings* existent on the territory of each farming system. Looking at the share of agricultural land in the total agricultural land of each system, legal entities prevail in four of the five Czech farming systems (80 % in *Crops–Oriented Maize*, 77 % in *Livestock–Oriented*, 73 % in *Mixed–Oriented Potatoes*, and 70 % in *Crops–Oriented Sugar beet*). When considering the farming structures existing in the associated territory of each farming system, individual farms prevail. The most numerous individual farms are encountered in *Crops–Oriented Sugar beet* and *Mixed–Oriented Grassland* systems with 17,391 farms and 10,133 farms, respectively. The distribution by size of the farms is also described by grouping them into four size classes. In two of the five farming systems small size farms (average size below 10 ha) prevail, namely *Crops–Oriented Maize* (91 %) and *Mixed–Oriented Grassland* (76 %).

The last criterion refers to the characteristics of the population living the associated territory of each farming system. The variables included refer to the share of agricultural employees on total employees of the given system and their associated earnings (in gross monthly wage per agricultural employee and as a share of the total wage in all economic sectors existing in the region associated with each system). As also these calculations are based on available statistics, the agricultural employee category includes also those employed in hunting and forestry sectors (AHF). The highest share of AHF employees is reported for *Livestock–Oriented* system (9.27 %), the lowest for the *Crops–Oriented Sugar beet* system (3.36 %). There are no obvious differences in terms of the gross average monthly wage per AHF employees, in all systems this is about €800. In all systems, the AHF average gross monthly wage is about 75 % of that obtained in the overall economic sectors with small differences among systems.

The geographical distribution of the farming systems identified is depicted in Map 1. For each farming system, the borders of composing LAU1s are also marked. With two exceptions (*Crops–Oriented* and *Livestock–Oriented* systems) the area associated with the farming systems identified is rather dispersed across the territory. This is in particular the case of *Mixed–Oriented Grassland* system for which the associated (homogeneous) LAU1s are in five non–contiguous locations. This dispersion is the result of applying the above criteria and supports the assertion that similarities exist in relatively space–dispersed territories.

Map 1 Farming systems identified in the Czech Republic



Source: Compiled by the authors, 2005.

2.2.3 Lithuania

Following the same methodology as that applied in the Czech Republic, six farming systems are identified in Lithuania. The criteria used are the same but the associated variables are different owing to the differences in statistics available in Lithuania and the Czech Republic. Factors such as a fairly balanced production profile (including crops — mainly cereals, potatoes and fodder crops — and livestock — mainly milk, pork and beef), concentration of LFAs in certain parts of the country and prevalence of individual small holdings working most of the agricultural land are considered when identifying the Lithuanian farming systems. The average values reported in Table 2 are obtained by grouping and aggregating the variables computed at LAU1 level into farming systems.

Table 2 Main variables used to characterise the Lithuanian farming systems (average values)

DESCRIPTORS: Criteria and associated variables		FARMING SYSTEMS					
		LIVESTOCK–ORIENTED	CROPS–ORIENTED	CROPS–MARGINAL	LIVESTOCK–MARGINAL	URBAN–ORIENTED	INTER–MEDIATE
Criterion 1: Land use							
Total system area (ha)**		702,129	1,589,178	1,666,695	720,241	642,883	1,118,324
System agricultural area (ha)**		448,910	1,002,779	700,093	383,270	296,334	633,869
System agricultural area/ Total agricultural area of Lithuania (%)**		12.89	28.78	20.10	11.00	8.51	18.19
System agricultural area/ Total system area (%) **		55.88	62.58	41.98	53.21	42.41	55.79
Arable land/ agricultural area (%)**		84.05	90.49	79.82	75.18	81.49	85.35
Grasslands/ agricultural area (%)**		14.12	8.26	18.62	23.80	14.88	13.19
Orchards/ agricultural area (%)**		1.83	1.25	1.56	1.02	3.63	1.46
Production area (crop area/total area under cereals, sugar beet, potatoes and rapeseed)**	Cereals (%)	68.70	69.08	61.69	55.43	61.65	59.45
	Sugar beet (%)	2.56	3.18	0.07	0.10	1.14	0.06
	Potatoes (%)	6.47	3.43	12.79	9.54	12.52	7.50
	Rapeseeds (%)	3.58	7.69	1.57	1.94	2.86	4.44
Protected area/ Total system area (%)*◊		8.36	6.04	18.80	12.10	10.80	7.76
Total area of organic crop/ agricultural area (%) ***		0.54	0.62	2.66	1.45	1.70	0.81
Criterion 2: Agro–climatic conditions							
LFA/ agricultural area (%)*		11.42	7.00	96.59	76.65	37.90	42.56
LFA–Mountainous/ agricultural area (%)*		0	0	0	0	0	0
LFA–Specific/ agricultural area (%)*		0	2.68	0	0	0	0
LFA–Others/ agricultural area (%)*		11.42	4.31	96.59	76.65	37.90	42.56
Yields of main crops**	Cereals (t/ha)	3.47	3.42	2.06	2.68	2.70	2.44
	Sugar beet (t/ha)	42.51	36.55	34.41	22.89	37.92	32.82
	Potatoes (t/ha)	16.52	17.64	13.31	17.31	14.35	14.24
Average land quality*◘		42.39	45.49	33.53	32.64	38.25	37.45
Criterion 3: Livestock density and production							
Livestock unit density per 100 ha****	LU/100 ha of agricultural area	37.48	29.63	23.68	42.25	47.89	31.75
	LU/100 ha of grassland	265.45	358.82	127.20	177.57	321.88	240.72
Average production of milk** (t/100 ha agricultural area)		75.03	51.49	39.87	67.02	40.00	51.95
Average livestock and poultry for slaughter** (t/100 ha agricultural area L)		8.71	8.27	4.14	7.39	16.21	6.66
Average livestock products (in milk equivalent)** (t/100 ha agricultural area)		120.40	94.96	63.43	105.40	148.97	89.35

Density of cattle (heads/100 ha agricultural area)**		36.54	22.25	20.04	39.83	18.95	28.24
Density of cows (heads/100 ha agricultural area)**		17.55	11.81	11.03	18.00	10.50	13.58
Density of pigs (heads/100 ha agricultural area)**		48.34	36.67	18.21	33.75	31.66	28.43
Criterion 4: Property and holding size							
Share of agricultural area /Total agricultural area by legal form**	Legal entities (%)	10.82	24.11	4.10	2.33	9.66	7.50
	Individual farms (%)	89.18	75.89	95.90	97.67	90.34	92.50
Number of farms by legal form**	Legal entities	66	282	70	27	80	85
	Individual farms	40,159	64,287	56,190	33,437	29,251	48,177
Farms with average size <10 ha	Area ha/agricultural area (%)**	35.39	24.46	47.29	34.79	52.05	33.11
	Number**	32,877	54,452	47,521	25,321	26,602	37,468
Farms with average size 10-<50 ha	Area ha/agricultural area (%) **	32.66	20.19	34.13	44.80	23.20	39.64
	Number**	6,583	8,051	8,211	7,563	2,493	9,838
Farms with average size 50-<100 ha	Area ha/agricultural area (%)**	8.91	9.24	5.00	8.97	4.91	9.37
	Number**	486	1,061	302	421	127	645
Farms with average size >100 ha	Area ha/ agricultural area (%)**	23.04	46.12	13.58	11.44	19.85	17.88
	Number**	279	1,005	226	159	109	311
Criterion 5: Population characteristics							
Rural population** (inhabitants)		147,894	277,982	202,604	124,100	201,904	193,973
Rural population/Total population** (%)		44.81	38.91	50.45	52.78	16.82	34.36
Employees in agriculture, hunting and forestry sectors (AHF)/Total employees (%)**		4.49	7.04	3.58	2.63	1.30	2.00
Gross wage per employee in AHF* (€/month) ♦		213.93	200.57	237.52	252.11	278.01	246.01
Gross wage per employee in AHF/Total activities (%) **		92.75	81.71	94.74	105.67	113.17	85.11

Notes: ◊ Protected areas include natural and cultural reserves, national and regional parks, natural monuments and nature protection areas.

◘ The quality of soil is reflected by the soil productivity grading system (lowest – 30 points, highest – 50 points) in the Rural Development Plan 2004–2006 Lithuania, p.67.

♦ 1 Euro = LTL 3.4524 LTS (Average as at 31 December 2003. See: OJ C 1, 6.1.2004). Available from: http://europa.eu.int/abc/doc/off/bull/en/200312/p000559.htm.

This table is not comparable with Table 1 (for the Czech Republic) as several variables differ.

Sources: *Rural Development Plan 2004–2006 Lithuania, 2004.

** Last available year of publication: Department of Statistics of Lithuania, 2004. Counties in Lithuania 2003–Economic and social development. 502 pp. Vilnius, Lithuania.

*** Ekoagros, 2004.

**** Department of Statistics of the Republic of Lithuania, 2005. Results of the 2003 Total Agricultural Census in Lithuania by county and municipality. Vilnius, Lithuania.

By the land use criterion, the widest Lithuania system identified is *Crops–Marginal* (covering 1,666,695 ha), followed by *Crops–Oriented* system (1,589,178 ha). The highest share of agricultural area is reported for *Crops–Oriented* system (63 % of total area of this system), the lowest, ca. 42 %, in the case of *Crops–Marginal* and *Urban–Oriented* systems. Of the total agricultural area of each farming system, the prevailing land use category is arable land, with values ranging from 90 % in *Crops–Oriented* system to 75 % *(Livestock–Marginal* system*)*. The share of grassland in the total agricultural area of the corresponding system is high in *Livestock–Marginal* system (ca. 24 %). Orchards category represent about 3.6 % of total agricultural land in the *Urban–Oriented* system while for the other systems the corresponding shares are under 2 %. The four 'identifying' crops used to distinguish the production profile of the Lithuanian systems are cereals, sugar beet, potatoes and rapeseed. In all systems, most of the total land of these four crops is under cereals (the shares ranging from 69 % in *Crops–Oriented* to 55 % in *Livestock–Marginal* system). In all systems areas, under rapeseed and sugar beet are small (maximum of 3 % of land is cultivated with sugar beet and maximum 7.7 % of land is under rapeseed in *Crops–Oriented* system). Relatively more important areas are cultivated with potatoes (ca. 12 % of the total land under the four 'identifying' crops are in *Crops–Marginal* and *Urban–Oriented* systems). Relatively important shares of their corresponding land (compared with the other systems) are classified as protected areas in two systems, namely 19 % in *Crops–Marginal* and 12 % in *Livestock–Marginal* system, from where the attribute *marginal* in the label of the systems. Additionally, 2.7 % of land in *Crops–Marginal* system is under organic farming, while in the rest of the systems this value is under 2 %.

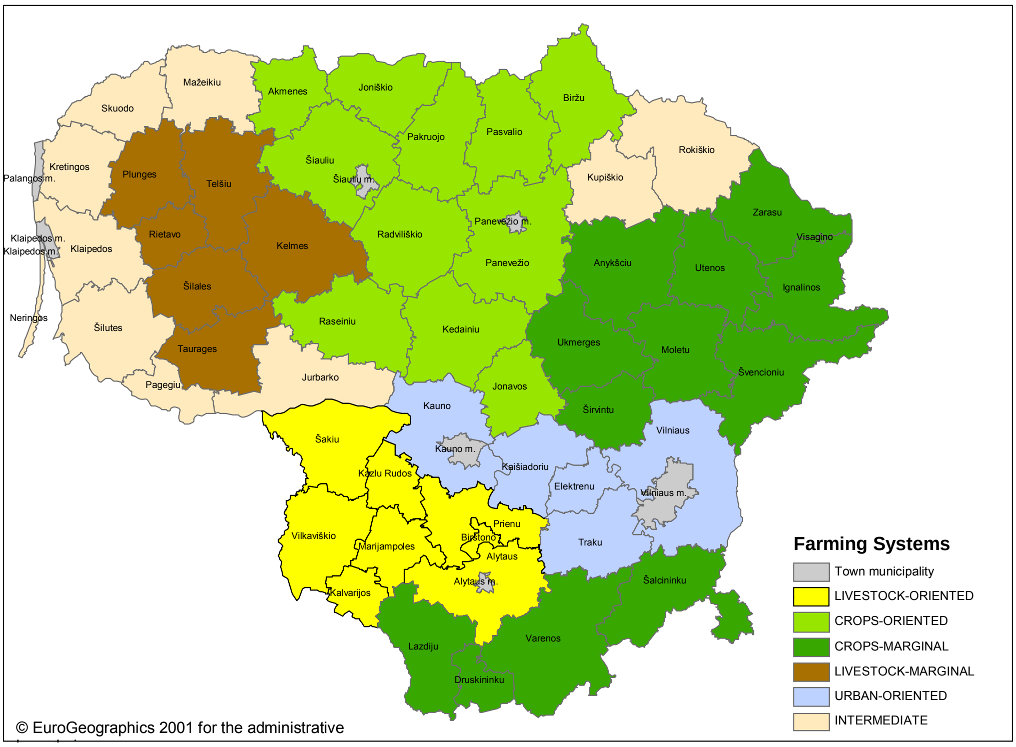
The *agro–climatic conditions* criterion includes variables related to the presence of LFA in the associated territory of the farming systems. The highest share of LFA in the agricultural area of the system is reported for *Crops–Marginal* system (97 %), the lowest in *Crops–Oriented* system (7 %). In terms of yields of prevailing crops, in four of the six systems cereals yield is under 3 t/ha, and only in *Livestock–Oriented* and *Crops–Oriented* systems the yields are slightly over this value reaching an average of 3.4 t/ha. Average sugar beet yield is also the highest in *Livestock–Oriented* system (42.5 t/ha), while the highest average potatoes yield is reported for *Livestock–Marginal* system (17.3 t/ha). The average land quality assessed on a 30 (min) to 50 (max) scale is rather low in all systems, as only in two systems the values are above 40 (42 in *Livestock–Oriented* system and 45 in *Crops–Oriented* system).

The variables associated with the *livestock characteristics* criterion refer as in the Czech Republic at livestock density per 100 ha of agricultural land as well as per 100 ha grassland. In the first case, the highest average value is reported for *Urban–Oriented* system (48 Livestock Units (LU) per 100 ha agricultural land), while in the second case, the highest density is reported in the case of *Crops–Oriented* system (359 LU/100 ha grassland). In the case of *Urban–Oriented* system, the average livestock and poultry for slaughter (16 t/100 ha agricultural land) and average livestock products (in milk equivalent) of 149 t/100 ha agricultural land reach maximum values compared with the other Lithuanian systems. This outcome suggests an orientation of the production towards the large urban nuclei (located in the territory of this system), and justifies the attribute *urban* in its label. The highest densities of cattle and cows are reported for the *Livestock–Marginal* system (ca. 40 heads/100 ha agricultural land and 18 heads/100 ha agricultural area). In *Livestock–Oriented* system, pig density reaches the highest value (48 heads/100 ha agricultural land), while in the other systems the values are around 30 heads/100 ha agricultural land.

As in the case of the Czech systems, *individual farms* prevail in the farming structure of all Lithuanian systems. The highest share of agricultural land farmed in individual farms is reported in *Livestock–Marginal* system (98 % of the total agricultural land of this system) and the values are around 90 % also for the other systems except for *Crops–Oriented* system (76 %). In terms of distribution by farm size, small farms (under 10 ha) prevail in *Crops–Oriented* system (54,452 units representing ca. 24 % of agricultural area of the system). In *Livestock–Marginal* system, middle size class farms (10–50 ha) farm 45 % of the agricultural area, while large farms (over 100 ha) prevail in the farming structure (compared with the other systems), covering 46 % of agricultural area (1,005 units).

As for the *population characteristics* criterion, the share of rural population in total population of the associated territory of a given farming system reaches the highest value in *Livestock–Marginal* system (53 %), closely followed by *Livestock–Marginal* system (51 %). The highest level of agricultural employment is reported for *Crops–Oriented* system (7 %) whereas the average monthly gross wage per employee is around €200 in all systems. The location on the Lithuanian territory of the farming systems identified is depicted in Map 2. Contrary to the situation observed in the Czech Republic, the farming systems identified here are more compact, except for *Crops–Marginal* and *Intermediate* systems (each in two locations).

Map 2 Farming systems identified in Lithuania



Source: Compiled by the authors, 2005.

2.3. Identification of sustainability dimensions

The concept of sustainability applied to agriculture has emerged in response to increasing concerns about the adverse environmental and economic impacts of intensive agriculture (Rasul and Thapa 2003). The definition of sustainable agriculture often depends on the field or professional background of researchers (Haberl, Fisher–Kowalski *et al.* 2004). Moreover, the definition is continuously modified to reflect for example "increasing concern over agriculturally–related environmental problems" (Lockeretz 1988, p. 32). The diversity of definitions lead to a range of views about what are the aims of sustainable agriculture, the list including goals such as *(i)* achieving food sufficiency, *(ii)* ensuring the stewardship of natural resources, *(iii)* maintaining social well–being (Peterson and Norman 2001) or community (Lowrance, Hendrix *et al.* 1986), *(iv)* sustenance of welfare over time. This diversity of views is somehow justified by the fact that "agricultural sustainability tends to be site–specific (i.e. at the field, farm, and community levels)" (Peterson and Norman 2001, p.13; also Byerlee and Murgai 2001), and it is strongly influenced by developments at higher levels (i.e. national policies, globalisation trends, or international markets). Disagreements in defining sustainable agriculture emerge from *(a)* different views about what is to be sustained (e.g. constant consumption, constant stock of natural resources, intergenerational equity), *(b)* length of time during which the characteristic(s) are to be sustained, *(c)* adequate thresholds against which to evaluate the current sustainability level and/or to account the eventual reach of agricultural sustainability and *(d)* methodological issues (Carpenter 1995; Sen 1992). Consequently, agricultural sustainability was defined either in *techno–economic*, *ecological* (ability/not to support the current level of per capital consumption for a continuously population growth), or *community* (supporting self–reliant stewardship–conscious rural communities) terms (Ruttan 1994). Most definitions, however, seem to converge to three dimensions and goals of agricultural sustainability, namely economic efficiency, environmental stability and intergenerational equity (Pannell and Schilizzi 1999). Ideally a holistic appraisal of agricultural sustainability should integrate at least these three dimensions. Other dimensions such as the institutional one are also sometimes included in the analysis. González Laxe and Martín Palmero (2004) add some regional–relevant aspects such as communication infrastructures and investigation and development expenses. Zhen and Routray (2003) remark that sustainable agriculture is a time– and space–specific concept and its assessment should be closely linked to the context in which the specific farming system is taking place. A broader understanding of sustainability extends, however, to also include a set of features linked to land and land use such as the protection of landscapes, habitats, and bio–diversity, and to overall objectives such as the quality of water and air.

2.3.1 Methodological approach

For this study, the definition of a sustainable farming system is based on the view that "sustainable farming systems … must be resource–conserving, socially supportive, commercially competitive and environmentally sound" (Ikerd 1993). This definition contains the three main dimensions of agricultural sustainability namely the social, economic and environmental ones. The aim here is to attach to each of these dimensions quantitative indicators that can be extracted or built based on available secondary data. As relevant statistical information below the LAU1 level is difficult to obtain from the countries considered here, this level is adopted as the minimum territorial level for both agricultural systems delimitation and the assessment of sustainability.

The farming system is seen here as the appropriate level to investigate agricultural sustainability, providing conclusions relevant for the policy–making process, since the farming system is the level where overall managerial decisions take place, and "the notion of sustainable agriculture require us to consider how farming systems ought to appear if they are part of an economy on a sustainable path" (Peterson and Norman 2001, p. 8). This approach is also appropriate in the context of the 2003 reform of the CAP that shifts the emphasis of support from commodity to farm level.

The methodology used here builds on González Laxe and Palmero (2004) approach, itself having as main antecedent the one developed for the assessment of environmental sustainability among EU countries at Yale and Columbia Universities (see Esty *et al.* 2005). Briefly, González Laxe and Palmero approach relies on 78 variables, 37 sub–indicators and 13 indicators to construct country–level indices of sustainability along the economic, social, environmental and institutional dimensions. The indices are subsequently aggregated into a synthetic index of sustainability computed for each EU countries. This study adapts the above methodology to the assessment of sustainability at the farming system level and focuses only on the economic, social and environmental dimensions. The adaptation requires identification and selection of relevant variables, indicators and dimensions and is influenced by the statistical information available at LAU1 level and the expert knowledge and choice of the research team in assigning variables to one or another dimension.

Given the multi–dimensionality of the sustainability concept, a review of the related literature on agricultural sustainability, its evaluation and measurement is first carried out refining a pre–existing list (see Cáceres *et al.* 2004 for details), identifying this way the most frequently used and relevant indicators.

The economic, social and environmental dimensions of farming system sustainability are investigated based on partial indicators. The indicators taken into account to construct the *environmental sustainability index* relate to livestock density, soil erosion, nitrate pollution, area under organic farming and biodiversity of the system. The *social sustainability index* includes information on population (density, share of elderly population, rate of variation), farming land concentration and unemployment rate. The e*conomic sustainability index* includes information about the degree of size fragmentation of regional farming structures, presence of less favoured areas, income and prevailing groups of crops (see Annex 2 for details).

Once all indicators and their respective variables are selected, the methodological steps are:

1. compile all basic data at LAU 1 level (or higher aggregation level if LAU1 data unavailable);

2 obtain a unique value for each variable of each farming system. *From this step on, all calculations are at the farming system level;*

3. compute the standardised value of each variable to rend them comparable and to group them into indicators. This operation has been carried out separately for each country. The standardised values have been obtained through two different ways, namely

$$Z_{si} = \frac{X_i - \overline{X}}{\sigma x}$$ for variables with a direct link with sustainability, and

$$Z_{si} = \frac{\overline{X} - X_i}{\sigma x}$$ for those with an inverse sense

where Zsi is the value of the standardise i^{th} variable at farming system level, $\overline{X}$ is the mean of the distribution at farming system level, Xi is the value of a variable at the farming system level, σx is the standard deviation of the distribution at the farming system level. When an indicator is the result of more than one variable, its standardised value is obtained by calculating the arithmetic mean of the component variables. For the rest of the cases the value of the indicator is the same as the one of the standardised variable;
4. obtain the standardised variable for every dimension as the arithmetic mean of standardised variables calculated for indicators;

5. normalise the standardised variables so they can be ranked and compared. For this, the value obtained for every dimension becomes a normal standard percentile taking values from nil to 100. *Values obtained this way are not absolute sustainability values; they allow defining a sustainability ranking of the farming systems in each of the three dimensions*.

6. obtain the global Farming System Sustainability Index (FSSI) as the unweighted arithmetic mean of percentiles calculated for each sustainability dimension. As in the previous case, the global index is used to establish a sustainability ranking of the farming systems and it is not an absolute sustainability value.

Given the country case study approach used, two rankings are derived, one for each country. Comparisons between the two countries are to be treated with care owing to different variables and scales used for some indicators (e.g. livestock density, soil erosion, etc.) see Annex 5. Farming systems are then ranked descending based on its value (a lower value placing the corresponding system lower in the ranking). The ranking so defined allows comparisons with the other systems identified within the same country. The main outcomes of ranking the systems upon the partial indices of sustainability associated with each dimension are reported in the next section. When interpreting the results, one has to consider that the results reported herein are the consequence of criteria and variables utilised, at their turn the selection of the later being based on the expert knowledge of the research team and available data from LAU1 level in each country.

2.3.2 The Czech Republic

Table 3 reports the environmental, economic and social sustainability indices computed for each Czech farming system as well as the synthetic index (FSSI).

Table 3 Sustainability dimensions and indices of the Czech farming systems

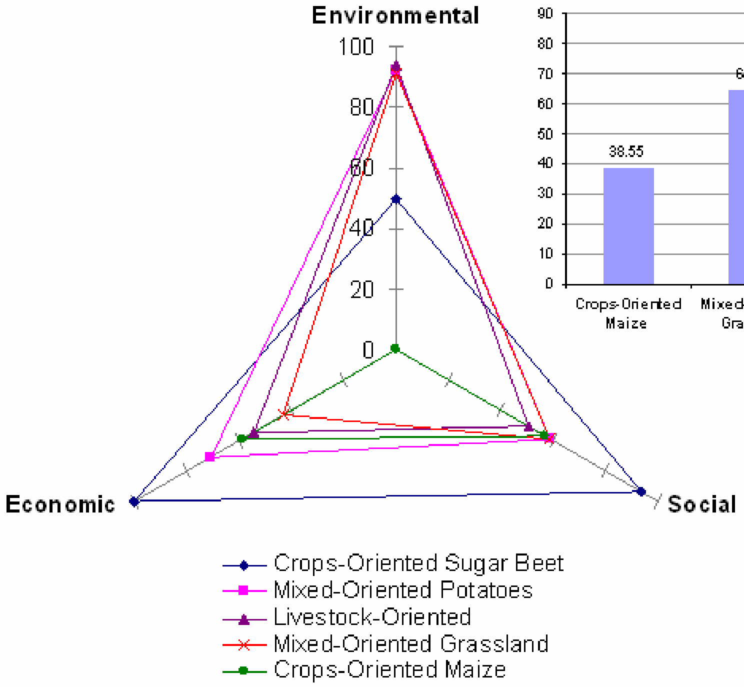
Farming system	Sustainability dimension and indices			Farming System Synthetic Index
	environmental	social	economic	
Crops–Oriented Sugar Beet	49.82	93.72	100.00	**81.18**
Mixed–Oriented Potatoes	92.35	58.99	70.82	**74.05**
Livestock–Oriented	93.99	50.26	54.41	**66.22**
Mixed–Oriented Grassland	91.26	58.96	43.26	**64.49**
Crops–Oriented Maize	0.00	56.72	58.93	**38.55**

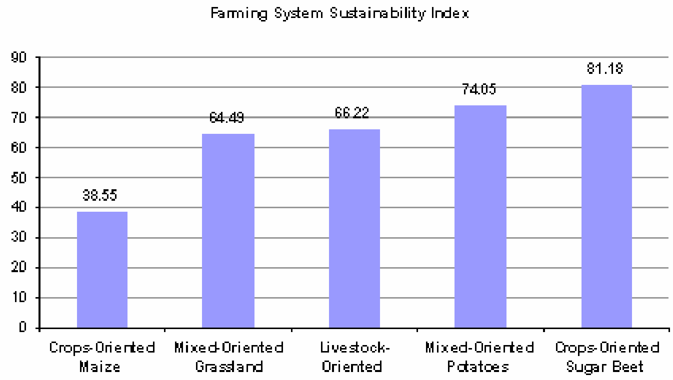
When considering the environmental sustainability index, three farming systems have high and rather close values, namely *Livestock–Oriented* (94), *Mixed–Oriented Potatoes* (92) and *Mixed–Oriented Grassland* (91). The exception is *Crops–Oriented Maize* system for which the value of the environmental sustainability index is nil. Along the social dimension the values are under 60 for all but one system. The exception is *Crops–Oriented Sugar beet* system for which the value of the social sustainability index is high (94). Furthermore, this system reports the maximum value also for the economic dimension while for the other systems the value of this index is low (below 60 for *Livestock–Oriented*, *Mixed–Oriented Grassland* and *Crops–Oriented Maize* systems and 71 for *Mixed–Oriented Potatoes* system). The overall ranking based on the value of synthetic sustainability index places *Crops–Oriented Sugar beet* system on the first position (owing to the high values of the indices for the social and economic dimension) and *Crops–Oriented Maize* system on the last one (mainly the result of the nil value of the index for the environmental dimension).

The methodology used here allows tracing back the variables that lead to such outcome. In the case of *Crops–Oriented Maize* system, this is the result of highly negative values of almost all associated environmental indicators, above all those related to high soil erosion and low livestock density (see Annex 5 for average values of variables for each farming system; also Annex 6 for standardised values of indicators and Annex 7 for standardised values by sustainability dimension).

A summary of the sustainability dimension of the Czech systems together with the ranking upon the value of the FSSI index is illustrated in Figure 1.

Figure 1 Summary of farming systems ranking along sustainability dimensions (Czech Republic)





2.3.3 Lithuania

Table 4 reports the results of environmental, social and economic sustainability indices obtained for each Lithuanian farming system, together with the synthetic sustainability index.

