Assessing the Socio-Economic Consequences of the Rise of Organic Farming in the European Union

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Abstract

Although organic farming is considered the poster child of rural development in Europe, there is little empirical evidence assessing its success in achieving the ambitious socio-economic objectives of support for small farms and employment generation that it is purported to assist. I present empirical evidence from the growth of organic farming in Europe over the past two decades that questions the highly optimistic claims of policy makers. I show that the rise in a region's share of agricultural land farmed under organic methods is associated with higher average farm size. Additionally organic farms in Europe display larger average sizes and lower rates of labor intensity than their conventional counterparts. Since the agricultural labor intensity in a region (the labor application per hectare) is not positively related with the share of organic area, the efficacy of organic farms to generate employment is set in doubt. I assert that this these developments point to the "conventionalization" of organic farming and present a serious challenge to European policy-making. Finally I suggest that the success of organic farming should be evaluated by the numbers of organic farmers, rather than by area covered, as has been the predominant approach so far.

1 Introduction

Over the past 20 years, organic farming has grown rapidly transforming the European countryside. Since the 1992 MacSharry reforms, the European Union has modified its Common Agricultural Policy (CAP) to include payments to farmers for the provision of environmental services and the preservation of nature. Among the agri-environmental measures, payments to farmers producing under organic methods constitute a major component of the Second Pillar of the Common Agricultural Policy, which explicitly focuses on Rural Development and which has gained in significance over the last years. Organic production fulfills environmental demands by creating less pressure on ecosystems because of less intensive methods, while contributing to the preservation of the rural landscapes that European urban dwellers view as precious. Organic production also satisfies consumer concerns around food quality, and public health and has positive implications for animal welfare. In addition to its health and environmental benefits, it is often viewed as a potential solution for keeping rural residents in the countryside because of its purported higher labor requirements.

Organic farmers receive direct income support for converting conventional land into organic and (in most countries) even for maintaining it as such. High prices for niche organic commodities are also thought of as a way to boost small farmers' incomes without relying on traditional price supports. Thus, aside from being an attractive solution to the problem of rural development in the eyes of environmentalists, organic farming promises to relieve the budgetary pressures of the CAP, fulfilling the wishes of the fiscal conservatives within the EU.

I examine whether the rise of organic farming in the European Union has, first, been associated with small-scale farming and, second, has led to higher application of labor in agriculture. Using regional data from the Farm Structure Survey for the period 2000-2010, I present statistical evidence of a positive relation between average farm size in a region and the share of utilized agricultural area farmed under organic methods. Furthermore, I show that a region's organic share of agriculture is not associated with higher application of labor per hectare of agricultural land.

The structure of the paper is as follows: The second section traces the changes of the CAP, from a set of traditional protectionist measures towards a document that promotes environmental policy, and analyzes the central discursive role of organic farming in the arsenal of the European Commission for addressing a variety of environmental and social problems. The third section lays out the data and empirical methodology, and the fourth section presents the necessary statistical evidence in order to commence the process of evaluating

the degree to which these policies have achieved the social goals of the CAP. The fifth section offers concluding remarks.

2 Agricultural policy in the European Union

2.1 From industrial agriculture to agri-environmental measures

After WWII, most European government pursued protectionist agricultural policies in order to achieve self-sufficiency and to tackle balance of payments difficulties[1] (Hoggart et al., 1995; Tracy, 1989). In 1955, West Germany's Agricultural Act codified the country's attempts to raise productivity and farm incomes through the stabilization of agricultural prices and supplies. This latter codification provided the framework for Article 39 of the Treaty of Rome in 1957, which signified the creation of the European Economic Community (EEC)(predecessor of the European Union) by Germany, France, Italy, Belgium, Luxembourg, and the Netherlands (Hoggart et al., 1995, 114-115).

The agricultural sector already held a predominant position in this inaugural document, as is easily demonstrated by the fact that it lays out the original objectives of the CAP of the EEC. These were:

- to increase agricultural productivity
- to ensure a fair standard of living for the agricultural community
- to stabilize markets
- to assure the availability of supplies
- to ensure reasonable prices for consumers (European Union, 2006, 54).

In order to achieve these goals, the CAP implemented significant payments to support agricultural production, in the form of subsidies to producers. Price supports were implemented for products in which the EEC wanted to achieve self-sufficiency, while tariffs and levies were imposed on imported products: 72% of agricultural production was receiving both price supports and external protection, whereas 25% was solely enjoying external protection (Sampson and Yeats, 1977; Commission of the European Communities, 1975).

However, the CAP led to a series of problems. Subsidies led to mounting agricultural surpluses in Europe and were primarily channeled towards the largest and most productive arable farms, creating a highly unequal situation within the agricultural sector. Thus, the initial agricultural policies, which didn't specifically target regional imbalances, failed to allow rural residents to participate in the welfare boost that urban residents

[1]The exception to the protectionist rule was Denmark, which attempted to win markets through diversification of its farm exports and free-trade.

experienced after WWII (Joossens and Raw, 1991; Grafen and Schramek, 2000; Groier and Loibl, 2000; Weis, 2007).

