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Unay-Gailhard, İlkay; Bojnec, Štefan

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Farm size and participation in agri-environmental measures: Farm-level evidence from Slovenia[1]

İlkay Unay-Gailhard *, Stefan Bojnec **

*****Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Theodor Lieser Str. 2, D-06120 Halle (Saale), Germany

******Faculty of Management, University of Primorska, Koper, Slovenia

Abstract

This paper analyses the determinants of farmer participation in agri-environmental measures (AEMs) using the Slovenian Farm Accountancy Data Network (FADN) during the 2004-2010 period. Previous papers have not shown a straightforward relationship between farm size and decisions to participate in AEM. Considering explicitly the farm size, the controversial subject of the role of farm size is investigated by conducting logit regression analyses. We examine the influence of farm-specific characteristics on participation in AEMs using three different farm sizes: small, medium, and large. The findings strongly suggest that there are differences between the determinant factors of AEM participation based on farms' utilised agricultural area, particularly between small and large farms. This conclusion is supported by those variables that describe farm capital per land intensity, off-farm income and type of farming as significant determinants for large farm models but not for small farm models. Furthermore, variables that describe land productivity negatively influence participation in AEMs for large farms, whereas these variables positively influence the participation of small farms. The results highlight the importance of how these previously confirmed factors influencing AEM participation differ according to the three different farm sizes.

Keywords: Agri-environmental measures, farm size, land use, FADN, logit model, Slovenia.

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1. Introduction

In recent years, agri-environmental measures (AEMs) have become important elements of rural development (RD) policies by addressing issues such as multifunctionality, biodiversity and eco-efficiency in farm and agricultural development (EC, 2005; Beltrán-Esteve1 et al., 2012). Correspondingly, there are several studies of farmers' attitudes towards environmental conservation, including their AEM participation. In addition to the debate over the role of farm size on environmentally friendly farming practises, previous studies have investigated the influence of farm size on the acceptance of AEMs. However, the findings do not yield a straightforward relationship between farm size and AEM participation. Therefore, we aim to investigate the determinants of farmers' participation in AEMs by explicitly considering the role of farm size. This study contributes to the investigation of AEM participation in Slovenia using farms' utilised agricultural area (UAA) size divisions and farm-level evidence from the Farm Accountancy Data Network (FADN).

RD subsidies have not been uniformly adopted among the member states of the European Union (EU). High levels of RD subsidies are common in Slovenia, Austria, and Luxembourg, whereas there is a relatively low level of average RD subsidies in Denmark, Spain, Italy and Greece (EC, 2009). In Slovenia, as in Austria and Luxembourg, RD subsidies are larger than first pillar direct payments. Furthermore, Slovenia has the highest level of RD subsidies among those member states (NMS-10) that joined the EU with it in 2004; in addition, Slovenia's subsidies are higher than any of the old EU-15 member states and are three to four times higher than that of its neighbour, Italy. This characteristic might be explained by Slovenia's implementation of RD measures even before accession to the EU, which contrasted with some other NMS-10 member states that were only able to implement certain measures post-EU accession. In addition, Slovenia adopted the Common Agricultural Policy (CAP) immediately upon entering the EU, whereas others adopted it only gradually. In the meantime, Slovenia paid the difference from its national budget.

The AEMs that play an essential role in the RD programme for Slovenia are significant policy tools for addressing multifunctionality in both rural and agricultural development policies. According to the Slovenian FADN, 72% of farms participated in AEM farming practices in 2010. Slovenian farmers received the highest average AEM payment per hectare (ha) among the NMS-10 at least in part because of a relatively high participation rate of farms in the AEM programme and relatively high support per hectare (EC, 2009).

Slovenia's accession to the EU in 2004 was a watershed event for structural change in Slovenian agriculture. Between 2005 and 2010, the total number of farms decreased, with an increase in the number of very small farms (less than 1 ha) and of large farms (greater than 20 ha) but a substantial decrease in the number of medium-sized farms (Bojnec and Latruffe, 2013). An increase in the number of small farms might have been associated with a transfer of small farms from parents to children, which is an important issue in the Slovenian semi-subsistence farm life cycle as a social buffer that provides food for home consumption and hobby farming. However, an increase in the number of large farms might be interpreted as the entry and growth of farms operated by younger and more educated farmers who have increased their farm sizes by buying and renting land because these farmers see farming as a career opportunity.

These structural changes in the number and size of farms have produced new decision-making processes for farmers with respect to maintaining sustainable rural development. The central point on which our research focuses thus concerns an analysis of the determinants of farmers' AEM participation behaviour by explicitly considering the dimension of farm size. The main research question is whether and to what extent farm sizes contribute to decision making in connection with AEMs among Slovenian farmers. Thus, based on FADN evidence, we seek to understand what the determinants are for AEM participation in different farm size categories. The relationship between farm size and incentives for participation in AEMs is of particular relevance to improve both the understanding and design of AEMs, which is important for research and practise due to the distributional and allocation effects of environmental regulations and payments. Our research provides deeper insights into the investigation of AEMs that may lead to different environmental farming incentives for particular farm sizes.

This study examines how certain farmland use characteristics (including farm inputs such as family labour and capital per land intensity, off-farm income, land productivity, and farm types) influence AEM participation behaviour. By considering structural changes in Slovenian farms, our model captures the behaviour of three different groups of farms in terms of their sizes: small and medium-sized farms (which are mostly family-owned and operated) and large farms (which include larger family-owned farms, new entrances, operated farmers and a small number of commercial farms owned by private companies).

The remainder of this paper is organised as follows. Section 2 provides a literature review of the role of farm size in AEM participation. Section 3 describes the data source utilised herein and provides descriptive evidence for the main features of AEM participation in Slovenia. Section 4 explains the methodological approach of the farm-size-specific logit model. Section 5 presents the results and discusses the differences among the determinant factors for the acceptance of an AEM by the three farm size models. Finally, section 6 concludes with a summary of the results that are important for AEM policy making and recommendations for future research.

2. Background

2.1. Facts on land use, the evolution of the farm structure and agri-environmental programmes in Slovenia

Slovenia is a largely mountainous country with rolling hills in which the majority of agricultural land (72.5%) is situated in less favoured areas (LFAs). One third of Slovenia's total land area (20,273 km^2) is agricultural land (32%) and more than half of the total land area is covered by forest (59.8%). Table 1 presents detailed land use characteristics.

Table 1
Land use in Slovenia (2005)

Land use	Total hectare (000 ha)	Percentage (%)
Total forest area	1,213	59.8
Other land	166	8.2
Total agricultural land	648	32.0
Fields and gardens	(196)	(30.3)
Permanent grassland and pastures	(354)	(54.6)
Perennial crops	(55)	(8.4)
Other agricultural land	(43)	(6.7)
Total area	2,027.3	100.0

Source: *MAFF, 2007*

Cattle and cow, pig and poultry breeding are the most important types of livestock production economically. In 2013, agricultural holdings bred 399,349 livestock units (LSU) (SORS, 2013). Table 2 shows the number of animals and agricultural holdings.