Table 4 Sustainability dimensions and indices of the Lithuanian farming systems

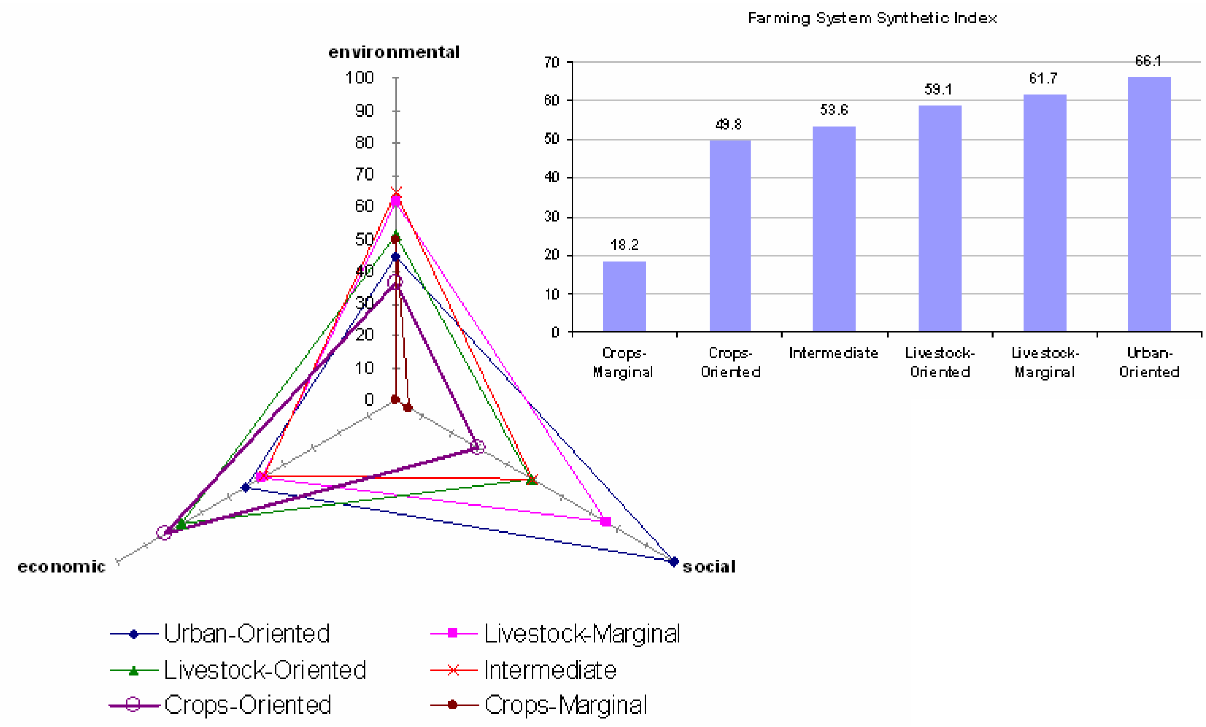
Farming system	Sustainability dimension and indices			Farming System Synthetic Index
	environmental	social	economic	
Urban–Oriented	44.55	100.00	53.78	**66.11**
Livestock–Marginal	61.36	76.10	47.61	**61.69**
Livestock–Oriented	51.52	48.73	76.98	**59.08**
Intermediate	64.51	49.13	47.03	**53.56**
Crops–Oriented	36.51	29.82	82.97	**49.77**
Crops–Marginal	49.92	4.60	0.00	**18.17**

The values of the environmental sustainability index range from about 37 (*Crops–Oriented* system) to 65 (*Livestock–Oriented* system). Within the social dimension, the variation between minimum and maximum values is noticeable. While the maximum possible value for an index (according to the methodology followed) is reported for the *Urban–Oriented* system, the lowest value (ca. 5) is encountered for the *Crops–Marginal* system. To explain this outcome, one has to examine the variables that enter in the composition of this dimension (see Annex 5). *Crops–Marginal* system is characterised by the highest share of elderly population in the associated territory (24 %) compared with the other systems, lowest average population growth (7.4 ‰) and population outflow (migratory balance over the last two years is -1.53, the lowest of all Lithuanian systems).

A similar situation to the one observed for the social dimension is encountered in the economic dimension. The indices associated with this dimension vary from nil (*Crops–Marginal* system) to 83 (*Crops–Oriented* system). Again, examination of the values reported in Annex 5 gives an indication of which variables explain such outcome. In the case of *Crops–Marginal* system, particularly the high share of land classified as LFA (97 % of total land associated with this system), lower yields for some crops and relatively lower average monthly wages (95 % of the level in the economic sectors of the region) explain the value of associated index.

Overall, when ranked upon the value of synthetic sustainability index, *Urban–Oriented* system ranks first (mainly owing to the maximum value reached for the social sustainability index), and *Crops–Marginal* system ranks last, with low values for both social and economic dimensions. A summary of the sustainability dimension of the Lithuanian systems together with the ranking upon the value of the FSSI index is illustrated in Figure 2.

Figure 2 Summary of ranking farming systems upon sustainability dimensions (Lithuania)



When considering the results in both countries, although strong conclusions cannot be derived given the methodological shortcomings mentioned earlier, Czech farming systems report higher sustainability values than their Lithuanian counterparts in all three dimensions (the difference in aggregated FSSI is about 13 points). The main variables leading to such results in Lithuania are: low share of organic agriculture, significantly higher concentration of elderly population in rural areas, especially low population density (three times lower than in the Czech Republic case), high unemployment and high share of small holdings. Although average monthly gross wages per employee are higher in the Czech Republic, the difference between agricultural wages and wages in other activities is smaller in Lithuania.

2.4. Conclusions

The results of investigating the sustainability dimensions at the farming system level indicate that the leading sustainability dimension (i.e. the one that causes their position among the other systems in the overall ranking) varies among the systems. For example, those systems associated with so–called marginal territories (mountainous areas; areas with a high share of LFAs) such as *Crops–Marginal* system in Lithuania reach higher values for the index of environmental dimension. Such outcome is mainly the consequence of a high share of land under organic farming in the associated region that compensate for the negative impact of low crops diversification when constructing the corresponding environmental sustainability index. For more specialised systems as is the case of C*rops–Oriented Sugar beet* system in the Czech Republic or *Crops–Oriented* system in Lithuania, the economic dimension is the leading one, mainly as a result of better agro–climatic conditions that characterise the associated territories of these farming systems. When considering the values of the social sustainability index, the gap between the first and the last system in the overall ranking is particularly noticeable in Lithuania (95 points difference) compared with the Czech Republic (37 points difference). The outcome suggests a more imbalanced social situation (judged upon the quantitative variables used to construct the associated index) across the Lithuanian territories and the important effect urban proximity has in shaping not only the production profile of the farms but also their earnings level (see the case of Lithuanian *Urban–Oriented* system that has the largest two cities of the country located in its territory and for which the social sustainability index reaches the maximum value; a similar situation occurs in the case of Czech *Crops–Oriented Sugar beet* system where the social sustainability index reaches the highest value compared with the other Czech systems considered).

The main factors characterising the systems *ranking low* according to one or another dimension of sustainability are similar in both countries:

- A low environmental sustainability position in the ranking is associated with a too low livestock density (which is important for conservation of meadows and pastures), high soil erosion, high nitrate pollution and low crop diversification.
- A low social sustainability position in the ranking is associated with farming systems characterised by low farmer density in the associated territory, concentration of elderly population in rural areas and small size of farms.
- A low economic sustainability position in the ranking is associated with farming systems characterised by the high share of LFAs in the associated territory, low land productivity and low farm income.

The methodological approach, particularly the variables selected and associated with each of the sustainability dimensions influence the final outcome and the results reported here should be understood from this perspective. The selection of variables is at its turn guided by the availability of statistics at the level of analysis considered here, as well as by experts' choice of variables and their allocation to one or another sustainability dimension. Consequently, the results reflect these choices and data used. The methodology is relatively simple but innovative and sufficiently flexible to be applied in any other country context where statistics from such a disaggregated level exist. The results should be seen primarily as illustrating the method rather than being uncritically used as input in the policymaking process. Particularly, the choice of variables associated with each dimension of sustainability should be selected through a consultation of all interested stakeholders, especially if the results are to be used to support a decision–making process.

3 DETERMINANTS OF ADOPTING ORGANIC FARMING

3.1. Introduction

The environmental and economic problems associated with intensive farming lead many farmers to improve production technologies or to seek alternative approaches. At the same time, a wide interest exists among agricultural policymakers and researchers regarding the process of adopting sustainable farming practices, barriers for adoption, and possible measures to promote the adoption of sustainable farming practices.

Having identified in a first step the sustainability dimensions of various regional farming systems, the analysis in this study turns now to investigate the key determinants of adopting sustainable farming practices. The aim is to investigate what differences exist in terms of factors that influence the adoption behaviour among farming systems in the context of the countries selected. The analysis is limited to organic farming without assuming that sustainable agriculture and organic farming are synonymous, but that organic farming is part of the development of sustainable practices cited in the literature (Pretty 1995; Cobb, Feber *et al.* 1999; Rigby and Cáceres 2001; van Elsen 2000; Helander and Delin 2004; Madre *et al.* 2002). The reasons to limit the analysis to organic farming also include the existence of clear definition and identification criteria supported by European and national legal frameworks;[4] regulated production standards associated with this farming practice, as well as the support it receives through national and European funding schemes. When adopting new technologies or different agricultural practices numerous factors affect adoption decisions. The relevant literature indicates a wide range of social, economic and environmental factors determined by local and regional milieu in which the farmer operates, including agronomic and market conditions, land tenure and infrastructure (Feder and Umali 1993; Franzel, Coe *et al.* 2001); farmers' skills level or technical capacity (Rosenberg 1972; Hall and Khan 2003); environmental and institutional factors (Hall and Khan 2003).

3.2. Methodological approach

The methodology to identify the key determinants influencing the decision to convert to organic farming includes the following steps:

1. Identification of the structure of organic and non–organic farms

First, based on national FADN data, the structural characteristics of a typical (average) non–organic farm, at country and at farming system levels (i.e. LAU1 grouped), are identified. For

[4] In the EU context, organic farming is currently the only environmental-friendly farming practice recognised and supported by a Council Regulation EEC N° 2092/91 (in OJ L 198, 22.7.1991, p. 1). The Regulation (further amended) is organised around three instruments, namely: regulated standards (production rules), certification procedures (compulsory inspections schemes), and a specific labelling scheme. Council Regulation establishes a 'de minimis' set of standards; regional administrations or/and certification bodies could apply new standards where competent and develop the practices already included in the Regulation.

each case, individual farms and legal entities are described separately. Second, information collected via field survey regarding the main enterprises and total farm size is used to describe the farm structure of organic and non–organic farms associated with each of the farming systems previously identified. To this aim, the shares of different crops (in terms of land area) and livestock (in terms of livestock units calculated according to FADN methodology, 2002[5]) in the total structure of each farm interviewed are computed. The average farm structure per farming system in each country is then obtained as a simple arithmetic mean.

2. Opinions of experts regarding the adoption of organic farming

To support the interpretation of the information from the field survey, in particular to be able to place the results in the national context, expert knowledge is collected through mail survey from several national experts in the two countries. The opinions collected through questionnaires relate in particular to the economic and social aspects of organic farming in the national context.

3. Social characteristics of organic and non–organic farms

A comparison at the country level between the social aspects of organic and non–organic farms is carried out in order to draw the social profile of organic and non–organic farmers.[6] Building on the same approach as Young (1997), some comparisons of labour used in organic and non–organic farms (in terms of age, educational level and labour use) are carried out mainly based on information collected from the field survey. Data corresponding to each variable are compiled and average values are obtained for both organic and non–organic farms. The results are compared with the opinions received from the national experts.

4. Key determinants of adopting organic farming

The determinants of adopting organic farming are extracted from a pool of factors extracted from screening the relevant literature.[7] Building on the results of a previous study (Cáceres *et al.*, 2004), the list of determinants is modified in order to: (1) adapt it to current research context; (2) take into account the opinions of the national experts, and (3) support drawing up the questionnaires to farmers. The following questions, containing the determinants of adopting organic farming, have been included in the questionnaires to farmers:[8]

- *Organic farming is more environmentally respectful and produces better (higher quality) food.*

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[5] Community Committee for the farm accountancy data network (FADN) Definition of variables used in FADN standard results RI/CC 882 Rev.7.0.

[6] Owing to incomplete or even inexistent answers in the interviews, analysis at local/farming system level would have no relevant outcomes.

[7] The starting list of decision factors was developed in a previous study (see Cáceres *et al.* 2004).

[8] For each of these questions, the interviewee is then required to provide further details in order to bring support to the reply provided.

- *My farm fitted (qualified) the certification requirements for organic farming.*
- *There is an accessible market for organic production/someone buys the organic produce of the farm.*
- *Organic farming is more profitable than non–organic farming.*
- *There were organisations/others that advised the farmer / I (the farmer) knew how to produce organically.*
- *I (i.e. the farmer) had access to suited machinery/technology required for organic farming.*

Based on the field survey, the determinants are scored, and the results classified and analysed. Where appropriate, the analysis is carried out at the country/farming system, obtaining aggregated results. When analysing the determinants of adoption, field data and opinions of the experts are compared and integrated wherever available. In addition, a break down of farms according to their location in or outside LFAs and by managerial form is done in order to investigate how agro–climatic conditions and business organisation influence farming decisions.[9]

5. Economic impact of adopting organic farming

An evaluation of the differences in the economic position between organic and non–organic farms based on gross farm income (as reported in the national FADN databases) is carried out. To this aim, FADN data for the main productions of non–organic farms in each country is used as a starting point. Standard farms are defined considering the average data corresponding to the production structure of FADN sample in each farming system. Second, using field survey data, differences in yields, prices, variable costs and taxes are evaluated at the country level for organic and non–organic farms based on average values of these variables for each farming system. Subsidies are estimated applying the values set by national regulations to the standard farms of each farming system (taking into account the different productive structure of each standard farm). Finally, the obtained differences applied to baseline data and variables as Total Output, Intermediate Consumption or Gross Farm Income are calculated per hectare for organic productions and compared with those reported for non–organic farms.

6. Case studies at farming system level

Finally, based on the field survey data, a comparative analysis is carried out between organic and non–organic farms corresponding to each farming system identified. The analysis relies on a case study approach, and focuses on the economic (total sales income, variable costs, subsidies and taxes), and social (age, educational level, etc. of the labour force) aspects. The

[9] Information about the location of the farms interviewed was included in the questionnaires applied in both countries.

farms are selected as case studies considering their production technology profile (organic vs. non–organic) and their close similarity of other characteristics.[10]

In terms of data, the main source used is the field survey.[11] A total of 62 interviews were carried out in August 2005 in the Czech Republic (of which 30 organic farms and 32 non–organic farms). In Lithuania, 89 farmers were interviewed (of which 23 organic farms and 66 non–organic farms). Furthermore, for each of the sub–groups the analysis distinguishes between family farms and corporate companies (i.e. the interviews in the Czech Republic included 20 organic family farms, 10 organic corporate farms, 15 non–organic family farms and 17 corporate farms; in Lithuania the interviews included 23 organic family farms, 54 non–organic family farms and 12 non–organic corporate farms). The lack of adequate information from the desired level of analysis and by the sub–groups of interest prevented the extraction of the samples following statistical criteria. Consequently, the results reported are not statistically representative, their main merit being in bringing to fore detailed information otherwise unavailable to date. For each farming system, the size and structure of farms interviewed in each country is provided in Annex 3.

The social characteristics of the organic adopters and non–adopters are investigated using primary information also collected via questionnaires applied during the field survey. The information refers mainly to characteristics of the head of the farm and the farm labour used. The number of farmers who answered to these questions is small (19 organic farms and 15 non–organic farms in the Czech Republic; 23 organic farms and 53 non–organic farms in Lithuania) and the results reported are not statistically representative.

A comparative analysis of the impact of adopting organic farming on the crops and livestock yield, prices and input use is carried out for each farming system using information from the 2005 field survey carried out. For this, farms are organised pair wise (one organic and one non–organic farm) with similar characteristics (in terms of legal type, main farm enterprises, etc.) and their data (related to market income, variable costs, subsidies and taxes) contrasted. This last exercise, without claiming that its results are representative at national level, brings to fore valuable empirical information for the policymakers and about the economic position of the farms in 2005, the first year post-accession of the two countries.

3.3. Structural and social characteristics of organic and non–organic holdings

3.3.1 Structural characteristics

The investigation of structural characteristics is carried out under the assumption that the structure of organic holdings (associated with a given farming system) may have different

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[10] Given the large amount of detail, the information is not reported here but is available from the authors by request.

[11] The field survey was commissioned by the authors and sub-contracted to specialised institutions in Lithuania and the Czech Republic. In order to homogenise the nomenclature used in both countries, the Czech term 'individual farms' is applied also to Lithuanian family farms and the Czech term of 'legal entities' is applied to Lithuanian agricultural companies as well. This simplification was assumed after consulting the national statistical agencies in both countries.

features compared with that of a non–organic holding (in the same system). Therefore, based on the data collected through the field survey, 'typical' organic and non–organic holdings (at country and farming system levels) are demarcated and examined in more detail. These sample–based holdings provide information on the production profile, distribution and structure of organic and non–organic holdings associated with each farming system.

The Czech Republic

A general description of the aggregated (country level) sample is reported in Table 6. The organic farms interviewed represent 3.6 % of all organic holdings in the Czech Republic and 3.1 % of total certified agricultural land in the country. According to field survey data, non–organic Czech farms interviewed are larger than the organic ones, except in the case of individual organic farms. The highest share of organically farmed land is under pastures and meadows, followed by arable land. In non–organic holdings the structure of land use is completely the opposite, with arable land prevailing, while meadows and pastures occupy significantly smaller areas.

As for livestock, a high concentration of beef cattle, followed by pigs and sheep, is characteristic for organic farms. In contrast, non–organic farms have a more homogeneous distribution of different types of livestock, the prevailing categories including pigs, dairy cows and beef cattle.

Table 5 General description of the sample in the Czech Republic

Variables		Organic				Non–Organic			
		Individual farms	Legal entities	Total		Individual farms	Legal entities	Total	
Total sample		**20**	**10**	**30**		**15**	**17**	**32**	
Total farm land (ha)		**3,151.4**	**5,139.9**	**8,291.3**		**1,358.9**	**30,445.0**	**31,803.9**	
Average size (ha)		157.6	514.0	276.4		90.6	1,790.9	993.9	
Total land use (ha)	**Arable**	774.7	1,281.9	**2,056.6**	**24.80%**	838.2	23,833.0	**24,671.2**	**77.57%**
	Orchards	3.0	59.0	**62.0**	**0.75%**	30.1	200.0	**230.1**	**0.72%**
	Vineyards	13.5	0.0	**13.5**	**0.16%**	1.2	75.0	**76.2**	**0.24%**
	Pastures	1,720.1	2,762.0	**4,482.1**	**54.06%**	205.3	2,660.0	**2,865.3**	**9.01%**
	Meadows	640.0	1,037.0	**1,677.0**	**20.23%**	221.1	2,901.5	**3,122.6**	**9.82%**
	Forest	0.0	0.0	**0.0**	**0.00%**	53.0	612.0	**665.0**	**2.09%**
	Other	0.1	0.0	**0.1**	**0.002%**	10.0	163.5	**173.5**	**0.55%**
Total livestock (LU)	**Dairy cows**	10.0	4.0	**14.0**	**0.69%**	220.0	4,909.0	**5,129.0**	**29.77%**
	Beef cattle	629.5	974.0	**1,603.5**	**78.74%**	237.0	3,751.0	**3,988.0**	**23.15%**
	Pigs	210.0	0.0	**210.0**	**10.31%**	143.7	7,124.4	**7,268.1**	**42.19%**
	Sheep	95.2	19.3	**114.5**	**5.62%**	5.1	35.0	**40.1**	**0.23%**
	Goats	0.5	0.0	**0.5**	**0.02%**	0.4	8.0	**8.4**	**0.05%**
	Poultry	2.2	0.0	**2.2**	**0.11%**	0.0	791.0	**791.0**	**4.59%**
	Other	2.4	89.4	**91.8**	**4.51%**	0.0	4.2	**4.2**	**0.02%**

Notes: Percentages of total land used by type of land use.

Source: Field survey, August 2005.

Almost all utilised agricultural land in the Czech sample is rented (86.7 % organic holdings and 82.1 % non–organic). Individual farms show higher shares of owned land (26.5 % organic farms and 22.4 % non–organic farms) than legal entities (2.9 % organic farms and 4.2 % non–organic farms) (Table 7).

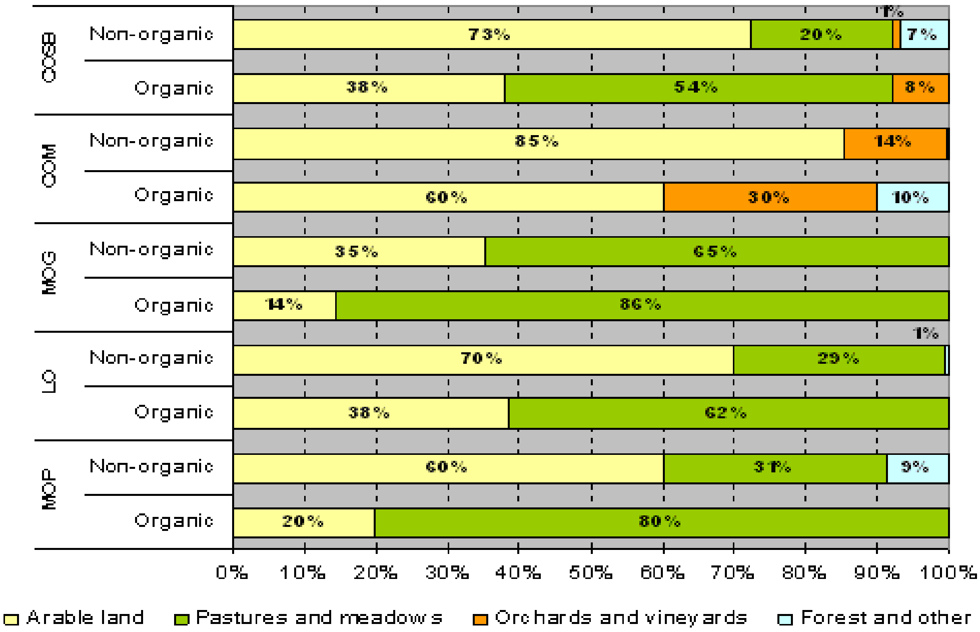
Table 6 Type of land tenure in the Czech Republic

Total land farmed	Type of farm					
	Organic			Non–organic		
	Individual farms	Legal entities	TOTAL	Individual farms	Legal entities	TOTAL
Owned (%)	26.5	2.9	**13.3**	22.4	4.2	**4.9**
Rented (%)	73.5	97.1	**86.7**	77.6	82.3	**82.1**
Leased (%)	0.0	0.0	**0.0**	0.0	13.5	**13.0**
Total land (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Field survey, August 2005.

The structure (in terms of land use and livestock) of the average organic and non–organic holding associated with each farming system is also presented. The values summarised in Figure 3 are average value of all interviewed holdings in each system. The results indicate similar values to those obtained at the country level. In the Czech Republic (Figure 3), farmed land in the average holding of all farming systems is mainly arable land and pastures and meadows. Nevertheless, noticeable differences exist between systems and between organic and non–organic holdings. Non–organic holdings, in all farming systems, allocate a higher share of total land to arable land compared with organic holdings, except for *Mixed–Oriented Grassland* system, where meadows and pastures prevail in the land use pattern. In contrast, organic holdings have larger plots of pastures and meadows, especially in the mixed–oriented systems. The exception is *Crops–Oriented Maize* system where, in both organic and non–organic holdings, arable land predominates (there are no pastures and meadows in this system). Different land use patterns are characteristic only for certain farming systems, as in the case of orchards and vineyards that are found only in *Crops–Oriented Sugar beet* and *Crops–Oriented Maize* systems.

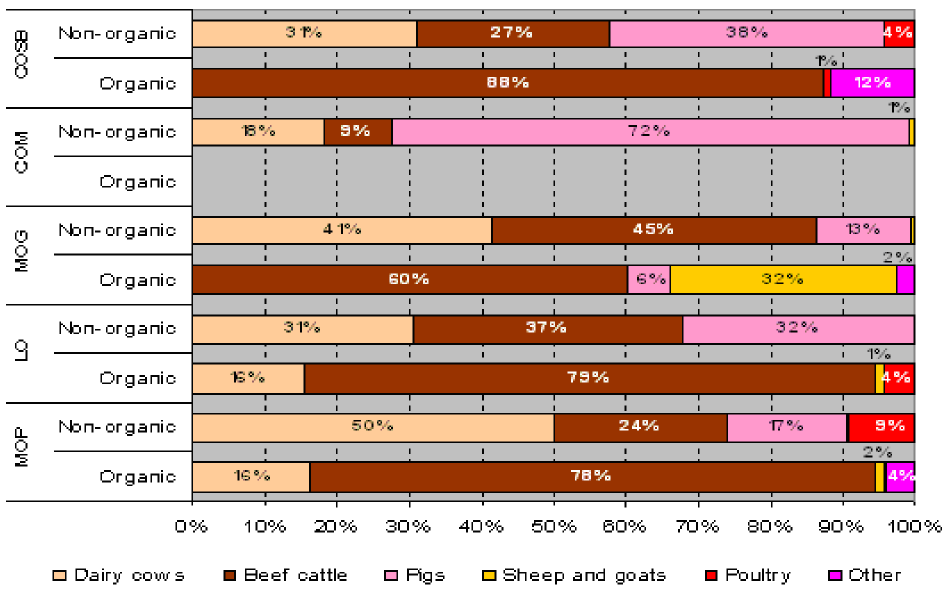
Figure 3 Structure of land use in an average Czech holding (by farming system type)



Source: Field survey, August 2005.

As for livestock, the noticeable differences found at the country level are also encountered at the farming systems level. Beef cattle enterprise predominates in the average organic holding, while dairy cows, beef cattle and pigs are evenly distributed in average non–organic holdings (Figure 4).

Figure 4 Structure of livestock in an average Czech holding by farming system



Source: Field survey, August 2005.

There are also some livestock categories that exist only in some farming systems. For example, sheep and goats are basically found on organic holdings operating in *Mixed–*

Oriented Grassland system and poultry is found in *Crops–Oriented Sugar beet*, *Livestock–Oriented* and *Mixed–Oriented Potatoes* systems.

Lithuania

A summary description of the Lithuanian sample is presented in Table 7. The farms interviewed represent 1.9 % of all organic holdings, 2.5 % of all organically farmed land in Lithuania and 3.8 % of total grassland area. An analysis of the average size of holding shows that non–organic farms are larger than organic farms. More than a half of the land managed by organic holdings is under meadows and pastures, the rest being arable land. In contrast, arable land occupies the major part of total utilised area on non–organic farms, while pastures and meadows account for only a small share. As for livestock structure, dairy cows and beef cattle predominate in both organic and in non–organic holdings. Sheep is the other main enterprise in organic farms.

Table 7 General description of the sample in Lithuania

Variable		Organic				Non–Organic			
		Individual farms	Legal entities	Total		Individual farms	Legal entities	Total	
Total sample		**23**	**0**	**23**		**54**	**12**	**66**	
Total farm land (ha)		**1,324.17**		**1,324.17**		**5,625.29**		**1,5271.76**	
Average size (ha)		57.57		57.57		104.17	803.87	231.39	
Total land use (ha)	**Arable**	604.88		604.88	**45.68%**	4,760.17	8,363.07	1,3123.24	**85.93%**
	Orchards	7.19		7.19	**0.54%**	22.4	0	22.4	**0.15%**
	Berry gardens	7.06		7.06	**0.53%**	12.4	0	12.4	**0.08%**
	Pastures	533.70		533.70	**40.30%**	603.43	1,133.59	1,737.02	**11.37%**
	Meadows	142.66		142.66	**10.77%**	182.37	149.81	332.18	**2.18%**
	Forest	26.78		26.78	**2.02%**	35.25	0	35.25	**0.23%**
	Other	1.90		1.90	**0.14%**	9.27	0	9.27	**0.06%**
Total livestock (LU)	**Dairy cows**	192.00		192.00	**55.62%**	449	644	1093	**49.36%**
	Beef cattle	124.60		124.60	**36.09%**	317.6	664	981.6	**44.33%**
	Pigs	15.92		15.92	**4.61%**	139.46	0	139.46	**6.30%**
	Sheep	12.60		12.60	**3.65%**	0	0	0	**0.00%**
	Poultry	0.10		0.10	**0.03%**	0.42	0	0.42	**0.02%**

Source: Field survey, August 2005.

As for the ownership of farmland in Lithuanian organic and non–organic holdings, 71.8 % of non–organic holdings land is rented. Nevertheless, more than 70 % of farmland in non–organic individual farms is owned, compared with 95.9 % of rented land in Lithuanian legal entities (Table 8). Otherwise, there is no significant difference between the shares of owned and rented land among organic individual farms.

Table 8 Type of land tenure in Lithuania

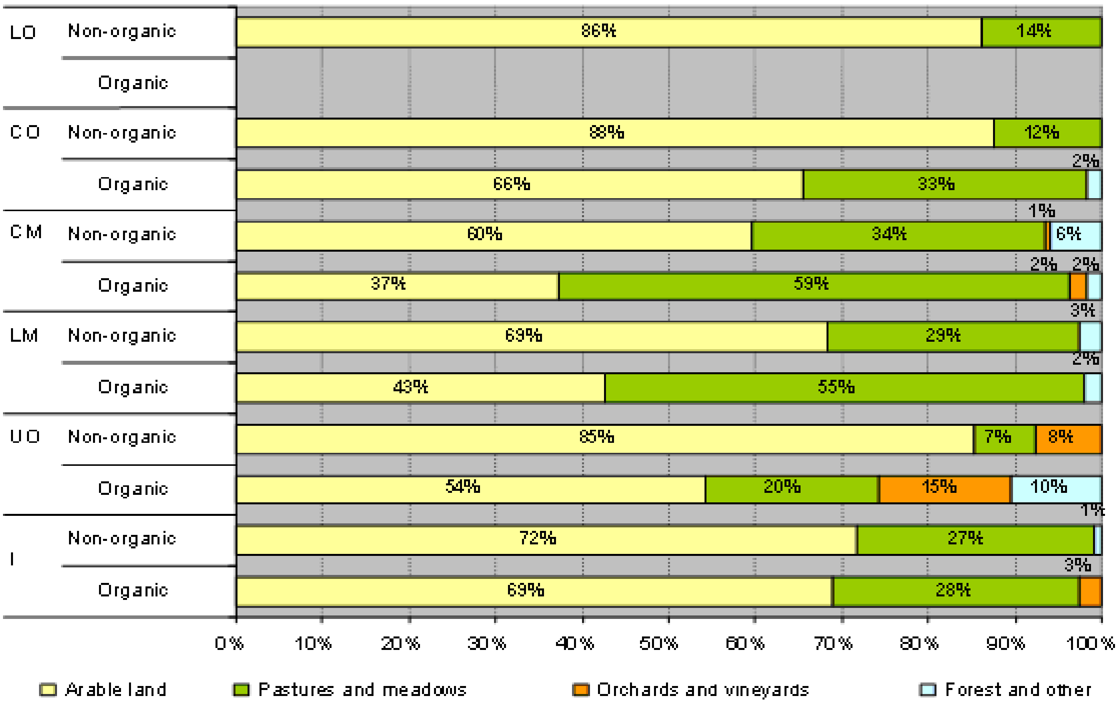
Total land farmed	Type of farm			
	Organic	Non–organic		
	Individual farms and total[(a)]	Individual farms	Legal entities	TOTAL
Owned (%)	56.8	71.3	4.1	**28.2**
Rented (%)	43.2	28.7	95.9	**71.8**
Total land (%)	**100.0**	**100.0**	**100.0**	**100.0**

Note: No organic legal entity in the survey.

