Determinants of farmers' participation in biodiversity conservation programs – Insights into biodiversity payments promoting quantity versus quality

Gabriele Mack, Christian Ritzel and Pierrick Jan[1]

***Abstract* - For increasing the effectiveness of its' biodiversity conservation program, the Swiss government redesigned the direct payment system for biodiversity conservation programs by combining a management- with a result-oriented approach. So-called QII payments for the provision of high nature value species on ecological focus areas (EFAs) and network payments for the integration of EFAs in ecological network projects were introduced. This study analyses socio-economic determinants driving the quantity and quality of EFAs at farm level using an unbalanced FADN panel dataset from 2015-2017. Quantity is measured by overall EFA shares, whereas quality is defined by EFA shares receiving direct payments either for floristic indicator species or for ecological networks. The GLM models show that biodiversity quantity is significantly determined by farm types, regions as well as organic farming and production intensity, whereas biodiversity quality is significantly influenced by cantons, a high education level, and production intensity.**

INTRODUCTION

Increasing concern over the loss of biodiversity in agricultural landscapes was one of the reasons for the introduction of agri-environmental schemes in Europe. To preserve biodiversity in agriculture, the Swiss government has provided payments for extensified or fallow land, or for landscape elements such as hedges, traditional orchards, and field margin strips since 1993. Since 1999, the government has included the requirement to manage at least 7 % of the farmland as EFAs in its cross-compliance scheme. In subsequent years, the share of EFAs steadily increased, although, criticism of their ability to effectively conserve biodiversity arose (Mann, 2010). As a response to this criticism, the Swiss government redesigned the EFA payment system by combining a management-oriented with a result-oriented approach in 2014.

The current EFA system distinguishes the following three cumulative payment types:
(1) EFA QI payments are granted if farmers comply with EFA management requirements (management-oriented approach).
(2) EFA QII payments are spent for biodiversity quality based on floristic indicator species (result-oriented approach).
(3) EFA network payments are granted for EFAs that are part of a regional ecological network project aiming at improving the spatial connectivity of local biodiversity conservation areas.

In 2017, the share of EFAs in the UAA (15.7 %) was more than twice higher than the minimal share required for cross compliance (7.0 %) (BLW, 2018). However, regional differences are high: The EFA share increases from approx. 10 % in the valley to 31 % in the mountain regions. On average, 37 per cent of the EFAs achieved biodiversity quality (QII) standards and 74 % of the EFAs were integrated in ecological networks (BLW, 2018).

This study aims at estimating the influence of economic, farm structure, farmers' characteristics, and institutional factors on different EFA farmland shares using panel data regression. We especially analyse socio-economic factors driving (i) the quantity of biodiversity provided by the farms (measured by the share of the total EFAs in the farmland area) and (ii) the quality of this biodiversity (measured by the share of the EFAs either with a quality level II or being part of a regional ecological network).

There is a growing body of research examining farmers' willingness to participate in voluntary agri-environmental schemes in European countries. Most of these studies relied on cross-sectional data from sample surveys analysing the effect of economic, farm structural, farmers' characteristics and social capital factors on the decision to participate in agri-environmental schemes. A meta-analysis conducted by Lastra-Bravo et al. (2015) reveals several key drivers for participation including "fair payments, lower household dependency on agricultural incomes, age and education levels, the presence of a successor and the ability to make progressive rather than slight changes to agricultural activities". However, only a few empirical studies have investigated determinants driving farmers to increase EFAs beyond the minimal cross-compliance requirements. Additionally, empirical studies identifying determinants, which enhance the quality of EFAs, such as the Swiss EFA QII program and the ecological network program are rather rare.

Data and methods

We used data from the Swiss FADN random farm sample "Income situation" from 2015-2017. The sampled population is made of individual family farms exceeding a minimum economic farm size, the size threshold being defined specifically for each agricultural region (plain, hill and mountain) based on standard output (Renner et al., 2019). The sample population encompasses around 36,000 farms out of the 50,000 Swiss agricultural holdings (Renner et al., 2019). The three-year unbalanced panel data set, on which our investigation relies, comprises 5,995 observations with an average of two observations per farm. During the study period 2015-2017, no significant changes in agricultural policy occurred. Individual FADN farm records were linked with AGIS records (Swiss agricultural census) providing information on the FADN farms' land-use including their EFAs eligible for QI, QII payments and ecological network payments.