Table 2
Breeding animals in Slovenia (2013)

Breeding animals	Number of animals	Number of agricultural holdings
Cattle	462,066	34,087
Young cattle	139,040	29,402
Pigs	287,498	23,700
Poultry	4,858,025	36,657
Horses	2,1832	6,029
Sheep	130,657	6,243
Goats	34,542	4,022
Rabbit	96,218	8,300
Deer	97,45	505

Source: *SORS, 2013a*

Slovenian agriculture is spatially fragmented with mainly small parcels of land (0.6-0.7 ha) and dispersed locations. Most farms are privately owned and operated, and agriculture is predominantly undertaken on family farms. In addition, there are also a small number of large-scale commercial farms that have descended from former state-owned agricultural enterprises. These farms continue today as private companies and mostly rent land from the State Fund of Agricultural Land and Forests (Bojnec and Swinnen, 1997).

The average farm size, measured by the UAA, was 6.4 ha in 2010 (SORS, 2013), which shows that Slovenian farms are small by European standards. Table 3 shows the evidence for structural changes in Slovenian farms, with a particularly important decline in the number of medium-sized farms (5-10 ha) following Slovenia's 2004 accession to the EU.

Table 3
Slovenian farm structure evolution (2003-2013)

Farm Size	Number of farms (by UAA)					Percentage change (%)			
	2003	2005	2007	2010	2013	2003-2005	2007-2010	2010-2013	2003-2013
> 5 ha	44,372	45,805	44,434	45,537	43,684	3.23	2.48	-4.07	-1.55
5.01-10.00 ha	20,633	19,775	19,143	17,530	17,207	-4.16	-8.43	-1.84	-16.6
> 10.01 ha	12,122	11,562	11,720	11,388	11,387	-4.62	-2.83	-0.01	-6.06

Source: *SORS, 2013b*

In Slovenia, AEM subsidies per hectare have been decoupled from farm size and the agri-environmental programme is based on the undertaking of three groups of environmental measures issued by the Slovenian Ministry of Agriculture and Environment[2]. The rural development programme (RDP) for the 2004-2006 period consisted of 21 measures. The number of measures increased to 26 measures in the RDP during the 2007-2013 period. Table 4 presents the AEM measures within the three groups of payments per hectare for the 2007-2013 period.

[2] The minimum agricultural land area for AEM participation is 0.1 ha.

Table 4
Agri-environmental measures (AEMs) and payments per ha in Slovenia (2007-2013)

Agri-environmental measures	Euros/ha
Group 1: reduction of negative impacts of agriculture on the environment	
Preservation of crop rotation	91.84
Greening of arable land	172.2
Integrated crop production	197.21
Integrated fruit production	336.61
Integrated wine production	381.71
Integrated horticulture	184.91
Organic farming	from 227.55 to 578.92[3]
Group 2: preservation of natural features, biodiversity, soil fertility and traditional cultural landscape	
Mountain pastures	61.09 or 72.57 (without or with shepherd(s))
Mowing steep slopes	90.20 to 142.27 (depending on steepness)
Mowing hilly meadows	132.84
Meadow orchards	93.89
Steep vineyards	326.77 or 900 (depending on steepness)
Rearing of autochthonous and traditional domestic breeds	89.38 (per head of animal)
Production of autochthonous and traditional agricultural plant varieties	102.91
Sustainable rearing of domestic animals	84.46
Extensive grassland maintenance	48.38
Preservation of extensive karst pastures	191.40
Group 3: maintenance of protected areas	
Animal husbandry in central areas of appearance of large carnivores	29.11
Preservation of special grassland habitats	121.36
Preservation of grassland habitats of butterflies	121.36
Preservation of litter meadows	198.44
Conservation of bird habitats in humid extensive meadows in Natura 2000 sites	83.23
Permanent green cover in water protection areas	31.57 to 184.50[4]

Source: *MAFF, 2007*

[3] The payments made vary according to the production technology used. Produce on the field, 298.07 euros; horticulture, 551.45 euros (outside), 487.90 euros (inside); orchards, 554.73 euros, meadow orchards, 237.80 euros; vineyards, 578.92 euros, meadow vineyards, 227.55 or 213.20 euros due to higher or lower stock density, respectively.

[4] Given payments depend on the field. Produce of field crops was 83.64 euros, orchards and vineyards was 184.50 euros and meadows was 31.57 euros.

The three different group payments aim at the conduct of environmentally friendly farming methods, emphasising the multifunctional role of agricultural production, maintaining the landscape and biodiversity and preserving the settlement of the Slovenian countryside in accordance with mandatory standards.

Entering AEMs is voluntary, and beneficiaries can participate in one or several measures. Participants undertake to implement the measures for the entire duration of the commitment, which is at least five years. Beneficiaries of AEMs should meet cross-compliance requirements and keep all records (i.e., crop rotation plans and records on work tasks) throughout the duration of the programme commitment and for four years from the day the last payments were made. Payments are disbursed as support for the current year. During the programme commitment period, a beneficiary must participate in a training programme of four hours per year. The supervision of the implementation of AEMs and monitoring how resources are spent by the Agency of the Republic of Slovenia for Agricultural Markets and Rural Development is in accordance with regulations.

2.2. Controversial subject: role of farm size in AEM participation

Since the early 1990s, with the implementation of programmes under the AEM scheme, the participation in voluntary AEMs by farmers has led to interest from academics. These studies have mainly used the theory of diffusion of innovation (Morris and Potter, 1995; Mathijs, 2003), theory of reasoned action and planned behaviour (Wauters et al., 2010; Grammatikopoulou et al., 2012; Mettepenningen et al., 2013), micro-economic modelling theory (Ozanne et al., 2001; Polman and Slangen, 2008), profit maximiser theoretical framework (Bonnieux et al., 1998; Dupraz et al., 2003), the social network approach (Deffuant et al., 2008; Unay Gailhard et al., 2014), and contract theory (Espinosa-Goded et al., 2013).

For each of the remaining major theoretical approaches, the literature demonstrates that several factors influence decision-making behaviours towards AEMs, such as attitudes and perceptions regarding conservation practices (Black and Reeve, 1993; Defrancesco et al., 2008; Vanslembrouck et al., 2002), financial factors (Morris and Potter, 1995; Wilson and Hart, 2000; Ducos et al., 2009; Sutherland and Darnhofer, 2012), continuance of the farm (Ingram et al., 2013), contract design (Fraser, 2011), social network actors (Warriner and Moul, 1992; Skerratt, 1998; Beedell and Rehman, 2000; Frondel et al., 2012), and farmers' characteristics and farm structure (Crabtree et al., 1998; Wynn et al., 2001; Kristensen et al.,2001).

Among the farm structure variables, farm size, farm type, and farm labour characteristics are important determinants of applying AEMs. Farm size is often measured by the size of the UAA and has been considered one of the most important determinants in AEM farming practices. This study contributes to the investigation of AEM participation by UAA size divisions. Furthermore, in addition to the UAA, studies have investigated the influence of farm size using measures such as the standard gross margin (SGM), Economic size in European Size Unit (ESU), and total sales.