Since the CAP embraced the productivist logic of the early era of industrial agriculture, it encouraged specialization and monocropping, which sacrificed natural resistance in favor of productivity. In the 1970s, the "intensive use of certain types of fertilizer and the misuse of pesticides" began to be viewed in Europe as a source of pollution, especially as pesticide intensification impacted water sources, with serious consequences for public health (Council of the European Communities, 1973; Andersen et al., 2000; Buller and Brives, 2000; Louloudis et al., 2000). In the early 1980s, various countries, such as Denmark, the Netherlands, Austria and the UK, implemented programs which paid farmers for environmentally friendly methods of production. The policy targets included promotion of organic farming, reduction of inputs, preservation of biodiversity, conversion of arable land to grassland and rotation measures, set-aside, landscape preservation etc[2] (Grafen and Schramek, 2000; Groier and Loibl, 2000; Hart and Wilson, 2000).

By 1985, the European Commission explicitly acknowledged that modern agricultural techniques were responsible for the extinction of species, the destruction of valuable ecosystems, and for increased risk of ground and surface water pollution (European Commission (1985, 50) as cited by Lynggaard (2006, 107)). During the McSharry reform of the CAP in 1992, the above mentioned agri-environmental schemes, set up by Member States on their own initiative, became "accompanying measures" to the more traditional price support policies of the CAP. This meant that every country was now required to design and implement measures for environmental protection in its respective territory, apart from and parallel to its support for agriculture. Then, in 1999, when the "Agenda 2000" reform of the CAP was implemented, Rural Development was explicitly designated as the Second Pillar of Agricultural Policy (the First Pillar being traditional price supports). Agri-environmental measures were incorporated into the Second Pillar, so as to achieve coherence with the other rural development policies, and began to constitute a major component in the rhetoric of European policymakers regarding the revitalization of the countryside[3] (European Commission, 2005; Schmid et al., 2007).

The move towards agri-environmental measures also aimed to support marginalized communities, thereby addressing the inequality created by the previous CAP, which favored large arable producers over small, low-income farmers (Buller et al., 2000, 5). Rural development (independent of agriculture) had become a prominent policy concern in the European Union after the inclusion of the UK and Denmark in the EEC,

[2]For a more complete list, see European Commission, 2005.

[3]Although a complete list of rural development projects would be impossible, some examples of Second Pillar measures would be subsidies to agro-tourist enterprises, funding for agricultural processing, and payments for preservation of biodiversity. For examples of rural development projects that were co-financed by the EU, see European Commission (2006).

two countries which already had policies to address inter-regional inequality (Shucksmith et al., 2005; Buller et al., 2000). Subsidizing farmers for being good stewards of the countryside and providing society with public goods, such as a clean environment and beautiful rural landscapes, provided a way of addressing farmers' demands (van der Ploeg, 2009; Grafen and Schramek, 2000; Buller and Brives, 2000; Groier and Loibl, 2000; Schermer, 2003; Darnhofer, 2006), while conforming to the guidelines of the General Agreement on Tariffs and Trade (GATT) which stipulated the abandonment of protective policies in agriculture (Garzon, 2006).

2.2 Organic farming as *Deus ex machina*

Organic farming is a key tool of rural development, as it seems capable of addressing both the environmental and the socio-economic shortcomings of the old CAP. Organic farming was viewed as a solution to intensive agricultural production and its effects on groundwater pollution and acid rain in various European countries (e.g. the Netherlands, the UK, Denmark) (Lynggaard, 2006, 134-135). Furthermore, organic farming reduces the use of energy and agro-chemicals, thereby contributing to the restoration of an economic and ecological balance, with favorable implications for human health (Lynggaard, 2006, 113).

In addition to the direct environmental and health benefits, organic farming conferred other social benefits. It was seen as protecting rural landscapes, while providing producers with an attractive niche market opportunity. The position of the agricultural community wouldn't deteriorate despite decreasing public support for agriculture (European Parliament, 1991; van der Ploeg et al., 2002). Small farms were viewed as less likely to implement intensive methods of production, and were in some cases, even already following organic farming methods without being recognized as organic producers[4]; thus they were considered natural candidates for inclusion into organic farming schemes. Organic farming was thereby directly linked by the European's Parliament Committee on Agriculture to the support and protection of small-scale farming (Lynggaard, 2006, 127). As the following quote from the European Commission's website on Rural Development illustrates, the European Commission directly connects organic farming to small farms and job creation.

> "The very nature of organic farming means that it contributes to creating job opportunities, large rural populations and rural wealth. Factors contributing to this include:
>
> - Organic farms tend to be smaller and more diversified than non-organic farms, which by comparison tend on the whole to be larger and more intensive [sic] managed

[4]Following traditional or "organic by default" agriculture (Altieri, 1987; Michalitsch, 2011).

- The often high labour intensiveness created by restrictions on inputs and emphasis on physical and mechanical production"[5].

Among other ways, support for organic farming is achieved through financial instruments[6]. These instruments include payments to organic farmers as compensation for potential income losses from the transition to organic farming. In every country with the exception of the Netherlands, organic farmers receive an annual payment for converting their land and, in most countries, also for maintaining their farm under the organic regulations[7](Sanders, 2011).

2.3 Towards the "conventionalization" of organic farming?

Although these policies receive general support in Europe, not everybody has joined in the optimism about the transformative character of organic farming. In fact, the "conventionalization" of organic farming has been highly debated in the literature on organic farming, primarily in the fields of rural sociology, geography and anthropology[8]. Tovey (1997) traces the ways through which EU agricultural policy leads organic agriculture to increasingly resemble conventional processes in Ireland. Buck et al., on the other hand, claim that the organic farming sector has created an opportunity for Californian agri-business, which can extract rents and accelerate accumulation through investing in organic farming. Through regulation (which involved registration with the state and third-party certification), the right to market produce organically conferred a rent to those having it. Hence, organic farming displays characteristics that were traditionally associated with conventional forms of agriculture, such as monocultures and long-distance trading, while labor practices also became increasingly more and more alike. Thereby, "'organic" becomes an industry rather than a different philosophy (Buck et al., 1997).

