Land Use Policy 46 (2015) 273–282

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

# Farm size and participation in agri-environmental measures: Farm-level evidence from Slovenia

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ARTICLE INFO

*Article history:*
Received 3 July 2014
Received in revised form 11 February 2015
Accepted 7 March 2015

*Keywords:*
Agri-environmental measures
Farm size
Land use
FADN
Logit model
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.



## 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

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http://dx.doi.org/10.1016/j.landusepol.2015.03.002
0264-8377/

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. "Background" section provides a literature review of the role of farm size in AEM participation. "Data" section describes the data source utilised herein and provides descriptive evidence for the main features of AEM participation in Slovenia. "Method: farm-size-specific logit model" section explains the methodological approach of the farm-size-specific logit model. "Results" section presents the results and discusses the differences among the determinant factors for the acceptance of an AEM by the three farm size models. Finally, "Conclusion" section concludes with a summary of the results that are important for AEM policy making and recommendations for future research.

## Background

### *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 | 1213 | 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 | 2027.3 | 100.0 |

Source: MAFF (2007).

**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 | 6029 |
| Sheep | 130,657 | 6243 |
| Goats | 34,542 | 4022 |
| Rabbit | 96,218 | 8300 |
| Deer | 9745 | 505 |

*Source*: SORS (2013a).

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, 2013a,b). Table 2 shows the number of animals and agricultural holdings.

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, 2013a,b), 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.

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

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

[5] 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.

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