However, previous studies did not observe a straightforward relationship between farm size and farmer participation in AEMs. These mixed results regarding the impact of farm size on AEM participation in farming practices can be classified into three groups.

The first group of studies argues for a positive association between farm size and participation in AEMs. In Scotland, Wynn et al. (2001) demonstrated that large farms (measured as total UAA in ha) are more likely than small farms to join schemes earlier in environmentally sensitive areas. In Greece, Damianos and Giannakopoulos (2002) found that farm size (in terms of ESU) positively influences both the probability of applying a nitrate reduction measure and the intensity of participation in that measure. Vanslembrouck et al. (2002) analysed two types of AEMs (extensification of field margins and farm beautification) in Belgium under the assumption that the participation behaviour of farmers is influenced not only by farmer and farm characteristics but also by the characteristics of the AEMs. The authors show that larger farms (>75 ha) demonstrated a greater acceptance of extensification of field margins than small (<35 ha) and medium-sized (35-75 ha) farms, after controlling for other explanatory variables. In a survey of 1,000 farm households in EU-9 member states[5] and Switzerland, Wilson and Hart (2000) suggest that AEM participation behaviour is influenced by farm size: farms that are larger than the regional average are often more likely to apply AEMs. In a recent study in Belgium and the USA, Mettepenningen et al. (2013) modelled the probability of participation in AEMs and found that participation increases with farm size; here, the authors used a standardised farm size to correct for differences between different types of farms. In the early years of AEM implementation, Wilson (1997) discussed the positive relationship between farm size and participation in AEMs by using eligibility criteria (i.e., small farms lacked substantial semi-natural habitats). Wilson and Hart (2000) conclude that the reason for this positive relationship is that farms that are larger than the regional average have larger ecologically important habitats on their farms that are eligible for AEM payments.

The second group of studies argues that there is no significant effect of farm size on AEM participation. In Belgium, Dupraz et al. (2003) showed that the participation rate in the two studied AEMs (late mowing and reduced use of farm inputs) does not significantly vary with farm size (measured as total UAA in ha). Wossink and Wenum (2003) focussed on both actual and contingent participation behaviour in biodiversity conservation by arable farms in the Netherlands. These authors considered the differences in the proportion of labour-intensive crops in large and small farms. Small farms typically grow a larger proportion of labour–intensive, high-return crops, and so biodiversity conservation would be less attractive for these farms. However, contrary to expectations, farm size has no effect on applying biodiversity conservation measures for both actual and contingent participation behaviour typologies. Studies that used both UAA and SGM measures of farm size, such as Defrancesco et al. (2008) for Italy and Polman and Slangen (2008) for the EU-6 member states[6], have concluded that farm size does not have an effect on applying AEMs in farming practices. Sattler and Nagel (2010) explained this non-significant effect by the importance of how well the implemented AEMs fit with production on the farm.

[5] These EU-9 member states were Austria, Denmark, France, Germany, Greece, Portugal, Spain, Sweden, and the United Kingdom (UK).

[6] These EU-6 member states were the Netherlands, Belgium, Czech Republic, Finland, France and Italy.

The third group of studies claim that there is a negative association between farm size and participation in AEM. For the Flemish region in Belgium, Vanslembrouck et al. (2002) demonstrated that large farms are significantly less likely to apply farm beautification measures of in-yard plantation (planting flowers) than those farms that are in the middle and smaller-than-middle categories of farm size. These authors explain that the reason for this bias is that larger farms already have realised plantations around their new buildings or that they are situated in more wooded areas. In line with these authors, Pascucci et al. (2013) recently found that small farms in Italy (<16 ESU) are more likely to participate in AEM supports. This negative relationship between farm size and participation in AEM is explained by the differences between large and small farms in terms of allocating their labour time and assets to implement AEMs because small farms may have higher benefits and lower opportunity costs relative to large farms. Separate from the relationship between farm size and participation behaviour, Mann (2005) investigated the participation in meadow extensification measures in growing farms in Switzerland and found that farm growth (in terms of increased farm size) negatively affects participation in AEMs. One of the arguments for that negative relationship involves economies of scale. The growth of farms provides greater benefits in terms of economies of scale in food production than the use of environmental services, such as AEMs.

Despite the fact that these previous models have incorporated farm size as an independent variable to explain AEM participation decisions, the literature has thus far not provided an assessment of models with increased predictive quality in terms of participation probability transitions at different farm sizes. Therefore, this paper aims to fill this gap in the literature and investigate the determinants of farmers' participation in AEMs by explicitly considering the role of farm size.

3. Data

3.1. Slovenian Farm Accountancy Data Network (FADN)

This paper employs the Slovenian FADN survey sample for the years 2004-2010. The FADN is a European farm sample survey system that is used as an instrument to evaluate the income of agricultural holdings and the effects of the Common Agricultural Policy (CAP) measures in EU countries (Eurostat, 2012a; 2012b). In our study, secondary farm-level data of the Slovenian FADN sample of farms are investigated with respect to the determinants of applying AEMs. The studied years (2004-2010) are in the post-EU accession period for Slovenia and contemporaneous with a shift from national agricultural policies to the EU CAP.

The Slovenian FADN dataset includes farms above two ESUs (one ESU equals 1,200 euros of SGM). All the nominal aggregates have been deflated by statistical price indices to obtain their real values in 2004 prices over time. Total output in the land productivity ratio was deflated by the producer price index of agricultural products. Total assets were deflated by the agricultural input price index for goods and services contributing to agricultural investment. The source of data for price deflators is the Statistical Office of the Republic of Slovenia. Table 5 describes the Slovenian FADN dataset used in this study.

Table 5
Description of the used Slovenian FADN dataset (2004-2010)

Variables	Description	Unit
Farm size samples	Total UAA in hectares (ha)	
	Size 1, small farms: less than 5 ha	1
	Size 2, medium farms: 5-10 ha	2
	Size 3, large farms: more than 10 ha	3
Dependent variable:		
Participation in agri-environmental measure (AEM)	Applied AEM by farm in the current year	0=no, 1=yes
Independent variables:		
Farmland use characteristics		
Land use		
Woodland areas	Share of woodland area on UAA of holding	Percentage
Cereals	Share of cereals on UAA of holding	Percentage
Forage crops	Share of forage crops on UAA of holding	Percentage
Tenure status		
Rented land	Rented areas as a percentage of the total UAA of holding	Percentage
Land productivity and capital per land intensity		
Land productivity	Total output to total land (Euros/ha)	Ratio
Capital per land intensity	Total assets to land (Euros/ha)	Ratio
Family labour and off-farm income		
Family labour	Unpaid family labour input (FWU) to total labour input (AWU)	Percentage
Off-farm income	Share of the off-farm income to total agricultural revenue	Ratio
Participation in rural development subsidies		
Less favoured area (LFA) payments	LFA measure applied by farm in the current year	0=no, 1=yes
Other rural development (RD) payments	Other voluntary RD policy measures applied by farm in the current year	0=no, 1=yes
Farm types	Eight farm types used as a dummy variable. These are field crops, horticulture, wine, other permanent crops, milk, other grazing livestock, granivore, mixed	0=no, 1=yes
Years	Survey years 2004-2010 used as dummy variables	0=no, 1=yes

