Risk assessment in EU organic certification system: a systematic literature review

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Abstract

This paper provides an overview of the recent studies on risk-based inspection in EU organic certification systems with the aim to evaluate the most relevant risk factors or farm types that are more likely associated with non-compliance. We have conducted a systematic revision of the literature regarding risk-based certification in EU organic farming. Our analysis provides a new systematic approach yielding a structured qualitative summary of the results of the publications.

Introduction

Recently, growing attention is being paid to the various aspects of certification in organic farming, which was for a long period a rather unexplored issue from a scientific point of view. The CERTCOST research project (www.certcost.org) has analysed in depth different economic aspects related to the issue of certification, and a growing number of scientific studies has been recently published, focussing in particular on the determinants of risk of non-compliance (NC) with the organic regulation. The objective of this study is to review the recent studies on risk-based inspection in organic farming and to reach an overall evaluation of the most relevant risk factors or farm types that are more likely associated with NC. A systematic revision of the literature was conducted in order to undertake a comprehensive analysis of all published studies (including accepted and in print publications at the date of our analysis) on risk of NC in EU organic certification systems. We have searched for studies regarding risk based certification in EU organic farming. The selected papers follow a range of different methodological approach, focus on different countries, and are published in a range of scientific reviews with different impact factors. Our analysis provides a new systematic approach yielding a structured qualitative summary of the results of the publications Results are normalised according to a synthetic index reflecting the number of time a risk factor is found as relevant, and the overall scientific relevance of the publication they refer to.

Material and methods

A systematic revision of the literature was conducted in order to undertake a comprehensive analysis of all published observational studies on risk of non-compliances in EU organic certification systems. We have performed searches using multiple term related to "risk based", "organic certification" and "non-compliances" in two computer database (scopus and organic e-print). Two general types of approaches are available. The first measures the effect of each risk factor singularly taken on the probability of NC occurrence [3-6; 8-12]. The second type of studies considers the risk of NC with respect to a set of farm types [2;3;8;11].

Single risk factor approach. The list of the single risk factors we have taken into consideration in this group of publication is summarised as follow. *Farm management complexity:* both in term of complex crop rotation, and/or different parallel livestock productions; *Farm size*: utilizable arable area in hectares; *Farmers' NC attitude*: farmers that have committed non-compliances in previous year and/or different type of non-compliances within the same year; *Farmer's experience:* the number of years the farm has been organically managed (in most of the publications, the number of years a farmer has been certified by the CBs was taken as a proxy, as the information on the actual number of years a farm was organically managed was not available); *Herd size*: total number of livestock units; *Licensee*: farmers who sell their products on the organic market; *Non organic land:* farms that have conventional and/or in conversion land; *Other certification schemes:* farmers who participate to other certification schemes besides the organic one, like ISO environmental schemes, Demeter certification, etc.; *Processing activity*: farmers who have processing activities in addition to the ordinary farming activities. Apart from the risk factors above mentioned, the available publications considered whether any specific crop or livestock increased (or decreased) the risk of non-compliances. The crop categories were: arable crops (*cereals, industrial crops, dry pulses, root crops, GMO-risk crops*[2]), *erbs*, fodder crops (*grasslands, green fodder*), permanent crops (*olives, grapes, fruit,*

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citrus, nuts), unused land (*fallow) and vegetables*. For the livestock types, five main categories were considered: *cattle, goats, pigs, poultry and sheep.*
Farm type approach. According to the available publications, four farm types can be considered. *Arable*: refers to farms where only arable crops are cultivated, with no livestock production and no fruit and horticulture production; *Fruit/horticulture: r*efers to farms specialised in fruit, vegetables, herbs, and aromatic plants, with no livestock and no arable crop production; *Livestock*: includes farms with livestock breeding (cattle, sheep, pig, poultry); *Mixed:* includes farms with a combination of livestock, arable and horticultural production not classified in other farm type due to mixed status.
Here we rank risk factors and the farm types according to a Risk Score that considers a "weighted" frequency a risk factor (or farm type) is found as having significant impacts in terms of risk of NC.

Concerning risk factors, for each publication *j* we take into consideration which risk factor is reported as having a significant Risk Effect (RE) on the risk of NC (either positive effect, i.e. increasing risk, or negative effect, i.e. decreasing risk). We consider that relevant risk factors increasing the risk of non-compliance have a RE = 1, while those decreasing risk have RE = -1; RE = 0 indicate no relevant impact on risk. In order to take into consideration the publication relevance, for each publication *j* we also develop a "publication weight", which is based on the following parameters: journal relevance (impact factor), geographical coverage (number of EU country analysed) and sample size of the analysis (nr of cases considered). These parameters are summarised in a publication weight score (PW_j).

For the j-th publication it results: $$PW_j = \frac{\frac{IF_j}{\max IF} + \frac{NR_j}{\sum_{j=1}^{n} NR} + \frac{SZ_j}{\sum_{j=1}^{n} SZ}}{\max PW} \quad (1)$$

where IF_j = j-th impact factor ; NR_j = j-th number of EU country analysed; SZ_j = j-th nr of cases considered.

