Agricultural Systems 149 (2016) 88–98

Contents lists available at ScienceDirect

Agricultural Systems

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

# How does greening affect farm behaviour? Trade-off between commitments and sanctions in the Northern Italy

Roberto Solazzo *, Fabio Pierangeli

*Council for Agricultural Research and Economics (CREA-PB), Via Po 14, Rome, Italy*

ARTICLE INFO

*Article history:*
Received 15 March 2016
Received in revised form 1 July 2016
Accepted 22 July 2016
Available online xxxx

*JEL classification:*
C61
Q12
Q18

*Keywords:*
CAP reform
Internal convergence
Greening
Sanction system
Positive mathematical programming (PMP)
Farm behaviour

ABSTRACT

Two of the most important features of the CAP reform 2014–2020 are the redistribution system of direct payments and the establishment of a "greening" component linked to 30% of the national ceiling. Both these features may affect in a very different way similar farms located in the same area; therefore, specific tools able to estimate the effects on the individual farmers' behaviour are needed. The paper contributes to the debate on the CAP reform, assessing the farmers' behaviour in response to the greening implementation, taking into account possible sanctions in case of non-compliance with the requirements.

We developed a two-step modelling approach able to estimate: i) the redistributive effect of direct payments reform for the greening and the basic payment scheme; ii) the farmers' behaviour, in terms of land use and income effects, with a positive mathematical programming (PMP) model on a Farm Accountancy Data Network (FADN) sample of Northern Italian farms, implementing the whole set of greening commitments and sanctions.

Although the overall greening impact is low, some specific areas and productions are affected to a greater extent: greening causes a decrease in maize and, in some contexts, in wheat which are replaced by nitrogen-fixing crop surfaces. The consequent average income reduction is lower than 0.5% (−7 €/ha) and almost all farms choose to fully apply the greening constraints in order to avoid sanctions. The weakening of greening measures during negotiations, the amount of greening payments and the sanctions system are strong incentives for farmers to fully comply with the greening practices.



## 1. Introduction

After three years of discussion and intensive negotiation, the agreement on the Common Agriculture Policy (CAP) reform for the period 2014–2020, was reached at the end of 2013. The reform introduces a new architecture of direct payments and a new flexibility for Member States, acknowledging the wide diversity of agriculture, agronomic production, potential and climatic environmental as well as socio-economic conditions and needs across the EU (EC, 2013). A sensitive element of the flexibility and an important topic of the reform was how to achieve, over the period 2015–2019, a more equitable and balanced distribution of direct support per hectare among farmers, reducing disparities and the link to historical references (EC, 2010).

In the final agreement, Member States were allowed to adopt, by way of derogation from the use of a uniform unit value of payment entitlements at national (or regional) level as from 2015, a process of progressive and partial *convergence* of payment entitlements unit value to the national (or regional) average. A large share of the total amount of resources earmarked for direct payments, equal to 30%, will be allocated to payment for agricultural practices beneficial for the climate and the environment, on condition of the production of public goods; this is termed "greening". Furthermore, a complex sanction system of greening payment (reductions and administrative penalties) was settled for partial or full non-compliance with the greening requirements. This issue introduces the evaluation of farmers' behaviour in the level of compliance with the greening requirements into the CAP reform debate.

Many authors have evaluated the impact of the past agricultural policies on farmer behaviour, mainly through the application of mathematical programming and econometrics techniques (Arfini, 2005; Judez et al., 2001; Louhichi et al., 2010; Buysse et al., 2007; Blanco et al., 2008; Lansink and Peerlings, 1996; Viaggi et al., 2011).

The combination of the features of the new direct payments and of the greening requirements, characterized by a farm specific implementation, makes the CAP assessment a particularly complex exercise (Anania and Pupo D'Andrea, 2015). Specific tools able to estimate and evaluate the effects of the reform on the individual farmer's behaviour are therefore needed (Louhichi et al., 2015; Solazzo et al., 2014; Waş et al., 2014). In Italy, Ciliberti and Frascarelli (2014) analysed the impact of convergence models on the net farm income using types of farm identified from the Italian Agricultural Census and Farm Accountancy Data

* Corresponding author at: Council for Agricultural Research and Economics (CREA-PB), Via Po 14, 00198 Rome, Italy.
*E-mail address:* roberto.solazzo@crea.gov.it (R. Solazzo).

http://dx.doi.org/10.1016/j.agsy.2016.07.013
0308-521X/

Network (FADN) data. Severini and Tantari (2013), using the Gini coefficient, investigated the impact of direct payments (DPs) concentration on farm income inequality in Italy. At European level, Grochowska (2013) analysed the convergence of direct payments within Member States in 2014–2020.

Recently, Waș et al. (2014) proposed an optimization model expanded with a non-linear cost function from the original Howitt's PMP approach in order to show the impact of greening on Polish farms. An evaluation of the greening effect in Netherlands was provided by the analysis of Boere and van Kooten (2015), where representative individual FADN farms are part of a crop allocation model calibrated using PMP. Louhichi et al. (2015) evaluated the effects of crop diversification and sanctions system related to this requirement, using a positive mathematical programming model.

To the best of our knowledge, the study by Louhichi et al. (2015) is the only one focussing on the sanction system, for a single greening requirement (*i.e.* crop diversification). There appear to be no studies assessing the three greening measures taking into account the whole sanction system.