Source: *Slovenian FADN dataset*
Note: *Annual work unit (AWU), 1 AWU=1,800 hours of labour per year (Eurostat 2010, p. 432).*

For purposes of this study, we investigated the determinants of AEM participation in different farm size samples. Based on the average Slovenian farm size of 6.3 ha in 2010 (Bojnec and Latruffe 2013), we designed three subsamples to meet the concurrent objectives of providing (1) an estimate for small farms with UAAs of less than or equal to 5 ha, (2) an estimate for medium-sized farms with UAAs of 5 to 10 ha, and (3) an estimate for large farms with UAAs of greater

than 10 ha. The categorisation into small, medium-sized and large farms would change for other regions in which average farm size is different from that in our study area.

The Slovenian FADN dataset considers three categories of RD subsidies: AEM, LFA and *other RD payments*. The AEM payments cover subsidies for environmental restrictions in farming practices. The LFA payments aim to mitigate risks, such as agricultural land abandonment, desertification and forest fires. *Other RD payments* aim to help farmers adapt to standards, use farm advisory services, improve the quality of agricultural products, conduct training, create new areas of forest, and increase the ecological stability of forests. Because we aim to assess the factors that explain farm participation in AEMs, our analysis focuses on AEM payments rather than on other categories of RD subsidies. This study was conducted in three logit regression analyses with small, medium and large farm sizes in which the decision to participate in AEMs in the current year was a dependent variable.

3.2. Descriptive statistics

Table 6 shows the summary statistics of the variables that were used in the empirical analysis during the 2004-2010 period, on average.

Table 6
Descriptive statistics (2004-2010)

Variables	Used statistics	Size 1: Small farms less than 5 ha	Size 2: Medium farms from 5-10 ha	Size 3: Large farms greater than 10 ha
Farm size samples	N	N=390	N=1260	N=3605
	(%)	(7.4%)	(24.0%)	(68.6%)
Farmland use characteristics				
Land use (as a percentage of agricultural land)				
Share of woodland areas	Mean %	127.42	119.53	73.67
	(Std.)	(28.0)	(4.0)	(1.8)
Share of cereals	Mean %	13.60	12.62	16.41
	(Std.)	(1.2)	(0.6)	(0.4)
Share of forage crops	Mean %	40.04	69.40	75.73
	(Std.)	(1.9)	(1.0)	(0.5)
Tenure status				
Share of rented land	Mean %	15.43	14.22	42.53
	(Std.)	(1.4)	(0.5)	(0.4)
Land productivity and Capital per land intensity				
Land productivity (Euros/ha)	Mean	3592.86	2221.37	2157.96
	(Std.)	(202.0)	(73.2)	(51.1)
Capital per land intensity	Mean	26,276.68	20,736.90	14,997.28
(Euros/ha)	(Std.)	(1113.9)	(399.6)	(131.2)
Family labour and off-farm income				
% of family labour	Mean %	95.83	96.69	95.93
	(Std.)	(0.5)	(0.3)	(0.2)
Off-farm income (Euros)	Mean	672.21	1880.16	3839.26
	(Std.)	(117.9)	(150.9)	(642.4)
Participation in rural development subsidies				
AEM payments	% of yes	57.44	76.51	73.29
LFA payments	% of yes	69.49	82.46	77.25
Other RD payments	% of yes	4.62	14.44	10.37

Source: *Slovenian FADN dataset*
Note: *mean and percentage (%) results represent the average of the 2004-2010 period. Variables represented with mean (as a %) are given with standard deviation (Std). These given Std numbers measure the mean amount of variation from the mean as a percentage. Therefore, a low standard deviation for these variables indicates that the data points tend to be very close to the mean within the percentage number.*

While small farms accounted for 7.4% of the sample, this subset consists of 23% medium and 68% large farms, confirming that the FADN sample included more viable farms that are larger than an average Slovenian farm (6.3 ha).

Regarding participation in RD subsidies, the share of participation in AEM is higher for medium-sized (76%) and large farms (73%) than for small farms (57%), confirming that, on average, the share of participants in AEMs is higher for medium-sized and large farms relative to small farms. Similarly, for the LFA and *other RD payments*, small farms exhibit lower percentages of participation relative to medium-sized and large farms. In addition to the average calculated results over the 2004-2010 period, Table 7 provides the share of farms that participated (%) and the average AEM subsidies (Euro/AWU) for the three farm size divisions for 2004, 2007 and 2010.

Table 7
Participation in agri-environmental measures (AEMs) in Slovenia, by farm size divisions

	%	**Mean** (Euro/AWU)	**Std.**	**Min.** (Euro/AWU)	**Max.** (Euro/AWU)
Size 1: small farms					
2004	63.33	900.86	422.11	252.47	1593.08
2007	55	605.12	390.79	129.69	1471.80
2010	57.77	638.34	295.25	121.10	1310.55
Size 2: medium-sized farms					
2004	72.27	1271.28	897.30	176.47	4131.18
2007	81.91	1247.63	788.02	111.84	3654.13
2010	75	1222.42	716.08	211.07	4333.04
Size 3: large farms					
2004	68.87	4579.02	7202.74	122.67	89,692.48
2007	77.95	4616.95	5684.33	67.66	38,070.49
2010	71.83	5216.3	6033.92	60.55	39,281.14

Source: *Slovenian FADN dataset*
Note: *percentage (%) represents the share of AEM participants, and mean numbers present the average AEM subsidies (Euro/AWU) that are received by farms.*

Consistent with the results for the average during the 2004-2010 period, the share of AEM participants is higher for medium-sized and large farms (approximately 71-81%) relative to small farms (approximately 55-63%) in the years studied (Table 7). For the three farm size models, the share of AEM participants varies slightly with the study years. As expected, the average amount received for the AEM subsidies was higher for large farms than for medium-sized and small farms. Overall, Table 7 shows a dualistic structure of participation behaviour in which a farm's UAA size plays an important role, indicating the necessity of investigating decision making in relation to AEMs by farm size.

4. Method: farm-size-specific logit model

This study hypothesises that the differences in farm sizes lead to different costs and benefits in AEM participation; thus, determinant factors in the participation decision should not be similar for small, medium-sized and large farms. During the decision-making process, the farmer faces two options: signing an AEM contract or not.