Despite being confirmed by several case studies[9], the conventionalization thesis is not universally accepted. The opponents of the conventionalization thesis sought to highlight the characteristics of organic farming as a social movement. Hence, Michelsen (2001) claims that both the Californian and the Irish case are associated

[5]See `http://ec.europa.eu/agriculture/organic/society-economy/rural-development_en`, accessed on July 15

[6]Stolze and Lampkin distinguish between three different types of instruments supporting organic farming: legal, communicative and financial instruments. The array of legal instruments refers to the shifting of the power to define organic farming from the private sector to government authorities. Hence, the meaning of *organic* has become disputed and regulated through the use of organic logos, certification agencies, etc. Communicative instruments are made up of the ways, including research, training, advice, and promotional campaigns, which support organic producers. Financing expositions of organic products or research on organic farming, particularly in public universities, would be two examples of the second group of instruments (Stolze and Lampkin, 2009)

[7]For example, organic farmers growing permanent crops in Germany and in Italy could receive an annual payment of 1,080-1,440 euros per ha (Stolze and Lampkin, 2009, 240).

[8]See Tovey (1997) and Buck et al. (1997).

[9]Research by Guthman (1998, 2004) and Allen and Kovach (2000) provide additional evidence in its support, both in the context of the US.

with a small share of organic agriculture, rendering generalizations "heroic" . In the case of New Zealand, Campbell and Liepins (2001) claim that the development of "organic" as an industry is contested by organic growers, thereby challenging its potential linear development, whereas Kaltoft (2001) draws similar results by examining the case of the Danish organic movement.

3 Empirical questions

3.1 Data description and methodology

I use regional Farm Structure Survey (FSS) data from the years 2000-2010 in order to evaluate whether the increase in organic farming in Europe confirms the claims of European policy makers regarding first the connection between organic and small-scale farming and second the positive impact of organic farming on labor intensiveness, or whether it displays characteristics that may confirm the "conventionalization" thesis, such as large size and smaller labor intensity. Unfortunately Eurostat does not make farm-level data publicly available; however, the regional data allows us to explore these questions at a European level, thus supplementing existing research which uses farm-level data in specific countries to explore the characteristics of farmers who take-up organic farming (Darnhofer et al., 2005; Läpple and Van Rensburg, 2011; Läpple and Kelley, 2013).

Since the Farm Structure Survey has included questions about organic farming only since 2000, I only have relevant data from the last five surveys, which were conducted in 2000, 2003, 2005, 2007 and 2010. The regional FSS data was acquired through private correspondence with Eurostat in the Spring of 2010 (for years 2000-2007) and Spring of 2013 (for the FSS of 2013). I augment the dataset with publicly available income data from the Eurostat website (accessed in the Spring of 2013). The regional data follows the NUTS (Nomenclature of Territorial Units for Statistics) classification which is used by the European Commission for dividing up the territory of the EU for statistical purposes. The current NUTS classification divides the European territory into 97 regions at the NUTS-1 level, 270 regions at the NUTS-2 level and 1294 regions at the NUTS-3 level[10] (Eurostat, 2011). The relevant variable definitions and the descriptive statistics are presented in table 1.

[10]The previous NUTS classification divided the European territory into 97 regions at the NUTS-1 level, 271 regions at the NUTS-2 level and 1303 regions at the NUTS-3 level (Eurostat, 2007, 10-11) This redistricting, which mostly applied to Finland and the UK, necessitated recalculating the 2000-2007 data so as to make them consistent with the recent territorial categories.

Table 1: Variables and descriptive statistics

Variable	Mean	Standard Error	N
Share of organic farming	0.040	0.001	1236
Average Farm Size (ha)	36.50	1.17	1240
Real GDP per capita (in constant 2005 euros)	21,561.02	299.74	1326
Average Labor Intensity (AWU/ha)	0.083	0.005	1240
Share of Specialist field crops	0.327	0.006	1218
Share of Specialist horticulture	0.011	0.001	1218
Share of Specialist permanent crops	0.073	0.004	1218
Share of Specialist grazing livestock	0.346	0.007	1218
Share of Specialist granivores	0.017	0.001	1218
Share of Mixed cropping	0.050	0.002	1218
Share of Mixed livestock	0.035	0.001	1218
Share of Mixed cropping-livestock	0.130	0.003	1218
Share of Non-classifiable holdings	0.007	0.001	1218

AWU stands for Annual Work Units, measured as full-time equivalent.
All variables measured as averages at the NUTS-2 regional level (270 NUTS-2 regions and five years of data)
Except for GDP per capita all variables derived from the FSS

3.2 The determinants of organic share

The area under organic methods has grown rapidly in the EU during the first decade of the 21st century, as shown in figure 1. Austria and Sweden lead the EU with more than 13% of their utilized agricultural area cultivated under organic methods. Furthermore, there is a rapid increase in the organic share in countries without a long-standing tradition in organic agriculture. Thus, countries such as the Czech Republic, Estonia, Greece and Latvia went from having virtually nonexistent organic farming sectors to about 10% of their agricultural area under organic methods within a period of only 10 years. Table 2 reveals, however, that the number of organic farms has not followed the same path as the share of organic agricultural area. Parallel to the rise of organic farming, several EU countries have seen their number of organic farmers stagnate or even decrease since the late 1990's.