Source: Field survey, August 2005.

In terms of land use categories, arable land prevails in total agricultural land among non–organic holdings of all farming systems. In organic holdings both arable land and pastures and meadows cover the major part of total land, except for *Livestock–Marginal* and *Crops–Marginal* systems, where pastures and meadows clearly predominate (Figure 5). Similar to the Czech Republic, also in Lithuania there are some farm enterprises characteristic only for certain farming systems; for example orchards, are important in the *Urban–Oriented* system, and to a smaller extent in organic holdings in the *Crops–Marginal* and *Intermediate* systems.

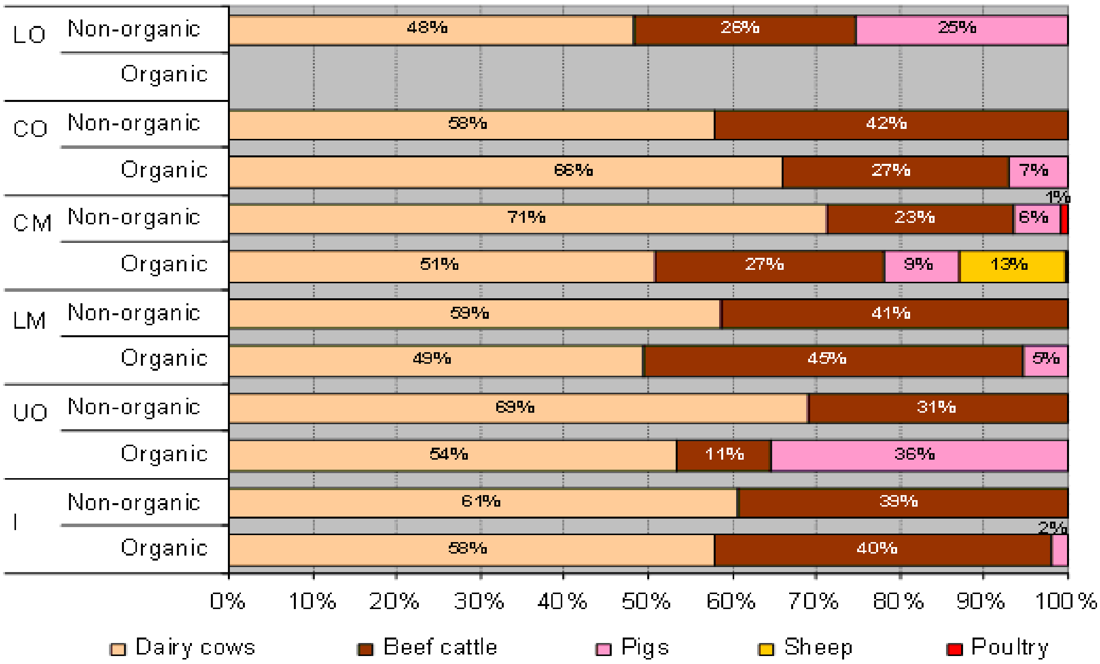
Figure 5 Structure of land use in an average Lithuanian holding by farming system



Source: Field survey, August 2005.

In Lithuania, as can be seen in Figure 6 referring to the structure of livestock in the average holding, the prevailing farming enterprises across all farming systems — both organic and non–organic holdings — are dairy cows and beef cattle. Dairy cows account for the biggest share in total number of livestock on non–organic holdings in the *Crops–Marginal* system and on organic holdings in the *Crops–Oriented* system. Higher beef cattle concentrations are observed on organic holdings in the *Livestock–Marginal* system and on non–organic holdings in the *Crops–Marginal* system.

Figure 6 Structure of livestock in the average Lithuanian holding by farming system



Source: Field survey, August 2005.

3.3.2 Social characteristics

Social characteristics are extracted from the interviews with farmers and analysed at country level as it is a more suitable approach for a better presentation and comparison of the general social characteristics of organic and non–organic farms. The results reported here are not statistically representative (some of the interviewees declined to answer and the size of the sample was limited).

Data were collected from 19 organic and 15 non–organic farms in the Czech Republic and from 23 organic and 53 non–organic farms in Lithuania. The results show that in both countries the labour force on organic farms (including head of farm, family members and other workers) is younger and has a higher education level than on non–organic farms.

In the Czech sample of individual farms, the head of the organic farm is younger than the one managing a non–organic farm (35–44 years old and 45–54 years old respectively). As for the hired labour, the results indicate that organic farm hired elder workers than non–organic farm (25–44 and 25–34 years, respectively). The heads of organic farms have more frequently attained a secondary with A level education (21 % of organic farmers interviewed), while non–organic farm managers have slightly more frequently university education (27 % of non–organic farmers interviewed). In Lithuania, the head of organic farms are younger than farmers of non–organic farm (45–54 years and 55–64 years, respectively). As for non–family hired labour, organic farmers hire younger workers than non–organic farms. Besides that, non–organic farmers hire a high percentage of workers who are of 65 years old or even older (6.9 %) compared with organic farm (2.7 %).

Further, the analysis focuses on some work–related social aspects, such as number of days worked per year on– and off–farm, average number of workers per farm. The results differ between the two countries (see Table 9). In the Czech Republic, the total labour force employed in organic farming works, on average, more days per year than the labour force on non–organic farms (324.9 days and 318 days, respectively), while in Lithuania the average number of days worked per year in organic farming is almost 14 % lower than in non–organic (215 days and 251 days, respectively). In both countries, more often than not organic farm workers have outside work (especially in Lithuania) where most of them are permanent employees (84 % in Lithuania and 45.4 % in the Czech Republic). The average number of days worked outside the farm shows almost no difference between organic and non–organic farm in the Czech Republic. In Lithuania organic farm workers distribute their work between equally on–farm and off–farm, while in non–organic farming they are engaged more in farm work. This observation may indicate that organic farming is seen more as an additional occupation than a basic agricultural activity in Lithuania.

Concerning the composition of total labour force in the Czech Republic and Lithuania, both types of farms (organic and non–organic) rely on family members input. In Lithuania, organic farming is based more on family members providing labour input, whereas in the Czech Republic non–organic farming relies more on family labour.

As for labour needs, in the Czech Republic there is no difference between organic and non–organic farming, while in Lithuania an organic farm needs even slightly less labour than a non–organic farm (i.e. less developed organic farming). These results are in line with the findings of Sell *et al.* (1995), which show that labour requirements (in terms of hours/year) are almost the same for conventional and organic farms.

Table 9 Characteristics of the total labour force in organic and non–organic farms

Variable	Organic farm		Non–organic farm	
	Czech Republic	Lithuania	Czech Republic	Lithuania
On–farm work (days/year)	324.9	215.0	318.0	251
Average number of workers/farm	2.7	3.2	2.7	4.1
Off–farm work (%)	22.0	26.0	7.50	8.0
Off–farm work (days/year)	196.36	209.0	196.67	170
Permanent employee outside farm (%)	45.45	84.0	3.0	n.a

Source: Field survey, August 2005.

3.4. Determinants of adopting organic farming

This section reports the findings of the field survey regarding the determinants of adopting organic farming in the Czech Republic and Lithuania. Looking at the aggregated (country level) results, the main determinants of adoption of organic farming in both countries relate to farmers' own beliefs (organic farming is perceived as ensuring better food quality and/or being more environmentally friendly) and to farm structure (i.e. suitable farm size and type of production in the Czech Republic and suitable farm structure in Lithuania). Economic factors (here, expected post–adoption profitability) do not emerge as important for adoption, contrary to what expected beforehand, an outcome partially justified by the effect of support schemes for organic farming. Moreover, in Lithuania farmers consider consumers' willingness to pay higher prices for organic produce also emerges from the field survey as a major reason for adopting organic farming practices. These results are common to farmers in both LFAs and non–LFAs. However, the interviewed Lithuanian organic farmers situated in LFAs appear to be more concerned about environment preservation than those in non–LFAs.

The opinions collected via the field survey in both countries do not fully coincide with expressed local experts' opinions. Although experts indicated environment–linked benefits of organic farming as important determinants, they consider the economic determinants — especially where related to public support — to be more important when it comes to adopting organic farming practices. This discrepancy of opinions can be explained to some degree by the non–statistical representativeness of the sample and by the fact that the reported field results reflect more local farm–specific situations.

3.4.1 Summary of results at country and farming systems levels

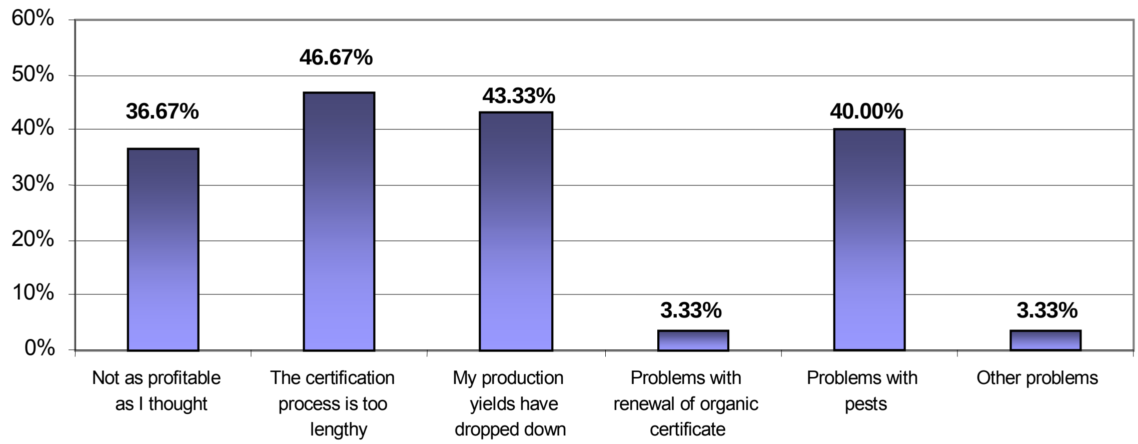
3.4.1.1. The Czech Republic

The questionnaires to organic farmers included several questions about the fulfilment of expectations post–adoption of organic farming.[12] The answers indicate that the majority of farmers interviewed are satisfied with the results obtained after adopting organic farming (80% of answers). Of the small number of farmers unsatisfied with the post–conversion situation, 3 out of 4 indicated that were considering reverting to non–organic production.

Regarding the pre–adoption decision, farmers were asked to indicate how they have learnt about organic farming, and the most repeated answer was 'through other farmers' (40 %). In general, most farmers said that they obtained enough advice when firstly adopted organic farming (57 %). Referring to nowadays situation, farmers considered they were well advised (83 %).

The results regarding the most important disadvantages since farmers adopted organic farming are summarised in Graph 1. The most mentioned disadvantage was lengthiness of the certification process (47 %), followed by the yields fall (43 %), and problems with pests (40 %).

Graph 1 Main disadvantages post–adopting organic farming (Czech Republic)



Source: Field survey, August 2005.

About the future of organic farms, the questions attempted to grasp the impact of two external variables: (1) organic farming grants, and (2) evolution of market prices. Czech farmers attached low importance to market prices (only 23 % of the farmers interviewed would leave

[12] Exclusively questionnaires to organic farmers are analysed in this paragraph, since we desire to know the main reasons why they adopted organic farming. In the next chapter barriers for not adopting organic farming would be analysed through non-organic farmers' answers.

organic farming if prices for organic products would be equal to non–organic ones). In terms of specific payments for organic farming, 47 % of farmers would end farming organically if payments would be discontinued.

Key determinants of adoption in Czech organic farms

The results presented in this section rely on the data obtained from interviews to 30 organic farms included in the Czech sample (total 62 farms). The answers from the 30 organic farmers are reported in Table 10. In order to obtain the key determinants of adoption, i.e. the main reasons why organic farmers adopted and maintain this type of production in the Czech Republic, farmers were asked to score several given motivations following a ranking (A = very important; B = rather important; C = rather unimportant; D = not important at all). They were also allowed to name other motivations as well. When farmers indicated a determinant as very or rather important, the specific reasons for such assertion were asked.

Table 10 Main determinants of adopting organic farming (Czech Republic; number of answers and %)

DETERMINANTS OF ADOPTION	A. Very important	B. Rather important	C. Rather unimportant	D. Not important at all	A+B	C+D	E. Does not know/ Does not answer	TOTAL (A+B+C +D+E)
Profitability	3 (10.0%)	0 (0.0%)	13 (43.3%)	13 (43.3%)	3 (10.0%)	26 (86.7%)	1 (3.3%)	30 (100%)
Environmental or food concerns	21 (70.0%)	4 (13.3%)	3 (10.0%)	2 (6.7%)	25 (83.3%)	5 (16.7%)	0 (0.0%)	30 (100%)
Farm characteristics	17 (56.7%)	8 (26.7%)	3 (10.0%)	2 (6.7%)	25 (83.3%)	5 (16.7%)	0 (0.0%)	30 (100%)
Accessible market	6 (20.0%)	6 (20.0%)	12 (40.0%)	6 (20.0%)	12 (40%)	18 (60.0%)	0 (0.0%)	30 (100%)
Advising or information	7 (23.3%)	3 (10.0%)	13 (43.3%)	7 (23.3%)	10 (33.3%)	20 (66.7%)	0 (0.0%)	30 (100%)
Suited machinery/technology	3 (10.0%)	7 (23.3%)	6 (20.0%)	14 (46.7%)	10 (33.3%)	20 (66.7%)	0 (0.0%)	30 (100%)
Other	3 (10.0%)	0 (0.0%)	1 (3.3%)	0 (0.0%)	3 (10.0%)	1 (3.3%)	26 (86.7%)	30 (100%)

Source: Field survey, August 2005.

The most important determinants of adoption for the Czech farmers relate to environmental and food concerns and to structural factors (farm characteristics matching organic certification requirements). In fact, when summing up A and B answers, both determinants show the same percentage (i.e. 83.3 % of farmers consider both factors as very or rather important).

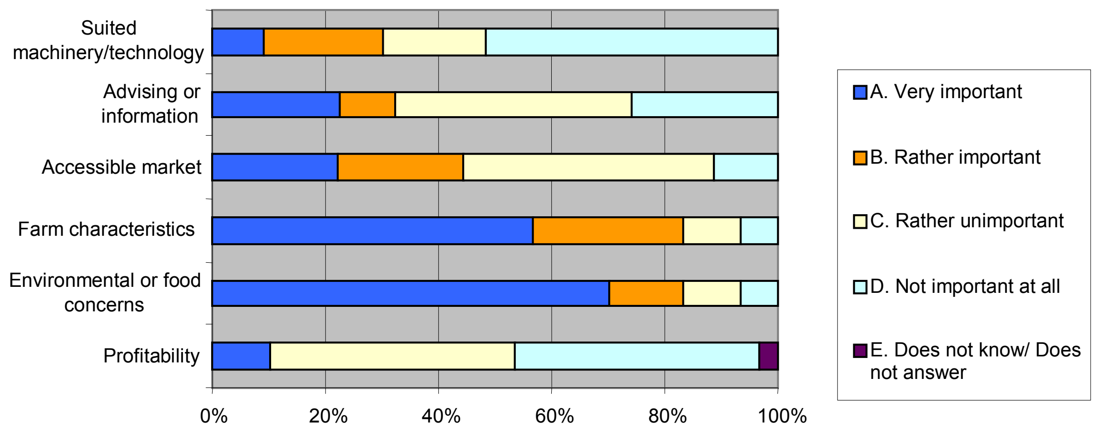
Concerning the *environmental and food* determinant, the main reason is farmers' belief that organic products are of higher quality than non–organic products and that organic farming is more respectful with environment than non–organic farming. This determinant is closely followed by *farm characteristics* factor, farmers pointing at the importance of the fact that the farm already fitted to the organic farming certification requirements. The main reasons were that the production structure and the size of the farm before changing to organic farming were suitable for conversion to organic.

The existence of an accessible market for organic products is not considered as very or rather important (60 % of organic farmers). In fact, there is a belief among the respondents that consumers are not generally ready to pay higher prices. The existence of an organised organic market was not perceived as important since the organic farmers interviewed were selling to already secured clients.

There are two determinants evaluated as rather unimportant or not important at all by 66.7% of respondents, namely the existence of advising organisations or access to information on organic farming and the access to suited machinery and technology.

Finally, economic reasons are not as noticeably important for conversion to organic farming as expected since 86.7 % of organic farmers estimated that profitability was rather unimportant or not important (C+D) at all when they decided to convert. In fact, although farmers that considered the economic determinant as important stated that prices for organic products compensate the increase in costs, they did not believe the public aids were sufficiently high to compensate loses. Such outcome does not coincide exactly with experts' beliefs. Although the latter consider important the environmental and health concerns, these factors are placed behind the economic determinants (especially public supports, seen as the most important determinant), as well as the socio–cultural factors such as the existence of associations supporting organic farming. One of the possible explanations for the relative low importance of profitability of organic farming for adopting this practice is that looking at the aggregated results at the country level hides differences among farming systems, where profitability emerges as important for some farming systems (see below).

Graph 2 Main determinants of adoption in the Czech Republic (% of total answers)

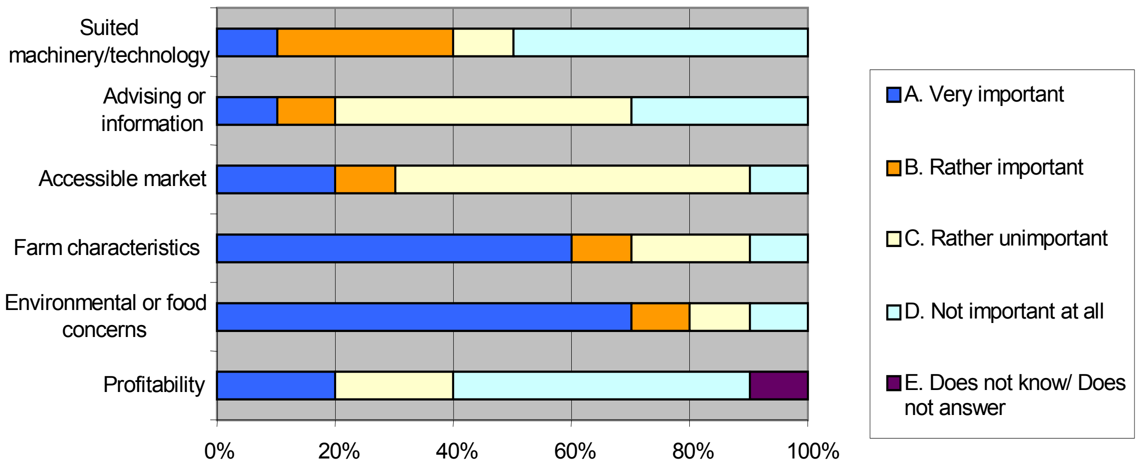


Source: Field survey, August 2005.

Differences in adoption behaviour according to the legal form of the farm

In general, data collected do not reveal noticeable differences of opinion according to the legal form of organic farms. In fact, for both types (individual and corporate) the most important determinants of adoption are again those concerning the characteristics of the farm related to eligibility criteria for organic certification, and farmers' own beliefs related to environmental and/or health concerns (Graph 3).

Graph 3 Main determinants of adopting organic farming by legal entities (Czech Republic)



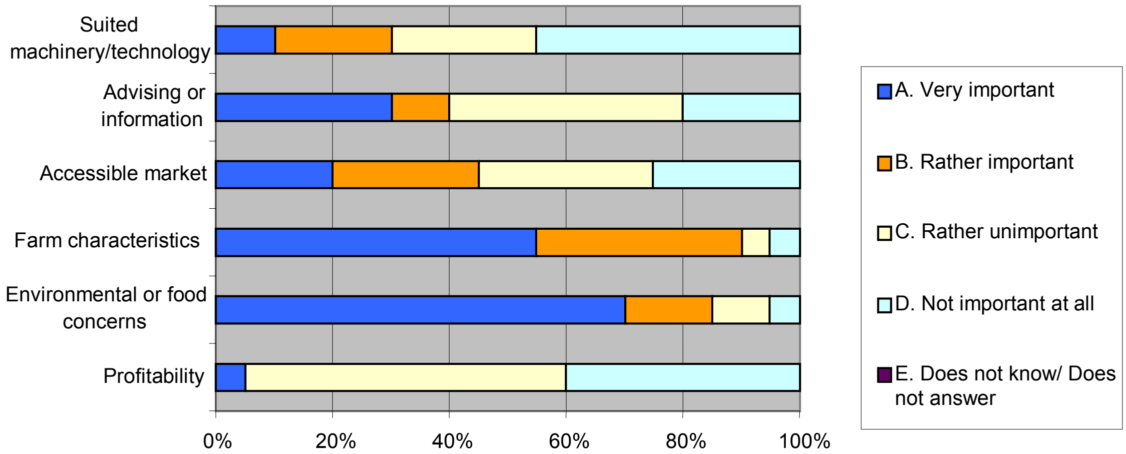
Source: Field survey, August 2005.

For most individual farms (A+B = 90 %), the characteristics of the farm previous to conversion were decisive when deciding to convert. The percentage is smaller for legal entities where 70 % considered this factor as very or rather important. Such outcome may be the result of higher investment ability of the legal entities to face important structural changes in their farms compared with individual farms whose efforts should be higher if their farms required many pre–conversion changes.

Another important difference concerns the access to information and to advising organisations. This determinant is again less important for the legal entities (C+D = 80 %) than for individual farms (C+D = 60 %) the latter depending more on the external advise. On the contrary, the access to suited machinery is less decisive for individual farms (C+D = 70 %) than for legal entities (C+D = 60 %) at the time of adoption, probably caused by higher economic facilities of the former to assume new technology.

Even if the profitability factor is the least important determinant for both farm types, legal entities value it much more (70 % of farmers from legal entities considered it as rather unimportant or not important in compared with 95 % of family farms).

Graph 4 Main determinants of adopting organic farming by individual farms (Czech Republic)



Source: Field survey, August 2005.

Findings at the farming system level

Most of the experts consulted about the possible differences among production areas did not signal territorial differences influencing the determinants of adopting organic farming. However, the results of the interviews to farmers indicate some differences as presented below.

Based on the answers from 30 organic farmers interviewed in the Czech Republic, Table 11 reports the percentage of organic farmers ranking the determinants of adoption (per farming system) as *very* or *rather important* (A+B) and *rather unimportant* or *not important* (C+D).

In general, for the two main determinants of adoption at country level (i.e. environmental and food concerns, and farm characteristics) there are no noticeable differences according to the farming system. In fact, for the first determinant, the values at the farming system level are similarly obvious for every farming system, standing out the *Mixed–Oriented Potatoes* system (100 % of farmers indicated it as essential). The *farm characteristics* determinant is pointed out as having the highest importance in the case of *Crops–Oriented Sugar Beet* and *Crops–Oriented Maize* systems, the importance decreasing from 83.3% at country level to 66.7% in both *Livestock–Oriented* and *Mixed–Oriented Potatoes* systems.

Differences also exist for the other determinants of adopting organic farming. Accessibility of organic products into the market, which was not pointed out as noticeable by 60 % of farmers at country level, was differently valued in the different farming systems. In fact, this determinant emerges as rather unimportant or not important for 83.3 % of organic farmers in *Mixed Oriented Potatoes* system, while it is seen as crucial by organic farmers in *Crops–Oriented Maize* system (100 % of answers). In the later system, the access to advice and information about organic farming was ranked higher than at the country level (60 % vs.

33.3%) whereas for organic farmers in *Livestock Oriented* system this determinant is less important (C+D = 83.3 %).

Concerning the *access to suited machinery and technology* determinant, this determinant is less important for 66.7 % of organic farmers. However, three systems are close to the values obtained at the country level: *Crop–Oriented Maize*, *Mixed–Oriented Grassland* and *Mixed–Oriented Potatoes*. In the case of *Crops–Oriented Sugar Beet* system access to technology is seen as less important (C+D = 83.3 %), while in *Livestock–Oriented system* is perceived as important (50 % of answers).

As for the *profitability* factor, the results at the country level indicated it as a less important factor influencing the decision to convert to organic farming (C+D = 90 % of answers). This outcome is confirmed for the organic farmers belonging to *Mixed–Oriented Grassland*, *Livestock–Oriented* and *Mixed–Oriented Potatoes* systems (each with 100% answers), while in the *Crop–Oriented Maize* system 60 % of answers indicated it as a *rather unimportant* (C) or *not important* (D) in influencing the decision–making process.

Table 11 Determinants of adopting organic farming by farming systems (Czech Republic)

DETERMINANTS OF ADOPTION	CROPS–ORIENTED SUGAR BEET		CROPS–ORIENTED MAIZE		MIXED–ORIENTED GRASSLAND		LIVESTOCK–ORIENTED		MIXED–ORIENTED POTATOES		CZECH REPUBLIC	
	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D
Profitability	16.7	83.3	40.0	60.0	0.0	100.0	0.0	100.0	0.0	100.0	**10.0**	**90.0**
Environmental or food concerns	83.3	16.7	80.0	20.0	71.4	28.6	83.3	16.7	100.0	0.0	**83.3**	**16.7**
Farm characteristics	100.0	0.0	100.0	0.0	85.7	14.3	66.7	33.3	66.7	33.3	**83.3**	**16.7**
Accessible market	33.3	66.7	100.0	0.0	28.6	71.4	33.3	66.7	16.7	83.3	**40.0**	**60.0**
Advising or information	33.3	66.7	60.0	40.0	28.6	71.4	16.7	83.3	33.3	66.7	**33.3**	**66.7**
Suited machinery/technology	16.7	83.3	40.0	60.0	28.6	71.4	50.0	50.0	33.3	66.7	**33.3**	**66.7**
Other	0.0	100.0	0.0	100.0	28.6	71.4	16.7	83.3	0.0	100.0	**10.0**	**90.0**
Number of organic farms	**6**		**5**		**7**		**6**		**6**		**30**	

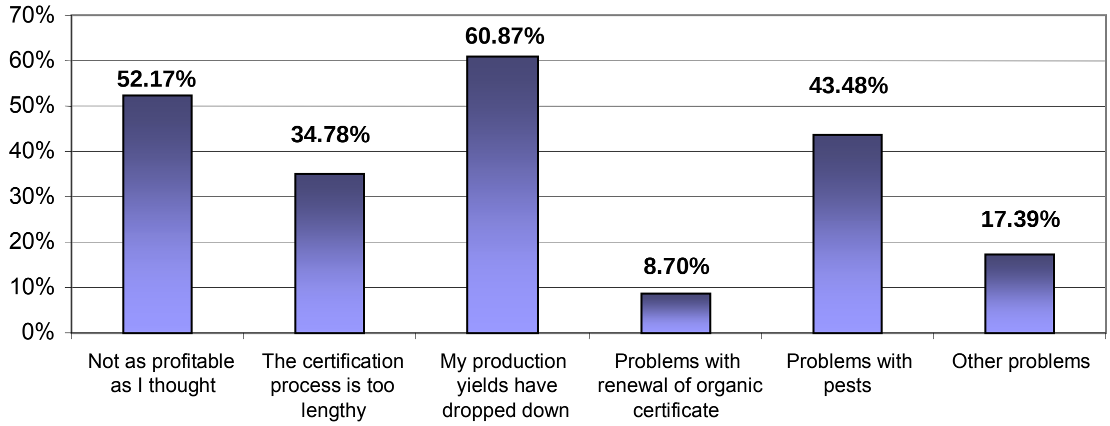
Source: Field survey, August 2005.

3.4.1.2. Lithuania

Fulfilment of expectations of Lithuanian organic farmers

In terms of fulfilment of the pre–adoption expectations, 78.3 % the Lithuanian organic farmers declared themselves being satisfied with the results obtained after the conversion. The main information source regarding organic farming was the same as in the Czech Republic, ‘through other farmers’ (43.5 % of answers). Farmers indicated that they obtained enough advising while adopting organic farming (69.6 %), and that were still receiving advice at the time of the interview (60.9 % of answers). The most important disadvantages post–conversion to organic as resulted from the questionnaires are summarised in Graph 5.

Graph 5 Main disadvantages post adopting organic farming (Lithuania)



Source: Field survey, August 2005.

The drop of yields was the most frequent cited disadvantage post–conversion (60.9 %), then realising that organic farming was not as profitable as initially thought (52.2 %), and increased problems with pests (43.5 %). About the future of organic farms, the Lithuanian farmers interviewed indicated a relatively high sensitivity to the receipt of organic farming grants and the market prices evolution. In a future context where specific payments for organic farming disappeared and organic market prices were similar to non–organic products, 56.5 % would abandon organic farming (reconverting to the previous practice).

Key determinants of adopting organic farming in Lithuanian organic farms

The answers of 23 organic farmers to questions related to their reasons to adopt and maintain this type of farming are summarised in Table 12. The specific reasons are reported in Annex 6.