In the first step of testing our hypothesis, three subsamples of farm sizes were pooled from the FADN dataset: small, medium-sized, and large farms. It is assumed that in various farm size divisions, AEM participation has a different impact on farmers' income by changing the output and the efforts to meet AEM requirements. We expect that in each farm size sample, the benefits of applying AE farming practices relative to farm income present farmers with a distinct decision-making process.
For the three farm size samples, choice modelling occurs in the second stage. Regarding the literature on the applied methodology for voluntary AEM participation, studies have mainly used discrete choice models by considering the participation decision as a dichotomous problem (Crabtree et al., 1998; Wynn et al., 2001; Vanslembrouck et al., 2002; Polman and Slangen, 2008; Hurle and Goded, 2007). Following these studies, we formulated the decisions of farmers as a discrete choice model. Based on micro-economic modelling theory, equation (1) shows that willingness to sign a voluntary AEM contract as an additional payment depends on farmers' estimates of the profits forgone.

$$y^* = \begin{cases} y = 1, \ signup\ an\ AEM\ contract \\ y = 0, \ not\ signup\ an\ AEM\ contract \end{cases} \quad (1)$$

During the last stage, we conducted farm-size-specific logit regression analyses. The objective of logit models is to predict the effects of multiple explanatory variables – which can be numeric and/or categorical – on the outcome variable. The general logit regression model is as follows:

$$In = \left(\frac{p'}{1-p'}\right) = B_0 + B_1 x \quad (2)$$

This formula is stated in terms of the probability that y=1, which is referred to as p'. The probability that y=0 is $1-p'$. The symbol of In refers to a natural logarithm, and $B_0 + B_1 x$ represents the equation for the regression line, where $B_0$is the regression constant and $B_1 x$ is the observation.

An empirical study has been conducted with logit models for small, medium and large farm size subsamples, where participation in an agri-environmental policy is a dichotomous dependent variable. We expect comparatively dissimilar dependent and independent variable associations among the three models.

Due to the missing values for the large farm UAA subsample, the number of observations for the logit analysis was reduced from 3,605 to 3,550. For the comparative analysis, the results from independent logit models are presented, including coefficient estimates, with P>|z| test significance levels and standard errors. The pseudo R^2 measure of goodness of fit is estimated at

0.186 for the small, 0.178 for the medium-sized and 0.242 for the large farm subsamples. This relatively low pseudo R^2 level can be explained by the specificity of the used unbalanced panel dataset, where it is possible and rather common to have low fit numbers.

5. Results

Table 8 presents the results of the logit regression analyses. These findings strongly suggest that there are differences between the determinant factors of AEM participation regarding firm size, particularly between small and large farms.

Table 8
Results of the farm-size-specific logit models for participation in agri-environmental measures (AEMs)

	Small farms N=390		Medium farms N=1260		Large farms N=3550	
	Coef.	**Std.**	**Coef.**	**Std.**	**Coef.**	**Std.**
Farmland use characteristics						
Land use						
Share of woodland areas	.001	.001	.003**	.001	.002**	.0007
Share of cereals	-.027**	.007	-.031**	.008	-.080**	.007
Share of forage crop	-.017**	.006	-.033**	.008	-.097**	.007
Tenure status						
Share of rented land	-.004	.005	-.003	.003	.001	.002
Land productivity and capital per land intensity						
Land productivity	.009**	.004	-.002**	.000	-.006**	.000
Capital per land intensity	-.000	.009	.000	.006	-.000**	.000
Family labour and off-farm income						
% of family labour	-.0136	.0146	-.0512**	.0211	.0005	.004
% of off-farm income	.000	.000	.000**	.000	.000**	.000
Participation in rural development subsidies						
LFA payments	1.247**	.308	1.066**	.231	1.028**	.123
Other RD payments	.504	.594	.143	.271	.623**	.201
Farm types						
Field crops	17.97	815.41	.270	1.219	-.346	.431
Horticulture	16.51	815.41	-.052	1.416		
Wine	17.04	815.41	-.745	1.336	5.371**	1.400
Other permanent crops	18.13	815.41	.443	1.326		
Milk	17.45	815.41	-.596	1.214	.981**	.379
Other grazing livestock	17.37	815.41	-.209	1.210	.886**	.386
Mixed	17.65	815.41	-.116	1.201	.390	.373
Years						
2004	.696	.570	.141	.312	.024	.173
2005	.768	.490	.583**	.287	.292*	.166
2006	-.123	.461	-.720**	.243	-.692**	.154
2007	.109	.480	.730**	.289	.708**	.166
2008	.450	.461	.914**	.283	1.152**	.166
2009	.216	.458	.4912*	.28	.0729	.151
Constant	-16.239	815.412	8.15**	2.60	9.922**	.911
Prob > chi2	0.000		0.000		0.000	
Pseudo R^2	0.186		0.178		0.242	

Source: *Slovenian FADN dataset*
Note: *The coefficient values are given with P>|z| test significance levels of ** p<.05 and *p<0.1. In the model, the variable "granivores" and the year "2010" were used as base (reference) categories for the explanatory variable groups of farm types and years, respectively.*

For the medium-sized and large farms, the likelihood of participation in AEMs increases with the share of existing woodland areas. Such farms are less likely to be situated in flat areas in Slovenia – where crop production is more common – and are more likely to be situated for production in limited hilly and mountainous LFAs. This positive relationship between the share of woodland area and AEM participation contrasts with the relationship between the share of agricultural production (cereals and forage crops) and AEM participation that negatively affects the likelihood of participation in the three models. These results indicate that applying AEMs is less attractive for farms that are under agricultural land use, regardless of farm size. This negative impact may explain the fact that AEM intensity in farming practices decreases production. If we express this decrease in production as an opportunity cost (Bertoni et al., 2011), it might be expected that, regardless of farm size, opportunity cost is higher for farms in which the share of UAA is high. Our findings for the share of cereal and forage variables agree with those of Wynn et al. (2001) in Scotland and of Defrancesco et al. (2008) in Italy. Farms are mostly situated in flat areas in central and north-eastern Slovenia, which is a greater use of agricultural land. These model results highlight the important role of this type of land use.

Land productivity and capital per land intensity

The positive sign of the estimates for the land productivity variable for small farms (but negative for medium-sized and large farms) indicates that the opportunity costs for maintaining environmental farming obligations are positively related to land productivity only for small farms. This positive effect is partly consistent with the findings of Glebe and Salhofer (2007), who investigated the influence of economic, environmental, and political factors on AEM participation for the EU-15 countries. These results suggest that farms that are situated on relatively unproductive agricultural land tend to participate in AEMs comparatively more often than farms that are located on highly productive land. The positive influence of land productivity on the small farms and the negative influence on the medium-sized and large farms can be explained by the differences in private costs (e.g., the use of request inputs that are linked to higher production costs and/or a decrease in the level of production, such as mineral fertilisers that must be applied or the soil fertility control that should be undertaken every five years) among the three studied farm size subsamples. In our case, only the medium-sized and large farms with a certain land productivity level fall below the threshold of profitability for scheme participation.

For the large farms, the negative and significant sign for capital per land intensity indicates that participation in AEM decreases as the ratio of fixed and current assets to farmland increases. This result confirms the findings of Pascucci et al. (2013) in Italy. These authors indicate that a high level of capital intensity (measured as horsepower mechanisation per ha) decreases the participation behaviour of two studied RD measures: support for AE services and support for competitiveness schemes. In Slovenia, this is particularly true for large farms, which are also more commercially oriented, whereas the capital per land intensity is not a significant determinant for explaining the attitude towards AEM participation for either small or medium-sized farms.

