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CAP payments and spatial diversity in cereal crops: An analysis of Italian farms

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ABSTRACT

Agricultural biodiversity conservation has been recognized as a fundamental resource for the maintenance of ecological and economic functions. In this paper, we test the hypothesis that the Common Agricultural Policy (CAP) has an impact on crop diversity decisions of farm managers. In so doing, we allow the diversity decision to depend on a rich set of economic and agro-ecological variables, such as prices of the most common cereal varieties, and agro-ecological and socio-economic characteristics at farm and regional level. Using a panel dataset over the period 2004–2010, we compare the results obtained from pooled-OLS and dynamic panel GMM estimators. The empirical analysis shows the existence of a positive relationship between CAP payments and diversity. In addition, decoupling subsidies from production seems to have a positive effect on biodiversity.

1. Introduction

On-farm biodiversity represents a fundamental economic asset providing a flow of ecological services of direct use for farmers. Resilient agro-ecosystems are characterized by a high degree of crop diversity (Heal, 2000) and crop diversification improves the capacity of agricultural systems to react positively to environmental fluctuations (Lin, 2011). Crop diversity may enable farmers to develop higher yielding varieties and improve quality characteristics. For instance, farmers can produce varieties that resist diseases and pests and are drought tolerant, providing more protection against the risk of crop failure. More generally, crop diversity represents a natural provider of insurance for farmers to protect against risk. This hypothesis is largely supported by recent theoretical and empirical studies showing that, in the presence of uncertainty, farmers seek to attain a higher level of diversity (Di Falco and Chavas, 2007, 2009; Baumgärtner and Quaas, 2010; McCord et al., 2015). Agro-ecological and commercial factors have been reported as important determinants of crop diversity at the farm level (Meng et al., 1999; Smale et al., 1998, 2003; Benin et al., 2004).

In the European Union, the Common Agricultural Policy (CAP) may encourage risk averse farmers toward the production of crops with more uncertain yield and more volatile market price. Specifically, under the assumption of decreasing absolute risk aversion, the policy measure may generate a 'wealth effect'. As wealth increases, farmers become less risk-averse and accept to grow crops, even if these are associated with a more uncertain outcome (Serra et al., 2011; Sckokai and Moro, 2006; Hennessy, 1998). Expanding the number of supported species may represent a further incentive for farmers toward biodiversity. Also, in a context of non-perfect financial markets and credit restrictions, subsidies are liquid money that can be invested in innovation, including the production of new species. Finally, decoupling may reduce the incentive to grow the crops that are not subsidized anymore, and may increase the incentive to grow other crops (Di Falco and Perrings, 2005).

In spite of a number of studies focusing on the impact of the CAP on farms' economic and structural characteristics (Zhu and Lansink, 2010; Viaggi et al., 2011, 2013; Raggi et al., 2013; Bartolini and Viaggi, 2013), little is known about the effect of the CAP on crop diversity. Brady et al. (2009), in a simulated optimization framework, study the effect of different policy scenarios on farm structure, land use and biodiversity in a number of European regions. As regards the impact on biodiversity, the authors do not find any conclusive results. Their study suggests that the introduction of single farm payments may have positive, null or negative

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effects depending on the region taken into consideration. Simulating the impact of different policy scenarios on land cover diversity in Finnish regions, Miettinen et al. (2004) find a general decrease in diversity of agricultural land-cover.

In this paper, we study the relationship between CAP payments and spatial diversity in cereal-producing farms. Learning more about this relationship may provide insights into how EU policies should be oriented to affect farmers' decisions. Analysis of the effect of direct payments on crop diversity may be useful to understand the potential effects of policy interventions toward a (i) reduction in the amount of subsidies, and (ii) reassignment of resources in favor of more targeted environmental measures.

We use inter-specific diversity among cereal species (oat, durum wheat, soft wheat, buckwheat, corn, millet, barley, rice, rye, sorghum, triticale) as a measure of biodiversity. We concentrate on cereal crops firstly because they account for a large share of the European Union budget. Cereals have a central role within the agricultural activities also because they are used as animal feed. In addition, cereals are a fundamental source of subsistence for very low income farming families. Focusing only on cereals allows the additional advantage of a lower unobservable heterogeneity to deal with in the empirical analysis. Finally, we are interested in evaluating how diversity in cereal crops is affected by changes to the Common Agricultural Policy, which have gradually removed product-specific subsidies for cereals and rice.

In Italy, the cereal sector plays an important role in the national agricultural economy. It accounts for the 20% of the total agricultural production and the 30% of the physical production. Moreover, the 25% of the total arable land is devoted to the production of cereals.[1] Sharing a common set of rules and economic incentives, it is likely that results observed for the Italian farms can be considered valid and extended to farms of other European countries.