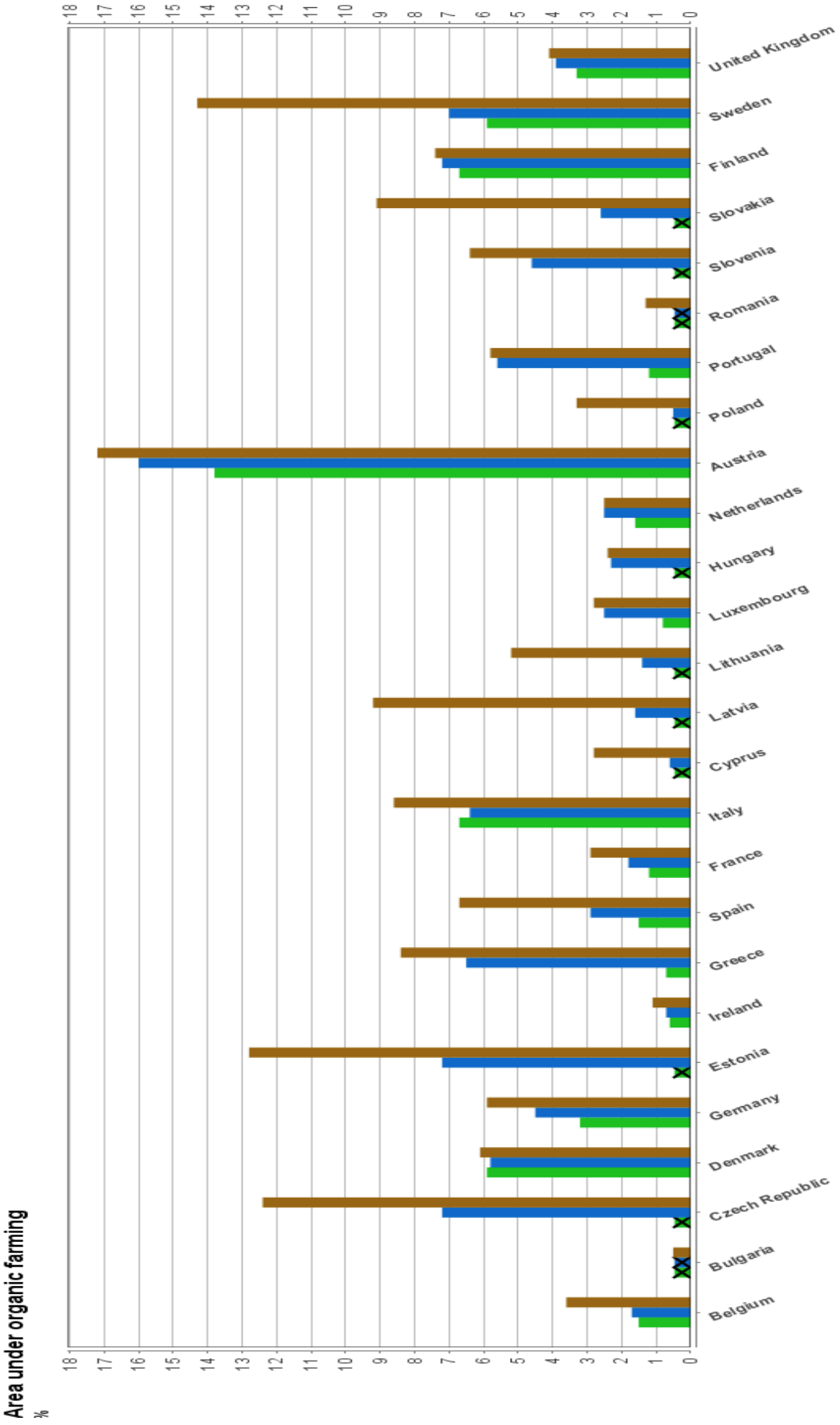

Figure 1: Organic area in the EU - 2000 to 2010 (Source: Eurostat)

Table 2: Number of organic farms, by country

	1985	1990	1993	1995	1997	2000	2003	2005	2007	2010
Austria	420	1539	9713	18542	19996	18880	17880	18760	18200	19190
Belgium	50	160	160	193	291	580	530	550	490	620
Bulgaria								30	110	170
Cyprus							100	130	210	310
Czech Republic		30	132	187	192		510	600	750	1520
Germany	1610	4188	11248	15055	12368	9570	11420	13480	13580	15170
Denmark	130	523	640	1050	1617	2520	2600	2440	2110	2100
Estonia							280	670	930	1060
Greece		25	165	568	2514	1460	7550	9610	27700	15440
Spain	264	350	753	1042	3526	17160	10270	14450	15920	14630
Finland	60	671	1599	2793	4381	4900	4280	4020	3620	3400
France	2500	2700	3231	3538	4784	7060	8610	9010	8910	12490
Hungary						1840	800	870	490	910
Ireland	8	150	162	378	808	1560	670	590	610	870
Italy	600	1500	4656	10630	30844	45710	38470	41000	39140	41920
Lithuania							240	790	1400	2200
Luxembourg	10	10	12	19	23	20	40	50	50	60
Latvia						5130	650	440	2970	2880
Netherlands	215	399	455	561	810	710	1140	1190	1160	730
Poland								3190	7150	11240
Portugal	1	50	90	331	278	810	900	880	1190	1020
Romania								90	1680	710
Sweden	150	1859	1876	4206	10869	9040	15040	2810	2940	3990
Slovenia						330		1220	1550	1860
Slovakia						60	60	70	190	300
UK	300	700	655	828	1020	1690	2750	2900	3210	3350