Family labour

The share of family labour has been assumed to be an important variable in previous studies to the extent that a high share of family labour was considered to be a labour intensive farming process, which therefore implied less willingness to apply for AEM(s). This hypothesis was partly confirmed by our estimated results, indicating that the probability of acceptance of an AEM decreases with an increasing share of family labour for medium farms but is not significant for small and large farms. However, it should be noted that 95% of Slovenian farms utilise predominantly family labour (see Table 6). This result demonstrates that, although the share of family labour is similar for all the studied farm sizes, the opportunity cost of AEM participation is high only for medium-sized farms because these farms "are too small to be economically efficient, but they are too large to be profitable" (Bojnec and Latruffe, 2013, p. 216). The finding that the share of family labour negatively influences AEM participation behaviour for medium-sized farms (5-10 ha) is consistent with the study of Defrancesco et al. (2008) in northern Italy (in the Alpine area, where the average farm size is 7.6 ha). The results of Defrancesco et al. (2008) indicate that a high level of family labour increases the marginal probability of non-participation in the three studied AEMs: low input measures, grassland conservation in the aquifer recharge belt and grassland conservation in the Alps.

Off-farm income

The share of off-farm income positively influences the AEM participation behaviour of medium-sized and large farms but is not significant for small farms. This result is explained by the off-farm income support that reduces uncertainty regarding farmers' incomes, decreasing the potential risk of income reduction and making the farmer less dependent on the market, which positively influences participation in voluntary conservation practices that provide subsidies, as a result. However, for small farms, even farm income gains are supported by the off-farm income, which seems to not offset the costs of shifting to environmentally friendly farming practices. For small farms, perhaps, involvement in AEM does not decrease their income uncertainty to the same extent as it does for medium-sized and large farms and might be perceived as a barrier to market entry.

The literature on the role of off-farm income in AEM participation has yielded diverse results depending on the studied AEM scheme and the region. Although Pascuci et al. (2013) found that off-farm activities do not lead to significant differences in AEM participation (such as afforestation and extensification), Wossink and Wenum (2003) demonstrated that off-farm income increases the likelihood of contingent participation but with no significant influence on actual participation. Jongeneel et al. (2008) found a positive relationship that is consistent with the results of our study. These authors investigated the participation in conservation activities in the Netherlands (where the average size of arable farms is 103 ha) and found that off-farm income increases the likelihood of a decision to participate. These authors explain the results as a consequence of the Netherlands' less labour-intensive farming methods. Based on the observation that off-farm employment is frequently combined with an agricultural system that uses less labour, these more extensive farms can be easily combined with farming practices that are related to ecological conservation.

Participation in other RD subsidies

AEM applications are significantly influenced by participation in the other two categories of RD subsidies: LFA and *other RD payments*. The positive signs of the estimates for the LFA payment variable in all the farm size models confirm that, regardless of farm size, applying for an LFA payment in the current year increases the likelihood of AEM participation. Our result partly corresponds with previous findings by Crabtree et al. (1998) regarding the participation behaviour in connection with the Farm Woodland Premium scheme in Scotland. This scheme encourages tree planting on farms, and the authors found that farms in the LFAs have a greater likelihood of planting.

Participation in *other RD subsidies* (such as payments that help farmers to adapt to environmental standards, to use farm advisory services, and to improve the quality of agricultural products) significantly positively affects the application of AEMs for large farms. However, this variable is not significant for small and medium-sized farms. Overall, it seems that large farms that actively participate in two categories of RD subsidies (LFA and *other RD payments*) also benefit from AEM payments.

Farm types

For large farms, AEM participation is significantly influenced by farm type, particularly for wine, milk and specialised livestock (e.g., sheep, goat and specialised cattle-rearing). This result demonstrates that vineyards and dairy and livestock farms (greater than 10 ha) have lower costs associated with AEM participation, which can be related to the use of less capital-intensive and more environmentally friendly production technologies. However, this positive effect is not observed for small and medium-sized farms, which might be explained by the increased opportunity cost of AEM participation in farm-size-specific management. The importance of large farms with dairy and other grazing livestock is also confirmed by the number observed in the FADN sample. For example, there are few small and medium-sized dairy and other grazing livestock farms in comparison with the number of large farms of those types. Non-significant results and large standard errors for the small farm model do not allow for any conclusive comparative statements. The finding that whether a farm is a livestock farm has a significant positive impact on large farm participation in AEMs corresponds with the previous findings of Hynes and Garvey (2009) for the applications of the Irish Rural Environment Protection scheme and of Espinosa-Goded et al. (2013) for the introduction of an alternative cropping system in northern Spain. These authors explained this positive relationship as the result of fewer changes in farm operations compared with intensive farmers. For livestock farms, introducing an alternative cropping system that is safe for the environment is associated with a lower cost of AEM participation relative to non-livestock farms. Furthermore, these livestock farms use these introduced cereal crops as animal feed.

6. Conclusion

Summary of results

This study developed and tested the hypothesis that differences in farm sizes can lead to different costs and benefits for farms, which plays an important role in the AEM participation decision-making process. Within this hypothesis, we examined the influence of the characteristics of the farmland use structure, the share of family labour and off-farm income, participation in *other RD measures* and the type of farming on farmers' participation in AEMs in Slovenia. The models of AEM participation behaviour depending on these determinants were tested separately for the three different farm sizes. Thus, the main novelty and contribution of this paper is its investigation of how previously confirmed influencing factors of AEM participation differ under the three different dimensions of farm size.

The results demonstrate that the influence of determinant factors that vary with farm size must be considered when applying for RD subsidies, particularly AEM(s). The predictions of the econometric logit model are consistent with the given conceptual framework, which posits that land use, land productivity, capital per land intensity, family labour, off-farm income, applying for *other RD subsidies* and the type of farming have significant effects on AEM participation. The differences between the three farm size models illustrate the findings and confirm that the factors that influence AEM participation differ with the size of farms.

Discussion

Derived from micro-economic modelling theory, these differences in the AEM participation decision-making process can be explained by profit maximisation and utility function frameworks. Previous studies, such as Bonnieux et al. (1998), Vanslembrouck et al. (2002), Dupraz (2003) and Espinosa-Goded et al. (2010), based their participation model on the assumption that farmers' utility maximisation depends both on the production of private goods (that bring the farm income) and on the provision of environmental goods and services. The application of voluntary AEMs as an additional payment depends on the farmers' estimates of forgone profits. In our case, the effects of farm structure, land productivity, capital per land intensity, family labour, participation in *other RD payments* and farm type have varying results on AEM participation in which farm size leads to divergent farmer decisions regarding profit maximisation.

