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Financial sustainability in Italian Organic Farms: an analysis of the FADN Sample

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Abstract

With the European Green Deal, presented in December 2019, the EU Commission aims at making Europe the world's first climate neutral continent by 2050. In this plan agriculture plays a key role and so does organic farming. The aim of this work is to assess the financial sustainability of organic farms compared to conventional ones, measuring the liquidity they generate, evaluating its adequacy and identifying the factors that influence its extent. Specifically, this study uses the Italian FADN sample, made up of 18 TFs, and measures the Free Cash Flow on Equity (FCFE) for both organic and conventional farms. The econometric analysis identifies the variables contributing to cash flow production and is based on three types of variables: structural, including the cash flow itself, relative to farm results. The analysis showed that financial sustainability is greater for organic than conventional farms, and in several cases the level reached by the former is very high especially in mixed TFs. Yet, a major part of the sustainability of organic farms is due to EU payments, mainly of the CAP II type. Also, the balance of business relationships with customers and suppliers allows organic farms to increase liquidity almost as much as the total amount of public aid received. Still, this result should be supported by improving price and yield conditions, as much of the GMO is achieved with below-average value for both variables. Finally, our analytical approach can be used by Countries using the FADN to assess the situation of their agriculture and help direct policy support better.

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Introduction

The *European Green Deal*, presented by the EU Commission in December 2019, is an ambitious plan whose goal is to make Europe the world's first climate neutral continent by 2050. In this plan agriculture plays a key role, as shown by *From Farm to Fork Strategy* that aims at a "*fair, healthy and environmentally-friendly food system*" (CE, COM/2019/640 final). More specifically, by 2030, EU aims at a 50% reduction of the use and risk of chemical pesticides, and at least 20% reduction of fertilisers, as well as a 50% reduction of the sales of antimicrobials for farmed animals. In this context, the goal is to expand at 25% European agricultural land under organic farming. Today in Italy nearly 14% of UAA is under organic farming, mostly located in Southern Italy (CREA, 2020). Yet, the area under conversion in the last three years has been reduced by 15%, which is hardly in line with the EU's objective. On the other hand, domestic Italian consumptions for organic food increased by 4.4% only in the first half of 2020, exceeding 3.3 billion of euros (SINAB, 2020). The organic market continues to grow (notably farmers who also process the product) and the Italian sector seems to have absorbed the impact of the pandemic better than the rest of the agri-food system (CREA, 2021).

Krause et Spicka (2017) and Rana et Paul (2017) highlight that consumer purchasing choices are ever more guided by considerations on food quality and safety, as well as on the environmental impact of food production, which is especially true for some age groups and territories. According to CREA (2021), despite a minor increase in the last period, the search for a healthy diet continues to increase the propensity of Italian consumers to buy organic foods, especially white meats, whole foods, and legumes. Furthermore, during the COVID-19 crisis, the purchases of these products in large-scale distribution increased (+11%), which contributed to expanding the market beyond the classic niche sales channels and specialized stores. The purchasing model of organic products is also changing, becoming more frequent and recurrent (SINAB, 2021). According to Furno *et al.* (2021), sector operators should adapt their marketing strategies in the various market segments to these trends.

Taking advantage of this growing market isn't always easy for local producers and the literature highlights various issues of sector development. According to Hanson *et al.* (2004) organic farmers, in addition to the typical risks of agriculture, also face sector-specific risks such as those of transition, soil conservation, crop protection from GMO contamination, as well as increased price volatility. In this regard, Berentsen *et al.* (2012), underline that the production risk of organic cow's milk is greater than in the conventional sector because sales take place in niche markets where prices are volatile, moreover in a context of much lower yield. Furthermore, the fragility of the production system can be amplified by the physical-climatic characteristics of some territories, making uncertain the adequacy of the economic awards for the efforts made (Seufert *et al.*, 2012; Cisilino *et al.*, 2019). Pimentel *et al.* (2005) also underline that, with the same production orientation, the organic method requires a greater amount of work than conventional management. This is accompanied by the need to adopt specific varieties and soil management practices as well as to respect constraints to the use of chemicals that make the daily management of the organic farm completely different from the conventional one (Ponti *et al.*, 2012; Bueren *et al.*, 2011; Bouttes *et al.*, 2019; COM, Reg. n. 889/2008, COM, Reg. n. 1584/2018). To this evidence Crowder and Reganold (2015) contrast the lower operating costs per hectare that would lead organic farms to have greater profits. Still, according to Home *et al.* (2018) the modest increase in the number of organic farms suggests that profit maximization is not enough to push farmers towards this method, but other factors must be considered as those relating to legislation and policy. Besides, according to Abele *et al.* (2007) and Bennett and Franzel (2013) the benefits of selling organic products go largely to intermediaries and traders, while exporting to richer markets is only accessible to larger farms (Tovar *et al.*, 2005) As a result, the difficulty in converting from conventional to organic is considered an important barrier especially for small and medium-sized farms (i.e., almost all Italian farms) and farmers' concerns may outweigh the benefits of embarking on a new management method (Łuczka et Kalinowski, 2020; Kallas *et al.*, 2010; Jouzi *et al.*, 2017). In this context, Willer *et al.* (2017) claim that the lack of information on the economic performance of organic farms, as well as research on key inputs and the challenges that they face, hinder the exploitation of the growing demand for organic products. The possibility of limitations in the use of chemicals in European agriculture makes it even more urgent to frame and analyse the conditions of the economic and financial sustainability of organic farming.