Source: Michelsen (2001), Eurostat

Table 3: Average size of farm (in hectares), by type: 2000-2010

	2000		2010	
	Conv	Org	Conv	Org
EU-27			13.8	47
EU-25			19.2	46.9
EU-15	18.4	33.4	23.1	41.2
Austria	16.7	20.0	18.6	22.8
Belgium	22.4	43.0	31.3	56.5
Bulgaria			12	82.4
Cyprus			3	7.9
Czech Rep.			147	227.5
Denmark	45.3	56	61.9	80.8
Estonia			45.4	92.7
Finland	27.1	31.4	35.4	44.8
France	41.9	46.9	54	55.3
Germany	36.0	51.1	55.6	60.2
Greece	4.4	4.8	4.6	14
Hungary	4.6	68.8	7.6	346.7
Ireland	31.5	26.8	35.7	36.9
Italy	5.8	18.0	7.4	27.5
Latvia	10.3	7.6	20	64.3
Lithuania			12.9	85.3
Luxembourg	45.3	51.5	59.7	56.7
Malta			0.9	
Netherlands	19.9	30.7	25.8	38.1
Poland			9.4	31.6
Portugal	9.0	145.8	11.7	109.2
Romania			3.4	70.6
Slovakia	29.7	854.8	70.9	607.1
Slovenia	5.6	8.6	6.2	15.4
Spain	20.1	40.1	23.5	55.3
Sweden	36.0	51.4	39.9	97.8
UK	66.6	222.1	82.4	171.1

Table 3 compares organic and conventional farms in terms of average farm size in different EU countries. Whereas the average organic farm size in the EU-27 is 47 hectares, the average conventional farm size is 13.8 hectares. This pattern of larger average conventional farm size than average organic farm size is present in all EU countries except Luxembourg. Furthermore, we notice that in countries such as Greece or Latvia where organic farms were either smaller or similar to conventional farms in terms of average farm size in

2000, average organic farm size becomes three times larger than average conventional farm size in 2010. This is similar to the pattern observed by Padel for Germany, Denmark, and the EU-15. According to her calculations, average organic farm size in all these countries is initially below, but eventually surpasses average conventional farm size[11] (Padel, 2001).

Table 4 reiterates the trends in the numbers of organic producers and organic land in Europe in the different NUTS-2 regions during the 2000s. The elements on the diagonal represent regions with a positive relationship between the number of organic producers and organic land over time. The lower off-diagonal elements display the existence of an unambiguous process of concentration of organic land[12]. Thus, in 30 regions the number of organic farmers decreases while organic land increases, whereas in 11 other regions organic land either increases with the number of organic producers unchanged. Hence, in a significant number of regions, a "rise in organic farming" means a rise in the organic share of agricultural land, without a rise in the number of organic producers.

Table 4: Regional trends, 2000-2010

	Organic land		
Organic producers	Increase	Unchanged	Decrease
Increase	181	0	2
Unchanged	11	11	2
Decrease	30	0	33

3.3 Labor intensity

Organic farming is often assumed to be inextricably interwoven with high labor intensity. In a study funded by the European Commission, Offerman and Nieberg claim that organic farms employ approximately 20% more labor per hectare than conventional farms (Offerman and Nieberg, 2000, 18). Jones asserts that "organic farming generally requires a higher level of labour input than more conventional forms of farming, mainly due to the substitution of chemical inputs by labour, and a higher proportion of labour intensive activities"[13] (Jones, 2003, 24). Writing in the early 2000s, Jones attributes the lack of a significant employment impact in rural Europe to the small scale of organic production at the time.

[11] This happened in the EU-15 in the late 1980s, in Germany in the early 1990s and in Denmark in the mid-1990s (Padel, 2001, 45).

[12] Such a process can be occurring even if both organic producers and organic land are moving in the same direction, as is the case in most regions.

[13] See also Soil Association (2006) or van der Ploeg et al. (2002).

Table 5 provides insight into the question of the potential relation between organic farms and high labor requirements by comparing labor intensity at the country level (measured as full-time equivalent annual work units per hectare) for conventional and organic farms. We notice that organic farms display higher labor intensity than conventional farms only in France, Ireland and Luxembourg. In Austria or Greece, where organic farms had a higher application of labor per hectare, this ceased to be the case during the last decade. This result points to the possibility that organic farms may be substituting other inputs for labor, contrary to the often-assumed association of organic farming with higher labor demands.

