ANALYSIS OF EFFICIENCY IN ORGANIC WINE AND OLIVE FARMS IN THE ITALIAN F.A.D.N. DATASET

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Abstract. *Over the recent years there has been in Italy a growth of organic farms with a positive consequence in increasing the farmer's income by a direct commercialization of products. The analysis has used a quantitative model of investigation in a dataset of organic and conventional farms belonging to the Farm Accountancy Data Network (FADN). The organic farms have underscored an inferior level of efficiency than conventional ones underling as land capital and labor force may be two pivotal variables in improving the level of economic and allocative efficiency in organic farms.*

Keywords: *Farm Accountancy Data Network, economic efficiency, organic farms, Italian olive farms*

JEL code: Q01, Q12

1. Introduction

Since the 1990s there has been a growth of organic farms in all European states due to an increase of the customer's demand of healthy food able in the same time to protect the environment and to improve the farmer's income. In Italy the consumption of organic food is equal to 1.4% of annual expenditures due to a significant development of alternative channels pivotal in order to buy these products such as farmers' market, specialized shops, direct sales by e-commerce, groups of local buyers (Inea, 2013), generating in a small scale of rural territories at risk of marginalization an endogenous and local development. In some countries located in the Basin of Mediterranean sea, such as Spain and Italy there has been a significant increase of organic surfaces; in fact, in these states it is concentrated a significant organic surface equal to 1.46 million of hectares in Spain and 1.10 million of hectares in Italy 2010 (Inea, 2013).

Despite the economic crises investments in organic farming have increased and in the same time there has been a growth of per capita demand of organic food in particular inside the European market. In Italy every family spends more than 1.5% of annual income buying organic foods and vegetables predominantly in informal channels such as the direct buying process in farms and local fairs or in formal market as mass markets and large-scale retail trade even if the brand and specific labels seem to be the pivotal factor in success fostered by an high level of investments in communication (Torazza, 2009) which a small farmer is not able to set up unless it does not use a direct sale in farm aimed to improve the direct income.

Analyzing the predominant agricultural cultivations the data have pointed out in 2012 as the most organic surface consists of forage crops followed by olive orchards and vineyard surfaces equal to 141,000 and 52,000 hectares (Inea, 2013). In the same time the geographical analysis has underlined as the distribution of organic cultivated surface is predominately located in the south of Italy, where there is a higher diffusion of certified quality olive oil than wine. The level of income for organic farmers is lower than conventional ones caused by specific techniques aimed to improve the quality of production instead of the quantity but in the same without having negative impacts on the environment by means of a low utilization of fertilizers and pesticides. The first and foremost bottleneck of organic farming is tightly linked to a significant impact of these techniques on the economical and technical efficiency of farms which are less productive than conventional ones; hence, they are more demanding and depending on subsides allocated to put into practice organic crops.

2. Aim of the research

The purpose of this research was to investigate, over four years (2008-2011), the level of technical and economic efficiency in viticultural and olive Italian farms. In general one of the most important drivers in the decision process to convert the agricultural production from a conventional model towards an organic one is the technical efficiency, the dimension of farms and in some case the level of specialization in terms of cultivated crops (Latruffe and Nauges, 2014). A lot of studies has underlined as the level of efficiency and productivity are tightly linked and a low level in technology and investments is typical of organic farms with some consequences on the efficiency (Lansink et al., 2002). Few studies have detected the first and foremost relationships in organic olive farming systems comparing them to conventional farms by a quantitative approach, underlining as a result there was an higher level of technical efficiency in organic farms than in conventional ones caused by a different level of inputs (Tzouvelekas et al., 2002).

In microeconomic analysis efficiency is connected to productivity and underlining as in Italy there is a direct relationship between farm dimension and efficiency (Galluzzo, 2013). To estimate over the time 2008-2011 the efficiency in organic and conventional crops and transformed products, such as wine and olive oil, it has used the Italian dataset FADN, acronym of Farm Accountancy Data Network, which is a standardized database made by the European Union aimed to assess the impact of Common Agricultural Policy on farmers. In Italy some studies have investigated the efficiency using the FADN dataset comparing organic and conventional systems of farming (Cisilino and Madau, 2007) in some specific crops such as cereals (Madau, 2007).