The objective of this paper is the impact assessment of the whole set of greening commitments at farm level, by developing a two-step modelling approach able to estimate: i) the amount of greening payment per farm for the year 2019; ii) the farmers' behaviour, in terms of land use (and consequent income effects), due to the greening application, taking into account the potential reduction of payments for full or partial non-compliance. Both the basic payment and the greening payment were estimated by means of the *CAP2020-Simulation tool* (Pierangeli and Ruscio, 2015), based on Integrated Administration and Control System database (IACS) micro data at the farm level, covering the whole Italy. The impact of greening measures was assessed by a positive mathematical programming (PMP) model (Paris and Howitt, 1998; Paris and Arfini, 2000) which implements the greening constraints and the complex sanction system to evaluate the response of farms in terms of changes in land use and income. This methodology can provide clear and useful results to policy makers, responding to a wide spectrum of policy analysis needs.

## 2. CAP reform and national choices

The strategic aims of the new CAP are a sustainable food production, a balanced territorial development to enhance the differentiation of agriculture and rural areas, and the sustainable management of natural resources to ensure the production of public goods and to offset the effects of climate change (Hart and Little, 2012; Matthews, 2012). Besides these main objectives, the CAP reform also aims at achieving a more balanced distribution of direct payments by means of a mechanism of "internal convergence". In general, Member States could choose between three different options for "internal convergence" (Henke et al., 2015): *full convergence in 2015* (with the same unit value per hectare under the basic payment scheme at national/regional level in 2015); *full convergence in 2019*; or *partial convergence* (with a progressive and limited reduction of unit values over the period). Direct Payments (DPs) reform represents the end of the single payment scheme (SPS). Indeed, in those countries still implementing the historic model, like Italy, it became increasingly difficult to justify the existence of individual differences in the level of support per hectare based on the historic reference period (mainly 2000–2002). The link to historic reference will progressively weaken over the next five years and this process will determine a sensitive redistribution of direct support, away from those farmers with unit values historically high to the benefit of those with unit values lower than the national average. Internal partial convergence is a mechanism introduced to move towards a more similar level of support per hectare in 2019, taking into account historical references. These are the basis for the quantification of the baseline for each farm, named the initial unit value. By this mechanism:

i) payment entitlements with an initial unit value lower than 90% of the national/regional average in 2019 should have, for the claim year 2019 at the latest, their unit value increased by at least one third of that difference (the "Irish model");
ii) payment entitlements, in 2019, should not have a unit value lower than 60% of the national/regional average in 2019 (the "minimum guaranteed level");
iii) Member States should finance this convergence by reducing, on the basis of objective and non-discriminative criteria, the value of payment entitlements that exceeds the national/regional average.

In this context, Member States could opt for limiting this reduction to 30% of the initial unit value of the concerned entitlements, even if such a limitation does not allow for all payment entitlements to reach 60% of the average value for 2019 (the "maximum loss").

Italy opted for this mechanism of internal convergence, choosing to implement the basic payment at the national level, by applying the "Irish model", the "minimum guaranteed level" and the "maximum loss" of 30%. The transition from the initial unit value of payment entitlements to their final unit value in 2019 is made in equal steps starting from 2015; furthermore, the values of the payment entitlements with an initial unit value higher than the national unit value are adjusted in order to ensure the compliance with the annual decreasing of the national ceilings for direct payments. Finally, "individual" greening payments, quantified as a share of the basic payment by single farms, was chosen.

The greening payment, equal to 30% of the total amount of resources earmarked to direct payments, is conditional on the production of public goods. The European Commission has emphasized the growing need for green agriculture, which guarantees the conservation of biodiversity, the maintenance of soil fertility, the conservation of water resources, thus acting as a buffering agent with respect to climate change. The Commission's proposal was followed by the amendments of the European Parliament and the Council which "eased" the greening requirements (Solazzo et al., 2015; European Parliament, 2013; Council of EU, 2013). Greening was one of the major areas of discussion between the Commission, the Parliament and the Council (Matthews, 2013). Moreover, it was subject to intense lobbying by interest groups and to severe *ex-post* critiques (Swinnen, 2015). Environmental non-governmental organisations considered the greening provisions as simply an attempt to justify the continuation of direct payments (Bureau et al., 2012).

The final CAP agreement established three greening requirements: i) crop diversification for farms with at least 10 ha of eligible arable land, (ii) maintenance of permanent grassland, and (iii) allocation of 5% of arable land to ecological focus area (EFA) for farms with more than 15 ha of eligible arable land (Table 1).

Units of the holding used for organic production are exempt from greening requirements and entitled *ipso facto* to the greening payment; moreover, exemption was established (from crop diversification and EFA) for farms with over 75% of grassland, fodder or underwater crops, where the remaining arable area was not above 30 ha (European Parliament and Council of the EU, 2013).

In terms of crop diversification, farmers are required to cultivate at least two crops when their arable land covers between 10–30 ha, and at least three crops when their arable land exceeds 30 ha. The main crop shall cover at most 75% of arable land, and the two main crops at most 95%. The maintenance of permanent grassland establishes that Member States must designate environmentally sensitive permanent grasslands that cannot be ploughed or converted. In addition, Member States must maintain the ratio of areas of permanent grassland to the total agricultural area, so as that it does not fall by more than 5% compared to the reference year. The ecological focus area shall cover at least 5% of the arable area of the holding, for farms with arable land over 15 ha. Italy decided to consider all those EFAs listed in the Regulation (EU) no. 1307/2013, reported in Table 1, except for the areas with catch crops or green cover.