# An econometric analysis for the evaluation of Risk of non-compliances in Turkey

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## Introduction

Risk-based analysis is becoming a key concept in the EU organic certification systems. Given that organic food imports from extra EU countries is conditional to the fulfilment of analogous standards, the strongly export oriented organic production of Turkey should benefit from a risk based analysis of non-compliance.

In this paper we analyse the data from inspections of a European control bodies in Turkish farms to analyse risk patterns of non-compliance with the organic regulation. Non-compliance in organic farming is a topic that is receiving recently a growing interest. Gambelli et al. (2012a 2012b, 2013a 2013b), Zanoli et al. (2013), Zorn et al. (2012, 2013), have analysed the issue of noncompliance at the European Level, while Zanoli et al. 2012, has proposed an analysis of sampling outcomes of organic inspections in Turkey. This study is a prosecution of the research of Zanoli et al. (2012) and can be considered as another attempt to analyse the issue of non-compliance in Turkish organic farming, based on a different methodological approach exploiting logit econometric models.

The aim is to find empirical evidence for crops that could be considered as increasing the risk of non-compliance with the organic production rules using an econometric approach. Organic Farming in Turkey is still a small sector but is growing steadily over the last years, mainly driven from export of typical Turkish products like raisins, fruit, and vegetables. Small farms are "intrinsically organic", so they can more easily be converted from a technical point of view than large farms, but their small dimension in many cases does not allow bearing the additional costs of certification. For this reason small organic operators are often organised as collective "projects" to share the cost of certification (Sayin et al., 2005). Given that the largest part of organic production is exported to Europe and that the EU organic regulations have been taken as a reference by the Turkish Ministry of Agriculture and Rural Affairs, it is no surprise that six of the seven authorized companies in Turkey for organic certification are from Europe (Olhan et al., 2005).

In this paper we analyse archives a European based control body operating in Turkey and concerning the results of sampling procedures of organic products. In what follows we consider a farm as non-compliant if it has received a sanction. We use a logistic regression model to explain how different risk factors might explain differences between compliant and non-compliant farm. Data and methods are described in the second section, results and discussion are shown in the third and fourth section, and the conclusions terminate the paper.

## Materials and Methods

We want to analyse if the farms that are compliant with the organic production rules are significantly different from those that are not compliant. This analysis could help in designing more efficient inspection schemes, which could reduce the cost of certification, considered as a main obstacle for the competitiveness of Turkish organic farms (Rehber and Turhan, 2002).

To analyse possible risk patterns of noncompliance we use available information at the farm level, concerning the type of crops, the farm size (acreage) and the farmers' gender and age. Our aim is to find if the occurrence of non-compliance is associated to the structural characteristics of the farms (risk factors). Data are obtained from a sample of farms certified by a European control body in the period 2008-2009. Basically two types of information are available: one referring to structural information for the certified farmers and processors and one referring to the sampling procedures implemented by the control bodies, that are used to check for possible non-compliance. If samples are positive to illegal substances, the farmer/processors are considered non-compliant with the organic regulation and are sanctioned by de-certifying the whole production lot. In more severe cases, the whole production of the farm/operator is excluded from further certification. However at the farm level we have not direct information about the reason

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that led to non-compliance, we only can measure what farm has been sanctioned due to non-compliance, and relate this information with the farms' structure. The number of inspected farms and the respective share of sanctioned farms are shown in Table 1.

**Table 1 – Number of farms and non-compliances by year**

| | 2008 | 2009 |
|---|---|---|
| Total Farms | 1,911 | 2,816 |
| Sampled farms | 433 | 540 |
| of which sanctioned | 19 (2%) | 31 (6%) |

The number of farms inspected increases in the period 2008-2009, and the variability of the datasets is confirmed by the information shown in Table 2. Farm size in particular is relatively stable between 2008 and 2009 for what concerns the average UAA size of total and sampled farms, but the size of sanctioned farms is particularly high in 2009. The high values of standard deviation confirm the general dispersion of data in the dataset, which should be taken into consideration when interpreting the results of the analysis of potential determinants of non-compliance.

**Table 2 – Utilisable arable area: total, sampled and sanctioned farms**

| | Total farms | Sampled farms | Sanctioned farms |
|---|---|---|---|
| Average UAA, 2008 (ha) | 8.8 | 18.3 | 11.3 |
| std dev | 44.7 | 91.4 | 12.2 |
| Average UAA, 2009 (ha) | 7.1 | 17.5 | 54.6 |
| std dev | 32.7 | 72.7 | 172.8 |

A logit model is used to analyse the effects of the different risk factors on the probability of non-compliance. The dichotomous dependent variable is a dummy that distinguishes between those that after the inspection have been considered as non-compliant and have received a sanction, from those that did not. The explanatory variables, or risk factors, are the structural variables describing the farm (see the list of risk factors in Table 3). Given that no information is available about the reason that led to the non-compliance, the logit model can only consider if the occurrence of sanctions is more likely when some crops are produced, or some structural factors are present in the farm. Two models are considered, for 2008 and 2009 respectively.