Table 12 Main determinants of adopting organic farming (Lithuania; number of answers and %)

DETERMINANTS OF ADOPTION	A. Very important	B. Rather important	C. Rather unimportant	D. Not important at all	A+B	C+D	E. Does not know/ Does not answer	TOTAL (A+B+C+D+E)
Profitability	3 (13.0%)	6 (26.1%)	7 (30.4%)	5 (21.7%)	9 (39.1%)	12 (52.2%)	2 (8.7%)	**23 (100%)**
Environmental or food concerns	7 (30.4%)	10 (43.5%)	2 (8.7%)	2 (8.7%)	17 (73.9%)	4 (17.4%)	2 (8.7%)	**23 (100%)**
Farm characteristics	2 (8.7%)	14 (60.9%)	4 (17.4%)	2 (8.7%)	16 (69.6%)	6 (26.1%)	1 (4.4%)	**23 (100%)**
Accessible market	1 (4.4%)	13 (56.5%)	3 (13.0%)	4 (17.4%)	14 (60.9%)	7 (30.4%)	2 (8.7%)	**23 (100%)**
Advising or information	2 (8.7%)	10 (43.5%)	6 (26.1%)	3 (13.0%)	12 (52.2%)	9 (39.1%)	2 (8.7%)	**23 (100%)**
Suited machinery/technology	2 (8.7%)	5 (21.7%)	7 (30.4%)	6 (26.1%)	7 (30.4%)	13 (56.5%)	3 (13.0%)	**23 (100%)**
Other	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**	**1 (4.4%)**	**0 (0.0%)**	**1 (4.4%)**	**22 (95.6%)**	**23 (100%)**

Source: Field survey, August 2005.

As in the Czech Republic, the main determinants of adopting organic farming in Lithuania are farmers' environmental and food concerns (73.9 % of answers indicating it as very or rather important), confirming the feedback received from the national experts. When farmers were asked specific reasons why they considered this factor so crucial the majority indicated their own belief that organic farming produces food of higher quality and/or solves environmental problems.

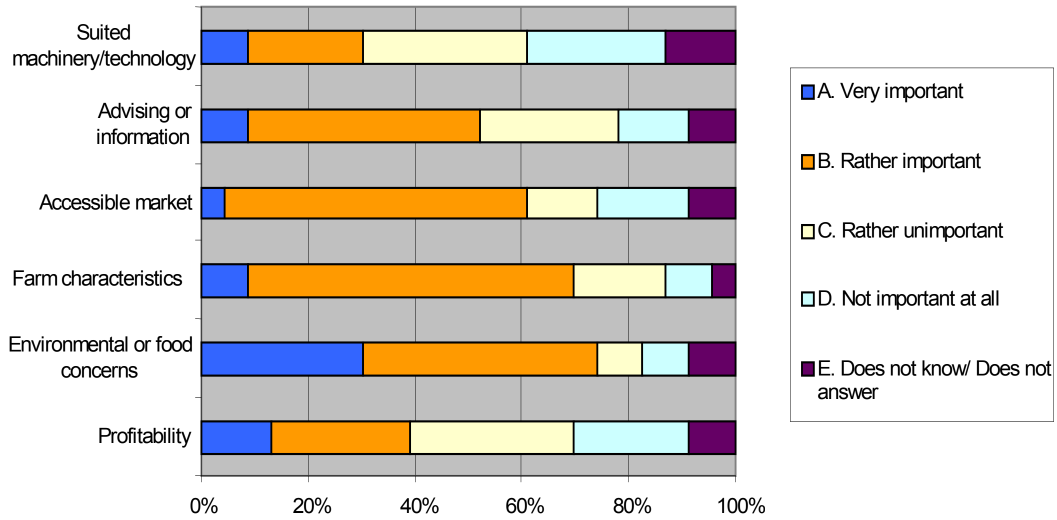
Another important determinant is *farm characteristics*, indicated as very or rather important (69.6 % of answers). One of the main reasons why farmers adopted organic farming is because the certification as organic did not require many changes of their farming practices. Moreover, the suitable size of farms and the production structure also influenced the decision to convert to organic farming. The answers coincided with the opinions of experts who indicated the size and production type as important factors.

The *market access* determinant was indicated as being rather important (A+B = 60.9 %). Farmers indicated that one of the reasons why they were farming organically was the presence of specific marketing agents buying their production. Unlike for the previous determinants, the experts did not attach a particular importance to this determinant.

Advising or *information* was reported as a very or rather important reason for adopting organic farming (52.2 % of answers). Those farmers who indicated it as an important determinant mentioned that they received training on management of organic farms. The experts also indicated technical consulting as an important feature linked to this determinant.

Finally, two factors obtained less than 50 % of farmers' answers as important for adoption: profitability (A+B = 47.8 %), and suitable machinery (A+B = 43.5 %). Most farmers answered that profitability was not an important reason for adopting organic farming, and the same explanation as in the Czech case can be put forward. This outcome disagreed with the experts' views who indicated for example public aids (an economic variable linked to profitability) as a key determinant influencing the conversion to organic farming. Regarding the technology, some farmers underlined that the availability of organic manure supported the decision to adopt organic farming.

Graph 6 Main determinants of adopting organic farming (Lithuania)



Source: Field survey, August 2005.

Findings at the farming system level

As in the case of Czech Republic, Lithuanian experts did not point out that any difference would exist among farming systems when analysing different determinants of adopting organic farming.

Although Lithuania displays currently high rates of adopting organic farming, the process is still incipient. Given the difficulties in localising organic farms only 23 organic farms were finally interviewed. Table 13 reports the results of the interviews carried out for each Lithuanian farming systems, as well as the sums of A+B (*very important* and *rather important*) and C+D (*rather unimportant* and *not important*) answers.

Table 13 Determinants of adopting organic farming by farming system (Lithuania)

DETERMINANTS OF ADOPTION	LIVESTOCK–ORIENTED		CROPS–ORIENTED		CROPS–MARGINAL		LIVESTOCK–MARGINAL		URBAN–ORIENTED		INTERMEDIATE		LITHUANIA	
	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D	%A+B	%C+D
Profitability	0	0	33.3	66.7	37.5	62.5	100.0	0	33.3	66.7	0	100.0	**39.1**	**52.2**
Environmental or food concerns	0	0	100	0	75.0	25.0	0	100	66.7	33.3	100	0	**73.9**	**17.4**
Farm characteristics	0	0	66.7	33.3	75.0	25.0	33.3	66.7	66.7	33.3	100	0	**69.6**	**26.1**
Accessible market	0	0	83.3	16.7	50.0	50.0	66.7	33.3	33.3	66.7	66.7	33.3	**60.9**	**30.4**
Advising or information	0	0	50.0	50.0	62.5	37.5	33.3	66.7	66.7	33.3	0	100	**52.2**	**39.1**
Suited machinery/ technology	0	0	16.7	83.3	37.5	62.5	0	100	33.3	66.7	66.7	33.3	**30.4**	**56.5**
Other	0	0	0	0	0	0	0	0	0	4.4	0	0	**0**	**4.4**
Number of organic farms	**0**		**6**		**8**		**3**		**3**		**3**		**23**	

Source: Field survey, August 2005.

Environmental or food concerns are the most important determinants that emerge at country level (73.9 %). Among systems, this factor is the most important for the *Crops–Oriented* and *Intermediate* systems (A+B = 100 %), and scored a high rate for the *Crops–Marginal* system (A+B = 75 %). On the contrary, none of the farmers of the *Livestock–Marginal* system mentioned this factor as an important one.

Farm characteristics was also an important factor in *Crops–Oriented* and *Urban–Oriented* systems (each with A+B = 66.7 %), *Crops–Marginal* system (75 %) and *Intermediate* systems (100 %), whereas in *Livestock Marginal* 66.7 % of organic farmers considered this factor as a rather unimportant or not important one.

Access to marketing channels was a key factor for adoption of organic farming in *Crops–Oriented* system (83.3 %). The results for *advising or information* factor stand out for *Crops–Marginal* system (62.5 %), as well as in *Crops Oriented* system (50 %). *Profitability* did not emerge as one of the most important factor influencing decision to convert neither in *Crops Oriented* (C+D = 66.7 %) nor in *Crops–Marginal* system (C+D = 62.5 %) but it is the main one for the *Livestock Marginal* system (A+B = 100 %).

Finally *suitable machinery/technology* factor was pointed out as less important in influencing the process of adoption of organic farming in *Crops–Oriented* system (C+D = 83.3 %) and in *Crops–Marginal* system (C+D = 62.5 %), and was considered even of lesser importance for adoption in the *Livestock–Marginal* system (C+D = 100 %).

3.4.2 Modelling adoption of organic farming using a binary logit model

In the previous section, the explanations of the adoption of organic practice are mainly related to the expressed reasons the interviewed farmers provided during the field survey interviews. It is therefore of interest to investigate whether statistical significance can be attached to this outcome. A binomial logit model is specified under the underlying assumption of a utility–maximising farmer pondering whether to convert to organic farming or to continue farming with its current production technology (hence, as a non–organic farmer). The utility–maximising choice, U_{it}, of the i^{th} farmer is assumed to depend on a set of socio–economic factors (X_i), that is

$$U_{it} = d_i X_i + \varepsilon_{it}$$

where U_i is the indirect utility the i^{th} farmer derives from continuing with its current practice or converting to the new one, t is the technology (taking value of 0 for the old technology, and 1 for the new one), d_i is a vectors of coefficients corresponding to the associated socio–economic factors (X_i), and ε is the additive error term. The farmer will adopt organic farming if $U_{i1}>U_{i0}$, or will continue with as a non–organic farm if $U_{i0} \geq U_{i1}$. Defining the qualitative dependent variable for the adoption of the alternative technology as $y_i = 1$ if the farmer adopts organic farming, and $y_i = 0$ otherwise, the binomial logit model is

$P_i = E[y=1 \mid X_i] = \dfrac{1}{1+e^{-(\beta_1+\beta_2 X_i)}}$, where β are the unknown parameters to be estimated, X_i is the set of variables influencing the decision, and e is the base of natural log raised at the power of the expression in brackets.

Of the several models available to model binary response, a binary dependent variable (logit) model is preferred here, mainly owing to the characteristics of data available.[13] In this case, the underlying cumulative logistic probability function allows transforming the dependent variable to predict probabilities within the bound (0, 1), and the probability that a farmer will convert to organic farming is the probability that the utility of the current practice is lower than the utility of the organic one. The dependent variable becomes then the logarithm of the odds when a positive choice is made (i.e. conversion occurs); given that Pi/(1-Pi) is the odds ratio in favour of adoption (i.e. the ratio of the probability that adoption will occur to the probability that adoption will not occur), the logit model is specified as

$$L_i[p_i / 1 - P_i)] = \beta_1 + \beta_2 X_i$$

where L_i is the log of the odds ratio, P_i is the probability of an event (i.e. adoption of the new technology, here, organic) occurs for an observed set of variables X_i, β_i are the coefficients to be estimated and X_i is the set of explanatory variables.

[13] If u_i is normal, then F is a cumulative normal distribution function associated with a linear regression model. However, the linear model is not constrained between 0 and 1 and the binary decision generates a non-linear response (which violates the assumptions of a linear regression model). For both probit and logit models their underlying probability function (normal and logit) are bounded between 0 and 1 and exhibit an S-shaped curve, consistent with the theory of adoption. The cumulative logistic function is flatter at the tails compared to the cumulative normal one (that is associated with the probit model). In large samples, with many observations falling at the tails, this characteristic makes the results of the logit and probit models to differ. Results from both probit and logit models are interpreted as the logarithm of the odds in favour of adoption. See Gujarati (2003).

In line with the theory of adoption, the model includes variables related to farmer's own belief in the benefits of organic farming, access to information, technology–specific knowledge, farm characteristics, and availability of labour. The selection of variables to be included in the model relied on both analyses of the results of the field survey as well as on the exploration of various alternative model specifications.[14]

For an easier interpretation, dummy variables are defined for the attitudinal variables (i.e. those which implied a ranked preference and referring at farmers' expressed attitude towards organic farming). For example, for the 'environmental or food concerns' determinant, which implied four alternative answers, A, B, C or D), the A and B answers (i.e. 'very important' and 'important') are coded as 1, while the C and D answers (rather 'unimportant' and 'not important') are coded as 0. The variables and their definition are reported in Table 14.

Table 14 Definition of explanatory variables included in the logit regression regarding conversion to organic farming in the Czech Republic and Lithuania

FORGME	membership in farmers' organisation; 0 = no; 1 = yes
BETENVD	belief in better environmental or food quality of organic production/produce (0 = limited or no belief; 1 = strong and very strong belief)
KNOWHD	knowledge about specificities of organic farming production (0 = no or very limited knowledge; 1 = good or very good knowledge)
FARMAR	farmed area (own and rented) (ha)
ADDFFL	additional family labour working on–farm (number of persons)
ADDNFL	additional non–family labour working on–farm (number of persons)

In terms of data, information for 112 family farms was extracted from the 2005 field survey database. Of the total sample available, three farms have been eliminated as outliers, and three for missing data so that the final sample utilised was of 106 records representing 33 Lithuanian farms (18 non–organic, and 15 organic), and 73 Czech farms (20 non–organic, and 53 organic). Both fully organic and phasing–in farms are included in the 'organic' farm category of the dependent variable, y. Descriptive statistics for the variables included in the model and Pearson correlation matrix are reported in Table 15 and Table 16, respectively. In

[14] At an earlier step, a model containing only the attitudinal variables was specified. The attitudinal variables are reported in Table 32. The estimated coefficients for all but two variables were not statistically significant. Model correct specification was tested using a Wald test and the null hypothesis that the coefficients of the variables associated with profit, farm eligibility, market characteristics and machinery are equal zero to could not be rejected at 5 % level of significance. Therefore, the associated variables were discarded and the analysis then proceeded with the remaining variables. A Cronbach's alpha test was also conducted for the attitudinal variables. The value for the overall sample is relatively low (0.401). When controlling for the farm location (i.e. country) and revealed behaviour (i.e. organic; non-organic), the test is above the 0.5 threshold, except for the Lithuanian organic farms (for which the small sample explains this outcome). The corresponding values are: Czech Republic (adopters; non-adopters) = (0.507; 0.520); Lithuania (adopters; non-adopters) = (0.336; -0.658). Consequently, the attitudinal variables considered here describe the same latent variable (i.e. conversion to organic farming) for each group of farmers and suggest the existence of other factors influencing the decision to convert besides farmers' own belief.

what concerns the correlation among variables, no noticeable pair correlation is observed except for the one related to farm size and non–farm labour use.

Table 15 Descriptive statistics of explanatory variables in the logit model

Variables	Minimum	Maximum	Mean	Standard Deviation
FORGME	0.00	1.00	0.18	0.38
BETENVD	0.00	1.00	0.42	0.50
KNOWHD	0.00	1.00	0.23	0.43
FARMAR	0.21	900.00	91.29	126.61
ADDFFL	0.00	5.00	1.70	1.28
ADDNFL	0.00	6.00	0.73	1.33

Table 16 Pearson correlation matrix of variables included in the logit model

Variables	FARMAR	FORGME	ADDFFL	ADDNFL	BETENVD	KNOWHD
FARMAR	1					
FORGME	0.404	1				
ADDFFL	-0.024	-0.153	1			
ADDNFL	0.619	0.203	-0.109	1		
BETENVD	-0.022	0.053	0.223	0.003	1	
KNOWHD	0.084	0.135	0.08	0.041	0.29	1

The model is estimated using the SYSTAT 11.0 statistical package. Table 17 reports the estimated coefficients, standard errors, t-values and the odds ratio of the logit model specified.

Table 17 Estimated coefficients of the logit regression associated with adoption of organic farming of the Czech and Lithuanian family farms

Parameter	Estimate (b)	Standard error	t–ratio (p–value)	Odds–ratio
CONSTANT	-5.076	1.271	-3.994*** (0.000)	60.58
BETENVD	4.104	0.857	4.789*** (0.000)	22.801
KNOWHD	3.127	0.989	3.162*** (0.002)	1.955
ADDFFL	0.670	0.293	2.285** (0.022)	2.691
ADDNFL	0.990	0.418	2.370*** (0.018)	0.992
FARMAR	-0.008	0.004	-1.996** (0.046)	9.117
FORGME	2.210	1.129	1.957** (0.050)	60.58

Log Likelihood of constants only model = LL(0) = -69.731

2*[LL(N)-LL(0)] = 82.948 with 6 df Chi–sq p–value = 0.000

McFadden's Rho–Squared = 0.595

Level of significance: 0.01***; 0.05**; 0.1*; n = 106

Two tests for the goodness of fit of the model are reported. First, the test of significance of the coefficients of the logit model which relies on a chi–squared distribution, when the Maximum Likelihood (ML) estimation is used (Table 17). The likelihood ratio (of the likelihood function) when all the parameters except the intercept are set equal to zero, follows a chi–square distribution and indicates whether the amount of variation explained by the model is significantly different from zero. Second, the correct classification power of the cases in various groups is also to be reported (Table 18). This procedure uses the explanatory variables for each farmer in the model estimated and predicts the probability that a farmer will convert to organic farming. A probability above 0.5 indicates a farmer that converted to organic farming. The logit model estimated here correctly predicts and classifies 83.6 per cent of farmers.

Table 18 Classification of the logit model predictions versus the observed behaviour towards conversion to organic farming

Actual choice	Predicted adoption (1)	Predicted non–adoption (0)	Percentage correct
observed adoption (1)	58.328	8.672	**87.1**
non–adoption (0)	8.672	30.328	**77.8**
Overall			**83.6**

The coefficients reported in Table 17 are the maximum likelihood estimators (i.e. they indicate the greatest probability giving the observed value). The coefficients indicate the direction of the effect of the associated explanatory variable on the probability of conversion. The last column in reports the magnitude of the effect associated with a particular explanatory variable. The value is obtained by taking the exponential of the expected value of B at the power of the logistic regression coefficient. The resulting value is the odds of an event happening (here, adoption of organic farming) as the explanatory variable increases by one unit.[15] A value of exp(B*i*) above one indicate that the odds increase, below one indicates decreasing odds, while a value of one indicates no change in the odds.

The results confirm that the decision to adopt organic farming is strongly influenced by farmer's own belief in the environmental and/or food quality benefits organic farming brings. The effect of own belief on the adoption of organic farming is positive and significant (4.104, odds–ratio = 22.801). The positive odds–ratio indicates that those farmers who believe in the environmental and/or better food quality benefits of organic farming are 22.8 times more likely to adopt such farming practice. Membership to farmers' association increases substantially the odds of adoption, most probably because farmers gain additional information on the characteristics and requirements of organic farming. The sign of the estimated

[15] As exp(0)=1 this can be used as a benchmark against with B_is can be compared to grasp the magnitude of the estimated coefficient. For positive coefficients, as B*i* increases, the exp(B*i*) increases faster than one and vice versa for the negative coefficients.

coefficients for labour availability are also positive, indicating that the odds of adopting organic farming increase where additional (family and non–family) labour is available. Such outcome is in line with the characteristics of organic farming technology that is more labour–intensive. The odds–ratio is higher for the family labour (2.691) compared with that for non–family labour variable (0.992), suggesting that where family labour is not a constraint, it is more likely that adoption of organic farming will take place. The only inverse relationship related to adoption of organic farming is observed for the farm size variable. The sign of the coefficient is negative, and the odds ratio indicates that when the farm is large, there is a 9.11 times lower chance that adoption of organic farming occurs, probably owing to the labour–intensive specific of the organic production technology, or of different enterprises structure of such farms.

3.5. Comparison between organic and non–organic production

The next step of the analysis aimed to identify any possible differences in terms of prices, yields, area and production costs (for both crops and livestock) between organic and non–organic holdings in both countries and to carry out an economic assessment. For comparative reasons, the analysis was performed only for those crops common to both organic and non–organic holdings.

In the case of crops, groups of cereals, protein crops, potatoes, oilseed crops, vegetables and flowers, fruits, wine and grapes, forage crops (including temporary grass, meadows and permanent pastures) and other crops were analysed. In the case of livestock, dairy cows and other cattle were taken into account.

3.5.1 Crop production

In the Czech Republic, as it can be observed in Table 10, the area and yields of cereals, protein crops, potatoes and wine in non–organic holdings are much higher than on organic farms. These results are directly influenced by the main trends in organic agriculture support policy, e.g. in the Czech Republic organic grazing livestock farms, which also achieve better economic results than arable crops farms, are especially promoted. In contrast, prices are higher for these crops when produced organically (the price of organic potatoes is twice as high as for non–organic potatoes). Unlike these cases, yields of organic and non–organic oilseed crops and fruits do not differ substantially, while prices for non–organic fruits are higher.

Table 19 Area, yields and prices of organic and non–organic crops in the Czech Republic

CROPS		AREA (ha)		YIELD (t/ha)		PRICE (EURO/t)	
		Non–organic	Organic	Non–organic	Organic	Non–organic	Organic
CEREALS	Barley	3,217.00	40.30	4.36	2.69	81.56	99.25
	Wheat	8,095.00	473.38	5.10	2.67	81.31	192.22

CROPS		AREA (ha)		YIELD (t/ha)		PRICE (EURO/t)	
		Non–organic	Organic	Non–organic	Organic	Non–organic	Organic
	Oats	226.25	50.74	3.66	2.61	68.96	105.95
	Rye	443.00	33.00	6.06	1.75	89.17	150.55
	Triticale	475.85	23.50	4.46	2.78	67.75	80.85
PROTEINS CROPS	Peas	131.00	36.50	2.79	1.40	105.45	192.37
	Soya	165.00	40.00	2.75	n.a.	242.56	368.02
POTATOES	Potatoes	114.25	10.30	21.31	13.73	103.40	213.75
OILSEED CROPS	Sunflower	556.00	24.58	2.88	2.88	190.53	317.83
FRUITS	Apples	52.10	4.00	17.50	17.00	158.92	83.64
	Cherries	12.00	5.00	2.00	6.50	501.84	267.65
	Currants	35.00	45.00	5.50	4.00	150.55	150.55
WINE AND GRAPES	Wine	76.20	13.50	9.67	6.25	524.14	n.a.
FORAGE CROPS	Clover	78.00	101.75	7.25	8.50	40.15	51.85
	Lucerne	9.00	17.00	5.82	9.00	n.a.	51.85
	Pastures and meadows	2,640.33	6,177.15	6.12	3.22	54.51	69.47
	Grass	11.10	821.00	n.a.	3.25	n.a.	55.20

Note: 1 Euro = 29.890 CZK; n.a. not available.

Source: Field survey, August 2005.

Table 20 reports the input costs (including seeds, fertilisers, herbicides, pesticides and fungicides) for crop enterprises in the Czech Republic for both types of holdings (organic and non–organic). In general, seeds costs are much higher for organic than for non–organic farms, except for seeds of organic forage crops which are cheaper. This could be due to more advanced organic farming in the Czech Republic, where farmers purchase better quality and more expensive organic seeds to improve their economic results.

Fertiliser costs are lower in organic farms, except in some cases (wheat, potatoes, fruits and wine). The use of pesticides, herbicides and fungicides is also practically non–existent in any of the organic holdings surveyed (except organic fruits and wine), which could be explained by a strategy of lower chemical inputs used in organic farming.

Table 20 Variable costs of organic and non–organic crops in the Czech Republic

CROPS	SEED (€/ha)		FERTILISER (€/ha)		HERBICIDES (€/ha)		PESTICIDES (€/ha)		FUNGICIDES (€/ha)	
	Non–organic	Organic	Non–organic	Organic	Non–organic	Organic	Non–organic	Organic	Non–organic	Organic
Barley	53.49	53.53	61.06	0.00	30.22	0.00	38.66	0.00	15.99	0.00
Wheat	54.53	118.41	80.28	104.55	34.24	0.00	49.77	0.00	26.16	0.00
Oats	35.30	88.24	50.75	27.88	27.12	0.00	20.07	0.00	14.64	0.00
Rye	54.50	166.03	98.41	8.36	44.91	0.00	16.73	0.00	0.00	0.00
Triticale	40.84	51.76	57.00	33.46	31.72	0.00	30.95	0.00	29.27	0.00
Peas	76.31	73.60	42.05	16.73	58.07	0.00	25.09	0.00	0.00	0.00
Potatoes	368.02	543.66	71.09	128.25	21.75	0.00	53.11	0.00	33.46	0.00
Apples	n.a.	n.a.	200.74	83.64	103.04	334.56	11.04	0.00	11.04	167.28

CROPS	SEED (€/ha)		FERTILISER (€/ha)		HERBICIDES (€/ha)		PESTICIDES (€/ha)		FUNGICIDES (€/ha)	
	Non–organic	Organic	Non–organic	Organic	Non–organic	Organic	Non–organic	Organic	Non–organic	Organic
Cherries	n.a.	n.a.	33.46	83.64	33.46	334.56	0.00	0.00	0.00	167.28
Currants	n.a.	n.a.	50.18	83.64	66.91	234.19	0.00	0.00	0.00	0.00
Wine	n.a.	7360.32	69.14	125.46	72.43	0.00	306.62	0.00	222.98	234.19
Clover	26.76	87.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lucerne	68.58	16.73	33.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pastures and meadows	61.29	28.67	34.75	12.04	0.00	0.00	8.43	0.00	0.00	0.00
Grass	65.24	60.22	133.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: 1 Euro = 29.890 CZK; n.a. = not available.

Source: Field survey, August 2005.

In Lithuania, all groups of crops (except for some types of fruits and vegetables and forage crops) are cultivated on smaller areas in organic holdings than in non–organic ones (Table 12). Moreover, the yields and prices of organic cereals and fruits are also much lower than non–organic farms. On the other hand, higher prices are paid for organic protein crops, vegetables and forage crops than for non–organic ones.

As for yields of other groups of crops, the results show that yields of organic potatoes and vegetables are lower (except for beetroot), although yields of organic forage crops are higher. Higher yield losses in organically grown vegetables could be explained by the fact that many organic vegetable growers do not breed animals and, therefore, use less organic fertiliser (manure) – substitution of synthetic fertilisers, which are very important for vegetables. Yields of organic and non–organic forage crops do not differ noticeably.

In general, prices for organic and non–organic produce are similar in Lithuania, i.e. organic prices are relatively low due to the low income of most of the Lithuanian population for these (quality) products, the high quality of traditional Lithuanian food, especially regional food (where there is access to local food there is no obvious preference for organic produce) and, in general, an underdeveloped organic market.

Table 21 Area, yield and prices of organic and non–organic crops in Lithuania

CROPS		AREA (ha)		YIELD (t/ha)		PRICE (€/t)	
		Non–organic	Organic	Non–organic	Organic	Non–organic	Organic
CEREALS	Barley	3,100.73	88.53	4.09	2.84	88.12	83.01
	Triticale	401.31	10.18	5.79	3.57	89.18	81.09
	Wheat	5,191.66	63.86	5.37	2.73	98.55	98.37
	Oats	18.80	19.92	3.16	1.80	82.25	73.37
	Rye	280.38	50.57	5.00	2.56	86.00	79.16
	Mixed cereals	10.00	3.00	2.70	1.30	95.57	86.88

CROPS		AREA (ha)		YIELD (t/ha)		PRICE (€/t)	
		Non–organic	Organic	Non–organic	Organic	Non–organic	Organic
PROTEINS CROPS	Peas	80.00	0.20	4.65	1.50	126.71	144.81
POTATOES	Potatoes	355.70	14.32	23.62	11.62	138.03	169.88
OILSEED CROPS	Rape	1,129.66	3.00	3.00	n.a.	162.00	n.a.
VEGETABLES AND FLOWERS	Strawberries	4.00	0.83	11.00	7.00	550.28	862.86
	Beetroot	10.50	2.32	7.6	21.60	91.23	115.85
	Cabbage	16.50	1.00	43.00	20.00	122.00	144.81
	Carrots	4.40	5.00	17.50	5.00	131.77	188.25
	Vegetables	0.10	9.02	15.00	10.00	126.00	206.00
FRUITS	Apples	20.70	5.36	4.72	3.30	223.97	28.96
	Apple and pear	0.50	0.20	2.00	2.50	28.96	28.96
	Blackcurrants	3.20	6.23	5.65	4.35	810.93	144.81
	Cherries	1.20	0.40	11.00	1.20	550.28	n.a.
	Raspberries	1.60	0.10	6.95	1.20	868.86	n.a.
FORAGE CROPS	Fodder beet	1.50	0.63	35.00	31.67	16.00	40.54
	Perennial grasses	31.00	38.50	2.30	3.87	36.20	50.68
	Vetches	4.10	23.68	1.50	3.60	57.92	89.30
	Pastures and meadows	2,047.20	676.47	6.71	6.67	33.76	39.40
OTHER CROPS	Mixtures	36.10	9.00	2.13	2.25	78.00	87.00

Note: 1 Euro = 3.4528 LTL.

Source: Field survey, August 2005.

In Lithuania, the costs of seeds are generally lower in organic holdings than in non–organic ones, although the seeds of organic protein crops, most vegetables and perennial grasses are more expensive (Table 22). This difference emerges from the fact that organic farms generally produce their own seeds but buy better quality organic seeds for vegetables and protein crops.

Expenditures with fertilisers and pesticides are lower and even non–existent in organic holdings (except for forage crops). This observation can be explained by the fact that Lithuanian organic farms seem not using generally expensive advanced organic farming technologies that rely on organic seeds resistant to diseases and pests, organic means of plant protection, etc. Moreover, the fact that organic farmers typically produce some or all of their organic fertilisers on farm, thus lowering production costs, can also influence the results reported.