In managed systems, crop diversity accounts for a considerable portion of overall agro-biodiversity (Di Falco and Chavas, 2008). The allocation of cultivated lands to different crops and varieties identifies the farm's diversity pattern. Previous studies focusing on the determinants of crop diversity have concluded that numerous factors contribute to affect diversity at both the regional and farm level. Benin et al. (2004) underline the role of market characteristics (population density, distance of the farm from roads and cities), and the role of agro-ecological and socio-economic features of both farms and households (i.e., number of farm plots, irrigation system coverage, land fertility, age and education of the farm manager). Smale et al. (2003), focusing on genetic diversity among wheat varieties, recognize the importance of some agronomic (e.g., variety yields, days to maturity) and agro-ecological (soil quality, erosion, rainfall) features of the production environment which are supposed to influence farmers' decisions through their impact on crop performance.

We account for the presence of any major potential confounding factors such as socio-economic, land and agronomic characteristics of the farm, prices of the most common cereal varieties, and, finally, economic and agro-ecological characteristics of the region where the farm is located. More specifically, we consider agro-ecological attributes (altitude level, irrigation system coverage, cropping intensity, land heterogeneity), socio-economic farm characteristics (total farmland, age of farm manager, labor units, labor productivity) and local economic conditions (cereal prices, distribution of farms by size in hectares, distribution of farms by altitude, legal structure, distribution of hectares by land use).

Apart from these factors, we also consider either the role of the EU agricultural policy (CAP) and the decoupling reform. After the introduction of the CAP Mid Term Review (MTR) in 2003 and the Health Check Reform in 2008, all compensatory payments were replaced by a Single Farm Payment (SFP) based on historical entitlements and decoupled from types and levels of production. Farmers are no longer required to produce commodities to be entitled to support but only to keep land in Good Environmental and Agricultural Condition (GAEC). The most recent reform, approved in 2013 and applying for the period 2014–2020 goes into the direction of providing concrete incentives in favor of the maintenance and enhancement of farmland biodiversity as it represents one of the targets of EU agricultural policy.

The shifting from a coupled to a decoupled policy regime is expected to provide the following positive outcomes: (a) a more diversified crop mix at farm level; (b) increased farm income due to the greater flexibility associated with guaranteed payments; (c) increased investment potential due to more relaxed budget constraints; (d) decreased incentives for excessive cultivation and investment due to the possibility of receiving payment even without crop cultivation.

The few existing studies based on a survey approach report little reaction on the part of farmers to decoupling (Tranter et al., 2007; Gallerani et al., 2008; Mosnier et al., 2009; Viaggi et al., 2010). Gallerani et al. (2008) and Viaggi et al. (2010) provide an analysis of the impact of decoupling on investment behavior and seek to identify the main patterns of reaction to decoupling. They find that decoupling of farm payments may have either positive and negative effects on income and the effect on investments is not significant.

The empirical analysis uses a sample of Italian cereal-producing farms drawn from the Italian Farmers Accountancy Data Network (FADN) database over the period 2004–2010. This dataset is integrated with regional data on farms collected from the Italian Institute of Statistics (ISTAT). Moreover, information on cereal prices are drawn from the database of the Italian Institute of Services for Agriculture and Food Market (ISMEA). Pooled ordinary least squares estimator with cluster-robust standard errors and dynamic panel data estimation methods are considered, and results are compared.

The remainder of the paper is organized as follows. The next section illustrates data and empirical model. Section 3 reports results and robustness checks. The last section concludes the paper.

2. Data and empirical model

2.1. Data

The empirical analysis is conducted on a sample of 14,628 cereal-producing farms drawn from the Italian FADN (RICA) database over the period 2004–2010 along the whole Italian peninsula. The RICA database collects annual information on the structure and economic performance of national commercial farms selected through a stratification process that accounts for territorial location, economic size and technical-economic orientation of farms. The sample representativeness of the underlying population is maintained by the rotating panel technique, where a portion of the sample is periodically updated, with annual renewal of 20–25% of the survey units. The RICA database is widely used in the literature also because of its maintained representativeness over time.

The sample consists of about 7500 yearly units of cereal-producing farms for the period 2004–2007 and about 4800 yearly units for the period 2008–2010. The rotating nature of the sample leads to discontinuity in observations and, as a consequence, only for a small number of farms do we have information throughout the whole period under consideration (1235 farms, 19%). Information on cereal prices is drawn from the Italian Institute of Services for Agriculture and Food Market (ISMEA) price database. Informa-

[1] Data refer to 2011 and are extracted from the Inea datawarehouse.