The aim of this work is to explore the issue of financial sustainability of organic farms compared to conventional ones, measuring the liquidity they generate, evaluating its adequacy and identifying the factors that influence its extent. The economic literature shows that the study of cash flows defines the financial constraints of the firm, measuring how much it depends on internal funds. The firm's relationship with these constraints helps to explain its investment decisions, the ability to obtain credit and, therefore, finance the investments (Fazzari *et al.*, 1988; Kaplan and Zingales, 2000; Mulenga and Bhatia, 2017). Several studies agree that defining a firm's financial profile reveals its ability to repay the loans (McNamara *et al.*, 2015) and to support its investment plans when, in case of credit crunch, internal funds remain the main, if not the only, source of financing. Dono *et al.* (2021) show the conditions for Italian agriculture as a whole and for its various production sectors, identifying financial sustainability as the ability to offset the farm production system depreciation with the generated cash flow, as identified by the Free Cash Flow on Equity (FCFE). A result of that study is a dichotomy between specialized Types of Farming (TFs), which largely achieve FCFE/depreciation ratios greater than 1, sometimes even a great deal, and other TFs, largely unspecialized, which generally present values of that ratio below unity. The latter TFs represent a relevant component for employment, production, and agricultural income in Italy, which makes it interesting to further explore the characteristics of this dichotomy. This study deepens that analysis by examining how organic farms fit into the dichotomy between highly and poorly financially sustainable TFs of Italian agriculture.

Specifically, the study uses a constant sample of farms from the Farm Accountancy Data Network (FADN) divided into organic and conventional farms to analyse and compare the achieved financial sustainability condition. This does not require assessing the production efficiency of conventional and organic methods but measuring their cash flow generation as a basis for comparing their financial, structural, and operational conditions. The analysis highlights the position of organic farms in 18 TFs that represent the main productive orientations of Italian agriculture. Then, using the classic elasticity measurements obtained from the regression analysis of Dono *et al.* (2021), the study identifies and compares the influences of structural and economic variables on the production of cash flows in organic and conventional farms. Indications emerge on the differences in financial sustainability and on the factors that influence it in the studied groups.

The next paragraph exposes the materials and methods, first describing the general characteristics of the sample of farms of which it highlights the general representativeness and the weight of the organic farms in it. Then, we describe the sequence of operations to calculate the cash flows and the characteristics of the econometric model that establishes the influence of a group of explanatory variables on those flows. The section on results follows, which first shows the levels of FCFE and the relationships with depreciation distinguishing between the two methods, the single TFs, and three of their clusters: poor, medium and high sustainability. For these various aggregates, the elasticities and their components are then reported as indicators of the influence of the explanatory variables on the generation of cash flow. The discussion and the conclusions sections follow.

1. Materials and methods

1.1. *General characteristics of the sample of farms*

We analyse the financial sustainability of Italian organic farms based on the constant sample of FADN data used by Dono *et al.* (2021). The FADN was established by the Reg. 79/65/EEC, updated by Reg. CE 1217/2009, and annually collects technical and economic data of a large farms sample following a similar approach in the European Union countries. The more than 86,000 FADN farms represent nearly 5 million farms in the EU, 90% of the Utilized Agricultural Area (UAA) and 90% of Standard Production. Currently the Italian sample is based on about 11,000 farms and covers more than 90% of the UAA, Standard Production, Work forces and Livestock Units. About 1,000 variables are recorded for each farm in the sample, more than 2,500 for the Italian FADN. The FADN sample only includes professional and market-oriented farms and is stratified by region, economic size class and Types of Farming according to Reg. CE n. 1242/2008, henceforth TF. The farms are assigned to a specific TF based on the prevalence of the standard productions of cultivation and livestock rearing conducted in a year. The TFs are divided into 3 levels with progressive ramifications: 8 classes of general basic TFs[1]; 21 branches of principal TFs; 61 further particular TFs.

Based on these data, Dono *et al.* (2021) obtain three years of financial statements (2014-2016) for a constant FADN sample consisting of 4,612 Italian farms, for a total of 13,836 observations. FADN classifies as organic also farms in conversion: these include farms that already carry out activities in organic and are extending this method to their other activities (63 observations in the sample), as well as farms that are converting exclusively from conventional (21 observations)[2]. The issue of conversion to organic should be evaluated on this second type. Yet, the low number of observations in the sample prevented a large development of this analysis. Table 1 shows the relative weight of conventional and organic farms, including farms in conversion, for important production and income variables. Organic farms are 13.1% of the total (1,812 observations) and represent 14.1% of the UAA and 12.2% of the Gross Capital. They also produce 10.8% of operating income and represent 11.5% of family farm work.