Table 22 Variable costs of organic and non–organic crops in Lithuania

CROPS		SEED (€/ha)		FERTILISER (€/ha)		PESTICIDES (€/ha)	
		Non–organic	Organic	Non–organic	Organic	Non–organic	Organic
CEREALS	Barley	56.37	25.34	112.69	90.14	55.03	28.96
	Triticale	68.45	32.94	148.36	115.85	0.00	0.00
	Wheat	60.57	27.91	154.58	66.25	66.61	0.00
	Oats	53.87	33.60	82.25	0.00	8.69	0.00
	Rye	69.01	32.82	129.25	45.62	0.00	0.00
	Mixed cereals	23.17	57.92	34.75	0.00	0.00	0.00
PROTEINS CROPS	Peas	108.61	289.62	117.50	0.00	0.00	0.00
POTATOES	Potatoes	372.08	350.58	150.73	140.47	0.00	0.00
OILSEED CROPS	Rape	35.72	28.96	149.31	0.00	81.09	0.00
VEGETABLES AND FLOWERS	Strawberries	3475.44	2896,20	333.06	260,66	0.00	0.00
	Beetroot	102.82	163,64	318.58	22,45	0.00	0.00
	Cabbage	174.35	579,24	374.77	14,48	0.00	0.00
	Carrots	86.89	289,62	127.43	14,48	0.00	0.00
	Vegetables	144.81	53,12	28.96	162,91	0.00	0.00
FRUITS	Apples	n.a.	n.a.	272.24	57.92	0.00	0.00
	Blackcurrant	n.a.	1158.48	278.04	0.00	0.00	0.00
	Cherries	n.a.	n.a.	270.79	0.00	0.00	0.00
	Raspberries	n.a.	n.a.	288.65	0.00	0.00	0.00
FORAGE CROPS	Fodder beet	79.65	36.69	34.75	95.57	0.00	0.00
	Perennial grasses	30.41	54.06	23.17	0.00	0.00	0.00
	Vetches	57.92	25.58	0.00	101.37	0.00	0.00
	Pastures and meadows	114.36	66.13	29.47	40.55	0.00	0.00
OTHER CROPS	Mixtures	34.39	22.45	29.36	0.00	0.00	0.00

Note: 1 Euro = 3.4528 LTL. n.a. = not available.

Source: Field survey, August 2005.

3.5.2 Livestock production

In the Czech Republic, yields of dairy cows are much lower in organic holdings while the prices of organic milk and meat are higher. These prices do not compensate for lower yields of organic production (see Table 23).

Table 23 Yields and prices of livestock in the Czech Republic

LIVESTOCK	NON–ORGANIC			ORGANIC		
	Production (t/head) or (l/head)(*)	Price (€/t) or (€/l)(*)	Production x Price (€/head)	Production (t/head) or (l/head)(*)	Price (€/t) or (€/l)(*)	Production x Price (€/head)
Dairy cows	5,359.70	0.26	1,393.52	2,706.30	0.32	866.02

Note: 1 Euro = 29.890 CZK.

Source: Field survey, August 2005.

Authors like Zivelová *et al.* (2003) show that milk yields on organic farms are much lower than on non–organic farms. The average farm gate price per litre of milk is also different, although the difference is not noticeable.

Concentrated feed and veterinary/miscellaneous costs are reported in Table 24. Organic livestock feed consumption is lower for both dairy cows and other cattle, as it is a more extensive type of production. Moreover, prices of non–organic feed are higher than organic, i.e. 59.3 % in the case of dairy cows and 75.7 % in the case of other cattle. In contrast, veterinary and miscellaneous costs are higher in organic production: 4.9 % for dairy cows and 68.3 % for other cattle.

Table 24 Variable costs of livestock production in the Czech Republic

PRODUCTION PROFILE	Variable	Dairy cows	Other cattle
NON–ORGANIC	Feed (t/head/year)	1.75	0.58
	Price of feed (€/t)	168.77	112.64
	Costs of feed (€/head/year)	294.91	65.65
	Veterinary/miscellaneous costs (€/head)	42.85	8.56
ORGANIC	Feed (t/head/year)	0.73	0.28
	Price of feed (€/t)	105.95	64.12
	Costs of feed (€ /head/year)	76.81	18.01
	Veterinary/miscellaneous costs (€ /head)	44.96	14.41

Note: 1 Euro = 29.890 CZK.

Source: Field survey, August 2005.

In Lithuania, both yields and prices of milk and meat are higher in non–organic holdings. This outcome is partly influenced by the lack of organic milk collection and processing systems and little or no market information available for farmers. Lower organic milk prices (although in general similar to non–organic prices) can also be due to several other reasons, namely the prices for milk collection (which can vary appreciably) and the quantity of milk supplied (bigger suppliers receive higher prices). As a result, income through prices is also higher on non–organic holdings than organic farms (see Table 25).

Table 25 Number of heads, yields and prices of livestock in Lithuania

LIVESTOCK	NON–ORGANIC			ORGANIC		
	Yield (t/head) or (l/head)(*)	Price (€/t) or (€/l)(*)	Yield x Price (€ /head)	Yield (t/head) or (l/head)(*)	Price (€/t) or (€/l)(*)	Yield x Price (€ /head)
Dairy cows	4,436.62	0.19	842.96	3,775.57	0.17	641.85

Note: (*) 1 Euro = 3.4528 LTL.

Source: Field survey, August 2005.

Feed consumption by organic livestock and the costs of organic feed are higher for both dairy cows and other cattle (Table 26). This could be due to increased costs of concentrates and the extra cost of straw for bedding in organic livestock farming, although the price of feed and veterinary and miscellaneous costs are higher in non–organic holdings.

Table 26 Variable costs of livestock production in Lithuania

Production profile	Variable	Dairy cows (*)	Other cattle
NON–ORGANIC	Feed (t/head/year)	0.75	0.60
	Price of feed (€/t)	429.41	447.74
	Costs of feed (€/head/year)	321.10	267.03
	Veterinary/miscellaneous costs (€/head)	56.43	37.65
ORGANIC	Feed (t/head/year)	1.20	0.63
	Price of feed (€/t)	346.67	359.78
	Costs of feed (€/head/year)	416.00	225.26
	Veterinary/miscellaneous costs (€/head)	38.43	19.76

Note: 1 Euro = 3.4528 LTL.

Source: Field survey, August 2005.

The results reported here for both countries (low yields, higher prices and lower specific costs due to lower pesticide and fertiliser costs) are similar with those cited in the relevant literature. In some cases, more expensive seeds are reported for organic farms (Zivelová et al. 2003; Pacini *et al.* 2003; 2004; Delate *et al.* cited by Kuminoff and Wossink, 2005). A number of specific cases are also found in the literature, with similar or higher yields for organic farms (oilseed crops, fruit, forage crops, clover and grass in the Czech Republic and forage crops and clover in Lithuania (see Kumm 2002)), similar or lower prices for organic produce (fruits in the Czech Republic and Lithuania, or organic milk induced by the absence of established markets (Zivelová *et al.* 2003)) and lower costs of seeds in Lithuania.

3.6. Conclusions

Determinants of adopting organic farming

The overall results reveal that the main reasons for farmers to adopt organic farming in both countries relate to (a) environmental and food concerns (as adopters consider organic farming as more environmental friendly and/or producing better quality food) and (b) farm intrinsic characteristics (suitable farm size, type of production) that make it more compatible to requirements of organic certification procedure.

In the Czech Republic, the results of the field interviews indicate that the most important determinants of converting to organic relate to farmers' environmental and food concerns and to farm intrinsic characteristics. Czech farmers interviewed indicate their belief that organic produce are of higher quality than non–organic produce, and that organic farming is more respectful with the environment than non–organic farming that influenced the most their decision to convert. Production structure and size of the farm that already fitted to the organic farming certification requirements at the time of deciding to convert are also among the factors that influenced the decision to convert. In Lithuania, the farmers interviewed indicated their own belief that organic farming produces higher quality products and/or addresses environmental problems have determined their decision to convert. The other important determinant that emerged is farm intrinsic characteristics that influence the changes needed to be implementing in the farm structure or production technology in order to meet the requirements of the organic certification process. The overall results at the country level indicate market access as being a rather important factor when deciding to convert to organic. Moreover, farmers indicate that the presence of middlemen buying their organic produce as a reason for not re–converting to non–organic production.

As for the social characteristics of organic and non–organic farmers, the results of the field survey in both countries indicate that labour force of organic farms (including head of farm, family members and other workers) is younger and has a higher education level than the labour force on non–organic farms. Organic farm workers often have outside work (especially in Lithuania) where they are permanently employed. As for regards the labour needs, field survey results in the Czech Republic indicate that no difference between organic and non–organic farms, while in Lithuania organic farming needs even less labour than non–organic farming (explained mainly by the underdeveloped organic farming sector). Moreover, in Lithuania organic farming seems to rely more on family labour, whereas in the Czech Republic this is more the case of the non–organic farms.

4 PROSPECTIVE IMPACT OF SELECTED POLICY INSTRUMENTS ON THE INCOME OF FARMING SYSTEMS

4.1. Introduction

This chapter reports the results of the assessment of the potential medium term impact of selected Common Agricultural Policy (CAP) instruments on the economic sustainability of the farming systems identified. Policy scenarios for the 2013 year horizon were developed to simulate implementation in both countries of the following CAP instruments: Single Farm Payment (SFP), organic farming payment and payment for energy crops.

The quantitative analysis uses non–organic farms as the starting point. For each of the eleven farming systems previously identified, an average standard farm is defined using information from the FADN databases for the 2001–2003 period. Three policy scenarios are defined (accession to the EU, non–accession, and enforced environmental support under the CAP). To each of these scenarios three managerial decisions are associated under the assumption that farmers would decide, given each of the policy scenarios, a) to make no change (i.e. continue as a non–organic farm), b) to change to organic farming, and c) to introduce energy crops (only rape seed considered here).

4.2. Methodological approach

The scenario analysis builds on the outcome of the previous two stages (farming systems identified and input from the field survey). The methodological approach includes the following steps:

- set up and describe the framework of scenarios (including assumptions applied, description of farms on which the simulations are performed using national FADN data),
- carry out several simulations for each farming system according to the assumptions of scenarios,
- review the results obtained and draw conclusions at farming system level.

The first step implies gathering all available information regarding the agricultural payments in Czech Republic and Lithuania before the EU co–financing started. The information collected refer at current levels of Single Area Payment Scheme, phasing–in period and prospects for the introduction of SFP scheme; previous, current and future subsidies for organic farming and energy crops, as well as percentage of EU co–financing. Additionally, several assumptions are made for costs, prices, yields, inflation, etc. for the 2013 time horizon, and for the differences between organic and non–organic farms (see below).

In the second step, in scenarios ‘No–Accession’ and ‘Baseline’ simulations are carried considering each of the three alternative managerial options mentioned and for each of the eleven farming systems. A sensitivity analysis is performed for the ‘Environmental CAP’ for which, apart of the same alternative options evaluated, a sensitivity analysis is carried out (three simulations using different rates of organic farm and energy crops subsidies on the one side, and the rate of the SFP on the other side).

The third step implies assessing the main outcomes of the analysis carried at the farming systems level and comparisons between systems and scenarios. The FADN variables used in the analysis and their calculation under each option are reported in Table 27. The key variables are: (i) total output (TO); (ii) intermediate consumption (IC); (iii) balance of current subsidies and taxes (ST); and (iv) gross farm income (GFI).

In terms of data and data sources used, the analysis relies on national FADN data (2001–2003) of non–organic farms to identify the main variables of interest (see below), and then projects them to the year 2013 considering the three alternative options in each scenario. For each farming system, the (2001–2003) FADN average data are calculated. The sample averages are taken to define the *standard farm* (i.e. representative farms on which scenario simulations are performed) associated with each farming system.

The selection of standard farms and the analysis in different scenarios and alternative options is performed without distinguishing upon the legal form of the farm, a choice justified as follows. First, as organic farms in Lithuania are associated mostly with individual farms, the field survey carried out in 2005 in this country included no data on organic corporate farms. Consequently, it was not possible to obtain the percentage values based on the 2005 field survey, the calculations for the 'go organic' option needed. Second, adding an extra criterion (legal form) when disaggregating FADN data to distinguish the different farming systems reduces significantly the number of available cases for establishing the standard farm. Third, the disaggregation of the 2005 field survey data also by legal form (in addition to the disaggregation by organic or non–organic farm) is untenable given the insufficient data. Since these data are essential when considering the alternative options of organic farm and farm partially dedicated to growing energy crops, the missing data (i.e. unavailable from 2005 field survey) on yields, prices and costs of certain groups of crops and livestock, has to be extracted from other information sources. However, none of the sources consulted distinguishes the values of the notions used here by legal form. Finally, the direct payments, important when defining the scenarios, are not related to the legal type of farm.

The main economic variable is *gross farm income* (GFI), together with input variables related to adoption of organic farming or implementation of energy crops. The use of GFI and not of the Farm Net Value Added (which would imply the subtraction of depreciation)[16] is justified on several grounds. First, various authors use the gross margin[17] when evaluating the sustainability of organic and non–organic farming systems (e.g. including revenues from

[16] Depreciation, as defined in FADN (SE360) is the depreciation of capital assets estimated at replacement value. The entry of depreciation of capital assets over the accounting year in the accounts is determined based on the replacement value. It concerns plantations of permanent crops, farm buildings and fixed equipment, land improvements, machinery and equipment and forest plantations. There is no depreciation of land and circulating capital.

[17] This variable is similar to variable of Gross Farm Income deriving from FADN and used in this study, as it basically considers the same elements.

production, compensation and agri–environmental payments, costs of fertilisers and pesticides and other variable costs (Pacini *et al.* 2003)). Second, various studies estimate that the depreciation of machinery and equipment per area cropped is similar in organic and non–organic production (Wynen 1998; 2001), hence no significant effect of depreciation would appear under both alternative options.

4.2.1 Definition of the policy scenarios

Three scenarios were developed, namely: (i) 'No–Accession' scenario, considering the hypothesis of non–accession of the Czech Republic and Lithuania to the EU; (ii) 'Business as usual' (or 'Baseline') scenario, based on developments of the agricultural policy until 2005 and the most probable direction agricultural policy is likely to take in the future and (iii) 'Environmental CAP' scenario, which maintains the general features of the 'Business as usual' scenario but reconsiders the subsidies for organic farming and energy crops. As this scenario was defined in relation to the 2003 CAP reform, where the tendency is to increase the focus on and support for environmental measures, higher rates of organic and energy crops payments combined with a proportional reduction in SFP are used as main assumptions.

The analysis starts with first defining the standard holding and then assesses using a 'what if' approach what this holding would be like in year 2013, depending on whether it (a) continued to be a non–organic farm, (b) converted to organic farming, or (c) changed its enterprises structure by introducing energy crops in crops rotation. Consequently, for each farming system there are three alternative farms (options) corresponding to each managerial option: a non–organic farm, an organic farm and a non–organic farm with energy crops. Hence, these options should be understood as alternative farmer behaviour, reactions to the possible changes in the agricultural support patterns.

Moreover, the policy instruments tested for each alternative type of standard holding were influenced by the assumed behavioural options described above. For non–organic farms, only the effect of SFP was evaluated. For the situation in which the non–organic farms would have had converted into organic farms, the differences in costs, productivity and prices with regard to non–organic farms were taken into account, using mainly field survey data. The current amount of organic payment per hectare, which varies according to the type of agricultural production, was supposed to be 10 % higher for non–organic farms converted to organic farms. In the case of non–organic farms with energy crops, it was assumed that (i) set–aside plots were cultivated only with rape as energy crops (i.e. 15 % of utilised agricultural land in both countries), and (ii) 50 % of the farmland covered by other field crops (potatoes, sugar beets, etc.) was also to be used for cultivating energy crops (also rape), the rest maintaining the same crop structure. Using the set–aside land to cultivate energy crops directly affects farm output, production costs and income, while, in the second case, the output and costs of sown crops do not radically change, apart from the level of subsidies received (since farmers start receiving energy crops subsidies for the area in question of 50 %). Farms with energy crops are the only case where the change in agricultural structure was considered in this study. The basic assumptions used for all scenarios and options are presented in Table 27.

Table 27 Assumptions of scenarios and managerial options

OPTION	SIMULATION SUBSIDIES	SUB–SIMULATIONS SUBSIDIES
SCENARIO ‘BUSINESS AS USUAL’ (BASELINE)		
NON–ORGANIC	SFP at a full rate, *i.e. 100% of EU–15 payment and varying according to type of crops*	
ORGANIC	SFP at a full rate, *i.e. 100% of EU–15 payment and varying according to type of crops* + organic payment per ha varying according to type of crops and 10 % higher than current payment	
NON–ORGANIC FARM WITH ENERGY CROPS	SFP at a full rate, *i.e. 100 % of EU–15 payment and varying according to type of production* + energy crops payment per ha at EU–15 level (45 € /ha)	
SCENARIO ‘NO–ACCESSION’		
NON–ORGANIC	2001–2003 FADN average payments	
ORGANIC	2001–2003 FADN average payments + organic payments per ha varying according to type of production (average 2001–2003 payment)	
NON–ORGANIC FARM WITH ENERGY CROPS	2001–2003 FADN average payments + energy crops payment per ha (exclusively in the Czech Republic)	
SCENARIO ‘ENVIRONMENTAL CAP’		
NON–ORGANIC	Amount depending on sub–simulation (see next column)	+ SFP at 99 % *(varying according to type of crops)*
		+ SFP at 98 % *(varying according to type of crops)*
		+ SFP at 97 % *(varying according to type of crops)*
ORGANIC	Amount depending on sub–simulation (see next column)	+ SFP at 99 % *(varying according to type of crops)* + organic payments per ha *(110 % of projection for 2013 and varying according to type of crops)*
		+ SFP at 98 % *(varying according to type of crops)* + organic payments per ha *(120 % of projection for 2013 and varying according to type of crops)*
		+ SFP at 97 % *(varying according to type of crops)* + organic payments per ha *(130 % of projection for 2013 and varying according to type of crops)*
NON–ORGANIC FARM WITH ENERGY CROPS	Amount depending on sub–simulation* (see next column)	+ SFP at 99 % *(varying according to type of crops)* + energy crops payment per ha *(110 % of projection for 2013) = Simulation 1*
		+ SFP at 98 % *(varying according to type of crops)* + energy crops payment per ha *(120 % of projection for 2013) = Simulation 2*
		+ SFP at 97 % *(varying according to type of crops)* + energy crops payment per ha *(130 % of projection for 2013)= Simulation 3*

Note: * see Annex 12 for results of all three simulations.

Source: Compiled by the authors, 2005.

The main output variable considered was gross farm income (GFI) and input variables related to conversion to organic farming or cultivation of energy crops (total output, TO, intermediate consumption, IC and balance of current subsidies and taxes, ST). This selection of FADN variables and the relation between them are presented in Annex 4.

4.2.2 Key assumptions of scenarios

The year 2013 is taken as the time horizon in all scenarios, a choice justified by the end of phasing–in of the 2003 CAP reform, when direct payments in the Czech Republic and Lithuania will reach parity with those in EU–15 (reaching parity earlier was not considered). The effect of inflation is taken into account when estimating prices, costs and taxes for the time horizon 2013, but subsidies are not assumed to increase with inflation (since CAP guidelines do not include inflation–linked annual increases).

No variations in costs are taken into account in real terms (apart from the effect of inflation). Additionally, the differences in costs between organic and non–organic farms (field survey data) (Table 28) were applied to the 'organic farm' option. The variations refer to the induced change of the values (costs, prices etc) at the 2013 horizon owing to the effect of inflation.

Table 28 Percentages of variation of specific costs in the Czech Republic and Lithuania

Specific costs		Inflation	The Czech Republic		Lithuania	
			Organic variation	Total Organic increase	Organic variation	Total Organic increase
	Cell code	A	B	A+B	C	A+C
Seeds and plants	1	20.71%	236.54%	257.25%	48.39%	69.10%
Fertilisers	2	20.71%	-68.03%	-47.32%	-71.81%	-51.10%
Crop protection	3	20.71%	-64.97%	-44.26%	-80.94%	-60.23%
Other crop specific costs	4	20.71%	51.15%	71.86%	-19.44%	1.27%
Feeding stuffs	5	20.71%	-81.61%	-60.90%	-3.78%	16.93%
Other livestock specific costs	6	20.71%	-23.03%	-2.32%	-42.87%	-22.16%

Note: 'Cell code' links the columns with the files of the table for identify each value with its source (see Annex 8).

Source: Compiled by the authors, 2005.

As for yields, the rate of increase until 2013 is assumed to be equal in both organic and non–organic farms (including those producing energy crops), despite the differences in yields between these two types of production.

Table 29 Percentages of variation of yields in the Czech Republic and Lithuania

Crops and livestock products			The Czech Republic			Lithuania		
			Non–organic increase	Organic variation	Total Organic increase	Non–organic increase	Organic variation	Total Organic increase
		Cell code	A	B	A+B	C	D	C+D
Crops and crop's yield	Cereals	1	3.22%	-38.84%	-35.62%	3.58%	-67.88%	-64.30%
	Protein crops	2	3.56%	-49.78%	-46.22%	-0.05%	-67.74%	-67.79%
	Potatoes	3	4.00%	-35.59%	-31.59%	0.87%	-50.78%	-49.92%
	Sugar beet	4	3.00%	-37.13%	-34.13%	5.63%	-41.21%	-35.59%
	Oil-seed crops	5	13.83%	-33.91%	-20.08%	3.61%	-33.91%	-30.30%
	Industrial crops	6	9.13%	-34.55%	-25.42%	10.89%	-34.55%	-23.66%
	Vegetables and flowers	7	6.63%	-52.91%	-46.29%	6.63%	-52.91%	-46.29%
	Fruits	8	1.25%	10.00%	11.25%	1.25%	-68.35%	-67.10%
	Wine and grapes	9	-3.25%	-35.34%	-38.59%	-3.25%	-0.65%	-3.90%
	Forage crops	10	-0.43%	-63.26%	-63.68%	10.51%	5.88%	16.39%
	Other crop's output	11	4.09%	-37.13%	-33.04%	3.97%	-41.21%	-37.24%
Livestock and yield	Cow's milk and products	12	2.45%	-49.51%	-47.06%	3.94%	-14.90%	-10.96%
	Beef and veal	13	0.30%	-54.67%	-54.37%	0.30%	-6.77%	-6.47%
	Pig meat	14	0.10%	-55.46%	-55.36%	0.10%	-55.46%	-55.36%
	Sheep and goats	15	0.10%	-97.65%	-97.55%	0.10%	-97.65%	-97.55%
	Poultry meat	16	2.33%	-94.29%	-91.95%	2.33%	-94.29%	-91.95%
	Eggs	17	0.00%	-94.29%	-97.65%	0.00%	-94.29%	-94.29%
	Sheep's and goat's milk	18	2.45%	-49.51%	-47.06%	3.94%	-14.90%	-10.96%
	Other livestock and products	19	1.10%	-71.25%	-70.14%	1.53%	-54.04%	-52.51%
	Other output	20	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Note: 'Cell code' links the columns with the rows of the table for identify each value with its source (see Annex 9).

Source: Compiled by the authors, 2005.

For prices, projections of world market prices are used in all simulations, making approximations where needed. Percentage differences in prices of organic and non–organic products are estimated using both primary (field survey) and secondary information sources (see Table 30).

Table 30 Percentages of variation of prices in the Czech Republic and Lithuania

Crops and livestock products			Nominal price (Non–organic)	The Czech Republic		Lithuania	
				Organic variation	Total Organic increase	Organic variation	Total Organic increase
		Cell code	A	B	A+B	C	A+C
r o p	Cereals	1	23.52%	59.65%	83.16%	-6.65%	16.87%

Crops and livestock products		Cell code	Nominal price (Non–organic)	The Czech Republic		Lithuania	
				Organic variation	Total Organic increase	Organic variation	Total Organic increase
		Cell code	A	B	A+B	C	A+C
	Protein crops	**2**	20.71%	82.42%	103.13%	14.29%	34.99%
	Potatoes	**3**	20.71%	107.43%	128.14%	23.08%	43.79%
	Sugar beet	**4**	-1.91%	50.00%	48.09%	50.00%	48.09%
	Oil-seed crops	**5**	15.94%	66.81%	82.75%	66.81%	82.75%
	Industrial crops	**6**	20.71%	51.72%	72.43%	51.72%	72.43%
	Vegetables and flowers	**7**	20.71%	62.84%	83.55%	62.84%	83.55%
	Fruits	**8**	20.71%	-38.14%	-17.44%	-79.87%	-59.16%
	Wine and grapes	**9**	20.71%	96.40%	117.11%	96.40%	117.11%
	Forage crops	**10**	20.71%	25.98%	46.69%	60.91%	81.62%
	Other crop's output	**11**	20.71%	10.82%	31.53%	10.82%	31.53%
Livestock and products	Cow's milk and products	**12**	17.69%	21.59%	39.27%	-14.64%	3.05%
	Beef and veal	**13**	5.87%	15.76%	21.63%	-37.88%	-32.01%
	Pig meat	**14**	-6.35%	-35.85%	-42.20%	-35.85%	-42.20%
	Sheep and goats	**15**	9.72%	15.76%	25.47%	-37.88%	-28.16%
	Poultry meat	**16**	-10.54%	100.00%	89.46%	100.00%	89.46%
	Eggs	**17**	-10.54%	100.00%	89.46%	100.00%	89.46%
	Sheep's and goat's milk	**18**	17.69%	21.59%	39.27%	-14.64%	3.05%
	Other livestock and products	**19**	20.71%	34.12%	54.83%	8.45%	29.16%
Other output		**20**	20.71%	0.00%	20.71%	0.00%	20.71%

Note: 'Cell code' links the columns with the rows of the table for identify each value with its source (see Annex 10).

Source: Compiled by the authors, 2005.

For taxes, all options assume an increase similar to accumulated inflation by year 2013. In addition, for the organic farm option, the differences between organic/non–organic farms (using values obtained from the 2005 field survey) are taken into account to estimate the value in percentages (Table 31).

Table 31 Percentages of variation in taxes in the Czech Republic and Lithuania

	Inflation (1)	Czech Republic		Lithuania	
		Organic farm variation (2)	Total Organic farm increase	Organic farm variation (2)	Total Organic farm increase
	A	B	A+B	C	A+C
Taxes	20.71%	47.05%	67.76%	-47.41%	-26.70%

Sources: (1) European Commission, Directorate–General for Agriculture and Rural Development (2005): *Prospects for agricultural markets and income 2005–2012*. Available from: www.europa.eu.int/comm.

(2) Field survey, 2005 (Differences between organic and non–organic farming (in %)). See Annex 11.

4.3. Agricultural and economic structure of the standard holdings

4.3.1 The Czech Republic

Table 32 lists the agricultural variables for the standard holdings corresponding to the farming systems. The first row of the table shows the average size of the FADN sub–sample (years 2001–2003) for each farming system, based on which the values of a standard holding were computed. Table 33 includes economic variables related to these standard holdings.

Table 32 Agricultural variables for Czech standard holdings used in scenarios

FADN CODE		Agricultural variables	Crops–Oriented Sugar beet (COSB)	Crops–Oriented Maize (COM)	Mixed–Oriented Grassland (MOG)	Livestock–Oriented (LO)	Mixed–Oriented Potatoes (MOP)
SYS03		Sub–sample farms (number)	*659*	*45*	*168*	*215*	*238*
SE005		**Economic size (ESU)***	**292.28**	**553.38**	**156.22**	**344.10**	**269.28**
SE025		**Utilised agricultural area (UAA) (ha)**	**626.07**	**1,030.18**	**611.10**	**849.83**	**758.60**
SE030		Rented UAA (ha)	601.67	1002.92	574.65	826.11	712.17
Area (%)	SE035	Cereals	50.13	54.35	26.34	40.04	43.13
	SE041	Other field crops	22.54	20.28	8.07	17.28	14.37
	SE046	Vegetables and flowers	1.03	1.18	0.02	0.06	0.02
	SE050	Vineyards	0.08	4.41	0.00	0.00	0.00
	SE054	Other permanent crops	0.45	0.92	0.20	0.04	0.11
	SE071	Forage crops	22.75	17.89	62.38	40.31	42.72
SE075		**Woodland area (ha)**	**0.20**	**0.40**	**0.28**	**1.21**	**0.10**
Livestock units (LU/100ha)	**SE080**	**Total livestock units**	**56.08**	**100.49**	**45.64**	**56.88**	**53.30**
	SE085	Dairy cows	15.13	9.68	17.57	23.26	19.95
	SE090	Other cattle	12.05	7.28	17.76	19.23	18.43
	SE095	Sheep and goats	0.01	0.11	0.26	0.09	0.10
	SE100	Pigs	22.16	28.67	8.76	13.71	11.32
	SE105	Poultry	6.69	54.68	1.15	0.57	3.48

Note: The table reports average values of FADN data for 2001–2003.

Source: Compiled by the authors using data from the Czech FADN Liaison Agency, 2005.

Table 33 Economic variables for Czech standard holdings used in scenarios

FADN CODE	Economic variables (€/ha)	Crops–Oriented Sugar beet (COSB)	Crops–Oriented Maize (COM)	Mixed–Oriented Grassland (MOG)	Livestock–Oriented (LO)	Mixed–Oriented Potatoes (MOP)
SYS03	Sub–sample farms (number)	*659*	*45*	*168*	*215*	*238*
SE131	**Total output (TO)**	1,152.49	1,039.99	650.13	1,030.68	840.33
SE135	Output crops and crops products	566.59	546.38	222.71	410.29	326.25
SE206	Output livestock and products	494.29	416.72	373.02	538.91	469.12
SE256	Other output	91.60	76.89	54.41	81.49	44.96
SE275	**Intermediate consumption (IC)**	831.94	740.72	504.91	734.04	642.98
SE281	Specific costs	498.67	456.99	288.83	465.41	417.23
SE336	Farming overheads	333.27	283.72	216.08	268.62	225.75
SE600	**Balance current subsidies and taxes (ST)**	34.65	32.97	94.34	55.68	61.09
SE605	Subsidies on product and costs	54.31	55.03	102.50	68.37	72.87
SE390	Taxes	19.66	22.06	8.16	12.68	11.77
SE410	**Gross Farm Income (GFI = TO-IC+ST)**	355.21	332.24	239.56	352.33	258.45

Notes: The table reports average values of FADN data for 2001–2003.
1 Euro = 31.99 CZK (average exchange rate in 2001–2003).

