



## ANALYSIS

Organic farming in Scandinavia – Productivity and market exit<sup>☆</sup>Johannes Sauer<sup>a,\*</sup>, Tim Park<sup>b</sup><sup>a</sup> Imperial College London and University of Kent, Wye Campus, UK; and University of Copenhagen, Denmark<sup>b</sup> University of Georgia, Athens, USA

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## ABSTRACT

This paper attempts to quantitatively measure the change in the productivity of Danish organic farming in recent years. Based on a translog production frontier framework the technical and scale efficiency at farm level is analysed by following a time trends as well as a general index model specification. Further this study tries to analyse the significance of subsidies for promoting long term growth in organic production by estimating a bootstrapped bivariate probit model with respect to factors influencing the probability of organic market exit. The results revealed significant differences in the organic farms' technical efficiencies, no significant total factor productivity growth and even a slightly negative rate of technical change in the period investigated. Evidence has been found for a positive relationship between subsidy payments and an increase in farm efficiency, technology improvements and a decreasing probability of organic market exit which was also confirmed for off farm income.

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## 1. Introduction

The promotion of organic farming has become an essential element of supranational and national food policy throughout Europe as well as other continents to promote safe and environmentally friendly food production. However, the finding that organic farming technology has developed with relatively little input from scientifically oriented research still holds (see Oude Lansink et al., 2002). Empirical evidence on the dynamic development of organic farming with respect to the underlying production structure is still rare and mostly based on partial measures of economic performance (see e.g. Jacobsen et al., 2005). So far, the issue of technical change and productivity development over time seems to be poorly investigated mainly because of a lack of adequate data at the farm level (most recently Sipiläinen and Oude Lansink, 2005). Denmark is currently one of the top-ten countries in Europe with regard to the share of organically cultivated area. However, in the last three to five years Denmark experienced a kind of stagnation with respect to the further development of the organic farming sector described as a 'natural weakening' by sectoral policy advisors (see e.g. Norfelt, 2005): While the export of organic products could not be expanded also the domestic consumption stagnated resulting in a total surplus of organic production. After continuing growth the total number of organic farms declined in this period from 3714 in 2002 to 3166 in the year 2004. Experts expect an enduring recession of organic farming in Denmark. This paper attempts to quantitatively measure the change in productivity for Danish organic farming in recent years by using panel

data on 56 organic farms mainly engaged in milk production for the period 2002 to 2004. Section 2 gives a brief overview of recent developments in the organic farming sector in Denmark, Section 3 summarises the modelling approaches as well as the main findings of most relevant economic studies on organic farming. Section 4 gives a brief theoretical review of the concepts of total factor productivity and market exit as well as outlines the underlying research hypotheses and the different models applied. Section 5 describes the data set and estimation procedures used followed by the exposition and discussion of the estimation results in Section 6. Section 7 finally concludes.

## 2. Organic farming in Denmark – sectoral developments

In the last 10 to 15 years the total organic production in Europe nearly tripled (Haring et al., 2004) whereas approximately 4–5% of the total agricultural area is organically cultivated. The organically cultivated total area in Denmark increased dramatically until the late 1990s whereas in the period from 1998 to 2000 the largest amount of farms under conversion to organic farming was experienced. These growth rates led to ambitious expectations with respect to the future development of organic farming in Denmark: in 1999 the Organic Council forecasted an organic share of 11% of the total agricultural area for 2003 and a long-term share of even up to 30% (The Organic Council, 1999). During this period of growth the highest increase in area cultivated was reached by large dairy farms mainly situated in the southern part of Jutland (see Jacobsen et al., 2005). However, since the year 2000 the rate of farms under conversion to organic farming is dramatically declining (see Fig. 1).

In the year 2003 only 62 new applicants were registered whereas 266 organic farms left the market – either by cessation of production or by converting back to conventional production. During the year 2004 the net

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\* Corresponding author. Wye, Ashford, Kent, TN25 5AH, United Kingdom.

E-mail address: [j.sauer@imperial.ac.uk](mailto:j.sauer@imperial.ac.uk) (J. Sauer).