## Results and discussion

Table 3 shows the results of the logit models for 2008 and 2009. Figures in bold refer to risk factors that show a significant effect on the likelihood of non-compliance. Industrial crops, grapes and land in conversion are risk factors that are found as statistically increasing the risk of non-compliance in both 2008 and 2009. Vegetables and citrus (2008 only), and other arable crops (2009 only) show a positive and significant coefficient as well but. Some risk factors show negative and significant coefficients (i.e. reducing the risk of non-compliance): cereals, fruits, (for 2009) and farm's size (for 2008).

These results are partially consistent with those of Zanoli et al. (2012), with some relevant differences concerning citrus and nuts (both found as low risk crops in Zanoli et al., 2012). Despite the obvious structural differences between the two countries, the Italian case provides relevant information for Mediterranean organic production, which could be used as a benchmark for the main findings of the analysis of the Turkish organic farms similar analysis made for Italy (Gambelli et al., 2011a; 2011b; 2012a; 2013a). Similarly with the Italian situation, a higher risk of non-compliance is concerning farms producing vegetables, industrial crops, grapes and non-organic land.

**Table 3 – Statistical relevance of risk factors: results from logit models, 2008 and 2009**

| Year | 2008 | 2009 |
|---|---|---|
| Nr of obs. | 433 | 540 |
| LR chi2(13) | 61.35 | 84.81 |
| Prob > chi2 | 0.00 | 00.00 |
| Pseudo R2 | 0.2474 | 0.3206 |
| Log likelihood | -93.3258 | -89.8561 |
| Risk factors | | |
| *male* | n.a. | 3.617457 |
| *age* | -.0257915 | -.0136234 |
| *nr of crops* | .0189398 | .4111241 |
| *farm's size (UAA)* | **-.0056115*** | .0000907 |
| *cereals* | -.4921014 | -**3.182699**** |
| *pulses* | n.a. | .2728798 |
| *Industrial crops* | **4.110313**** | **4.192004**** |
| *herbs* | .6867938 | -.4305907 |
| *other arable land* | n.a. | **2.449913**** |
| *fruits* | .2994321 | **-3.297888**** |
| *nuts* | -.5067467 | .1770873 |
| *citrus* | **2.155746*** | 1.153483 |
| *grapes* | **1.514964**** | **1.747566**** |
| *olives* | -.7586481 | .1873999 |
| *vegetables* | **1.733436**** | .5848617 |
| *conversion* | **1.750529**** | **1.28727**** |
| *constant* | **-2.197595**** | -7.236873 |

Significance levels : * 0.1 ≤ p < 0.05 ; ** 0.05 ≤ p < 0.01;*** p≤ 0.001

## Conclusions

Results of this study are partially consistent across the two years of analysis, and also with previous studies in this field. Our results indicate a rather reassuring situation concerning the risk of non-compliance, and therefore the overall quality, at least for the main Turkish organic products. The relevant risk factors in both years of the analysis are quite few. Fruits and nuts represent the main organic productions in Turkey (Sayne et al. 2005). Our results show that none of the two products is a statistically relevant risk factor, and fruit production shows even a negative effect on the risk of non compliance (2009 only). Such conclusions represent therefore a positive aspect in terms of development of export potentials.

These results are also relevant for what concerns the domestic demand for organic products. Akgüngör et al. (2010) show a relevant interest of urban Turkish consumers for certified organic products, and a considerable consumers' concern about aspects like health and hygienic characteristics of the products, while İlyasoğlu et al., (2010), show how Turkish consumers confidence in organic food is still moderate. The rather reassuring picture in terms of limited risk of non compliance for the main organic products emerging from our analysis seems could represent an important base for a further development of domestic demand for organic products.

Given these considerations, the potential of a reliable and efficient certification system seems particularly relevant. From this point of view a more structured framework to guide risk-based inspections and sampling is advisable. There is a need for more information particularly at the operator's level, as structural data alone cannot completely explain non-compliant behaviours. Efforts in this direction are suggested also for the European certification systems (Dabbert, 2011). The Turkish inspection system is well adapted to the EU system, and could therefore further enhance the integration with the developments that the European certification systems will experience.

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