The normalized risk score (NRS) for each factor is then computed as: $$NRS_i = \frac{RS_i}{|\max RS|} \quad (2)$$ where

i = risk factor / farm type; *j* = 1…n (n=total nr of publication);RE_i = i-th risk effect; *PWj* = j-th publication weight; RSi = i-th risk score = $\sum_{j=1}^{n} RE_i \; PW_p$

In our analysis max RS refers to *Poultry* (hence NRS=1.00): it shows RE=1 in six publications out of eight; also, these publications show high PWs. On the other hand the lowest NRS = -0.27 refers to *Citrus*, which shows RE = -1 in four publications (with an average PW of 0.33); RE=0 in three publications and RE = 1 in one publication (with PW of 0.13).

Results and discussion

In Table 1 we show the NRS of the different risk factors and farm types considered in the reviewed publications. High positive (negative) values of NRS indicate that the risk factor/farm type is considered as increasing (decreasing) the risk of NC in numerous and relevant publications.

Table 1: Classification of risk factors/farm types by NRS

Risk factors	High Risk of NCs NRS: 0.66 / 1.00	Medium Risk of NCs NRS: 0.30 / 0.65	Reducing Risk of NCs NRS: -0.27 / 0.00
Structural risk factors	*Farm size (0.95)* *Farmers' NCs attitude* (0.81)* *Non organic land (0.70)* *Processing activity (0.68)*		*Farmer's experience (-0.24)*
Crop risk factors	*Cereals (0.80)* *Industrial crops (0.79)* *Root crops (0.75)* *Grapes (0.74)*	*Fallow (0.53)* *Grassland (0.52)* *Dry pulses (0.47)* *Green fodder (0.36)* *Vegetables (0.35)* *GMO risk crops (0.30)*	*Fruit (-0.05)* *Olives (-0.22)* *Citrus (-0.27)*
Livestock risk factors	*Poultry (1.00)* *Cattle (0.75)* *Pig (0.75)*	*Sheep (0.32)*	-
Farm types	*Livestock farm (1.00)* *Arable farm (0.72)*	-	*Mixed farm (0.00)*

Please note that a high NRS indicates the likelihood a risk factor/farm type has to increase the risk of NC, but not necessarily the size of the risk increase. Also note that the analysis of the single risk factors and of the farm types have been performed separately, and that the number of publications dealing with farm types are quite few. In our analysis NRS ranges between -0.27 and 1.00. For reasons of space limitations, Table 1 only show high, medium and reducing risk factors/farm types. The risk factors/farm types not listed have a NRS between 0.00 and 0.29. In Table 1 we distinguish between structural, crop and livestock risk factors. Among structural risk factors, the *Farmers' NC attitude* plays a crucial role in the risk evaluation. *Farmers' NC attitude* can be considered as a general proxy for the personal attitude of farmers to fraud (for more details on this aspect see 1 and 8). *Farm size, Non-organic land,* and *Processing activities* are also emerging as factors increasing the risk of non-compliances. On the other hand *Farmers' experience* is the only structural risk-decreasing factor. With reference to the specific crops and livestock risk factors, the analysis shows that *Root crops* and *Industrial crops*, and the livestock production in general are critical risk factors: *Industrial crops* and *Root crops* are in fact indirectly related with livestock production as they can be used as animal feed. Livestock production in general (*Cattle, Pigs* and *Poultry*) is found as a high risk factor. From this point of view it is relevant to note how *Grassland, Fallow land* and *Green manure,* ranked as medium risk factors, are crops often found in relation with livestock production. Finally, Mediterranean crops like *Fruit*, and *Olives* and *Citrus* in particular, are classified as risk reducing factors. For what concerns the analysis of farm types, results are quite consistent with those of the single risk factors: the *Livestock farm* type reaches the highest NRS, and the *Arable farm* type is also ranked a high risk.

Conclusion

Some general conclusion can be drawn from this structured literature review. Firstly, structural factors like size, processing, not fully converted farms, are top ranked in terms of risk. Farmers' attitude to NC, though only a proxy of actual farmers' behaviour, is showing that personal aspects of the farmer might play a crucial role in the risk assessment. Secondly, livestock related activities are much more related to NC, while extensive and "southern" productions reduce the risk of NC. However these results are based on the analysis of available researches, which are still not very numerous, originating from few authors and mainly referring to structural aspects. Due to the general scarcity of data in particular, very little can be said in terms of risk associated with personal characteristics of the farmers (age, sex, crime records, etc.) and with economic aspects like turnover, financial indicators and so on. We think that structural and managerial data are not sufficient to provide an exhaustive evaluation of risk of NC, and ultimately a proper risk-based analysis. The availability of a more detailed and homogeneous set of data could represent an important step towards a more formalised and structured approach to risk based analysis in the field of organic agriculture.

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