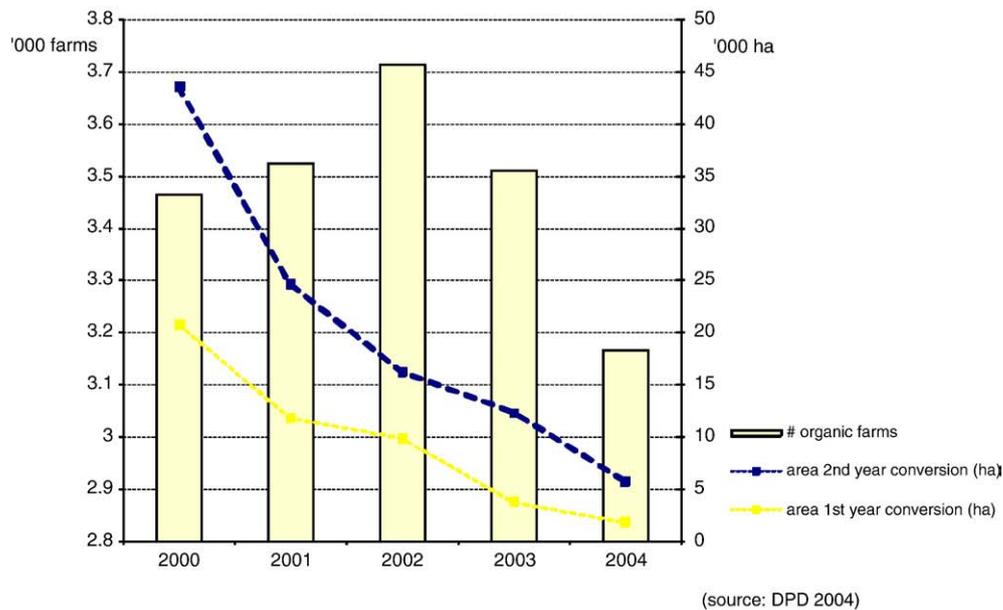


Fig. 1. Organic farms and area under conversion in Denmark 2000–2004.

number of organic farms exiting the market even increased by 69% to 344. Preliminary estimates for 2005 assume an ongoing decline in the total agricultural area organically cultivated mainly driven by the exit of dairy farms (DAAS, 2005). At the same time (November 2003) the overall political approach to the subsector of organic agriculture switched from an inflexible, more environmentally oriented to a flexible, more market oriented approach (Norfelt, 2005). The current support scheme aims at linking subsidy payments and environmental benefits. Experts, however, doubt the effectiveness and logic of this approach and expect an enduring recession of organic farming in Denmark. This pronounced decline in organic farming in recent years is more or less unique throughout Europe (Nieberg et al., 2005; Jacobsen et al., 2005). Market observers name as the main factors for this decline falling product prices stemming from decreasing consumption and export demand as well as reduced support measures. However, part time farming already plays an important role for organic production in Denmark and the majority of farms converting to organic production in the future is expected to mainly belong to this subsector (Jacobsen et al., 2005). Such part time farmers earn a large amount of their total income outside organic farming which makes the dependence on subsidy payments less pronounced (i.e. such farms have a softer budget constraint). The success of the latter is on the other hand crucially determined by the actual labor productivity and consequently the rate of technical change realized in the future to reduce the workload by farming activities. Large organic milk production accounts for the main part of current organic agriculture in Denmark, its ongoing importance is assumed by different sector observers. Because of this relative importance the following empirical analysis focuses on organic milk farms all over Denmark. Explanations for the recent decline in organic production found in the relevant literature are solely oriented towards a demand side argumentation stressing the implications of declining or stagnating consumption and hence product price decreases (see most recently Jacobsen et al., 2005). However, also supply side factors have to be stressed in order to fully understand the driving forces for the observed recession in Danish organic farming: significant organic overproduction reinforces ceteris paribus farm competition based on relative farm efficiency and the relative total factor productivity development over time. The individual organic farmer is concerned with relative profits and for the latter the relative efficiency of the agricultural operations is crucial. Economic stress leads to the likely exit of the least productive organic farms first and, hence, sectoral productivity increases. In addition, the mid to long term success of policy efforts to promote organic farming and to avoid adverse selection is crucially based on an adequate level of the

individual farms' efficiencies (see also Tzouvelekas et al., 2001a,b). So far, the efficiency as well as the productivity developments in organic farming have not been investigated for Denmark and only rarely for other European countries (see Section 3). The previously described developments in the sector suggest significant differences in farms' total factor productivities and their development over the last years.

### 3. Relevant analyses and research desiderata

Economic research with respect to organic farming at the farm level has been started in the mid 1990s and can be basically divided into two strands: empirically oriented analyses mainly applying a multivariate framework and more consultancy oriented partial economic analyses. Partial analyses using single productivity and cost measures have been conducted with respect to organic crop farms in France (Rainelli and Vermersch, 2000) and organic farming in the Czech Republic (Jánský et al., 2003). Multivariate studies revealed the following insights so far: Tzouvelekas et al. (2001a) found relatively high efficiency scores for conventional and organic cotton farms in Greece and a high inefficiency explaining power for the age and education of the farmers. Both types of farming exhibited a high allocative efficiency, however, organic farms in the sample were found to be less technically and consequently less overall efficient. The findings on the olive and durum wheat farms more or less confirmed these findings (Tzouvelekas et al., 2001b, 2002). Oude Lansink et al. (2002) compared the efficiency of organic and conventional crop and livestock producers in Finland and concluded on a higher relative efficiency of organic farms with respect to the organic frontier, but lower with respect to the overall frontier considering also conventional farms. Madau (2005) confirmed earlier studies on a higher average efficiency of conventional farms with respect to cereal farms in Italy for 2000 as well as 2001. Flaten and Lien (2005) concluded on a higher significance of production and institutional constraints than the degree of risk aversion for organic farming decisions in Norway. So far, the only contribution tackling the development of organic farms' efficiency over time was done by Sipilainen and Lansink (2005) by applying a stochastic distance frontier in a translog specification on a sample of conventional and organic dairy farms in Finland for the period 1995–2002. The results confirmed again a lower technical efficiency of organic farms and revealed that after an initial drop in farms' efficiencies in the period of conversion to organic farming, approximately 6 years after conversion farms' efficiencies start to increase again. The authors conclude on significant learning effects with respect to organic farming

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