3. Methodology

The method of assessing the efficiency has been predominately quantitative using the software PIM-DEA. We have used a non parametric methodology because a parametric function needs a defined function of production and specific assumptions to estimate efficiency. A non parametric model is able to investigate the level of technical and economic efficiency without using a specific function throughout the DEA (Data Enveloped Analysis).

The efficiency is a ratio between obtained output and used inputs and it is a pivotal tool to define the capability of each Decision Making Units (DMU) to produce a define quantity of output using a specific quantity of input in different cross sections data over the time. In term of productivity if there are two DMUs such as A and B able to produce y_a or y_b using a specific quantity of input x_a and x_b the productivity is a simple ratio y_a/x_a and y_b/x_b.

A model of analysis and estimation of the efficiency at the level of a specific frontier of production has been implemented by the introduction of a non-parametric model called Data Envelopment Analysis (DEA) and specific statistical programs to assess the efficiency in the primary sector (Farrell, 1957; Charnes et al., 1978; Battese, 1992; Coelli, 1996). The non-parametric linear model throughout the Data Envelopment Analysis is useful to estimate the relative efficiency in each Decision Making Units based on different inputs and outputs (Andersen and Petersen, 1993). In this paper it has used an approach input oriented, hence a DMU is able to be on the efficient front of a non parametric function of production but if the DMU is below this function it is not efficient (Maietta, 2007).

The goal of a non parametric model input oriented, such as in our research, of DEA linear programming is to minimize in a multiple-output model the multiple-input in each farm that is a ratio of efficiency which in a mathematical model is (Coelli, 1996; Charnes et al., 1978):

$$\max h = \Sigma_r u_r y_{rjo} / \Sigma_i v_i x_{ijo} \quad (1)$$

subject to

$$\Sigma_r u_r y_{rj} / \Sigma_i v_i x_{ij} \leq 1 \quad (2)$$

$j = 0, 1, ...n$ (for all j)

$u_r, v_i \geq 0$

This model has many possible solution and u_r* and in v_i* are variables of the problem and they have to be greater to 0 or an another small but positive quantity thus, any input and output can be ignored in estimating the efficiency (Coelli, 1996; Maietta, 2007). If h is 1 there are not issues because this unit ($DMUh_1$) is efficient compared to other $DMUh_n$, but whether h is above 1 there are lots of units more efficient than this unique unit ($DMUh_1$) then, every unit is tightly linked to input and output making each unit efficient (Maietta, 2007).

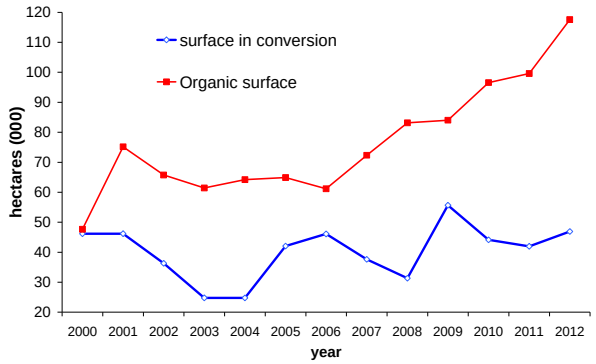

Figure 1. Organic olive surface in Italy over 12 years *(Source:www.sinab.it)*

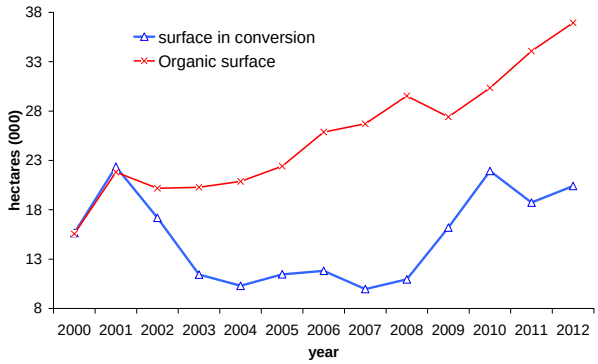

Figure 2. Evolution of the organic viticultural cultivated surface in Italy *(Source:www.sinab.it)*

4. Results and discussion

Over the last twelve years there has been a meaningful increase of organic cultivated surface in Italy with a consolidation about the surface in conversion or transition from a conventional agricultural model towards an organic one even if the economic crises has had a negative impact in many Italian regions reducing the agricultural organic cultivated surfaces.