1. Specialist field crops, Specialist horticulture, Specialist Permanent Crops, Specialist Grazing Livestock, Specialist granivores, Mixed Cropping, Mixed Livestock, Mixed crops Livestock.

2. FADN also defines as organic conventional farms whose production is only partially organic. Yet, for every farm, it provides details about products and certifications, and this allowed us to identify farms whose certification is defined as "mixed (organic processes mixed with conventional processes)" and/or whose products are defined as derived "from land under organic conversion".

Table 1 - Operating Income, Gross Capital, Family Work Forces, UAA and Farms as percentage on total sample for Conventional and Organic farms

	Operating income	Gross capital	Family work forces	UAA	Number of farms
Conventional	89.2	87.8	88.5	85.9	86.9
Organic	10.8	12.2	11.5	14.1	13.1

Source: FADN data (our elaboration).

1.2. *The calculation of cash flows*

Table 2 shows how the various farm activities generate cash flows. These are obtained by starting to subtract the tax component from the Operating Income, then by adding depreciation, provisions for severance pay and for risks and other expenses. The *variation of net working capital*, as made up of operating receivables with customers and operating payables with suppliers is then added. The same is done with *investments*, obtained as increase of inventories net of their depreciation, to generate the *Cash Flow From Operations*. FCFE is calculated by adding to the latter the balance of relations with the farm's financiers: where paying interest and principal on debts falling due in the year reduces liquidity, while obtaining new loans increases it. Public aid from the second pillar of the CAP and other national measures also increase liquidity, as well as revenue from other current accounts or other income, such as financial assets or divestments. Paying fines and repaying other loans reduces liquidity. This sequence generates a monetary liquidity variable that still includes payments to work, and the capital resources provided by the farmer: it plays a central role in the analysis and has been called CAFFE (*Free Cash Flow to Equity + Farm Family Earnings*). The final cash flow is obtained by subtracting cash withdrawals to pay for the farmer's resources: Dono *et al*. (2021) estimated these *Farm Family Earnings* at opportunity cost values and deducted from CAFFE to obtain the *Free Cash Flow to Equity* (FCFE). Yet, this is an approximation since the farmer does not necessarily collect opportunity cost payments for the resources provided as, moreover, it also happens in the case of the distribution of corporate dividends (Chay & Suh, 2009).

Table 2 - FCFE Calculation: formulas and FADN Databases (FDB) used

Income and cash flow items	FDB	NOTE
Operating income		
– Taxes	IS	
+ Depreciation		
+ Other provisions	BS	Δ (employee leaving indemnity fund + other funds)
± Δ Net working capital	BS	Δ (debts + credits + product stock + raw materials stocks)
– Investments		
Cash Flow From Operations (CAFFO)		
± Principal portion	BS	Δ medium/long term debt
– Interest portion		
+ Public aid	IS	EU second pillar aid and other national aid
+ Other receipts		
Free Cash Flow + Compensation to Farmer resources (CAFFE)		
– Payment to capital	BS	% of net capital
– Compensation to managerial work	IS	% of gross marketable output
– Compensation to manual labor	Lab	hourly wages for hours of family work
Free Cash Flow to Equity (FCFE)		

(IS) = Income Statement; (BS) = Balance Sheet; (Lab) = Labor file; D = variation over the year.

Financial sustainability is achieved when FCFE is greater than the depreciation of productive capital, even by a margin that can also repay a debt service provided at a subsidized rate. This indicator can be traced back to the financial analysis of the debt of the company that Bonazzi and Iotti apply to the tomato processing industry, aquaculture, and dairy cattle breeding in Italy (Bonazzi and Iotti, 2014a, 2014b, 2015a, 2015b; Iotti and Bonazzi, 2015). These authors calculate the financial sustainability of investment debt by relating its cost to the cash flows generated by various level of the operating activities[3]. Obviously, these indicators can be calculated only in relation to specific investment programs that are in place only in a part of the FADN farms. To carry out a general financial sustainability analysis for all farms, Dono *et al.* (2021) assess whether the final monetary liquidity surplus given by FCFE is sufficient to balance the residual implicit costs, i.e., the depreciation of technologies and provisions for risks or other funds. The index does not check whether the farms will reproduce the

3. Bonazzi and Iotti (2014b) consider, among others, the Operating Cash Flow, and the Unlevered Free Cash Flow, which subtracts the investment and adds the divestment to the former.

initial capital or not. Depreciation, in fact, is calculated at historical cost, which in the case of old plants can make the current restoration cost even very different from that associated with depreciation. Furthermore, new market, policy support and production technology conditions may not induce farmers to restore the original system. Thus, the index verifies a minimum sustainability condition, defined as weak, which reveals whether farms are generating additional cash flows at the same rate at which their technological system depreciates. Moreover, unlike the economic valuation indices, its financial components allow it to also embody the investment efforts of farms, as well as their commercial and financial relationships. Dono *et al.* (2021) calculate the index for the whole sample and for 18 TFs that aggregate the original particular FADN TFs. Table 3 shows the values of the indices and the percentage weights of the various TFs. For the purposes of our analysis, the TFs are divided into three clusters based on their financial sustainability condition.