Table 5: Average Labor Intensity (Annual Work Units per hectare), by type of farm

	2000		2010	
	Conv	Org	Conv	Org
EU-27			0.054	0.028
EU-25			0.047	0.028
EU-15	0.045	0.034	0.035	0.029
Austria	0.052	0.056	0.039	0.037
Belgium	0.052	0.042	0.043	0.029
Bulgaria			0.087	0.045
Cyprus			0.14	0.11
Czech Rep.			0.031	0.017
Denmark	0.024	0.022	0.019	0.017
Estonia			0.027	0.016
Finland	0.044	0.037	0.024	0.021
France	0.031	0.040	0.025	0.037
Germany	0.035	0.033	0.029	0.028
Greece	0.14	0.16	0.11	0.061
Hungary			0.091	0.02
Ireland	0.037	0.040	0.033	0.034
Italy	0.092	0.050	0.068	0.036
Latvia	0.10	0.14	0.049	0.03
Lithuania			0.055	0.023
Luxembourg	0.034	0.039	0.027	0.035
Malta			0.42	
Netherlands	0.095	0.067	0.076	0.059
Poland			0.13	0.044
Portugal	0.12	0.016	0.094	0.018
Romania			0.11	0.033
Slovakia	0.061	0.027	0.030	0.018
Slovenia	0.21	0.16	0.15	0.084
Spain	0.033	0.021	0.031	0.023
Sweden	0.023	0.021	0.018	0.013
UK	0.021	0.013	0.016	0.013

Source: Eurostat

3.4 Estimation Methodology

I assert that the socioeconomic effects of organic farming can be evaluated by examining the relation between different economic indicators and the rise in organic farming and also by estimating the impact of organic

farming on agricultural labor intensity. First, I investigate the factors predicting the rise of organic farming. In particular, I explore the relationship between organic farming as a share of agricultural area in a region and farm size. If smaller farms are more suitable for organic methods of production and may already have been following production methods resembling organic practices without reaping the benefits from certification and higher value-added. If the claims of the European Commission are correct, one should hypothesize a negative relationship between the share of organic farming in a region and average farm size. Naturally one would also expect that the presence of different cropping systems in a region to differentially impact the take-up of organic methods, for example one may expect to see more organic farming in a region where pastures are predominant.[14]

Second, I estimate the impact of organic methods on labor intensity, in order to evaluate its potential for employment generation. Since higher labor intensity in the agricultural sector leads to higher demand for agricultural labor, the claim that organic farming can act as a device for strengthening rural communities and economies through direct employment generation can be substantiated by showing a positive relation between organic methods and higher application of labor per hectare of land.

I use a model with regional and time fixed effects to estimate the relationships of interest. The fixed effects account for unobservable regional characteristics that are not explicitly controlled for in the empirical model but may be relevant in explaining the rise in organic farming. The general form of the model can be seen below:

$$\mathrm{y}_{it} = \alpha_i + \gamma_t + x'_{it}\beta + \epsilon_{it} \tag{1}$$

where the subscript i denotes the region and the subscript t denotes time.

The first estimation concerns the determinants of the share of organic farming in a region. If European policy makers are right to emphasize the connection between organic and small-scale farming, we should find a negative relationship between a region's average farm size and the region's organic share of agriculture. I control both for potential relationships between income and organic share using the logarithm of GDP per capita, and for crop and activity patterns[15]. Thus, I estimate the following equation:

[14]The different type of activities are specialist field crops, specialist horticulture, specialist permanent crops, specialist grazing livestock, specialist granivores, mixed cropping, mixed livestock holdings, mixed crops-livestock, arm non-classifiable holdings.

[15]The estimated equations omit land devoted to specialist grazing livestock, which was in 2010 the most common activity for organic production covering 46% of organic area in EU-27, and behind specialist field crops, the second most common land use category for European agriculture in general.

$$OrganicShare_{it} = \alpha_i + \gamma_t + \beta_1 \times logAverageFarmSize_{it} + \beta_2 \times logGDP_{it} + \beta_3 \times \%PermanentCrops_{it} + ... + \beta_{11} \times \%NonClassifiedHoldings_{it} + \epsilon_{it} \quad (2)$$

where $t = 2000, 2003, 2005, 2007, 2010$ and $i = 1, ..., 270$ NUTS-2 regions.

The second estimation concerns the impact of organic share on a region's average labor intensity, again using a fixed effects model. Following the European Commission's claim, I hypothesize that the share of organic land will be positively associated with labor intensity. The regression controls for GDP per capita, average farm size, and also for the region's crop and activity patterns. Thus, the estimated equation is:

$$logLaborIntensity_{it} = \alpha_i + \gamma_t + \beta_1 \times OrganicShare_{it} + \beta_2 \times logGDP_{it} + \beta_3 \times logAverageFarmSize_{it} + \beta_4 \times \%PermanentCrops_{it} + ... + \beta_{12} \times \%NonClassifiedHoldings_{it} + \epsilon_{it} \quad (3)$$

4 Estimation Results

4.1 The Determinants of Organic Share

Table 6 presents the estimation results for the relationship between the share of organic land and the average farm size of the region. I show four different specifications which all include time and region fixed effects. The first specification only includes the logarithm of average farm size on the right-hand side, while in the second and the third specifications I introduce the logarithm of GDP per capita and the shares of different cropping activities as controls respectively. The last specification includes both types of controls.

Contrary to my hypothesis of a negative relation between organic share and average farm size in a region, I find a positive relationship between organic share and average farm size. Thus, a 10% increase in average farm size is associated with a rise in organic share by approximately 0.07 percentage points, and a doubling in the average farm size is related with an expected mean increase in the share of organic land of approximately 0.54% *ceteris paribus*. This positive relationship is statistically significant in the first two specifications, and remains so even after controlling for the share of different types of cropping activities that take place in a region (in regressions 3 and 4). The fact that the relation remains statistically significant after controlling

for the shares of different cropping activities in a region shows that the positive relationship between organic share and farm size is not driven by an overrepresentation of organic farming in areas with a specific type of cropping activity (e.g. pastures).