Using panel data regression and, more precisely, a fixed effects dummy regression model, we investigated the determinants for biodiversity quantity measured by the EFA share (y1 variable: *EFA share = EFA/overall UAA*) and biodiversity quality measured by EFAq2 share and NetEFA share (y2 variable: EFAq2 *share = QII-payment area/overall EFA*; y3 variable: NetEFA *share = Network payment area/overall EFA*). The potential determinants were selected based on a literature review (Lastra-Bravo et al., 2015) taking into account data availability. Farm type (reference: dairy farm), region (reference: valley), canton (reference: Berne), farm size, production form (organic versus conventional farming), education level (reference: Federal diploma of professional education), off-farm income, and production intensity measured by market revenues per hectare (without EFA) were considered as determinants (x-variables) to explain EFA shares.

Results and Conclusions

The variable off-farm income has no significant effect on the quantity of EFAs, whereas it shows a significantly negative effect on EFAq2 shares and EFAs in ecological networks (NetEFA share). Our results suggest that farmers relying on off-farm income do not necessarily need to obtain additional income sources from QII or network payments. The variable "production intensity" influences both, quantity and quality of EFAs significantly negatively even when we control for regional and farm type differences. The results indicate that the higher the market income losses associated with an EFA expansion, the lower the EFA shares. For the variable "farm size" we only found a weakly significantly positive effect for the model variant where EFAq2 share is used as the dependent variable. Whereas, we found no effect on the model variants with EFA share and NetEFA used as dependent variables.

The variable "region" has a highly significantly positive effect on both, quantity and quality of EFAs. EFA shares are significantly higher in mountain regions compared to the valley region. For instance, in the upper mountain region II, a 6-7.2 percent point higher EFA share is found, although payment levels for EFAs are significantly lower. We also find evidence that the variable "region" highly influences EFAq2 shares: in the upper mountain region II, EFAq2 shares are by 17.7 % per cent point higher than in the valley region. These results are not surprising since the occurrence of high nature value species is favoured by abiotic factors in the upper mountain regions. Significantly higher NetEFA shares in the mountain compared to the valley region (3-5%) can be explained by the presence of high nature values species in these regions.
Furthermore, the results show that the variable "farmtype" significantly influences the quantity of EFAs, whereas their quality is less affected by this variable. Extensive ruminant farms' EFA shares (suckler cow and horses/sheep/goats farms) are significantly higher than those of dairy farms, whereas arable, combined, and winery farms have significantly lower EFA shares.

Organic farming has a highly significantly positive impact on both, quantity and quality of EFAs. Moreover, our findings indicate that older farmers have significantly lower EFAs in terms of quantity and quality. Low educated farmers have significantly higher EFA shares compared to higher educated farmers. However, high-educated farmers have significantly higher EFAq2 and NetEFA shares compared to low-educated farmers.

The high differences in the quality of EFAs among the 26 cantons could not be explained by economic factors, farm structures or farmers characteristics. As this study shows that cantonal authorities have a major effect on the quality of EFAs, further research is required investigating the role of cantonal authorities and their extension services. As older and lower educated farmers provide less EFAs with high nature value species and less EFAs in ecological network projects, extension programs for this group of farmers should be developed.

References

BLW, Bundesamt für Landwirtschaft (2018). Agrarbericht 2018. www.agrarbericht.ch.

Lastra-Bravo, X. B., Hubbard, C., Garrod, G., & Tolón-Becerra, A. (2015). What drives farmers' participation in EU agri-environmental schemes?: Results from a qualitative meta-analysis. Environmental Science & Policy, 54, 1-9.

Mann, S. (2010). Eine Schwachstellenanalyse der Ökoqualitätsverordnung. Agrarforschung Schweiz, 1(1), 24–29.

Reis, S., Howard, C., Sutton, M.A., 2015. Costs of ammonia abatement and the climate co-benefits. Springer.

Renner, S., Jan, P., Hoop, D., Schmid, D., Dux-Bruggmann, D., Weber, A. & Lips, M., 2019. Survey system of the Swiss Farm Accountancy Data Network with two samples: Income Situation sample and Farm Management sample. Agroscope Science, 68, 1-76.