Table 3 - TFs and clusters of TFs with percentage on total sample

Cluster	**TFs**	**% on total sample**	**FCFE/ Depreciation**
Poor general sustainability	Mixed Crops and Livestock	3.23	–0.08
	Extensive Beef Cattle	5.98	0.10
	Mixed Crops	6.07	0.38
	Mixed Fruits	10.78	0.80
	Arable Crops	21.96	0.82
	Sheep	5.20	0.87
	Dairy Cattle	8.74	1.15
Medium general sustainability	Vineyards	12.16	1.19
	Mixed Livestock	2.15	1.42
	Greenhouse Vegetables	0.91	1.44
	Olive Growing	3.84	2.08
High general sustainability	Swine	1.82	2.42
	Other	6.14	2.65
	Poultry	2.43	3.90
	Citrus Fruits	1.60	4.12
	Open Field Vegetables	4.51	4.48
	Fruits in Shell	0.82	6.86
	Intensive Beef Cattle	1.65	7.08
Total		**100.00**	**1.57**

Source: FADN data (our elaboration).

Specifically, the *poor general sustainability* cluster has index values below 1.15 and coincides with the area of financial difficulty identified by Dono *et al*. (2021). This cluster includes major specialized TFs, such as *dairy cattle*, which are in a border condition, *sheep*, and *arable crops*; however, most of these TFs are extensive and unspecialized. The *medium general sustainability* cluster has index values between the 1.15 and 2.10: it includes TFs specialized in activities that are very typical of Italian agriculture, such as *vineyards*, *greenhouses* and *olive growing*. The *high general sustainability* cluster has index values exceeding 2.10 and includes TFs of high income and peculiar production conditions, such as *fruits in shell*, *intensive beef cattle*, *poultry*. The adjective general of these definitions refers to the condition of the clusters for the whole of Italian agriculture: in the following it will be deleted since the specific condition of organic farms and the rest of agriculture do not always correspond.

1.3. *Econometric estimate of the formation of cash flows in Italian farms*

The econometric analysis to identify the variables that contribute the most to generating cash flows was based on three types of regressors, reported in Table 4.

Table 4 - Variables used in the econometric model

	Structural variables	
Farmland	Value of owned land	} at the beginning of the year
Inventories	Value of stocks of productive factors and products	
Depreciable	Value of depreciable capitals land	
	Variables composing the Cash Flow	
Investments	Increase in the value of the capital net of depreciation	at the end of the year
CAP I	EU first pillar aid	from the total farm revenues
CAP II	EU second pillar aid and other national aid	from extra-characteristic management
Δ Working Capital Change	Δ (debts + credits + product stock + raw materials stocks)	end - beginning of the year difference
	Farm results variables	
ROI	Efficiency index computed at the same opportunity cost used for FCFE	
Price Advantage	Difference in the prices of the farm over territorial average	From implicit prices of products
Yield advantage	Difference in the yields of the farm over territorial average	From products yields

The first group indicates the influences of the structural endowments of farms, defined as values of owned *farmland*, *inventories*, and *depreciable* assets. Then there is the group of variables that directly constitute the cash flow, namely: annual *investment* value, *CAP I* and *CAP II* payments; changes in operating working capital (ΔWCC). Finally, there are the variables relating to the level of efficiency of the farm and some of its market and production results, namely: the Return on Investment without CAP first pillar aid (*ROI*)[4]; *price advantage* is the difference in Gross Marketable Output (GMO) of each farm at the observed implicit prices of its products, and at the arithmetic mean of these prices in the geographic area where the farm operates; *yield advantage* is the difference in GMO of each farm at the observed yields of its products, and at the arithmetic mean of these yields in the geographic and altimetric area where the farm operates[5]. All these variables were divided by the family work units available in the farm to consider that in most Italian farms, classified as single or simple company, business and entrepreneur are identified. This causes the productive and reproductive spheres to overlap, placing the business risks precisely on the family, that is, on the farmer and his family assistants (Corsi and Salvioni, 2012; Davidova and Thomson, 2014). Hence, it seemed relevant to assess the generation of cash flows with respect to the work provided by the farm family. Later we will keep the names listed above also for the variables obtained with this standardization.

The influence of these variables on CAFFE were represented with a quadratic functional form which, with its typical curvature, fits the data with flexibility and allows non-linear relationships, in which the effect of an explanatory variable depends on the values it assumes. Specifically, the quadratic term allows representing the curvature of the function, which denotes the weakening or intensification of the influence of the explanatory

4. ROI is an indicator of farm efficiency based on Operating Income, which reflects the effect of managing operational activities. Instead, ROE includes the income from extra-typical activities, that in agriculture do not depend on farmer decisions, i.e., taxation (Fontana, 2017) or depend on long-term decisions (interest or contributions for investments). Like FCFE, ROI calculation uses opportunity cost compensations for the labour resources of the farmer and his family.

