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CAP's environmental policy and land use in arable farms: An impacts assessment of *greening* practices changes in Italy

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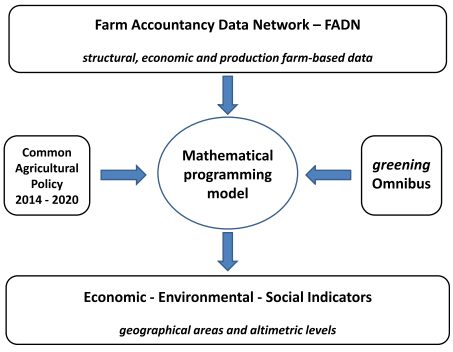
HIGHLIGHTS

- We evaluate the impacts of new *greening* practices and of CAP first pillar reform.
- Net income increases in particular in the mountain areas of Northern Italy.
- The pesticide use increases in the intensive areas of the plain of Northern Italy.
- Employment decreases especially in the most depressed areas of Southern Italy.
- The future CAP should adapt more to the needs of the various territories.

GRAPHICAL ABSTRACT



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ABSTRACT

The study assesses the possible impact of first pillar reform of the Common Agricultural Policy by focusing on the new *greening* rules defined by the recent *Omnibus* regulation. The analysis was carried out on a Farm Accountancy Data Network sample of Italian farms using by a Positive Mathematical Programming model. Moreover, our analysis is stratified by geographical area and altimetric level and uses some additional environmental and social indicators beyond those economic.

The results indicate that the new *greening* rules generate positive but limited environmental impacts, which reinforce those already determined by the previous CAP reform, for example the use of chemical fertilizers is further reduced. These additional positive environmental impacts are obtained with very limited income reductions. Yet, the impacts on the various geographical areas and their altimetric levels are different, and sometimes controversial. For example, there is a growth in the use of pesticides in the northern plains, due to the increase in rice and soybean areas. On the other hand, agricultural employment in Southern Italy decreases, where agriculture is an important source of employment for the rural population. This reduction also affects the mountain areas, thus accentuating the already high risk of abandonment.

All this suggests that more targeted measures will have to be implemented in the future planning of agricultural policy, so as to shape the various actions according to the characteristics of the various rural areas, as well as to the specific priorities of the Member State.

1. Introduction

Over the last decades, the Common Agricultural Policy (CAP) has shifted emphasis from price and market intervention to direct payments, partly conditional on environmental requirements (Matthews, 2013;

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Alons, 2017). In 2015, the CAP reform introduced the *greening* criteria, which conditioned 30% of direct payments to meet three environmental requirements: crop diversification, maintaining permanent grassland and Ecological Focus Area (EFA). From February to May 2017, the European Commission organized a public consultation of all interested EU organizations and citizens on issues and modalities to modernize and simplify the CAP (European Commission, 2017a): its results demonstrated the important role attributed to the CAP in maintaining and improving environmental conditions in rural areas by intervening on agricultural activities. Pending on the CAP post 2020, the mid-term review of the current CAP (*Omnibus* regulation, entered into force on 1 January 2018) has also changed the first pillar of CAP, including the *greening* practices (De Castro, 2017). The review has eased the constraints on diversification and EFA, trying to simplify some commitments that have proved difficult to satisfy for farms, and for administration and control systems (European Commission, 2017a, 2017b).

In a context such as this, of frequent adjustments and ongoing changes to agricultural policy, ex-ante evaluation of their impact on the agricultural sector can enable policymakers to make more informed decisions about future policies (Reidsma et al., 2018). Many studies and evaluations of changes in agricultural policy have used mathematical programming models focused on the impact on production choices and on economic, social and environmental performance (Buysse et al., 2007; van Ittersum et al., 2008; Britz et al., 2012; Pelikan et al., 2014; de Frahan et al., 2016). Numerous studies have been conducted to evaluate the impacts of the 2015 reform of the direct payment system, in particular using Positive Mathematical Programming (PMP) models. Among the most recent, Solazzo et al. (2016), Cortignani et al. (2017), Gocht et al. (2017) and Louhichi et al. (2018) show that the previous *greening* rules have limited impacts, that acting on coupled payments is more effective in generating environmental benefits, and that *convergence* has the highest economic impact among all the components of the reform.

The main objective of this paper is to evaluate the effects of *greening* practices defined in the recent *Omnibus* regulation on the arable crops sector which includes the cultivation systems most affected by the *greening* practices (Cimino et al., 2015). Furthermore, the analysis considers the impacts of the changes to the first pillar of the CAP in force since 2015. This allows understanding if the recent changes (*Omnibus* regulation) continue or reverse what started with the 2015 reform.