The findings of this study suggest that previous participation in *other RD payments* increased the probability of applying for AEM only for large farms. The *other RD payments* require a complex application process relative to LFA and AEM payments, and their association with large farms can be explained by the transaction cost advantage, i.e., the information cost related to completing administrative forms or following regulatory frameworks. Large farms with knowledge and experience of the paperwork required for applications related to the *other RD payments* were those most likely able to fulfil the administrative requirements needed to comply with AEM schemes. This finding has policy implications. Transaction cost advantages for large farms could also be spread to other farm structures by the differentiated information flow from extension services to farmers. Consistent with Winter (1997) and Wilson and Hart (2000), the learning objectives of farms depend on farm structures and both extension services and policy implementations must consider the heterogeneity of farm structures. This differentiated information flow to farmers would help minimise the extension service cost burden to small

farms and encourage their demand for extension services in complying with *other RD payment* applications.

Unlike medium-sized and large farmers, small farms' probabilities of participating in AEMs are greater with increasing land productivity. This result indicates that AEMs are aimed more at highly productive small farms. It could also be that small farms favour more environmentally friendly farming practices even when they have high land productivity. From this finding, we derive our second policy recommendation related to the mixed effect between land productivity and AEM participation based on farm size. A cost-benefit analysis of AEM participation requires a careful consideration of farm management differences among farm sizes. Failure to identify the role of land productivity on AEM participation behaviour might lead to underestimating the costs of participation.

AEMs do not appear to attract all studied farm sizes that use the land for different types of agricultural production (i.e., production of cereal and forage crops). However, in Slovenia, there are AEMs that have been designed specifically for arable land (i.e., preservation of crop rotation, greening arable land, and integrated crop, fruit, and wine production). The majority of these measures were introduced and implemented prior to EU accession. Despite this longer period of AEM implementation, the economic benefits from the commitment to environmental conservation participation may yet be found as a less favourable alternative among farmers than the economic profit from agricultural production. Therefore, higher and targeted policy incentives are required among farms where the share of arable land in total agricultural land is relatively high. This policy incentive should improve the cost-benefit evaluation of the commitment to environmental conservation benefits for arable landowners. However, an open question remains as to whether this policy incentive can be achieved with current budgetary spending vis-à-vis other economic and management practices.

Our results suggest that different decision-making processes influenced by farm size must be considered when designing AEMs following Slovenian accession to the EU in 2004. The factors that influence AEM participation by farm size must be judged within a wider context of structural change in agriculture and rural areas generally. If the average agricultural area per farm continues to grow, it is likely that the factors that influence farmers' AEM participation decisions will adjust to the structural change. This effect has not yet been studied by focusing on farm size growth and AEM participation in Slovenia. Our results for Slovenia and those of Mann (2005) for Switzerland could lead to practical implications and potential structural change. The farm management factors that influence farmers' participation in environmental practices must take farm size into account. The policy implications are to generate regulations that would help for the potential shift to adjust AEMs to structural change in agricultural and rural areas.

Although our study highlights the importance of factors on AEM participation without distinction for any specific AEM, it would be interesting to focus on farmers' applications of a specific measure. This distinction could help predict calculated costs and benefits in the decision-making process of farmers for a specific AEM and could be compared within farm sizes. In addition, the factors influencing AEM participation could focus on changing decision-making behaviour by increasing farm size. Furthermore, the given framework may guide future research in the field by considering farm location as a challenging research and policy issue.

References

Beedell, J., Rehman, T., 2000. Using social-psychology models to understand farmers' conservation behaviour. Journal of Rural Studies 16 (1), 117–127.

Beltrán-Esteve1, M., Gómez-Limón, J.A., Picazo-Tadeo, A.J., 2012. Assessing the impact of agri-environmental schemes on the eco-efficiency of rain-fed agriculture. Spanish Journal of Agricultural Research 10 (4), 911–925.

Bertoni, D., Cavicchioli, D., Pretolani, R., Olper, A., 2011. Agri-environmental measures adoption: New evidence from Lombardy region. In The Common Agricultural Policy After the Fischler Reform: National Implementations, Impact Assessment and the Agenda for Future Reforms (p. 275–294), edited by Sorrentino, A., Severini S., Henke, R., Ashgate Publishing, Surrey, UK.

Black, A.W., Reeve, I., 1993. Participation in Landcare Groups: The Relative Importance of Attitudinal and Situational Factors. Journal of Environmental Management 39 (1), 51–71.

Bonnieux, F., Rainelli, P., Vermersch, D., 1998. Estimating the Supply of Environmental Benefits by Agriculture: A French Case Study. Environmental and Resource Economics 11 (2), 135–153.

Bojnec, Š., Latruffe, L., 2013. Farm size, agricultural subsidies and farm performance in Slovenia. Land Use Policy 32, 207–217.

Bojnec, Š., Swinnen, J., 1997. Agricultural privatisation and farm restructuring in Slovenia. In: Swinnen, J., Buckwell, K., Mathijs, E. (Eds.), Land Reform, Agricultural Privatisation and Farm Restructuring in Central and Eastern Europe. Avebury, Aldershot.

Crabtree, B., Chalmers, N., Barron, N., 1998. Information for Policy Design: Modelling Participation in a Farm Woodland Incentive Scheme. Journal of Agricultural Economics 49 (3), 306–320.

Damianos, D., Giannakopoulos, N., 2002. Farmers´ participation in agri-environmental schemes in Greece. British Food Journal 104 (3/4/5), 261–273.

Deffuant, G., Huet, S., Skerratt, S., 2008. An agent based model of agri-environmental measure diffusion: What for? In Agent based modelling in natural resource management (p. 55–73), edited by INSISOC, Valladolid, Spain.

Defrancesco, E., Gatto, P., Runge, F., Trestini, S., 2008. Factors Affecting Farmers` Participation in Agri-envirionmental Measures: A Northern Italian Perspective. Journal of Agricultural Economics 59 (1), 114–131.

Ducos, G., Dupraz, P., Bonnieux, F., 2009. Agri-Environment Contract Adoption under Fixed and Variable Compliance Costs. Journal of Environmental Planning and Management 52 (5), 669–687.

Dupraz, P., Vermersch, D., Henry de Frahan, B., Delvaux, L., 2003. The environmental Supply of Farm Households. A Flexible Willingness to Accept Model. Environmental and Resource Economics 25 (2), 171–189.

EC, 2005. Agri-environment measures: overview on general principles, types of measures, and application. European Commission Directorate General for Agriculture and Rural Development, Brussels, 25 March.

EC, 2009. Rural development (2000-2006) in EU Farms. European Commission Directorate General for Agriculture and Rural Development, Brussels, 28 July.

Espinosa-Goded, M., Barreiro-Hurlé, J., Ruto, E., 2010. What do farmers want from agri-environmental scheme design? A choice experiment approach. Journal of Agricultural Economics 61 (2), 259–273.

Espinosa-Goded, M., Barreiro- Hurlé, J., Dupraz, P., 2013. Identifying additional barriers in the adoption of agri-environmental schemes: The role of fixed costs. Land Use Policy 31, 526–535.