5. The arithmetic averages of the implicit prices of the various farms are calculated on North, Centre, and South macro-areas (arithmetic average of the implicit prices of tomatoes in Southern farms). The implicit price of meat derives from the ratio between the gross profit of the stable and the number of animals of the farm. For the other animal products, the gross saleable production (GSP) and the quantities of milk (cattle, buffaloes, sheep, goats), or GSP and the number of animals (chickens, bees) are reported. Altimetry is also considered for average yields, with Mountains, Hills, and Plains (arithmetic average of tomato yields in the farms in the southern plain). For meat, eggs, and honey it was not possible to calculate the average yield and only the saleable production at the observed yields was considered. As with implicit prices, the average yield value is an arithmetic average of the values of individual farms.

variable. The existence of the misspecification due to *endogeneity* was verified with the Hausman test and consequently corrected. The model estimates of the coefficients were used to calculate the classic elasticity indicator that represents CAFFE's response to each regressor in the analysis. For the generic regressor $\boldsymbol{x}$ this indicator is expressed as:

$$\boldsymbol{\varepsilon_{\bar{x}}} = \frac{\Delta\%\, \boldsymbol{CAFFE}}{\Delta\%\, \boldsymbol{x}} = \frac{\Delta \boldsymbol{CAFFE}/\overline{\boldsymbol{CAFFE}}}{\Delta \boldsymbol{x}/\bar{\boldsymbol{x}}} = \frac{\Delta \boldsymbol{CAFFE}}{\Delta \boldsymbol{x}} \cdot \frac{\bar{\boldsymbol{x}}}{\overline{\boldsymbol{CAFFE}}}$$

The elasticity, i.e., the reactivity of CAFFE to the various regressors, is made up of two components. First, the slope of the function indicates the ability to generate CAFFE by varying the endowments of the capitals, the farm efficiency level, the price, and yield advantages. For the variables that flow into CAFFE, it identifies the net share of the regressor that becomes cash flow. Second, the ratios of the regressors values on CAFFE indicates the relative importance of the regressor or, equally, the ability to produce CAFFE with the equipment or levels assumed. The elasticity, the slope of the tangent and the weight of the regressors on CAFFE are calculated at the mean value of the variables.

2. Results

2.1. *General conditions of sustainability*

Table 5 presents for each TF and their aggregates: the percentage of organic and conventional farms; the cash flow value per unit of family work; the value of the financial sustainability index (F/D = FCFE/depreciation). The value of F/D of the entire sample is 1.57, indicating that, on average, FCFE balances capital depreciation and generates a surplus of liquidity to pay any financial charges of the reconstitution. Table 5 shows that F/D is 2.10 in organic farms and 1.50 in conventional. The data also show that the various TFs and their clusters present different positions of organic farms, even opposite to those in conventional. Let's see the situation for the three clusters.

The *poor sustainability* cluster represents 62.0% of the sample (Table 3) and organic farms make up 12.4% of it (Table 5). The sustainability condition is favourable for organic farms (1.66), poor for conventional ones (0.66). The former group generates more liquidity than the latter, which applies also to the various TFs, excluding *dairy cattle*. Similarly, the index is greater than 1 in most of the TFs in organic farming, while it is lower than 1, and with negative values, for most of the conventional ones. Exceptions are *sheep*,

Table 5 - Percentage on total sample, of Organic (O) and Conventional (C) farms, FCFE and FCFE/Depreciation for TFs and their clusters

	% on TF		**FCFE**		**F/D**	
	O	**C**	**O**	**C**	**O**	**C**
Mixed Crops and Livestock	11.9	88.1	42,100	–6,519	2.75	–0.75
Extensive Beef Cattle	17.0	83.0	10,455	–1,098	1.23	–0.13
Mixed Crops	16.2	83.8	16,268	195	1.71	0.03
Mixed Fruits	17.2	82.8	19,540	3,052	3.25	0.40
Arable Crops	7.5	92.5	21,711	5,278	2.71	0.66
Sheep	23.2	76.8	13,498	7,083	0.94	0.83
Dairy Cattle	6.4	93.6	–2,364	26,573	–0.11	1.24
Vineyards	9.4	90.6	16,627	8,605	1.46	1.14
Mixed Livestock	10.8	89.2	106,810	2,398	9.28	0.26
Greenhouses Vegetables	7.1	92.9	34,004	17,482	1.67	1.41
Olive Growing	49.9	50.1	11,516	10,086	2.49	1.75
Swine	1.2	98.8	34,723	82,789	5.91	2.41
Other	5.8	94.2	19,800	15,316	1.81	2.75
Poultry	6.3	93.8	8,837	62,303	0.81	4.04
Citrus Fruits	55.4	44.6	33,187	10,517	5.24	2.24
Open Field Vegetables	9.0	91.0	22,000	44,940	1.72	4.86
Fruits in Shell	20.2	79.8	82,256	23,238	9.12	5.61
Intensive Beef Cattle	7.0	93.0	–5,713	143,296	–0.47	7.44
Poor Sustainability	12.4	86.9	16,963	6,575	1.66	0.66
Medium sustainability	17.6	80.4	20,265	8,508	2.63	1.09
High Sustainability	11.1	93.3	28,778	47,795	3.12	3.98
Total	**13.1**	**86.9**	**19,703**	**14,927**	**2.10**	**1.50**

Source: FADN data (our elaboration).

which show similar results in both methods (0.94 vs 0.83) and *dairy cattle*, whose conventional farms show the best result of the group, while organic farms have the worst result (–0.11 vs 1.24).