Table 6 also shows that the relationship between the organic share of agriculture and GDP per capita is positive. Thus, we tend to see a higher share of organic farming as the real GDP per capita in a region increases. One potential explanation for this is that higher income per capita provides local demand for the more expensive organic products. Turning to the relation between different cropping activities and organic farming, we notice that the presence of specialist field crops tends to be negatively associated with the share of organic farming (a 1% increase in the share of specialist field crops at the expense of specialist grazing land tends to be associated with a decrease in organic area by around 0.06%). A similar result can be obtained for the presence of mixed cropping systems.

Table 6: Determinants of organic share - Fixed effects

	Reg1	Reg2	Reg3	Reg4
	(1)	(2)	(3)	(4)
Av. Farm Size (log)	0.019**	0.019**	0.018**	0.018**
	(0.008)	(0.008)	(0.008)	(0.008)
GDP per capita (log)		0.017		0.024*
		(0.010)		(0.014)
% sp. field crops			-0.060*	-0.061*
			(0.032)	(0.032)
% sp. horticulture			-0.259	-0.295*
			(0.158)	(0.164)
% sp. permanent crops			-0.046	-0.037
			(0.082)	(0.081)
% sp. granivores			-0.065	-0.070
			(0.053)	(0.055)
% mixed cropping			-0.089***	-0.063*
			(0.033)	(0.037)
% mixed livestock			-0.069	-0.033
			(0.060)	(0.064)
% mixed crop-livestock			-0.012	-0.002
			(0.041)	(0.042)
% non-classifiable			-0.020	-0.018
			(0.020)	(0.020)
Region FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R-squared	0.077	0.078	0.091	0.094
N	1236	1213	1218	1195

*$p < 0.10$, ** $p < 0.5$, *** $p < 0.01$

Standard errors in parentheses, clustering at the NUTS-2 level

Omitted type of agricultural activity is specialist grazing livestock

Fixed effects model with NUTS-2 region fixed effects (270 NUTS-2 regions)

4.2 Labor intensity

Given the significant increase in organic farming over the last decade, we are now well-positioned to evaluate whether the switch towards organic practices has had a significant impact on a region's agricultural employment, and thus evaluate whether the rise of organic farming has been an effective tool in the fight to prevent rural depopulation. Table 7 presents the results of the fixed effects model estimating the relationship between labor intensity and the organic share of agriculture at the regional level, while controlling other characteristics. The first specification includes only time and region fixed effects, whereas the second and the third regression introduce controls for the logarithm for GDP per capita and the logarithm of average farm size respectively. The fourth and the fifth specification control for the share of different cropping activities in a region, first without and then including a control for average farm size (regressions four and

five respectively).

Contrary to the stated null hypothesis, I find a statistically significant negative relation between a region's organic share and its agricultural labor intensity (log transformed) in the first two specifications. In both cases coefficient equal to approximately -0.5 is that a 10% increase in organic share is related with a drop in a region's agricultural labor intensity by approximately 5%. The coefficient for the effect of GDP per capita on labor intensity is negative as expected: one explanation for this relation is that as GDP per capita in a region increases, people previously employed in agriculture find employment opportunities in other sectors. However, the coefficient on GDP per capita is not statistically significant in any specifications.

While the relationship between agricultural labor intensity and organic share remains negative in all specifications, the statistical significance ceases to exist after controlling for the average farm size of a region shown in regression 3. This finding is not surprising given the strong association between organic share of agriculture and average farm size in a region. In fact, the negative relationship between average farm size and labor intensity is quite strong: a 10% increase in average farm size is associated with a decrease in labor application per hectare of around 4.5%[16]. Furthermore, turning to regressions 4 and 5, we see that the type of agricultural activity matters for labor intensity. In particular, an increase in the presence of granivorous livestock and of mixed cropping-livestock operations (at the expense of specialize grazing) have an economically and statistically significant positive effect on the labor per hectare that is expended in the region. This finding is particularly important as it points to integrated cropping and livestock activities as a potential solution for employment generation in rural areas.

[16]The pairwise correlation between the logarithm of average labor intensity and the logarithm of average farm size is in fact very strong at -0.91.

Table 7: Determinants of average labor intensity - Fixed effects

	Reg1	Reg2	Reg3	Reg4	Reg5
	(1)	(2)	(3)	(4)	(5)
Organic Share	-0.503*	-0.506*	-0.242	-0.589	-0.351
	(0.292)	(0.289)	(0.311)	(0.437)	(0.443)
GDP per capita (log)		-0.120	-0.092	-0.008	-0.036
		(0.105)	(0.074)	(0.100)	(0.076)
Av. Farm Size (log)			-0.452***		-0.437***
			(0.065)		(0.066)
% sp. field crops				-0.020	-0.122
				(0.155)	(0.136)
% sp. horticulture				1.366	1.381
				(1.368)	(0.846)
% sp. permanent crops				0.460	0.099
				(0.367)	(0.253)
% sp. granivores				1.007***	0.592**
				(0.284)	(0.271)
% mixed cropping				0.957***	0.218
				(0.337)	(0.276)
% mixed livestock				-0.137	0.036
				(0.440)	(0.336)
% mixed crop-livestock				0.645***	0.304**
				(0.189)	(0.152)
% non-classifiable				-0.020	-0.354**
				(0.163)	(0.166)
Region FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.451	0.452	0.617	0.478	0.628
N	1227	1204	1204	1186	1186