Comparing the organic surface in olive farms and viticultural farms it is possible to point out a predominant development of olive organic areas with a sharply increase since 2006 (Fig. 1); the same feature has been observed in viticultural organic farms (Fig. 2). Despite the economic downturn in all economic sectors the organic cultivation and strategies in the two investigated organic crops have not been affected by economic issues.

The results have pointed out as the conventional production of olive oil and wine are in general more technically efficiently as organic products. In contrast, the Protected Designed of Origin (PDO) wine using organic methods of cultivation has a level of technical efficiency lower than 1 due to demanding constraints in order to cultivate and to transform the product (Tab 1). The average of technical efficiency in transformed agricultural products has shown that organic olive oil was more economically efficient than the conventional product; as well as the analysis showed as the traditional common wine, which is not true in the case of organic Protected Designed of Origin wine, has a lower level of economic efficiency compared to the traditional product. However, the analysis has pointed out as in terms of allocative efficiency and economic efficiency both in transformed biological olive oil and

wine and also in conventional productions results are not efficient and they are also far away from the unit value of efficiency.

Table 1. Average value of efficiency in transformed organic and conventional products over 5 years *(Source: our elaboration on data http://www.rica.inea.it/public/it/area.php)*

Conventional product	**Technical efficiency**	**Economic efficiency**	**Allocative efficiency**
Olive oil	100.00	61.43	61.43
Wine	100.00	90.75	90.75
Protected Designation of Origin (PDO) wine	100.00	93.71	93.71
Organic product	**Technical efficiency**	**Economic efficiency**	**Allocative Efficiency**
Olive oil	100.00	90.22	90.22
Wine	100.00	99.11	99.11
Protected Designation of Origin (PDO) wine	90.94	58.69	64.49

Table 2. Average value of efficiency in organic and conventional crops over 5 years *(Source: our elaboration on data http://www.rica.inea.it/public/it/area.php)*

Conventional crop	**Technical efficiency**	**Economic efficiency**	**Allocative efficiency**
Olive	38.76	22.17	57.23
Wine	100.00	100.00	100.00
Protected Designation of Origin (PDO) wine	100.00	66.82	66.82
Organic crop	**Technical efficiency**	**Economic efficiency**	**Allocative efficiency**
Olive	48.13	29.16	56.35
Wine	100.00	100.00	100.00
Protected Designation of Origin (PDO) wine	71.53	38.56	52.38

By analyzing and comparing the system of cultivation between the organic and conventional olive and viticultural farms, the study has underlined as the organic olive farmers are more efficient than conventional olive oil ones even if these farms are less efficient than viticultural farms (Tab. 2). The olive farms, in fact, were the less efficient at the technical level in terms of cost and allocative efficiency. The traditional viticultural farms not specialized in producing an organic wine labeled as PDO have values of economic efficiency and allocative efficiency close to the unit. The analysis represents that the conventional viticultural crops are more efficient than those that producing an organic wine certified by an international label of quality such as the Protected Designed of Origin.

5. Final remarks

In general the organic transformed products are more efficiently than the cultivations and the olive cultivation have had the lowest level of efficiency. Organic farms have underscored a lower level of efficiency than normal farmers underling as some parameters such as the agrarian capital and labor force may be two pivotal variables in improving the level of economic and allocative efficiency, even if the olive farms, due to a small size of the

cultivated surface, have underlined a low level of efficiency with positive impacts of levels of input and output produced.

For the future it is pivotal to implement funds and subsides allocated by the European Union in the Common Agricultural Policy towards organic farmers, in particular in favour of many of them living in less favored areas, where are located a significant percentage of olive farms in order to reduce the marginalization and the out-migration from the countryside. Italian farms should have positive consequences by the introduction of incentives correlated with the level of greening, in the new process of rural planning proposed by the European Union, aimed in stimulating the extensification of crops and in reducing the negative impact on the environment.

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