The *medium sustainability* group constitutes 19.1% of the sample and has a higher percentage of organic farms (17.6%), which generate considerable liquidity and reach a high level of sustainability. Moreover, organic farms show better results than conventional ones in all TFs, with the excellent performance of *mixed livestock* (9.28).

The *high sustainability* group represents 19.0% of the sample and organic farms are a clear minority of it (11.1%). The organic farms results are better than the results showed by the previous clusters, even if this is the only group where conventional farms are more sustainable than organic ones. Indeed, the absolute value of FCFE in organic is lower especially for *poultry* (0.81 vs. 4.04) and *intensive beef cattle* (–0.47 vs. 7.44), that are unsustainable in organic but show high index values in conventional. Conversely, organic farms show their highest sustainability in *fruit in shell* (9.12 vs 5.61) and *citrus fruits* (5.24 vs. 2.24)[6].

2.2. *Elasticity*

The elasticities of CAFFE reflect the influence of the regressors on the ability of the farms to generate cash flows, which depends on the slope of the function and on the weight of the variable over CAFFE. Table 6 reports the average elasticities for the various clusters of the organic and conventional farms. The values are shown by type of regressor: structural features of the farms (*farmland, inventories, depreciable*), cash flow elements (*Investments, CAP I, CAP II, ΔWCC*), economic and productive results (*ROI, price advantage, yield advantage*).

Table 6 - Average elasticities for Total Sample and for groups of TFs

TFs	Farm-land	Invento-ries	Depre-ciable	Invest-ments	CAP I	CAP II	ΔWCC	ROI	Price Advan-tage	Yield Advan-tage
Poor	0.72	0.14	0.002	–0.19	0.17	0.08	0.19	–0.11	–0.07	–0.02
Medium	0.81	0.18	0.003	–0.42	0.26	0.14	0.00	–0.30	–0.01	–0.02
High	0.71	0.09	0.001	–0.16	0.14	0.14	–0.05	–0.15	–0.08	–0.36
Organic	**0.74**	**0.14**	**0.002**	**–0.23**	**0.19**	**0.10**	**0.12**	**–0.15**	**–0.06**	**–0.06**
Poor	1.19	0.21	0.004	–0.49	0.29	0.07	0.02	–0.32	–0.05	–0.01
Medium	1.01	0.42	0.002	–0.44	0.12	0.05	–0.03	–0.23	–0.04	–0.02
High	0.37	0.30	0.002	–0.14	0.11	0.02	0.00	–0.05	–0.23	–0.15
Conventional	**0.88**	**0.30**	**0.003**	**–0.36**	**0.20**	**0.05**	**0.01**	**–0.21**	**–0.11**	**–0.06**
Total	**0.85**	**0.27**	**0.002**	**–0.33**	**0.20**	**0.06**	**0.03**	**–0.20**	**–0.10**	**–0.06**

Source: FADN data (our elaboration).

Table A1 in the Appendix reports the elasticity to regressors for all the TFs and the clusters. Table A2 reports the slope of the function, indicating how much of the variable converts into cash flow at the average values. Table A3 reports the weight of the regressor, indicating its relative

6. Also, *swine* shows excellent results both in organic and in conventional (5.91 vs. 2.41) but with a very small number of observations for organic farms.

importance on CAFFE; its reciprocal indicates the ability, or productivity, of the regressor in generating cash flow.

2.2.1. Structural variables

For both organic and conventional methods, the regressor with the higher elasticity, and impact, on cash flow is *farmland* (Table 6), due to the high incidence of this endowment on CAFFE (Table A3). Conventional farms are more responsive to changes in *farmland* due to the greater weight of the regressor. The reciprocal of the ratio also indicates that these farms produce less CAFFE per unit of the resource. Organic farms, instead, produce more CAFFE per unit of *farmland*, which makes them less responsive to its variations. This productivity gap of farmland between organic and conventional is accentuated in the clusters with *poor* and *medium sustainability*, especially in the TFs *arable crops*, *mixed fruit*, *mixed crops*. The situation is opposite in highly sustainable cluster, where organic farms require more land than conventional ones to produce one unit of CAFFE. The slope of the function is similar in the two groups, and this indicates that about one-tenth of the variation in farmland results in a variation in CAFFE (Table A2).