Compared to the existing literature, the paper presents some innovative elements. The analysis refers to the entire national territory as opposed to other recent papers, where the study areas are specific regions (Solazzo and Pierangeli, 2016; Solazzo et al., 2016) or territories (Cortignani et al., 2017; Cortignani and Dono, 2018). Moreover, compared to other studies dedicated to the entire agriculture of various European countries (Gocht et al., 2017; Louhichi et al., 2017; Louhichi et al., 2018) our analysis is structured by geographical area and altimetric level and uses some additional environmental and social indicators. In this way we aim to highlight how *greening* practices, defined in a uniform way for all the territories, affect areas with very different characteristics of the agricultural activity. In other words we want to analyze how the various *greening* practices affect the intensive plain areas and the other less intensive areas (hill and mountain) considering also the different characteristics for geographical area (north, centre, south). Finally, the focus on the use of pesticides and employment is due to the growing interest in the environmental and occupational effects of the various CAP measures.

2. Materials and methods

2.1. Data and characteristics of farms sample

The analysis was been carried out using by the Farm Accountancy Data Network[1] (FADN) that provide data for evaluating the income of agricultural holdings and the impacts of the Common Agricultural Policy. The data refer to physical and structural characteristic (such as location, crop areas, labour force, uses of chemical input and water, etc.) and economic data (such as the revenue of the different crops, production costs, CAP payments, etc.). These data were used to elaborate the PMP model, being explained later on.

The analysis was conducted on the 2798 Italian arable farms and classified as *specialist cereals, oilseeds and protein crops*, *general field cropping*, *specialist vegetables outdoor*. This sample represents 147,603 Italian farms and 3591,000 ha of Utilised Agricultural Area (UAA; Table 1). Therefore, a prominent part of the 7,009,000 ha of arable land detected by the VI Italian Agricultural Census is covered. The choice of these farms types has been carried out considering that, given the characteristics of cultivation systems,[2] these farm types are the most influenced by the *greening* practices (Cimino et al., 2015) and the changes made in the *Omnibus* regulation.

Table 1 shows in detail the data on land use, on the use of inputs and on the main economic variables for the total number of farms represented by the FADN sample, and distinguished by geographical areas and altimetric levels. These values represent the reference scenario (baseline, year 2014) for the simulations of the CAP scenarios shown in the results section.

2.2. Representation of economic analysis: PMP model, input data and simulations

Farm-level mathematical programming models are important and widely used analytical tools in agricultural economics because they are able to represent farmer responses to changes in policy and market conditions. In the second half of the 1990s researchers moved from the classical linear or quadratic programming to PMP. This latter approach requires a relatively limited amount of data and can be perfectly calibrated to the reference period. It recovers additional information from observed activity levels, allowing researchers to specify a quadratic objective function so that the resulting nonlinear model exactly reproduces the observed behaviour of farmers and can be used for simulation analyses (Arfini and Paris, 1995; Howitt, 1995; Paris and Howitt, 1998; Heckelei and Wolff, 2003). This method not only automatically and exactly calibrates the model to observed activity levels, but also avoids adding ad-hoc constraints and over-specialised responses of the model to policy changes (de Frahan et al., 2016).

The following figure (Fig. 1) summarizes the relevant aspects of the economic analysis.

The inputs of PMP model refer to crops and farms. The objective function maximizes the farms gross margin and considers for each crop the revenue and production costs, the areas and the CAP coupled payments. The constraints concern the availability of land and farm labour. The model also considers the possibility of hiring external labour at a relative price (in the objective function). As for the use of inputs, labour needs of crops were used to consider the total requirement in the labour constraint and to evaluate its overall use in the various scenarios. On the other hand, the needs of the other inputs (water, nitrogen, phosphorus, potassium, pesticides) were not explicitly modelled in the objective function and in the constraints, but have been used to quantify the overall use of production factors based on land use in the different scenarios. The results also concern the economic results of the farms.

The model was calibrated to the scenario observed in 2014 year and then used to carry out two types of simulations: "A" is based on the first pillar reform of the CAP 2014–2020; "B" is based on recent changes in *greening* practices defined by the *Omnibus* regulation.

[1] http://ec.europa.eu/agriculture/rica/

[2] Specialised farming in the cultivation of durum wheat, maize, soft wheat, barley, rice, grain legumes, forage legumes, processed tomato.