*$p < 0.10$, ** $p < 0.5$, *** $p < 0.01$, Standard errors in parentheses, clustering at the NUTS-2 level

Omitted type of agricultural activity is specialist grazing livestock

Fixed effects model with NUTS-2 region fixed effects (270 NUTS-2 regions)

Table 8: Differences between organic and conventional farms, 2010

	Org - Conv	Org - Conv
Crop activity	Average Farm Size	Average Labor Intensity
All	48.02***	-0.020***
	(6.78)	(-3.04)
Specialist field crops	41.42***	-0.003
	(4.56)	(-0.87)
Specialist horticulture	6.92***	-0.091***
	(4.45)	(-2.66)
Specialist permanent crops	9.06***	-0.064***
	(7.92)	(-6.45)
Specialist grazing	54.76***	-0.023***
	(6.46)	(-9.16)
Specialist granivores	-2.76	-0.031***
	(-0.92)	(-2.64)
Mixed cropping	5.18*	-0.020*
	(1.3)	(-1.60)
Mixed livestock	2.02	-0.026***
	(0.33)	(-4.40)
Mixed cropping-livestock	36.60***	-0.023***
	(3.30)	(-4.60)
Non-classified	1.19	-.146
	(1.10)	(-1.32)

270 NUTS-2 regions, t-statistics in parantheses, *$p < 0.10$, ** $p < 0.5$, *** $p < 0.01$

Table 8 reiterates that the findings in this section are not driven by a particular type of crop activity in which organic farms are either larger or less labor intensive than conventional farms. To do so, I show in table 8 the differences between organic and conventional farms in terms of average farm size and average labor intensity at the NUTS-2 level for 2010. Organic farms have a higher average farm size than their conventional counterparts for six out of nine categories of cropping activities: the differences are statistically significant at the 1% level for specialist field crops, specialist horticulture, specialist permanent crops, specialist grazing, mixed cropping-livestock and at the 10% level for mixed cropping. Similarly for seven out of nine categories, average labor intensity is lower for organic farms compared to conventional farms: the differences are statistically significant at the 1% level for specialist horticulture, specialist permanent crops, specialist grazing, specialist granivores, mixed livestock and mixed cropping-livestock farms, and at the 10% level for mixed cropping[17].

[17]A difference of -0.02 in average labor intensity (labor per hectare) means a difference of 1 full-time worker in a 50-hectare farm.

5 Concluding remarks

The preceding sections cast doubt on the effectiveness of organic farming for achieving the socio-economic objectives that they are purported to assist in the European Union. My analysis shows, first, a positive relationship between a region's share of organic land and the region's average farm size. This result, combined with the fact that organic farms are on average larger in terms of land size than conventional farms, disproves the idea that organic farming is "naturally" intertwined with small-scale farming. Second, my analysis highlights that the presence of more organic area in a region does not necessarily lead to a higher application of labor per hectare. Organic farms use on average less labor than conventional farms. Together, these results suggest that organic farms in the European Union substitute land and capital for labor[18]. These characteristics would provide evidence in support of the "conventionalization" thesis, rather than for positive employment results and the purported benefits for small-scale farms.

These findings have implications for what a successful transition to organic farming actually means and requires. European countries commonly measure the success of taking-up organic through the use of quantitative targets. For example, Austria and Slovenia have current targets of 20%, while the Czech Republic and Denmark have targets of 15% for 2015 (Sanders and Metze, 2011, 44). Measuring the success of agri-environmental projects by land coverage as a share of utilized agricultural area, however entails the risk that it may be easier and faster to achieve those targets by the transition of a few large producers, rather than by many small ones. Organic farms are not representative farms which might be why agricultural labor intensity does not increase as a result of the rise in the share of organic land. A transition to organic would require policies explicitly designed to favor small farms, rather than assume that small farms are going to derive benefits from them.

Over the last decade the impressive "rise in organic farming" has happened in many cases without a rise in the number of organic producers. Notwithstanding the possible environmental benefits, such a development puts in question the longevity of the "organic movement" and its potential for influencing agricultural practices. Contrary to popular misconception which equates organic with "doing nothing" (because nature presumably does everything), organic farming is a knowledge-intensive activity, which is based on constant experimentation (Kummer and Vogl, 2009; Milestad et al., 2010). Hence, the proliferation and the deepening of organic practices become precarious unless they are widespread among a large number of farmers.

Thus, the results presented in this paper should confront European policy-makers with a serious problem.

[18] For a similar conclusion, see Konstantinidis (2012, 2013).

They challenge the idea that small farms, who theoretically should face fewer challenges than larger farms for the transition to (certified) organic processes actually take advantage of the new policies. Hence, it becomes difficult to articulate the claim that the discrepancy between organic and conventional farms is a temporary phenomenon, possibly happening for reasons advanced by the adoption/diffusion framework, which would be ameliorated over time with the growing appearance of organic methods[19].

The problem, however, does not lie in organic farming *per se*. European agricultural policies have measured success in a region's transformation towards "greener" methods in agriculture by the share of organic land in its utilized agricultural area, while treating social dimensions as mechanically derivative of the growth in organic farming. Thus, the failure of these rural development policies to fulfill more ambitious social goals is unsurprising and one that should be addressed if we are to imagine an ecologically and socially sustainable future.

[19]See Albrecht (1974); Feder and O'Mara (1981) or Läpple and Van Rensburg (2011); Läpple and Kelley (2013).

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