Inventories elasticity is lower than for *farmland*, especially due to the lower weight of the endowment of this capital on CAFFE. Then, in organic farms this weight is less than in conventional ones, which further reduces its elasticity (Table A3)[7]. This lower weight is found for all organic clusters: it indicates a higher average productivity of *inventories* in terms of CAFFE, marked for high sustainability TFs. Again, the slope of the function is the same for the two methods and indicates that more than 40% of the change in this asset endowment translates into a change in CAFFE. The value of the slope reveals that varying the *inventories* endowment modifies the value of CAFFE more consistently than a similar variation in *farmland* (Table A2).

Depreciable elasticities of the three groups are also similar. Their low value depends on the very low slope of the function, indicating that less than 2‰ of the variation in the asset results in a variation of CAFFE (Table A2). On the other hand, the endowment of this asset per unit of CAFFE is higher than that of *inventories*. Yet, the comparison between the two methods shows that the endowment of this capital per unit of CAFFE is lower in organic farms, i.e., the average productivity of this capital is higher in organic than in conventional farms (Table A3). Exceptions are *dairy cattle*

7. Inventories average value for organic *Swine* and *Fruits in Shell* is equal to zero, thus their elasticities are not available.

and *greenhouse vegetables*, whose high endowment of *depreciable* makes the relative elasticity of organic TFs up to ten times higher than the average and conventional ones, even if always very low (Table A1).

2.2.2. Cash Flow Composition Variables

Investments subtract value from the cash flow, which makes negative the sign of the elasticity. The differences in elasticity depend on the size of *investments* on CAFFE: the greater their weight, the greater the sensitivity to their variation, as happens in the TFs with *medium sustainability* of both methods[8]. The weight of this variable on CAFFE is lower in organic farms than in conventional ones, which indicates that the former require greater availability of cash flow to activate their investments. This difference is essentially due to the large weight gap in *poor sustainability* cluster. On the other hand, the slope of the function is not different amongst TFs and production methods: its value (–0.91) indicates that a variation of investments is transmitted 90% to the cash flow of the year.

CAP I elasticity is higher for conventional TFs with *poor sustainability* and organic TFs with *medium sustainability*. The slopes of the function are similar (0.65), indicating that about 65% of the payment translates into CAFFE. Exceptions are *mixed crops and livestock* in organic farming, whose slope reaches 0.76 (Table A2)[9]. The high incidence of *CAP I* in the many *arable crop* farms in conventional and *olive growing* in organic, increases the elasticity of the clusters they belong (*poor sustainability* and *medium sustainability*). Conversely, the low incidence of *CAP I* in conventional *vineyard* reduces its elasticity. The weight of *CAP II* on CAFFE is also dominant in differencing reactivity, since the slope of the function is analogous in all TFs and with respect to *CAP I.* These payments concern specific measures for organic farming, and this increases the incidence and elasticity in these farms, especially in TFs with *medium* and *high sustainability.* Exceptions are *mixed crops and livestock* and *greenhouse vegetables,* where these payments are less relevant or completely absent in organic farms.

Organic farms also show a higher Δ*WCC* elasticity. The average figure reflects differences in value and sign of elasticity, with TFs where the relationship with the market leads to a liquidity loss and others with the

8. The case of organic *mixed livestock* is interesting because of the high elasticity due to higher investments in relation to CAFFE (Table A1).

9. In that case, the limited weight of CAP I on CAFFE keeps the elasticity value low (Table A3).

opposite result. The elasticity in the organic cluster with *poor sustainability* is positive and relatively high, for a favourable relationship with the market due to the high absolute value of the variable (not reported) and of its weight on CAFFE (Table A3). The conventional cluster with *high sustainability* shows a similar condition, mainly due to *intensive beef cattle*. All the other groups have a negative balance of the relationships with customers and suppliers. It is interesting to note that the slope of Δ*WCC* is greater than for *CAP I* and *CAP II*, that is the increase of this variable has a greater ability to generate CAFFE (Table A2). Furthermore, it should be noted that the average incidence of this variable on CAFFE in organic TFs is like that of *CAP II* (0.17 vs 0.15 - Tab. A3), while it reaches the levels of *CAP I* in the organic cluster with *poor sustainability* (0.26 vs 0.27 - Table A3).

2.2.3. Economic and productive results variables

ROI elasticity shows the influence of changes in efficiency: the variable is calculated net of CAP I payments. This subtraction makes negative the sign of *ROI* and of its elasticity; yet efficiency gains increase CAFFE, which requires assessing that elasticity based on its absolute value. In this sense, most of the TFs in the *poor sustainability* cluster have lower elasticity in organic than in conventional due to a smaller incidence of ROI on CAFFE (Table A3)[10]. In the other two clusters the situation is opposite and organic farms are more responsive than conventional to increases of efficiency. Most of the sensitivity of the *medium sustainability* cluster is due to the high inefficiency, consequently the high incidence of *ROI* on CAFFE, in organic *greenhouse vegetable*s (Table A3). The organic farms of the *high sustainability* cluster show more sensitivity to changes in efficiency, mainly for reactivity of *poultry, citrus fruits,* and *intensive beef cattle*.