Eurostat, 2010. Europe in figures. Eurostat statistical yearbook 2010. Eurostat, Luxembourg.

Eurostat, 2012a. Farm Accountancy Data Network. European Commission, Luxembourg.

Eurostat, 2012b. Farm Accounting Data Network: an A to Z of methodology. European Commission, Luxembourg.

Fraser, R., 2011. Moral Hazard, Targeting and Contract Duration in Agri-Environmental Policy. Journal of Agricultural Economics 63 (1), 56–64.

Frondel, M., Lehmann, P., Wätzold, F., 2012. The impact of information on landowners' participation in voluntary conservation programs – Theoretical considerations and empirical evidence from an agri-environment program in Saxony, Germany. Land Use Policy 29 (2), 388–394.

Glebe, T., Salhofer, K., 2007. EU Agri-environmental Programs and the Restaurant Table Effect. Agricultural Economics. 37, 211–218.

Grammatikopoulou, I., Iho, A., Pouta, E., 2012. Willingness of farmers to participate in agri-environmental auctions in Finland. Food Economics 9 (4), 215–230.

Barreiro-Hurlé, J., Espinosa-Goded, M., Dupraz, P., 2010. Does intensity of change matter? Factors affecting adoption of agri-environmental schemes in Spain. Journal of Environmental Planning and Management 53 (7), 891–905.

Hynes, S., Garvey, E., 2009. Modelling Farmers' Participation in an Agri-environmental Scheme using Panel Data: An Application to the Rural Environment Protection Scheme in Ireland. Journal of Agricultural Economics 60 (3), 546–562.

Ingram, J., Gaskell, P., Mills, J., Short, C., 2013. Incorporating agri-environment schemes into farm development pathways: A temporal analysis of farmer motivations. Land Use Policy 31, 267–279.

Jongeneel, R., Polman, N., Slangen, L.H.G., 2008. Why are Dutch farmers going multifunctional? Land Use Policy 25 (1), 81–94.

Kristensen, S.P., Thenail, C., Kristensen, L., 2001. Farmers´ involvement in landscape activities: An analysis of the relationship between farm location, farm characteristics and landscape changes in two study areas in Jutland, Denmark. Journal of Environmental Management 61 (4), 301–318.

Mann, S., 2005. Farm Size Growth and Participation in Agri-environmental Schemes: A Configural Frequency Analysis of the Swiss Case. Journal of Agricultural Economics 56 (3), 373–384.

Mathijs, E., 2003. Social capital and farmers' willingness to adopt countryside stewardship schemes. Outlook on Agriculture 32 (1), 13–16.

Mettepenningen, E., Vandermeulen, V., Delaet, K., Van Huylenbroeck, G., Wailes, E.J., 2013. Investigating the influence of the institutional organization of agri-environmental schemes on scheme adoption. Land Use Policy 33, 20–30.

MAFF, 2007. Rural Development Programme of the Republic of Slovenia 2007-2013, Ministry of Agriculture, Forestry and Food, 20 July.

Morris, C., Potter, C., 1995. Recruiting the New Conservationists: Farmers' Adoption of Agri-environmental Schemes in the U.K. Journal of Rural Studies 11 (1), 51-63.

Ozanne, A., Hogan, T., Colman, D., 2001. Moral hazard, risk aversion and compliance monitoring in agri-environmental policy. European Review of Agricultural Economics 28 (3), 329–347.

Pascucci, S., de-Magistris, T., Dries, L., Adinolfi, F., Capitanio, F., 2013. Participation of Italian farmers in rural development policy. European Review of Agricultural Economics 40 (4), 605–631.

Polman, N.B.P., Slangen, L.H.G., 2008. Institutional design of agri-environmental contracts in the European Union: the role of trust and social capital. Wageningen Journal of Life Sciences 55 (4), 413–430.

Sattler, C., Nagel, U.J. 2010. Factors affecting farmers' acceptance of conservation measures: A case study from north-eastern Germany. Land Use Policy, Soil and Water Conservation Measures in Europe 27 (1), 70–77.

Skerratt, S., 1998. Socio-economic evaluation of UK agri-environmental policy: lessons from an ESA case study. In: Jacques Brossier, Barry Dent, dir., Gestion des exploitations et des ressources rurales. Entreprendre, négocier, évaluer (p. 317–331). Etudes et Recherches sur les Systèmes Agraires et le Développement (31). INRA Edition, Versailles, France.

SORS, 2013a, Agriculture and Fishing, Agricultural Holdings, Livestock, Number of livestock, Slovenia, by years http://pxweb.stat.si/pxweb/Database/Environment/Environment.asp

SORS, 2013b, Agriculture and Fishing, Agricultural Holdings, Land and Land Use, Agricultural holdings by size classes of utilised agricultural area (UAA), Slovenia, by years http://pxweb.stat.si/pxweb/Database/Environment/Environment.asp

Sutherland, L.A., Darnhofer, I., 2012. Of organic farmers and 'good farmers': Changing habitus in rural England. Journal of Rural Studies 28 (3), 232–240.

Unay Gailhard, İ., Bavorová, M., Pirscher, F., (in press). Adoption of Agri-Environmental Measures by Organic Farmers: The Role of Interpersonal Communication. The Journal of Agricultural Education and Extension.

Vanslembrouck, I., Van Huylenbroeck, G., Verbeke, W., 2002. Determinants of the Willingness of Belgian Farmers to Participate in Agri-environmental Measures. Journal of Agricultural Economics 53 (3), 489–511.

Warriner, G. K., Moul, T. M., 1992. Kinship and Personal Communication Network Influences on the Adoption of Agriculture Conservation Technology. Journal of Rural Studies 8 (3), 279–291.

Wauters, E., Bielders, C., Poesen, J., Govers, G., Mathijs, E., 2010. Adoption of soil conservation practices in Belgium: An examination of the theory of planned behavior in the agri-environmental domain. Land Use Policy 27 (1), 86–94.

Wilson, G.A., 1997. Factors Influencing Farmer Participation in the Environmentally Sensitive Areas Scheme. Journal of Environmental Management 50 (1), 67–93.

Wilson, G.A., Hart, K., 2000. Financial imperative or conservation concern? EU farmers`motivations for participation in voluntary agri-environmental schemes. Environment and Planning 32 (12), 2161–2185.

Wilson, G.A., Hart, K., 2001. Farmer Participation in Agri-Environmental Schemes: Towards Conservation-Oriented Thinking? Sociologia Ruralis 41 (2), 254–274.

Winter, M., 1997. New policies and new skills: agricultural change and technology transfer. Sociologia Ruralis 37 (3), 363–381.

Wossink, G.A.A., van Wenum, J.H., 2003. Biodiversity conservation by farmers: analysis of actual and contingent participation. European Review of Agricultural Economics 30 (40), 461–485.

Wynn, G., Grabtree, B., Potts, J., 2001. Modelling Farmer Entry into the Environmentally Sensitive Area Schemes in Scotland. Journal of Agricultural Economics 52 (1), 65–82.