Source: Compiled by the authors using data from the Czech FADN Liaison Agency, 2005.

4.3.2 Lithuania

As in the Czech Republic, one standard holding per farming system was identified in Lithuania for the purposes of policy simulation exercise. These standard holdings correspond to FADN data averages for 2001–2003. Table 34 and Table 35 reports the agricultural and economic variables of the Lithuanian standard holding used in the simulations.

Table 34 Agricultural variables for Lithuanian standard holdings used scenarios

FADN CODE		Agricultural variables	Livestock–Oriented (LO)	Crops–Oriented (CO)	Crops–Marginal (CM)	Livestock–Marginal (LM)	Urban–Oriented (UO)	Intermediate (I)
SYS03		Sub–sample farms (number)	*191*	*382*	*234*	*147*	*94*	*211*
SE005		**Economic size (ESU)***	**10.54**	**23.23**	**5.55**	**5.72**	**10.49**	**6.14**
SE025		**Utilised agricultural area (UAA) (ha)**	**51.48**	**130.07**	**40.35**	**39.12**	**52.04**	**39.71**
SE030		Rented UAA (ha)	34.38	109.06	27.98	21.48	38.10	23.55
Area (%)	SE035	Cereals	54.19	54.10	34.85	33.23	52.95	40.41
	SE041	Other field crops	27.92	31.26	18.99	9.73	18.13	20.97
	SE046	Vegetables and flowers	0.23	1.15	0.32	0.20	0.51	0.33
	SE050	Vineyards	0.00	0.00	0.00	0.00	0.00	0.00
	SE054	Other permanent crops	0.19	0.61	0.63	0.65	0.20	0.50
	SE071	Forage crops	17.47	12.88	45.22	56.18	28.21	38.26
SE075		**Woodland area (ha)**	**0.60**	**1.86**	**4.98**	**4.76**	**2.94**	**4.97**
Livestock units (LU/100ha)	**SE080**	**Total livestock units**	**20.08**	**9.63**	**26.46**	**35.73**	**25.85**	**28.88**
	SE085	Dairy cows	8.18	5.00	14.40	18.33	11.66	13.94
	SE090	Other cattle	5.06	2.50	6.63	12.42	6.24	9.01
	SE095	Sheep and goats	0.00	0.00	0.15	0.03	0.44	0.01
	SE100	Pigs	6.68	1.92	4.63	4.74	7.03	5.63
	SE105	Poultry	0.16	0.21	0.65	0.22	0.48	0.29

Note: The table reports average values of FADN data for 2001–2003.
(*) ESU = European Size Units.

Source: Compiled by the authors using data from the Lithuanian FADN Liaison Agency, 2005.

Table 35 Economic variables for Lithuanian standard holdings used in scenarios

FADN CODE	Economic variables (€/ha)	Livestock–Oriented (LO)	Crops–Oriented (CO)	Crops–Marginal (CM)	Livestock–Marginal (LM)	Urban–Oriented (UO)	Intermediate (I)
SYS03	Sub–sample farms (number)	*191*	*382*	*234*	*147*	*94*	*211*
SE131	**Total output**	**509.70**	**453.94**	**378.84**	**442.69**	**508.00**	**463.57**
SE135	Output crops and crop's products	388.67	380.24	207.97	236.13	324.20	260.45
SE206	Output livestock and products	116.98	66.26	157.68	199.20	164.15	187.99
SE256	Other output	4.05	7.45	13.19	7.36	19.64	15.12
SE275	**Intermediate consumption**	**313.66**	**271.62**	**231.31**	**295.51**	**328.48**	**290.35**
SE281	Specific costs	228.65	190.80	157.90	215.28	229.07	204.28
SE336	Farming overheads	85.01	80.82	73.41	80.23	99.41	86.07
SE600	**Balance current subsidies and taxes**	**31.21**	**26.27**	**36.52**	**35.05**	**31.90**	**31.79**
SE605	Subsidies on product and costs	33.33	28.52	37.85	36.68	33.35	33.92
SE390	Taxes	2.12	2.25	1.32	1.64	1.45	2.12
SE410	**Gross Farm Income**	**227.25**	**208.60**	**184.05**	**182.23**	**211.41**	**205.01**

Note: The table reports average values of FADN data for 2001–2003. 1 Euro = 3.4529 LTL (average exchange rate 2001–2003).

Source: Compiled by the authors using data from the Lithuanian FADN Liaison Agency, 2005.

4.4. Results of scenarios calculations

4.4.1 The Czech Republic

4.4.1.1. 'Business as usual' (Baseline) scenario

The simulation results of the 'Baseline' scenario (Table 36) indicate that under the current (post–EU accession) agricultural policy all farming options induce income increase. The non–organic farm with energy crops (in all farming systems) option exhibits the highest GFI, while under the organic farm option the income increase is not that large. In all farming systems, the non–organic farm benefits when introducing energy crops in rotation since additional payments and additional production outputs (hence income) are gained.

Table 36 'Business as usual' (Baseline) scenario results in the Czech Republic

Simulation results (€/ha)		Crops–Oriented Sugar beet (COSB)	Crops–Oriented Maize (COM)	Mixed–Oriented Grassland (MOG)	Livestock–Oriented (LO)	Mixed–Oriented Potatoes (MOP)
NON–ORGANIC FARM	Total Output	1,343.66	1,209.98	761.43	1,223.46	985.70
	Intermediate Consumption	1,004.22	894.11	609.47	886.05	776.13
	Balance of Subsidies and Taxes	147.96	141.21	128.29	144.75	148.14
	Gross Farm Income	**487.40**	**457.08**	**280.25**	**482.16**	**357.71**
ORGANIC FARM	Total Output	999.03	899.16	512.81	905.40	687.03
	Intermediate Consumption	872.30	750.78	484.19	774.59	593.23
	Balance of Subsidies and Taxes	279.88	291.64	206.43	253.76	254.84
	Gross Farm Income	**406.62**	**440.02**	**235.05**	**384.57**	**348.65**
NON–ORGANIC FARM WITH ENERGY CROPS	Total Output	1,402.02	1,269.90	789.06	1,269.48	1,031.87
	Intermediate Consumption	1,024.94	915.39	619.28	902.39	792.52
	Balance of Subsidies and Taxes	153.03	145.77	130.11	148.64	151.37
	Gross Farm Income	**530.11**	**500.29**	**299.89**	**515.74**	**390.72**

Note: 1 Euro = 31.99 CZK (Average exchange rate in 2001–2003).

Source: Compiled by the authors, 2005.

Regarding the differences between farming systems, non–organic farms in specialised systems (*Crops–Oriented Sugar beet* and *Livestock–Oriented*), with higher GFI values (mainly due to higher total outputs and subsidies obtained) are also observed to be the best placed (in terms of GFI increase) when converting to non–organic farms with energy crops of those systems. Non–organic farms and non–organic farms with energy crops in marginal systems (*Mixed–Oriented Grassland* and *Mixed–Oriented Potatoes*) show the lowest GFI values. These results are consistent with the characteristics of the given farming system, i.e. specialised systems are those with better soils and higher yields (and therefore better economic results), while mixed–oriented systems are more marginal in terms of soils and production structure.

As mentioned above, converting to organic farming means GFI decrease in all farming systems. This decrease is induced by higher yield losses of farms operating on fertile soils while the reductions in associated costs when converting to organic farming are modest. Higher prices for organic produce do not compensate for the losses. Small income decrease when converting to organic farm is observed for *Mixed–Oriented Potatoes* and *Crops–Oriented Maize* systems. The *Crops–Oriented Maize* system reports the highest values of GFI due to a significant decrease in intermediate consumption and an increase in subsidies. This outcome can be explained by the fact that *Crops–Oriented Maize* system has the highest share of arable land, which activates higher organic subsidies (compared with small areas of forage crops which receive lower levels of subsidies) in all farming systems.

4.4.1.2. 'No–Accession' scenario

Had the Czech Republic not acceded to the EU and continued to apply national agricultural support measures, changing into organic farm would have resulted in significant losses of GFI compared with non–organic farm or non–organic farm with energy crops. Lower intermediate consumption and a better balance of subsidies and taxes in organic farm do not compensate for the losses in yields and thus lower total output (Table 37). Contrastingly, producing energy crops provides the best economic results in all farming systems due to the extra income generated (starting to use previously unused arable land) and the additional subsidies obtained (for energy crops). In this scenario non–organic farm and non–organic farm with energy crops options in *Crops–Oriented Sugar beet* and *Livestock–Oriented* systems follow the already observed pattern of reporting the highest GFI values among all farming systems. At the system level, converting to organic farming causes negative changes in GFI in all farming systems. The highest losses of converting are in *Livestock–Oriented* and *Crops–Oriented Sugar beet* systems and the lowest in marginal systems (*Mixed–Oriented Grassland* and *Mixed–Oriented Potatoes*).

Table 37 'No–Accession' scenario results in the Czech Republic

Simulation results (€/ha)		Crops–Oriented Sugar beet (COSB)	Crops–Oriented Maize (COM)	Mixed–Oriented Grassland (MOG)	Livestock–Oriented (LO)	Mixed–Oriented Potatoes (MOP)
NON–ORGANIC FARM	Total Output	1,343.66	1,209.98	761.43	1,223.46	985.70
	Intermediate Consumption	1,004.22	894.11	609.47	886.05	776.13
	Balance of Subsidies and Taxes	30.58	28.40	92.65	53.06	58.66
	Gross Farm Income	**370.02**	**344.27**	**244.61**	**390.47**	**268.23**
ORGANIC FARM	Total Output	999.03	899.16	512.81	905.40	687.03
	Intermediate Consumption	872.30	750.78	484.19	774.59	593.23
	Balance of Subsidies and Taxes	75.49	72.56	130.06	95.64	102.55
	Gross Farm Income	**202.23**	**220.94**	**158.67**	**226.45**	**196.36**
NON–ORGANIC FARM WITH ENERGY CROPS	Total Output	1,402.02	1,269.90	789.06	1,269.48	1,031.87
	Intermediate Consumption	1,024.94	915.39	619.28	902.39	792.52
	Balance of Subsidies and Taxes	49.97	45.84	99.59	67.92	71.01
	Gross Farm Income	**427.05**	**400.36**	**269.37**	**435.01**	**310.36**

Note: 1 Euro = 31.99 CZK (Average exchange rate in 2001–2003).

Source: Compiled by the authors, 2005.

4.4.1.3. 'Environmental CAP' scenario

Despite various simulation options applied in this scenario (see section 4.1), the results show that in all farming systems non–organic farms continue to have much higher GFIs than organic farms but lower GFIs than non–organic farms with energy crops (mainly due to the increase in total output and subsidies) (Table 38). However, the income gap between organic and non–organic farms becomes narrower, except for *Crops–Oriented Maize* and *Mixed–Oriented Potatoes* systems, where organic farms generate larger differences in terms of GFI than non–organic farms.

In conclusion, in the 'Environmental CAP' scenario, non–organic farms with energy crops show the best economic results, followed by non–organic farms and organic farms, respectively. In spite of the payments increase, organic farming would hardly achieve the same GFI values as non–organic farms, which do not receive any extra payments.

Table 38 'Environmental CAP' scenario results in Czech Republic

Simulation results (€ /ha)		Crops–Oriented Sugar beet (COSB)	Crops–Oriented Maize (COM)	Mixed–Oriented Grassland (MOG)	Livestock–Oriented (LO)	Mixed–Oriented Potatoes (MOP)
NON–ORGANIC FARM	Total Output	1,343.66	1,209.98	761.43	1,223.46	985.70
	Intermediate Consumption	1,004.22	894.11	609.47	886.05	776.13
	Balance of Subsidies and Taxes	146.25	139.53	126.91	143.15	146.52
	Gross Farm Income	**485.68**	**455.40**	**278.87**	**480.56**	**356.09**
ORGANIC FARM	Total Output	999.03	899.16	512.81	905.40	687.03
	Intermediate Consumption	872.30	750.78	484.19	774.59	593.23
	Balance of Subsidies and Taxes	292.28	306.04	213.25	263.66	264.44
	Gross Farm Income	**419.02**	**454.42**	**241.86**	**394.47**	**358.25**
NON–ORGANIC FARM WITH ENERGY CROPS	Total Output	1,402.02	1,269.90	789.06	1,269.48	1,031.87
	Intermediate Consumption	1,024.94	915.39	619.28	902.39	792.52
	Balance of Subsidies and Taxes	151.82	144.55	128.91	147.43	150.07
	Gross Farm Income	**528.90**	**499.07**	**298.69**	**514.52**	**389.42**

Note: 1 Euro =31.99 CZK (Average exchange rate in 2001–2003).

Source: Compiled by the authors, 2005.

4.4.2 Lithuania

4.4.2.1. 'Business as usual' (Baseline) scenario

Unlike in the Czech Republic, the on–going agricultural policy favours in all Lithuanian farming systems especially the conversion to organic farms as organic farms reach the highest GFI compared with non–organic farms and non–organic farms with energy crops options (Table 39). This is mainly due to very high subsidies received (up to 212 % higher), which compensate for lower outputs in these farms. Therefore, in Lithuania, even specialised systems would gain if converting to organic farming, especially those in the *Crops–Oriented* system. Most probably, in practice non–organic farms in specialised systems will not convert to organic farming as they obtain the best economic outputs through fertile soils and high production yields even when producing via conventional farming. Their conversion to organic could imply undesired changes of the currently applied technology and significant yield losses.

On the other hand, growing energy crops could be also considered a good option for non–organic farms in all farming systems, as it induces 8 % higher outputs, despite receiving lower subsidies compared with those received by organic farms. Again, growing energy crops provides better income results in specialised systems (*Crops–Oriented* and *Livestock–Oriented*), for similar reasons as in the Czech Republic.

In general, marginal systems (*Crops–Marginal* and *Livestock–Marginal*) show the worst economic results (in terms of GFI) in all options, while specialised systems exhibit the best results. Therefore, growing energy crops could be a better option for non–organic farms in specialised farming systems, while converting to organic farming could be seen as an alternative for non–organic farms in marginal systems. Smaller yield losses when converting, combined with similar variable costs whether farming organically or not, in marginal areas would facilitate conversion.

Table 39 'Business as usual' (Baseline) scenario results in Lithuania

Simulation results (€/ha)		Livestock–Oriented (LO)	Crops–Oriented (CO)	Crops–Marginal (CM)	Livestock–Marginal (LM)	Urban–Oriented (UO)	Intermediate (I)
NON–ORGANIC FARM	Total Output	615.84	559.89	460.44	539.38	618.36	561.87
	Intermediate Consumption	378.62	327.87	279.22	356.71	396.51	350.48
	Balance of Subsidies and Taxes	168.57	155.89	152.00	169.14	161.28	171.40
	Gross Farm Income	**405.79**	**387.92**	**333.23**	**351.82**	**383.13**	**382.79**
ORGANIC FARM	Total Output	363.69	328.48	329.71	415.88	403.10	385.74
	Intermediate Consumption	312.72	266.62	265.16	326.37	361.35	318.47
	Balance of Subsidies and Taxes	577.75	589.13	447.91	415.99	522.39	498.00
	Gross Farm Income	**628.73**	**650.99**	**512.46**	**505.50**	**564.13**	**565.28**
NON–ORGANIC FARM WITH ENERGY CROPS	Total Output	673.58	619.90	498.29	569.59	668.34	605.03
	Intermediate Consumption	401.74	351.90	294.37	368.80	416.52	367.76
	Balance of Subsidies and Taxes	174.85	162.93	156.27	171.33	165.36	176.12
	Gross Farm Income	**446.69**	**430.93**	**360.19**	**372.12**	**417.18**	**413.38**

Note: 1 Euro = 3.4529 LTL (average exchange rate in 2001–2003).

Source: Compiled by the authors, 2005.

4.4.2.2. 'No–Accession' scenario

Had Lithuania continued to apply the national agricultural support measures that existed before its accession to the EU, growing energy crops would have been the best option to increase the GFI of non–organic holdings, as it has positive economic effects on all farming systems (mainly owing to the opportunity of generating additional income using previously idle land). This option is particularly beneficial in specialised systems (*Livestock–Oriented* and *Crops–Oriented*) where non–organic farms already generate the highest total outputs before converting to energy crops (Table 40).

This scenario gives totally different results for the organic farm choice, which, although the best option in all farming systems under the current (as in year 2005) agricultural policy, is the worst option under the pre–accession policy in Lithuania. Intermediate consumption on organic farms is 11.3 % lower and subsidies are triple compared with those of non–organic farms. However, these values do not cover the yield losses, resulting in a 35 % lower GFI on average for organic farms. The *Livestock–Marginal* system reports the lowest loss of total output (24 % in comparison to 41 % in *Crops–Oriented* system) when converting to organic farming, which posts the highest GFI among all farming systems (mainly owing to a lower decrease in livestock productivity in comparison to the sharp drop in crops yields when converting).

Table 40 'No–Accession' scenario results in Lithuania

Simulation results (€/ha)		Livestock–Oriented (LO)	Crops–Oriented (CO)	Crops–Marginal (CM)	Livestock–Marginal (LM)	Urban–Oriented (UO)	Intermediate (I)
NON–ORGANIC FARM	Total Output	615.84	559.89	460.44	539.38	618.36	561.87
	Intermediate Consumption	378.62	327.87	279.22	356.71	396.51	350.48
	Balance of Subsidies and Taxes	30.77	25.81	36.25	34.71	31.60	31.36
	Gross Farm Income	**267.99**	**257.84**	**217.47**	**217.38**	**253.45**	**242.74**
ORGANIC FARM	Total Output	363.69	328.48	329.71	415.88	403.10	385.74
	Intermediate Consumption	312.72	266.62	265.16	326.37	361.35	318.47
	Balance of Subsidies and Taxes	98.70	97.42	93.72	85.72	92.71	91.91
	Gross Farm Income	**149.67**	**159.28**	**158.27**	**175.23**	**134.45**	**159.19**
NON–ORGANIC FARM WITH ENERGY CROPS	Total Output	673.58	619.90	498.29	569.59	668.34	605.03
	Intermediate Consumption	401.74	351.90	294.37	368.80	416.52	367.76
	Balance of Subsidies and Taxes	30.77	25.81	36.25	34.71	31.60	31.36
	Gross Farm Income	**302.61**	**293.81**	**240.16**	**235.49**	**283.42**	**268.62**

Note: 1 Euro = 3.4529 LTL (Average exchange rate during 2001–2003).

Source: Compiled by the authors, 2005.

4.4.2.3. 'Environmental CAP' scenario

In all simulations performed for this scenario, non–organic farm reports the lowest average GFI compared with that for organic farm and non–organic farms with energy crops options. Differences in GFI are basically generated by the different weight of subsidies in each case (since in organic farm case, subsidies account for almost the totality of GFI). The differences at farming system level follow the same trends, i.e. *Livestock–Oriented* and *Crops–Oriented* systems show the highest values in GFI in all cases (non–organic, organic and non–organic with energy crops) and are thus the most economically viable systems. On the other hand, farms operating in *Livestock–Marginal* and *Crops–Marginal* systems receive the lowest rates of subsidies and thus report low GFI values.

Table 41 reveals that organic farm options is the most beneficial in terms of subsidies received, organic subsidies increasing by 40 €/ha (i.e. 10 % increase) compared with the 'Baseline' scenario. This is not the case of non–organic farms with energy crops option, where the increase in subsidies is only about 2 €/ha and the GFI drops owing to a 1 % reduction in SFP amount received.

Table 41 'Environmental CAP' scenario results in Lithuania

Simulation results (€/ha)		Livestock–Oriented (LO)	Crops–Oriented (CO)	Crops–Marginal (CM)	Livestock–Marginal (LM)	Urban–Oriented (UO)	Intermediate (I)
NON–ORGANIC FARM	Total Output	615.84	559.89	460.44	539.38	618.36	561.87
	Intermediate Consumption	378.62	327.87	279.22	356.71	396.51	350.48
	Balance of Subsidies and Taxes	166.86	154.31	150.47	167.43	159.65	169.66
	Gross Farm Income	**404.08**	**386.33**	**331.69**	**350.11**	**381.50**	**381.05**
ORGANIC FARM	Total Output	363.69	328.48	329.71	415.88	403.10	385.74
	Intermediate Consumption	312.72	266.62	265.16	326.37	361.35	318.47
	Balance of Subsidies and Taxes	616.86	630.76	475.91	438.88	556.80	528.82
	Gross Farm Income	**667.84**	**692.62**	**540.46**	**528.39**	**598.55**	**596.09**
NON–ORGANIC FARM WITH ENERGY CROPS	Total Output	673.58	619.90	498.29	569.59	668.34	605.03
	Intermediate Consumption	401.74	351.90	294.37	368.80	416.52	367.76
	Balance of Subsidies and Taxes	173.77	162.04	155.16	169.84	164.13	174.85
	Gross Farm Income	**445.61**	**430.05**	**359.08**	**370.62**	**415.95**	**412.11**

Note: 1 Euro = 3.4529 LTL (Average exchange rate in 2001–2003).

Source: Compiled by the authors, 2005.

4.5. Comparative analysis of the outcome of managerial options among systems

4.5.1 The Czech Republic

Comparing the alternative managerial options (non–organic farms, organic farms and non–organic farms with energy crops) in the various scenarios shows that for non–organic farms in the Czech Republic (in all farming systems) the current (i.e. in year 2005) agricultural policy ('Baseline' scenario) is the most favourable in terms of income outcome (high GFI) compared with non–accession to the EU (Figure 7). The 'Environmental CAP' scenario also produces good results, even with a 10 % reduction in SFP. If total output and intermediate consumption variables do not change, the increase in GFI is due to larger amounts in subsidies (CAP subsidies). It is worth mentioning that even without CAP subsidies (as in the 'No–Accession' scenario) these farms would be economically viable as they are able to obtain high GFI values owing to better yields obtained and/or technology used. Moreover, non–organic farms in specialised systems (*Crops–Oriented Sugar beet*, *Crops–Oriented Maize* and *Livestock–Oriented*) obtain higher GFI than standard holdings located in marginal areas (mainly *Mixed–Oriented Grassland* and *Mixed–Oriented Potatoes*), which have the lowest GFI values despite a significant share of subsidies.

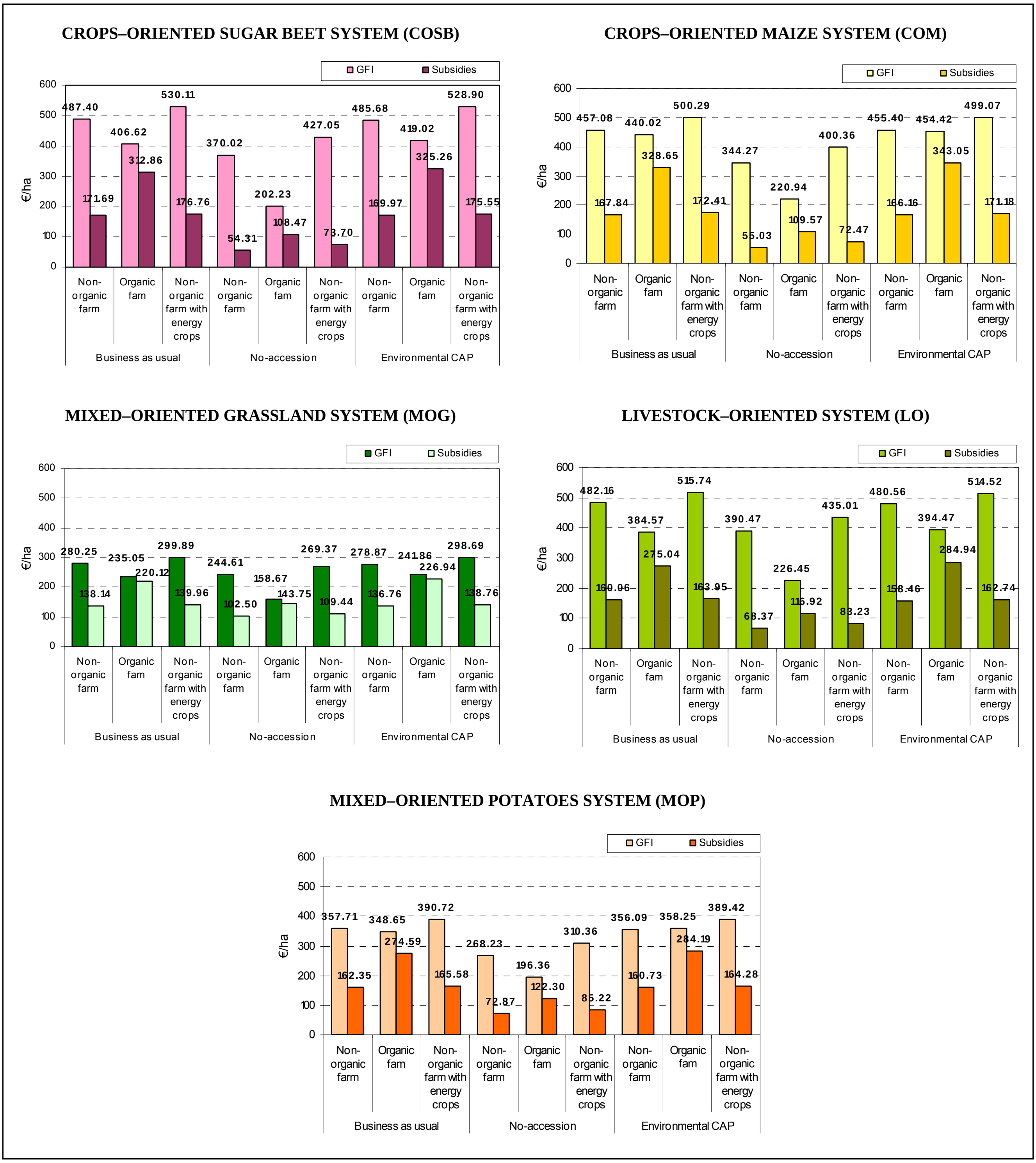
Although the EU accession of the Czech Republic entails a significant increase in GFI for organic farms (due to CAP subsidies, including SFP and organic farming aid) in all farming systems compared with the pre–accession period, organic farm option reports the lowest GFI values and is also the least economically sustainable (in terms of GFI) because subsidies represent more than 70 % of GFI of farming systems (reaching even 93.7 % in the *Mixed–*

Oriented Grassland system) (Figure 7). Some exceptions exist, e.g. *Crops–Oriented Maize* and *Mixed–Oriented Potatoes* systems, where the option of adopting organic farming (as simulated under 'Environmental CAP' scenario) generates higher GFI than the non–organic option. This outcome is mainly induced by the high share of farmland covered with crops that receive greater subsidies (vineyards, other permanent crops, cereals and vegetables) and the lower share of forage crops receiving lower payments. Fairly large differences are observed in organic farms with crops–oriented systems (*Crops–Oriented Sugar beet* and *Crops–Oriented Maize*), which are located in areas with fertile soils and for which the significant increase of GFI under the current agricultural policy is caused by the variety in the rates of subsidies (depending on type of crops).

Based on the assumptions made and simulations performed in the Czech Republic, non–organic farms with energy crops are the most economically sustainable (in terms of GFI), since the effect of payments, when compared with non–organic farms, is minimal while GFI increases significantly (reaching the highest values among the options) owing to the economic impact of using set–aside land to grow energy crops. However, differences between 'Baseline' and 'No–Accession' scenarios are observed. *Mixed–Oriented Grassland* and *Mixed–Oriented Potatoes* systems operating in marginal areas report the lowest GFI values and the general differences are similar to the case of non–organic farms (Figure 7). In this case the increases are slightly higher in that additional to the SFP they also include CAP payments received for energy crops.

On the other hand, the effect of an 'Environmental CAP' scenario induces a slight decrease of GFI of 'non–organic' and 'non–organic with energy crops' farms compared with 'Baseline' scenario, a rather surprising outcome at first. The results suggest that a reduction of general subsidies exceeds the benefits from increasing energy crops payments (since these crops occupy only a limited area of total farm land, explaining the lower amounts of subsidies reported for this scenario for the abovementioned two options, see Figure 7).

Figure 7 Gross farm income and subsidies of the Czech farming systems (€/ha)



Source: Compiled by the authors, 2005.

4.5.2 Lithuania

Rather significant GFI differences can be observed for non–organic farms under the current (post–accession) agricultural support policy and alternative scenarios. A 50 % increase of GFI can be observed in the 'No–Accession' scenario, mainly owing to CAP subsidies (received as SFP) that account for a large share of the total farm income (Figure 8), whereas the contribution of pre–accession payments to the GFI of non–organic farms is minimal.

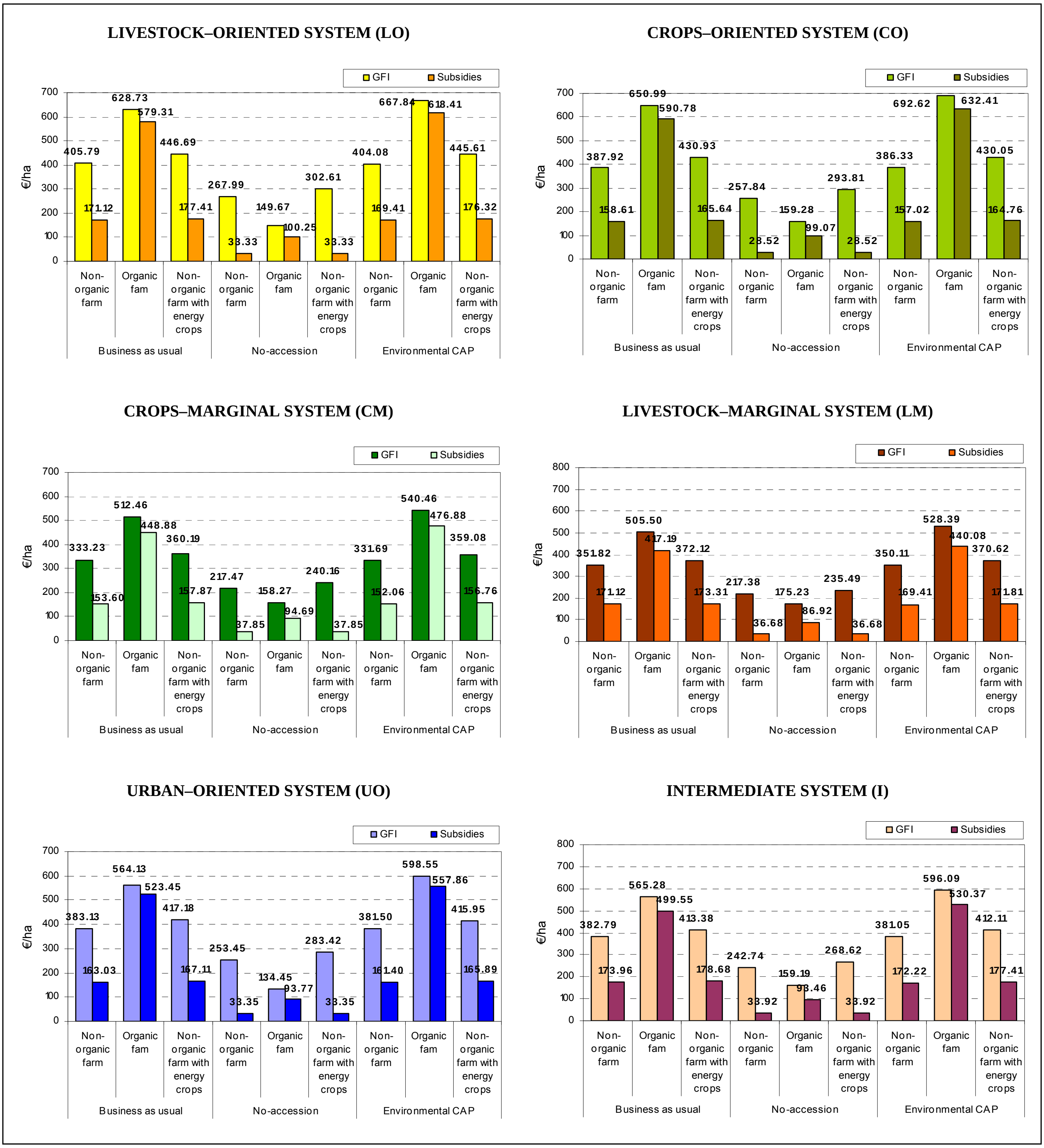
The differences between farming systems are not particularly high. Nevertheless, standard holdings located in marginal areas (*Crops–Marginal* and *Livestock–Marginal* systems) show the lowest GFI values, while specialised systems in the areas with the best soils (*Livestock–Oriented* and *Crops–Oriented* systems) report the highest GFI in all scenarios. Finally, the simulations applied in the 'Environmental CAP' scenario entail a slight decrease in GFI due to the reduced SFP.

Totally different results are obtained for organic farms. Figure 8 illustrates that GFI of organic farms in the pre–accession period is the lowest (four times lower) compared with the 'Baseline' and 'Environmental CAP' scenarios and even lower when compared with the GFI of non–organic farms during the same period. This outcome is due, on the one hand, to significantly lower organic production yields, not so high organic farm gate prices and, on the other hand, to lower organic subsidies (although more than half of total farm income) when compared with the current (post–accession) period. It should be mentioned that, in all Czech and Lithuanian farming systems, subsidies are the base of GFI of organic farms (89.3 % in Lithuania, in the 'Baseline' scenario). This observation reflects, on the one hand, a situation in which organic farming cannot be maintained without subsidies and, on the other hand, the fact that an extremely high share of payments in total income does not ensure economic sustainability for the organic farms.

Noteworthy differences also appear at the farming system level. The GFI values of organic farms in marginal areas (*Crops–Marginal* and *Livestock–Marginal* systems) and organic farms in areas with good quality soils (*Livestock–Oriented* and *Crops–Oriented* systems) differ in absolute values by almost 150 €/ha. Moreover, in the case of non–accession to the EU, the lowest GFI values would have been obtained by organic farms in marginal systems (especially in *Livestock–Marginal* with the lowest share of payments in GFI) and the highest GFI in more specialised systems. This is entirely the consequence of higher subsidies received. The differences between marginal and specialised systems are mainly due to the different share of crops receiving higher subsidies (cereals) in the farm structure. Moreover, even if organic farms in marginal systems (forage crops predominate in farm structure) receive organic payments combined with SFP and, in some cases, with payments for LFAs, they do not reach the income levels of organic farms in specialised systems with cereals covering a major part of farmed land.

The 'Environmental CAP' scenario, where Simulation 1 indicates significantly improved margins for organic farms, also means a massive increase in payments leading to a higher dependency on this type of support, but not to economic sustainability. It should be also noted that these simulations use the full amount of organic payment, although the payments for organic farms in Lithuania are different during the conversion period and after conversion. Therefore, rather different results would have been obtained if these different rates of payments had been considered. Differences in the GFI values of non–organic farms with energy crops between the 'Baseline' and 'No–Accession' scenarios are similar to those in the case of non–organic farms (and not as high as differences observed for organic farms). However, in the non–accession case, these farms post higher GFI values than non–organic and organic farms (see Figure 8).

Figure 8 Gross farm income and subsidies of the Lithuanian farming systems (€/ha)



Source: Compiled by the authors, 2005.

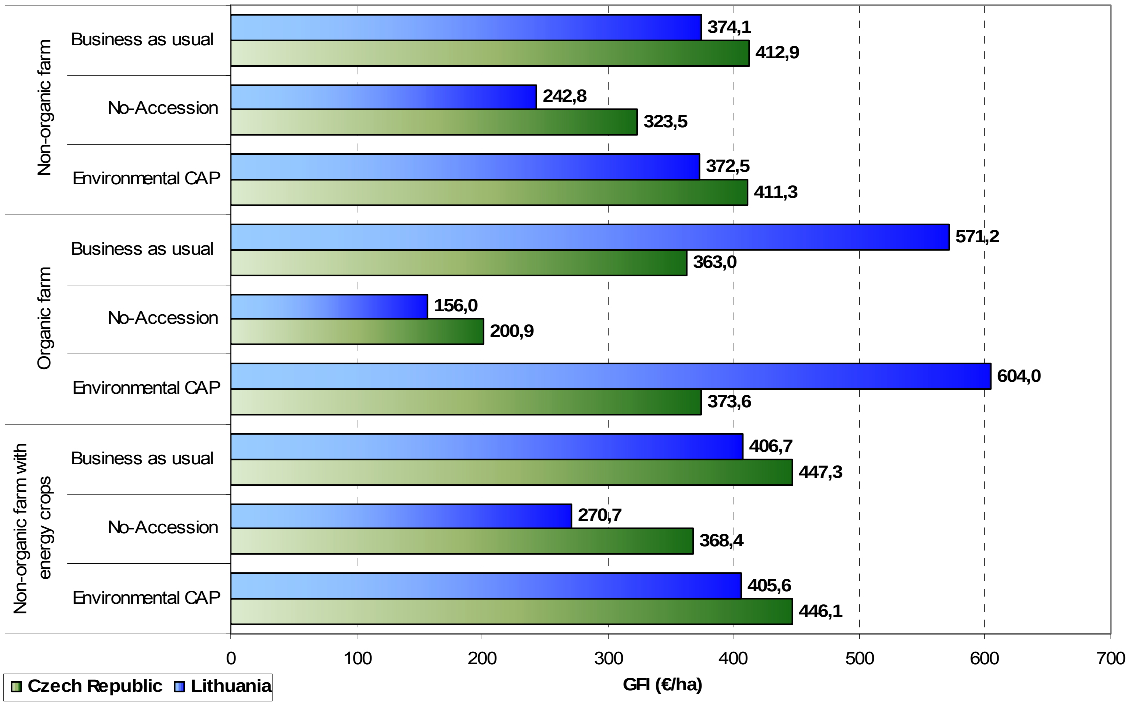
The effect of CAP payments on the income of both non–organic farms with energy crops and non–organic farms in general is low. Since total output and intermediate consumption do not change, differences in the GFI of these two farm types appear due to extra income generated (in terms of SFP and specific energy crops payments) from set–aside land brought under agricultural use. The results suggest that the differences among systems are not large.

Simulation results in the ‘Environmental CAP’ scenario report lower GFI values than in the ‘Baseline’ scenario, although differences are not considerable. Such results mean that the increase of energy crops payments does not offset the GFI loss caused by a reduced SFP.

4.5.3 Comparison between countries

EU membership clearly benefits all farming options (non–organic, organic farms and non–organic farm with energy crops) in both countries if a comparison is performed for the year 2013. As can be seen in Figure 9, all GFI values are lower in the ‘No–Accession’ scenario than in the ‘Baseline’ scenario, especially in the case of organic farms.

Figure 9 Inter–country comparison of average gross farm income under different scenarios



Source: Compiled by the authors, 2005.

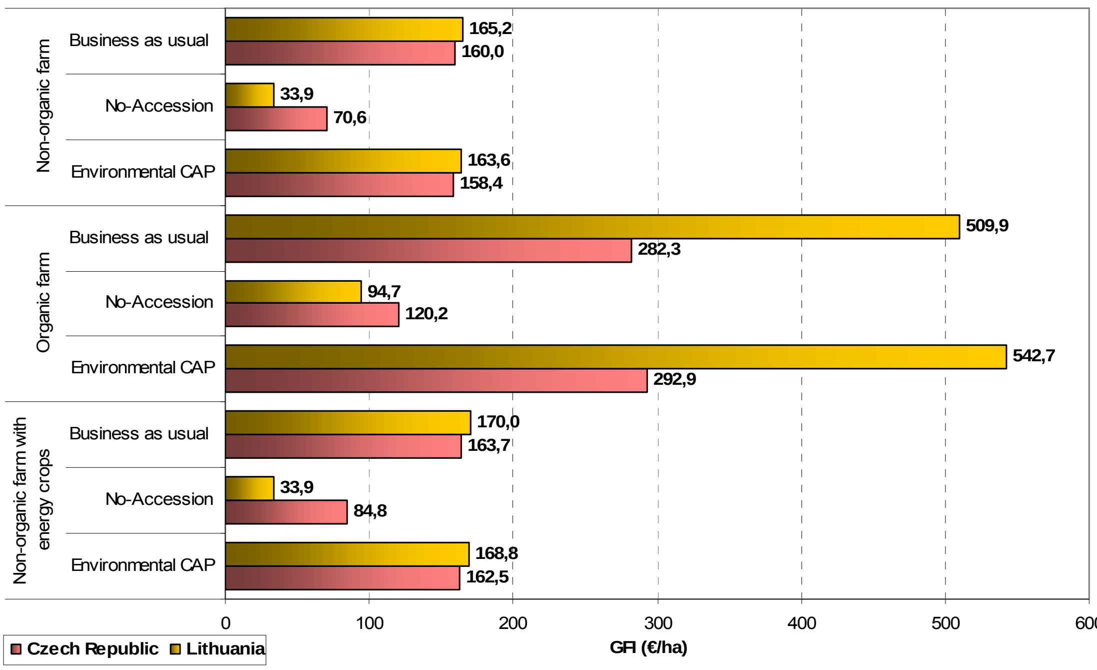
In both countries, converting from non–organic farms to non–organic farms with energy crops entails insignificant changes in GFI values in the ‘Baseline’ and ‘Environmental CAP’ scenarios. A slightly higher GFI is obtained when growing energy crops, due to extra payments received and improved total output.

Furthermore, from the scenarios and simulations performed it emerges that the most income–advantageous way of farming in the Czech Republic is to devote part of farmed land to growing energy crops, while in Lithuania it is to convert to organic farming (basically due to the high organic subsidies). However, one should keep in mind that the outcome will be more favourable for certain systems than others.

As for the share of subsidies in GFI under the different options (Figure 10), non–organic farms and non–organic farms with energy crops have considerably lower levels than organic farms (subsidies are about 80–90 % of total GFI in the latter case). This aspect is characteristic for both countries, although the levels are higher in Lithuania.

The Czech Republic had higher pre–accession levels of agricultural subsidies, especially for non–organic farms, compared with Lithuania. Moreover, Czech farmers received subsidies for cultivating energy crops, which was not the case in Lithuania.

Figure 10 Inter–country comparisons of average subsidies under different scenarios



Source: Compiled by the authors, 2005.

4.6. Comparisons of the potential income under managerial options among scenarios

The section below summarises the results regarding the impact of managerial options on the gross farm income under the policy background and policy instruments considered.

4.6.1 Czech Republic

(a) '**Non–organic farm**' **option:** The gross farm income under 'Baseline' scenario registers a significant increase compared with 'No–Accession' scenario. In relative terms, the value of gross farm income under 'No–Accession' scenario is 13 % to 25 % lower than in 'Baseline' scenario (depending on the farming system). The high amounts of CAP subsidies explain this outcome since total output and intermediate consumption are assumed to not change. The effect of 'Environmental CAP' scenario compared with 'Baseline' scenario in non–organic farms is rather modest. As this farm option does not include organic or energy crops, only the SFP decrease influences the gross farm income value. Depending on farming system, the simulations indicate that a 1 % reduction of SFP induces 0.49 % to 0.33 % decrease of the gross farm income.

(b) '**Organic farm**' **option**: According to results of the simulations at the 2013 time horizon, the EU accession of Czech Republic entails a significant increase of the gross farm income for organic farms compared with that under the non–accession alternative. Differences are rather high for Crops–Oriented Sugar Beet and Crops–Oriented Maize systems located in areas with good agricultural soils. While in the 'No–Accession' scenario exclusively national subsidies are considered, the 'Baseline' scenario includes organic aids and SFP that imply higher amounts. Differences among the standard farms also appear owing to their diverse agricultural structures (e.g. payments for meadows and pastures are low, while those for industrial crops, fruit–trees, vegetables, etc. are higher). As a consequence, those standard farms having high shares of industrial crops or vegetables in their cropping structure report a higher gross farm income. Under the 'Environmental CAP' scenario, gross farm income increases when specific payments to organic farming also increase.

(c) Under '**Energy crops farm**' **option** differences between 'Baseline' and 'No–Accession' are observed, the relative values varying from 10 (Mixed–Oriented Grassland system) to about 20 percentual points (Livestock–Oriented system). Compared with 'No–Accession' scenario, the gross farm income increase rates of energy crops farm in 'Baseline' scenario is similar to the differences observed for the non–organic farms. Here the increases are slightly higher, in the sense that they include CAP payments for SFP and energy crops. The gross farm income values are lower under the 'Environmental CAP' scenario compared with 'Baseline' scenario. The reduction of SFP generated by a 10 % increase of energy crops payments explains this outcome. The results indicate that the reduction of general subsidies exceeds the benefits from increasing the payments for energy crops which cover only a limited area of total farm land.

4.6.2 Lithuania

(d) The '**Non–organic farm**' **option** under the 'Baseline' scenario assumptions results in a 50 % increase of GFI in year 2013 (compared with ′No–Accession' scenario), mainly justified by the high share of SFP in the farm income. Under both 'Baseline' and 'No–Accession' scenarios, there are not significant differences among farming systems in terms of the income levels reached in 2013. However, under 'Environmental CAP' scenario the gross farm income falls as the increases of payments for organic farming and energy crops do not compensate for the loss of income the SFP cut induces.

(e) Under ‘**organic farm**’ **option** the gross farm income values in ‘No–Accession’ scenario are rather low for organic farms. This outcome is influenced by the data from 2005 field survey, i.e. organic yields are significantly lower than non–organic ones. Under ‘Baseline’ scenario assumptions, SFP and specific organic payments induce a notable gross farm income increase compared with ‘No–Accession’ scenario. In absolute values, divergences between the associated farms in marginal areas (*Crops–Marginal* and *Livestock–Marginal* systems) and those in areas with good quality soils (*Livestock–Oriented* and *Crops–Oriented* system) reach almost 150 €/ha. In ‘Environmental CAP’ scenario, 10 % increase of organic subsides generate more than 5 % rise in GFI in all but one (*Livestock–Marginal* system) farming systems.

(f) ‘**Energy crops farm**’ **option**: The gross farm income differences under ‘Baseline’ and ‘No–Accession’ scenarios are similar to the case of non–organic farm option. For example, Livestock–Marginal system has a 58.02 % of the gross farm income, the highest one among standard farms in relative terms (the lowest is 46.67 % of the Crops–Oriented system). Overall, the differences among systems in terms of gross farm income are not very large, the SFP and energy crops accounting for most of the increase. Under the ‘Environmental CAP’ scenario, the gross farm income values are lower than under ‘Baseline’. As in the case of Czech systems, these results imply that the increase of energy crops payments does not compensate for the gross farm income loss caused by the decrease in single farm payment amount received.

4.7. Conclusions

Scenario–based impact of the 2003 CAP instruments on farm income

In the Czech Republic (all farming systems) the results of the ‘Baseline’ and ‘Environmental CAP’ scenarios indicate that the gross farm income of non–organic farms is higher compared with the one under ‘No–Accession’ scenario. Although the accession to the EU of the Czech Republic brings a significant increase of the gross farm income of organic farms (owing to European subsidies received) questions related to the continuity of this type of farming remains given that subsidies represent more than 70 % of the gross farm income of these farms. The results of the field survey point on the importance of farmers’ own belief in the benefits of organic farming practices but further research using statistically representative samples is needed before retaining or discarding this assertion.

The results of scenario simulations indicate that in the Czech Republic, the highest gross income is attainable under the assumptions of the ‘Baseline’ scenario combined with the ‘non–organic farm with energy crops’ (i.e. 447.3 €/ha in 2013), mainly because of the subsidies received and the assumed increase of the total output value. The lowest gross income is encountered for the combination ‘No–Accession’ × ‘organic farm’ (i.e. 20.9 €/ha). In Lithuania, the results of the scenarios simulations reveal that the combination

‘Environmental CAP’ and organic farm would lead in 2013 to the highest gross farm income (604 €/ha) compared with 156 €/ha of the ‘No–Accession’ × ‘organic farm’ combination.

To conclude, the results of scenarios indicate that the highest gross farm income is obtained if non–organic farms partly convert to growing energy crops (Czech Republic) or when non–organic farms convert to organic (Lithuania). However, as only the effect of subsidies was considered here, these results are to be understood in the specific context and assumptions applied. Further work is needed to incorporate all the income support received at the farm level through the CAP and national schemes, and investigation of their effects on all sustainability dimensions at the farming systems level.

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6 ANNEXES

Annex 1 Nomenclature of the administrative regions selected (Czech Republic and Lithuania)

Administrative unit	Czech Republic	Lithuania
NUTS 1	State (Území)	State (Salies)
NUTS 2	Regions (Oblasti)	State (Salies)
NUTS 3	Areas/Regions (Kraje)	Counties (Apskritys)
LAU 1	Districts (Okresy)	Municipalities/Districts (Savivaldybes)
LAU 2	Municipalities (Obce)	Wards (Seniūnijos)

Note: Translation into Lithuanian and Czech in brackets.

Source: EUROSTAT, 2005.

Annex 2 Dimensions, indicators and variables selected for sustainability assessment

Dimension and associated indicators	Variables	Sense of the variable in sustainability measurement
Environmental dimension		
1.1.Livestock density	Livestock density (LU/ha of agricultural land) (only for ruminants)	Direct
1.2.Soil erosion	Czech Republic: Degree of soil erosion (qualitative scale; from 0 to 10)	Inverse
	Lithuania: Degree of soil erosion (qualitative scale; from 0 to 5)	
1.3.Pollution by nitrate	Degree of pollution by nitrate (qualitative scale; from 0 to 5)	Inverse
1.4. Organic farming	% of cultivated agriculture area under organic practices (including agricultural land and agricultural land in conversion)	Direct
1.5. Agro–ecosystem biodiversity	Herfindahl Index (H) for definition, see below	Inverse
Social dimension		
2.1.Density of farmers	Density of farmers (No farmers/ha agricultural land)	Direct
2.2. Elderly population	Elderly population (% population over 65)	Inverse
2.3. Density of population	Density of population (inhabitants/km^2)	Direct
2.4. Variation of the rate of population	2.4.A). Population natural rate of growth (average variation in the last 2 years in ‰)	Direct
	2.4.B). Migratory balance (average variation in the last 2 years in ‰) (= Outflow - inflow)	Direct
2.5.Unemployment	2.5.A). Unemployment rate (% of total active population)	Inverse
	2.5.B). Variation of the unemployment rate (average change in employment between 2001and 2003 in %)	Inverse

Dimension and associated indicators	Variables	Sense of the variable in sustainability measurement
2.6. Concentration of farming land index (Gini Index)	Concentration of farming land index (Gini Index)	Inverse
Economic dimension		
3.1.Structure of farming holding	% of area in holding of less than 10 ha	Inverse
3.2.Main crop/group of crop yield	3.2.A). Main crop/group of crop yield A (t/ha)	Direct
	3.2.B). Main crop/group of crop yield B (t/ha)	Direct
	3.2.C). Main crop/group of crop yield C (t/ha)	Direct
3.3.Incomes of the farmers	3.3.A). Gross monthly wages of employees in agriculture (€/month)	Direct
	3.3.B). Average agricultural wage/average wage of all economical activities (%)	Direct
3.4.Less Favoured Areas	% LFA/Agricultural land	Inverse

Note: No weights assumption applied.

Source: Compiled by the authors, 2005.

Definition of variables

I. Environmental dimension

Livestock density: measures the density of livestock per unit of area. It has been considered with a direct sense, because high livestock density would beneficial for the preservation of soil fertility (and preservation of meadows and pastures) through the organic manure input. However as high livestock density is environmentally harmful, it cannot exceed the established maximum thresholds. In the two countries, the maximum threshold values are in the Horizontal Rural Development Plan as agri–environmental measures (1.5 LU/ha in the Czech Republic, 1.7 % in Lithuania). In both countries the values are below the maximum thresholds.

Soil erosion: is a qualitative indicator related to the state of eroded soils in Lithuania (0 = not eroded, 5 = total eroded)) and potentially eroded (0 = not eroded, 10 = total eroded in the Czech Republic). It is seen as an inverse sense variable, since the loss of land due to erosion is related to a less sustainability in an environmental dimension. The differences among countries in defining this indicator are generated by data availability.

Pollution by nitrate: this qualitative parameter is related to leakage of nitrates to the underground water. This is an inverse sense variable, since this kind of pollution has a negative effect for the sustainability of farming systems.

Organic farming: a high percentage of cultivated agriculture area under organic farming practices. Organic farming is seen as an environmentally–friendly practice hence contributing positively to the sustainability of farming systems.

Agro–ecosystem biodiversity: from the various methods available in the literature for studying the extent of diversification, here was selected the Herfindahl Index (H) defined as

$$H = \sum_{i=1}^{n} p_i^2$$

where p_i = proportion under i crop. $p_i = \frac{Ai}{\sum_{i=1}^{n} Ai}$ where $Ai =$ Area under i^{th} crop and

$\sum_{i=1}^{n} Ai =$ total cultivated area.

The value of Herfindahl index varies from nil to one (0 = perfect diversification, 1 = perfect specialisation). This index was considered being inversely related to sustainability, because from an environmental perspective, a higher degree of diversification is desirable for the long–term resilience of the systems. In the Czech Republic this indicator was calculated using NUTS 3 data (no data available from LAU 1).

II. Social dimension

Density of farming population*:* number of farmers per hectare of agricultural land. It is a direct sense variable.

Share of elderly population*:* percentage of population over 65 in all LAU 1 in every farming system (except urban areas).[18] It is assumed that those systems where elderly population share is high are less sustainable from the social point of view, because the generational renewal is more difficult. Therefore, this is an inverse sense variable.

Density of population*:* the number of inhabitants per total km^2 area. To compute this variable, urban areas have been excluded within each farming system.[18] This is a direct variable, since the abandonment of the areas is a main obstacle for the social sustainability of a farming system.

Variation of the rate of population

- *Population natural rate of growth*: this variable measures the variation of the population size (taking into account only the death and birth rates). The variable has been calculated using data on the natural growth of the population in the last two years for which statistics were available (excluding urban areas within the systems).[18] This variable has been assumed having a direct sense: a population with a positive natural growth has more possibilities of guaranteeing continuity of the types of agriculture characteristic of a farming system. This statement is valid for some context for the growth of population. In the demographic scope, where the countries under study are located, the natural growth of the population is always within these limits.

[18] In Czech Republic LAU 1 administrative units have been considered as urban areas when agriculture employment is below 2% and UAA sums up less than 45% of the total area of this unit (8 LAU1).

In Lithuania LAU 1 named as ‘town municipality’ have been considered as urban for the purpose of the study (7 LAU1)

– *Migratory balance*: it represents the percentage of the migratory rate over total population in a particular year. The value of the variable has been calculated from the average of the data for the migratory movement in the last two years with national statistics available (excluding urban areas).[18] Like in the case of natural movement of the population, in the context of the countries under study (in which immigration spreads within certain limits) a positive migratory rate is understood as a positive social sustainability.

Unemployment

Unemployment rate: percentage of total (agricultural and non–agricultural) unemployed population over the total active population in every territorial span of the farming systems studied (excluding urban).[18] It has been assumed as an inverse sense variable for sustainability within the social dimension.

Variation of the unemployment rate: annual total employment growth along a three–year period.[18] It has been calculated for each farming system as the arithmetical average of the available values year 2003 (X_3) and the values of year 2001(X_1) (urban areas were excluded). An integral loss of jobs is negative and opposed to sustainability and therefore understood as inverse.

$$\Delta \text{ Unemployment rate} = \frac{X_3 - X_1}{2}$$

Index of concentration of farming land*:* a Gini Index was computed to measure the he concentration level of any economic or social variable. The Gini index is the Gini coefficient expressed as percentage. In this study variables are defined considering the number of holdings number and their land. This variable shows a rate of the concentration level in holdings of each farming system.

Gini coefficient takes values between 0 and 1, the value 1 means that the whole land belongs to one single holding or farmer whereas value 0 means an equal distribution level between holdings. A land distribution based on medium size holding (Gini Index values near to 0) is assumed being more socially sustainable. The formula is

$$G = |1 - \sum_{k=1}^{k=n} (X_k - X_{k-1})(Y_k + Y_{k-1})|$$

where G = Gini coefficient, X is the cumulated proportion of the holding variable, and Y is the cumulated proportion of the area of the holding.

III. Economic dimension

Structure of farming holdings*:* percentage of agricultural area in holdings of less than 10 ha. It represents the proportion of small holdings existing in the country. A high percentage of agricultural area in small holdings is assumed having a negative impact on the economic sustainability of the system.

Yield of main crop/group of crops*:* this indicator is subdivided into different variables according to the significance of crops in each country. In Lithuania three different crops have been considered (cereals, sugar beet and potatoes) and two in the Czech Republic (potatoes and wheat), resulting into four and two variables respectively. The yield is measured in tonnes per ha and the value is taken as being directly related to the economic sustainability of any given system. This indicator in Czech Republic was computed from data at farming system level (no available data at LAU 1 level).

Income of farmers:

– *Gross monthly wages of the employees in agriculture*: farmer's gross incomes (in terms of currency units per farmer). This variable tries to give a measure of the economic productivity of farming on each system and it was assumed being positively related to the economic sustainability of a farming system. In Czech Republic this indicator was computed using NUTS 3 data (no data available at LAU 1 level).

– *Average agricultural wage /average wage of the whole of economical activities (as per cent).* This variable relates through wages the agricultural activity with the rest of activities of the country. A very low percentage suggests the possibility that the farmer might abandon the agricultural activity for other remunerated activities. Therefore the value of this variable would be direct for the measurement of the economic sustainability. In Czech Republic this indicator was computed from data at NUTS 3 level (no available data at LAU 1 level).

Less Favoured Areas (LFAs)*:* percentage of LFAs per agricultural land in every system. The existence of a high percentage of LFAs in a region means a series of limitations that hinder the normal development of its activities (including agriculture), which in turns means a fall on the economy of the system, hence, low economic sustainability. This variable is inversely related to the economic sustainability of the farming system.

Annex 3 Size and structure of the samples of interviewed farms in the Czech Republic and Lithuania

CZECH REPUBLIC						
Farming system	Main productions	Organic Farm		Non–Organic Farm		**TOTAL**
		Individual farms	Legal entities	Individual farms	Legal entities	
Crops–Oriented Sugar Beet System	– Arable crops (sugar beet and cereals)	3	3	3	3	**12**
Crops–Oriented Maize System	– Arable crops (maize and/or other arable crops) – Livestock and crops – Herbs – Wine	4	1	3	3	**11**
Mixed–Oriented Grassland System	–Mixed–Oriented Grassland and crops (potatoes, cereals, others)	4	3	3	4	**14**
Livestock–Oriented System	– Cattle	5	1	3	4	**13**
Mixed–Oriented Potatoes System	– Livestock and crops (potatoes or potatoes and other crop).	4	2	3	3	**12**
Total		**20**	**10**	**15**	**17**	**62**

LITHUANIA						
Farming system	Main productions	Organic Farm		Non–Organic Farm		TOTAL
		Individual farms	Legal entities	Individual farms	Legal entities	
Livestock–Oriented System	– Cereals–sugar beet – Dairy cows–cattle – Pigs–potatoes	0	0	14	3	**17**
Crops Oriented System	– Cereals–sugar beet – Dairy cows–cereals – Cereals–vegetables – Potatoes–vegetables	6	0	7	3	**16**
Livestock–Marginal System	– Cereals–potatoes – Cattle–meadows/pastures – Dairy cows–cereals	3	0	9	0	**12**
Crops–Marginal System	– Potatoes–vegetables – Cattle–meadows/pastures	8	0	8	0	**16**
Urban–Oriented System	– Potatoes–vegetables – Orchards–berries – Dairy–cows–cattle	3	0	6	6	**15**
Intermediate System	– Cereals–flax – Dairy cows–cereals – Cereals–potatoes	3	0	10	0	**13**
Total		**23**	**0**	**54**	**12**	**89**

Annex 4 FADN variables and associated assumptions of managerial decisions under policy scenarios

FADN CODES	FADN VARIABLES	FORMULA	SCENARIO:		
			NON–ORGANIC FARM	ORGANIC FARM	NON–ORGANIC FARM WITH ENERGY CROPS
SE131	**Total output (TO)**	**SE131=*SE135+SE206+SE256***	**SE131**	**SE131**	**SE131**
SE135	***Output crops and crop's products***	***SE135***=SE140+SE145+SE150+SE155+SE160+SE165+SE170+SE175+SE185+SE195+SE200	***SE135***	***SE135***	***SE135*** + Output of additional cultivated land of energy crops(15% of cereals and other field crops area)
SE140 SE145 SE150 SE155 SE160 SE165 SE170 SE175 SE185 SE195 SE200	Cereals Protein crops Potatoes Sugar beet Oil–seed crops Industrial crops Vegetables & flowers Fruits Wine and grapes Forage crops Other crops output		Prices of each crop (2013)*Yield of each crop (2013)	Prices of each crop (2013)*Yield of each crops (2013) + Differences between organic and non–organic (%)	Prices of each crop (2013)*Yield of each crop (2013)
SE206	***Output livestock and products***	***SE206***=SE216+SE220+SE225+SE230+SE235+SE240+SE245+SE251	***SE206***	***SE206***	***SE206***
SE216 SE220 SE225 SE230 SE235 SE240 SE245 SE251	Cow's milk & products Beef and veal Pig meat Sheep and goats Poultry meat Eggs Sheep's and goat's milk Other livestock and products		Prices of each livestock (2013)* Yields of each livestock (2013)	Prices of each livestock (2013)* Yields of each livestock (2013) + Differences between organic and non–organic (%)	Prices of each livestock (2013)* Yields of each livestock (2013)
SE256	***Other output***		2001–2003 FADN data + Effect of inflation		
SE275	**Intermediate consumption (IC)**	**SE275=*SE281+SE336***	**SE275**	**SE275**	**SE275**
SE281	***Specific costs***	***SE281***=SE285+SE295+SE300+SE305+SE310+SE330	***SE281***	***SE281***	***SE281***
SE285 SE295 SE300	Seeds and plants Fertilisers Crop protection		2001–2003 FADN data + Effect of inflation	2001–2003 FADN data + Effect of inflation + Differences between organic and non–organic (%)	2001–2003 FADN data + Effect of inflation + Specific cost of additional cultivated land of energy (15% of cereal and other field crops area)
SE305 SE310 SE330	Other crop specific costs Feeding stuffs Other livestock–specific costs				2001–2003 FADN data + Effect of inflation
SE336	***Farming overheads***		2001–2003 FADN data + Effect of inflation		
SE600	**Balance current subsidies and taxes (ST)**	**SE600=*SE605–SE390***	**SE600**	**SE600**	**SE600**
SE605	Subsidies on product and costs		2001–2003 national subsidies + EU subsidies depending on scenario	Subsidies non–organic + Organic subsidies depending on scenario	Subsidies non–organic + Energy crops subsidies depending on scenario
SE390	Taxes		2001–2003 FADN data + Effect of inflation	2001–2003 FADN data + Effect of inflation + Differences between organic and non–organic (%)	2001–2003 FADN data + Effect of inflation
SE410	**GROSS FARM INCOME (GFI)**	**SE410=SE131–SE275+SE600**	**SE410**	**SE410**	**SE410**

Source: Compiled by the authors, 2005.

Annex 5 Average of values of variables for each farming system

MEMBER STATE	FARMING SYSTEM	DIMENSIONS/INDICATORS/VARIABLES																		
		ENVIRONMENTAL					SOCIAL								ECONOMIC					
		1.1.	1.2.	1.3.	1.4.	1.5.	2.1.	2.2.	2.3.	2.4.		2.5.		2.6.	3.1.	3.2.		3.3.		3.4.
		1.1. (LU/ha AL)	1.2. (scale 0–10)	1.3. (scale 0–5)	1.4. (%)	1.5.	2.1. (nº farmers/ ha AL)	2.2. (%)	2.3. (inhabitants /km^2)	2.4.A) (%)	2.4.B) (%)	2.5.A) (%)	2.5.B) (%)	2.6.	3.1. (%)	3.2.A) (t/ha)	3.2.B) (t/ha)	3.3.A) (€/ month)	3.3.B) (%)	3.4. (%LFA/ AL)
CZECH REPUBLIC	1. Crops–Oriented Sugar Beet	0.22	5.05	2.85	1.86	0.13	0.06	13.98	127.82	-1.57	3.27	10.12	0.61	87.13	2.17	4.65	20.60	371.87	72.29	15.32
	2. Crops–Oriented Maize	0.12	7.44	3.86	1.90	0.13	0.06	13.25	101.46	-1.53	-0.84	13.88	0.59	89.61	7.68	4.09	25.62	356.12	75.97	0.62
	3. Mixed–Oriented Grassland	0.26	3.63	1.40	16.70	0.21	0.05	11.97	114.34	-1.20	-0.23	13.11	0.73	89.50	4.12	3.79	22.44	363.12	78.08	64.03
	4. Livestock–Oriented	0.41	2.70	2.98	1.41	0.13	0.06	13.79	74.21	-0.98	0.29	9.33	0.88	88.46	2.87	3.87	20.47	363.50	80.91	66.92
	5. Mixed–Oriented Potatoes	0.31	2.94	2.21	10.28	0.18	0.05	13.43	76.18	-1.34	2.38	8.77	0.69	87.00	1.79	3.92	20.60	372.80	78.10	65.70

MEMBER STATE	FARMING SYSTEM	DIMENSIONS/INDICATORS/VARIABLES																			
		ENVIRONMENTAL					SOCIAL								ECONOMIC						
		1.1.	1.2.	1.3.	1.4.	1.5.	2.1.	2.2.	2.3.	2.4.		2.5.		2.6.	3.1.	3.2.			3.3.		3.4.
		1.1. (LU/ha AL)	1.2. (scale 0–5)	1.3. (scale 0–5)	1.4. (%)	1.5.	2.1. (nº farmers/ ha agricultural land)	2.2. (%)	2.3. (inhabitants /km^2)	2.4.A) (%)	2.4.B) (%)	2.5.A) (%)	2.5.B) (%)	2.6.	3.1. (%)	3.2.A) (t/ha)	3.2.B) (t/ha)	3.2.C) (t/ha))	3.3.A) (€/ month)	3.3.B) (%)	3.4. (%LFA/ AL)
LITHUANIA	1. Livestock–Oriented	0.24	3.42	2.08	0.54	0.20	0.09	22.79	36.93	-4.04	-0.64	12.71	-1.47	57.57	35.39	3.47	42.51	16.52	213.93	92.75	11.42
	2. Crops–Oriented	0.18	2.03	3.87	0.62	0.17	0.09	21.60	29.31	-4.16	-0.41	13.07	-1.82	71.01	24.46	3.42	36.55	17.64	200.57	81.71	7.00
	3. Crops–Marginal	0.16	3.65	1.46	2.66	0.35	0.08	24.19	24.09	-7.43	-1.53	13.15	-1.10	47.68	47.29	2.06	34.41	13.31	237.52	94.74	96.59
	4. Livestock–Marginal	0.30	2.88	2.00	1.45	0.38	0.12	20.87	32.65	-3.29	-1.22	11.81	-1.08	51.19	34.79	2.68	22.89	17.31	252.11	105.67	76.65
	5. Urban–Oriented	0.15	3.59	2.04	1.70	0.22	0.07	19.34	43.30	-2.94	10.11	10.12	-1.61	51.07	52.05	2.70	37.92	14.35	278.01	113.17	37.90
	6. Intermediate	0.21	1.78	2.14	0.81	0.27	0.10	20.49	31.90	-3.13	0.47	14.24	-0.86	55.41	33.11	2.44	32.82	14.24	246.01	85.11	42.56

Note: For codes see legend on next page.

Source: Compiled by the authors, 2005.

Legend to Annex 4

Dimension	Indicator	Variables*
Environmental	1.1. Livestock density	Livestock density (LU/ha of agricultural land) (only for ruminants)
	1.2. Soil erosion	Czech Republic: Degree of soil erosion (qualitative scale; from 0 to 10)
		Lithuania: Degree of soil erosion (qualitative scale; from 0 to 5)
	1.3. Pollution by nitrate	Degree of nitrate pollution (qualitative scale; values from 0 to 5)
	1.4. Organic farming	% of cultivated agriculture area under organic practices (included agricultural land and agricultural land in conversion)
	1.5. Agro–ecosystem biodiversity	Herfindahl Index (H)
Social	2.1. Density of farmers	Density of farmers (nº farmers/ha agricultural land)
	2.2. Aged population	Aged population (% population over 65 years old)
	2.3. Density of population	Density of population (inhabitants/km^2)
	2.4. Variation of the rate of population	2.4.A).Population natural rate of growth (average variation in the last 2 years in ‰)
		2.4.B).Migratory balance (average variation in the last 2 years in ‰) (=Outflow - inflow)
	2.5. Unemployment	2.5.A).Unemployment rate (% of total active population)
		2.5.B).Variation of the unemployment rate (average change in employment between 2001and 2003 in %)
	2.6. Concentration of farming land index (Gini index)	Concentration of farming land index (Gini index)
Economic	3.1. Structure of farming holding	% of area in holding of less than 10 ha
	3.2. Main crop/group of crop yield	3.2.A). Main crop/group of crop yield A (t/ha)
		3.2.B). Main crop/group of crop yield B (t/ha)
		3.2.C). Main crop/group of crop yield C (t/ha)
	3.3. Incomes of the farmers	3.3.A).Gross monthly wages of the employees in agriculture (€/month)
		3.3.B).Average agricultural wage/average wage of the whole of economical activities (%)
	3.4. Less Favoured Areas	% LFA / Agricultural land

Note: * For definitions see Annex 2 above.

Annex 6 Standardised value of indicators

Country	Farming system	DIMENSIONS/*INDICATORS*														
		ENVIRONMENTAL					SOCIAL						ECONOMIC			
		1.1.	*1.2.*	*1.3.*	*1.4.*	*1.5.*	*2.1.*	*2.2.*	*2.3.*	*2.4.*	*2.5.*	*2.6.*	*3.1.*	*3.2.*	*3.3.*	*3.4.*
Czech Republic	Crops–Oriented Sugar Beet	-0.5	-0.4	-0.2	-0.8	0.74	0.1	-1	1.38	0.17	0.67	1.08	0.73	0.61	-0.3	0.95
	Crops–Oriented Maize	-1.5	-1.8	-1.5	-0.7	0.77	1.43	0.04	0.13	-1.1	-0.2	-1.1	-1.9	0.97	-1	1.46
	Grassland–Cattle	-0.1	0.41	1.53	1.68	-1.7	-0.6	1.86	0.66	-0.8	-0.7	-1	-0.2	-0.3	-0	-0.8
	Livestock –Oriented	1.54	0.94	-0.4	-0.8	0.77	0.57	-0.7	-1.2	0.57	-0.5	-0.1	0.4	-0.7	0.51	-0.9
	Mixed–Oriented Potatoes	0.48	0.81	0.55	0.63	-0.6	-1.5	-0.2	-1.1	0.4	0.62	1.2	0.91	-0.6	0.77	-0.8
Lithuania	Livestock–Oriented	0.6	-0.7	0.24	-1	0.89	0.13	-0.8	0.65	-0.2	0.15	-0.3	0.27	1.08	-0.6	1.05
	Crops–Oriented	-0.6	1.16	-2.1	-0.9	1.18	0.08	-0	-0.6	-0.2	0.52	-2	1.46	0.94	-1.4	1.18
	Crops–Marginal	-0.9	-1	1.07	1.83	-1.1	-0.8	-1.7	-1.5	-1.4	-0.6	1.05	-1	-0.9	-0.1	-1.6
	Livestock–Marginal	1.81	0.01	0.35	0.21	-1.5	1.73	0.43	-0.1	0	-0.1	0.59	0.33	-0.4	0.74	-1
	Urban–Oriented	-1.1	-0.9	0.29	0.54	0.58	-1.5	1.4	1.71	1.5	1.35	0.6	-1.5	-0.1	1.59	0.23
	Intermediate	0.17	1.49	0.17	-0.7	-0	0.36	0.67	-0.2	0.26	-1.4	0.03	0.51	-0.6	-0.3	0.09

Note: For codes see legend to Annex 5.

Annex 7 Standardised values of indicators (by dimension)

Country	Farming system	Dimension:		
		environmental	social	economic
Czech Republic	Crops–Oriented Sugar Beet	-0.22	0.40	0.49
	Crops–Oriented Maize	-0.93	-0.13	-0.09
	Grassland–Cattle	0.37	-0.09	-0.32
	Livestock–Oriented	0.41	-0.22	-0.16
	Mixed–Oriented Potatoes	0.38	-0.09	0.08
Lithuania	Livestock–Oriented	0.00	-0.05	0.45
	Crops–Oriented	-0.26	-0.38	0.55
	Crops–Marginal	-0.03	-0.82	-0.90
	Livestock–Marginal	0.17	0.43	-0.07
	Urban–Oriented	-0.12	0.85	0.04
	Intermediate	0.23	-0.04	-0.08

Source: Compiled by the authors.

Annex 8 Sources and other considerations about the percentages of variation of specific costs in Czech Republic and Lithuania

Values (Cell code)	Source	Other considerations
B1, B2, B3, B5	– Field survey, 2005 (Differences between Organic/Non–organic farming (%)).	
B4	– CZ: Czech FADN Liaison Agency, 2005. – Field survey, 2005 (Differences between Organic/Non–organic farming (%)).	First is calculated the share (average percentage) of other crops specific costs in total specific costs of crops in FADN data. The obtained percentage is applied to specific costs (seed plus plants, fertilisers and crop protection) of organic and non–organic crops (from Field Survey 2005), for calculation of the average value of other crop specific costs. Finally differences between Organic/Non–organic farms (%) are calculated.
B6	– Zivelová, I.; Jánský, J. ; Novák, P. (2003). Economic evaluation of cattle management in the system of organic farming. Mendel University of Agriculture and Forestry (Brno, Czech Republic), AGRI.ECOM.–CZECH, 49, 2003 (10):469–475.	
C1, C2, C3, C5, C6	– Field survey, 2005 (Differences between Organic/Non–organic farming (%)).	
C4	– LT: Lithuanian FADN Liaison Agency, 2005. – Field survey, 2005 (Differences between Organic/Non-organic farming (%)).	First is calculated the share (average percentage) of other crops specific costs in total specific costs of crops in FADN data. The obtained percentage is applied to specific costs (seed plus plants, fertilisers and crop protection) of organic and non–organic crops (from Field Survey 2005), for calculation of the average value of other crop specific costs. Finally differences between Organic/Non–organic farms (%) are calculated.

Source: Compiled by the authors.

Annex 9 Sources and other considerations about the percentages of variation of yields in Czech Republic and Lithuania

Values (Cell code)	Source	Other considerations
A1, A2, A3, A4, A5, A6, A9, A10	- EUROSTAT database. Agriculture and fisheries. (Data from 1996 to 2004), 2005.	Average of inter-annual variation
A7, A8		Equals C7, C8
A11		Average of A1 to A10
A12	- European Commission (2005): Prospects for agricultural markets and income 2005–2012. Directorate–General for Agriculture. 120 pp. Available from www.europa.eu.int/comm	
A13, A14, A15	- FAPRI–Ireland Partnership (2002): EU Baseline Briefing Book	
A16		Equals C16
A17		Equals C17
A18		Equals A12
A19		Average of A12 to A18
A20		No change
B1, B2, B3 B5, B6, B8, B9, B10	- Field survey, 2005 (Differences between Organic/Non–organic farming (%))	
B4		Average of B1, B2, B3 B5, B6, B7, B8, B9, B10
B7		Equals D7
B11		Average of B1 to B10
B12, B13, B15, B16	- Field survey, 2005 (Differences between Organic/Non–organic farming (%))	
B14		Equals D14
B17		Equals B16
B18		Equals B12
B19		Average of B12 to B18
B20		No change
C1, C2, C3, C4, C5, C6, C7, C8, C10	- EUROSTAT database. Agriculture and fisheries. (Data from 1996 to 2004), 2005.	
C9		Equals A9
C11		Average of A1 to A10
C12, C17	- LT: Department of Statistics of Lithuania (2005). Website. Available from: www.std.lt/en/	
C13, C14, C15	-FAPRI–Ireland Partnership (2002): EU Baseline Briefing Book	
C16	- EUROSTAT database. Agriculture and fisheries. (Data from 1996 to 2004), 2005.	
C18		Equals C12
C19		Average of C12 to C18
C20		No change
D1, D2, D3, D7, D8, D9, D10	- Field survey, 2005 (Differences between Organic/Non–organic farming (%))	
D4		Average of D1, D2, D3, D5, D6, D7,

Values (Cell code)	Source	Other considerations
		D8, D9, D10
D5, D6		Equals B5, B6
D11		Average of D1 to D10
D12, D13, D14	- Field survey, 2005 (Differences between Organic/Non–organic farming (%))	
D15, D16		Equals B15, B16
D17		Equals D16
D18		Equals D12
D19		Average of D12 to D18
D20		No change

Source: Compiled by the authors.

Annex 10 Sources and data for percentage variations of prices assumed for scenarios

World nominal prices for several years and projections

Commodity		Measurement Units	Marketing year / Calendar year (a)				Difference between 2012/13 projection and 2001–2003 average
			00/01	01/02	02/03	12/13	
WHEAT	Price (b)	USD/t	116.5	128.6	160.0	162.9	20.6%
COARSE GRAINS	Price I	USD/t	90.2	89.8	107.1	120.9	26.4%
RICE	Price (d)	USD/t	184.0	192.0	199.0	312.2	62.9%
OILSEEDS	Price (e)	USD/t	202.9	210.7	252.2	257.3	15.9%
OILSEED MEALS	Price (f)	USD/t	176.6	164.7	180.1	161.5	-7.1%
VEGETABLE OILS	Price (g)	USD/t	332.3	418.1	511.9	601.4	42.9%
SUGAR	Price, raw sugar (h)	USD/t	219.3	167.2	179.9	185.2	-1.9%
SUGAR	Price, refined sugar (i)	USD/t	252.3	235.3	223.0	218.3	-7.9%
BEEF AND VEAL	Price, EU (j)	€/100 kg dw	260.2	222.9	239.5	255.0	5.9%
	Price, USA (k)	USD/100 kg dw	247.7	258.5	238.4	249.8	0.7%
	Price, Argentina (l)	ARS/100 kg dw	148.1	133.5	361.9	508.3	136.9%
PIG MEAT	Price, EU (m)	€/100 kg dw	134.1	160.3	127.4	131.7	-6.4%
	Price, USA (n)	USD/100 kg dw	136.9	140.3	106.9	140.7	9.9%
	Price, Brazil (o)	BRL/100 kg dw	128.3	144.1	141.5	241.1	74.8%
POULTRY MEAT	Price, EU (p)	€/100 kg rtc	99.3	108.2	98.7	91.3	-10.5%
	Price, USA (q)	USD/100 kg rtc	123.9	130.3	122.6	145.5	15.8%
SHEEP MEAT	Price, New Zealand I	NZD/100 kg dw	299.5	385.0	421.5	404.5	9.7%
BUTTER	Price (s)	USD/100 kg	136.7	133.6	114.5	184.3	43.7%
CHEESE	Price (t)	USD/100 kg	186.1	217.2	174.0	226.3	17.6%
SKIM MILK POWDER	Price (u)	USD/100 kg	189.6	197.5	132.6	199.5	15.2%
WHOLE MILK POWDER	Price (v)	USD/100 kg	182.2	197.3	139.1	203.4	17.7%
WHEY POWDER	Wholesale price, USA (w)	USD/100 kg	40.8	57.2	42.4	41.7	-10.9%
CASEIN	Price (x)	USD/100 kg	403.8	499.0	459.9	489.3	7.7%

Notes: est. = estimate.

(a) Prices for crops are on marketing year basis and those for meat and dairy products on calendar year basis (e.g. 04/05 is calendar year 2004).

(b) No.2 hard red winter wheat, ordinary protein, USA f.o.b. Gulf Ports (June/May).

(c) No.2 yellow corn, US f.o.b. Gulf Ports (September/August).

(d) Milled, 100%, grade b, Nominal Price Quote, NPQ, f.o.b. Bangkok (August/July).

(e) Weighted average oilseed price, European port.

(f) Weighted average meal price, European port. (g) Weighted average price of oilseed oils and palm oil, European port.

(h) Raw sugar world price, New York No 11, f.o.b. stowed Caribbean port (including Brazil), bulk spot price.

(i) Refined sugar price, London No 5, f.o.b. Europe, spot.

(j) Producer price; (k) Choice steers, 1100–1300 lb lw, Nebraska - lw to dw conversion factor 0.63.

(l) Buenos Aires wholesale price linier, young bulls; (m) Pig producer price.

(n) Barrows and gilts, No. 1–3, 230–250 lb lw, Iowa/South Minnesota - lw to dw conversion factor 0.74.

(o) Producer price.

(p) Weighted average farm gate live chickens, first choice, lw to rtc conversion of 0.75, EU–15 starting in 1995. (q) Wholesale weighted average broiler price 12 cities; (r) Lamb schedule price, all grade average.

(s) f.o.b. export price, butter, 82% butterfat, northern Europe.

(t) f.o.b. export price, cheddar cheese, 40 lb blocks, Northern Europe.

(u) f.o.b. export price, non–fat dry milk, extra grade, Northern Europe.

(v) F.o.b. export price, WMP 26% butterfat, Northern Europe.

(w) Edible dry whey, Wisconsin, plant. (x) Export price, New Zealand.

Source: OECD and FAO Secretariats, 2005.

Sources and other considerations about the percentages of variation in prices in Czech Republic and Lithuania

Values (cell code)	Source	Other considerations
A1	OECD/FAO (2005). OECD–FAO Agricultural Outlook: 2005–2014. Highlights 2005. 46 pp. Available from: www.oecd.org	Average value of wheat and coarse grains (see 0)
A2, A3, A6, A7, A8, A9, A10, A11, A19, A20		As there is no prevision of price for these productions, their variation similar to inflation is applied.
A4	OECD/FAO (2005). OECD–FAO Agricultural Outlook: 2005–2014. Highlights 2005. 46 pp. Available from: www.oecd.org	Price of raw sugar
A5	OECD/FAO (2005). OECD–FAO Agricultural Outlook: 2005–2014. Highlights 2005. 46 pp. Available from: www.oecd.org	
A12, A13, A14, A15, A16	OECD/FAO (2005). OECD–FAO Agricultural Outlook: 2005–2014. Highlights 2005. 46 pp. Available from: www.oecd.org	
A17		Equals A16
A18		Equals A12
B1,B2,B3,B5,B6,B8,B9, B10	Field survey, 2005 (Differences between Organic/Non–organic farming (%))	
B4	Dolby, A., 2004. Select Committee on Environment, Food and Rural Affairs. The United Kingdom Parliament. Memorandum submitted by Barrington Park Estate (O22). Adrian Dolby (25 March 2004). Available from: http://www.publications.parliament.uk/pa/cm200304/cmselect/cmenvfru/550/550we22.htm	
B7		Equals C7
B11		Equals C11
B12, B13, B16	Field survey, 2005 (Differences between Organic/Non–organic farming (%))	
B14		Equals C14
B15		Equals B13
B17		Equals C17
B18		Equals B12
B19		Average of B12 to B18
B20		No change
C1,C2, C3, C7, C8, C10, C11	Field survey, 2005 (Differences between Organic/Non–organic farming (%))	

Values (cell code)	Source	Other considerations
C4	Dolby, A., 2004. Select Committee on Environment, Food and Rural Affairs. The United Kingdom Parliament. Memorandum submitted by Barrington Park Estate (O22). Adrian Dolby (25 March 2004). Available from: http://www.publications.parliament.uk/pa/cm200304/cmselect/cmenvfru/550/550we22.htm	
C5		Equals B5
C6		Equals B6
C9		Equals B9
C12, C13, C14	Field survey, 2005 (Differences between Organic/Non–organic farming (%))	
C15		Equals C13
C16		Equals B16
C17		Equals C16
C18		Equals C12
C19		Average of B12 to B18
C20		No change

Source: Compiled by the authors.

Annex 11 Computation of variation of taxes in the Czech Republic and Lithuania

Czech Republic	Non–Organic	Organic	Change (%)	Inflation (%)	Organic (%)	Total (%)
	a	***b***	***b–a/a *100***			
Taxes (CZK/ha)	813.3	1195.9	47.05	20.71	47.05	67.76
Taxes (€/ha)	*27.21*	*40.01*				

Lithuania	Non-Organic	Organic	Change *(%)*	Inflation *(%)*	Organic *(%)*	Total *(%)*
	a	***b***	***b–a/a *100***			
Taxes (LT/ha)	81.49	42.85	-47.41	20.71%	-47.41	-26.70
Taxes (€/ha)	*23.60*	*12.41*				

Source: Field survey, 2005.

Annex 12 Comparison of the GFI values of Czech and Lithuanian systems (all simulations)

Czech Republic

GFI (€/ha)		CROPS–ORIENTED SUGAR BEET	CROPS–ORIENTED MAIZE	MIXED–ORIENTED GRASSLAND	LIVESTOCK–ORIENTED	MIXED–ORIENTED POTATOES
Non–organic farm	Baseline	487,40	457,08	280,25	482,16	357,71
	No–Accession	370,02	344,27	244,61	390,47	268,23
	Environmental CAP, Simulation 1 (10%)	485,68	455,40	278,87	480,56	356,09
	Environmental CAP, Simulation 2 (20%)	483,97	453,72	277,49	478,96	354,46
	Environmental CAP, Simulation 3 (30%)	482,25	452,04	276,11	477,36	352,84
Organic farm	Baseline	406,62	440,02	235,05	384,57	348,65
	No–Accession	202,23	220,94	158,67	226,45	196,36
	Environmental CAP, Simulation 1 (10%)	419,02	454,42	241,86	394,47	358,25
	Environmental CAP, Simulation 2 (20%)	431,42	468,82	248,68	404,37	367,85
	Environmental CAP, Simulation 3 (30%)	443,82	483,23	255,50	414,26	377,45
Farm partially dedicated to energy crops growing	Baseline	530,11	500,29	299,89	515,74	390,72
	No–Accession	427,05	400,36	269,37	435,01	310,36
	Environmental CAP, Simulation 1 (10%)	528,90	499,07	298,69	514,52	389,42
	Environmental CAP, Simulation 2 (20%)	527,69	497,84	297,49	513,31	388,12
	Environmental CAP, Simulation 3 (30%)	526,48	496,62	296,29	512,10	387,13

Lithuania

GFI (€/ha)		LIVESTOCK–ORIENTED	CROPS–ORIENTED	CROPS–MARGINAL	LIVESTOCK–MARGINAL	URBAN–ORIENTED	INTERMEDIATE
Non–organic farm	Business as usual (baseline)	405,79	387,92	333,23	351,82	383,13	382,79
	No–Accession	267,99	257,84	217,47	217,38	253,45	242,74
	Environmental CAP, Simulation 1 (10%)	404,08	386,33	331,69	350,11	381,50	381,05
	Environmental CAP, Simulation 2 (20%)	402,37	384,75	330,16	348,39	379,87	379,31
	Environmental CAP, Simulation 3 (30%)	400,66	383,16	328,62	346,68	378,24	377,57
Organic farm	Business as usual (baseline)	628,73	650,99	512,46	505,50	564,13	565,28
	No–Accession	149,67	159,28	158,27	175,23	134,45	159,19
	Environmental CAP, Simulation 1 (10%)	667,84	692,62	540,46	528,39	598,55	596,09

	Environmental CAP, Simulation 2 (20%)	706,94	734,25	568,45	551,29	632,96	626,91
	Environmental CAP, Simulation 3 (30%)	746,05	775,88	596,44	574,18	667,37	657,73
Farm partially dedicated to energy crops growing	Business as usual (baseline)	446,69	430,93	360,19	372,12	417,18	413,38
	No–Accession	302,61	293,81	240,16	235,49	283,42	268,62
	Environmental CAP, Simulation 1 (10%)	445,61	430,05	359,08	370,62	415,95	412,11
	Environmental CAP, Simulation 2 (20%)	444,52	429,17	357,97	369,13	414,73	410,85
	Environmental CAP, Simulation 3 (30%)	443,44	428,28	356,86	367,64	413,51	409,58

Note: Simulation 1: 10% increase of organic or energy crops subsidies (with 1% decrease of SFP);
Simulation 2: 20% increase of organic or energy crops subsidies (with 2% decrease of SFP);
Simulation 3: 30% increase of organic or energy crops subsidies (with 3% decrease of SFP).

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Abstract

This report presents the main results of the study "Sustainable Farming Systems in the New Member States" carried out by the Empresa Pública Desarrollo Agrario y Pesquero S.A. under the coordination of the Institute for Prospective Techological Studies (IPTS). The general objective of the study was to analyse the present and potential future development of farming systems in terms of sustainability in the new Member States (EU-N10), using the Czech Republic and Lithuania as case studies.

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