The prices obtained and the yields achieved by most farms are lower than the average values of the areas in which they operate. This makes the losses of Gross Marketable Production (GMO) prevail and gives a negative sign to *price* and *yield advantages* elasticities. Even in these cases the slope of the function indicates that CAFFE grows as the *advantages* grow, that is, as *disadvantages* decrease. This requires evaluating the current situation based on the absolute value of those elasticities. *Price (dis)advantage* elasticity is lower in organic farms where the impact of GMO loss on CAFFE is lower than in conventional TFs. This is due to the condition of *medium* and *high sustainability* clusters. The organic cluster with *poor sustainability* has

10. The ratio of *ROI* over CAFFE in Table A3 is multiplied by 1,000,000 to better show the differences between the TFs.

instead a higher weight of *price (dis)advantage*, therefore, of the elasticity: this is mostly due to the large *price (dis)advantage* in the mixed TFs (Table A3)[11]. *Yield (dis)advantage* elasticity is the same for two methods. Greater differences are found in the organic TFs of the *high sustainability* cluster where, above all, in *other* and in *open field vegetables* the lower yields determine large losses of GMO in absolute value and in relation to CAFFE (Table A3). The slope of the function indicates that changing the *yield (dis) advantage* has a greater impact (0.20) than changing the *price (dis)advantage* (0.14); moreover, without differences between organic and conventional farms (Table A2).

3. Discussions

3.1. *General conditions of sustainability*

Organic farms represent 13.1% of the FADN sample analysed in this paper; their relevance is greater in some TFs, up to about 50% in *citrus* farms, and only a few TFs show a percentage value far from Italian agriculture real composition. The FCFE value indicates that organic farms generate more liquidity per unit of labour and compensate for capital depreciation more than conventional ones. This result find feedback in Mohamad *et al.* (2014) and in Brožová et Beranova (2017). Other authors obtain similar results comparing organic farms to conventional ones although, mainly, for economic profitability variables (Sgroi *et al.*, 2015a, 2015b; Acs *et al.*, 2007; Tudisca *et al.*, 2014; Hampl, 2020). Sorting the TFs of the two methods into three clusters allows a clear dichotomy to emerge. TFs with *poor sustainability* show good results only under organic farming. On the contrary, when engaged in the activities of this cluster, conventional farms generally fail to compensate for the depreciation of capital. In other words, in the segments of Italian agriculture that show greater difficulty in balancing capital depreciation with cash flow (62% of the FADN sample), farms that adopt the organic method are on average financially viable. The *high sustainability* cluster (19% of the FADN sample) is in the most favourable condition, and here the conventional farms obtain the best results. Organic farms are in a clear minority (11%) in this cluster and in some TFs do not compensate for the depreciation of the capital. This result confirms the findings of Pietola et Lansink (2001), i.e., that farms who require intensive processes, including labour, only convert to organic farming if they already have larger

11. Conversely, *open field vegetables* show a greater weight of this GMO loss on CAFFE, which makes *organic* farms more sensitive than *conventional* ones.

endowments of land, available only to a minority of farms. Furthermore, Pietola et Lansink (2001) and Bonfiglio et Arzeni (2019) highlight the impact of organic constraints and conclude that, because of them, farms in intensive sectors tend not to convert to this method. Also, Gillespie and Nehring (2013) affirm that organic cow-calf farms, *Intensive Beef Cattle* in this work, show higher fixed expenses and that they could only cover them by having greater returns than if the farm had been conventional. The *medium sustainability* cluster includes many TFs typical of Italian agriculture: here organic farms are more sustainable and generate more cash flow than conventional ones. This confirms the results of Sgroi *et al.* (2015a), Mohamad *et al.* (2014), Raimondo *et al.* (2021) about the *olive growing* sector, which in our study falls into this cluster.

3.2. *Influence of Factors Determining Elasticity*

These results can be associated with the elasticity values of the various TFs for: structural variables, variables composing the cash flow, and variables representing economic and productive results.

3.2.1. Influence of Structural Variables

Farms of both methods are more responsive to *farmland*, however, the reactivity in organic farms is lower, suggesting that those farms are closer to a better-balanced endowment than conventional. The gap is greater in *poor* and *medium sustainability* clusters, whose organic farms produce more CAFFE per unit of farmland than conventional farms. The opposite occurs in the *high sustainability* cluster, where policy constraints to organic farming require higher *farmland* endowments to produce CAFFE, and the high elasticity indicates that those farms are very sensitive to scale up. Organic farms also produce more CAFFE per *inventories* unit, which reduces the endowment of this capital compared to conventional farms. Especially in *highly sustainable* cluster, this makes organic farms less sensitive to this regressor, while conventional farms require greater stocks, also due to a greater number of cattle for the restock. The two regressors in the two production methods have similar function slope, indicating that 10% of a *farmland* endowment variation is transferred in producing CAFFE, while 40% is transferred for *inventories* variation.

Some analysis on the impact of various assets endowment on efficiency come to diverse conclusions. According to Madau (2007) land in arable farms has a greater impact in organic than in conventional. Cisilino et Madau

(2007) examine all organic farms in the FADN network and come to similar conclusions on the greater importance of scale in organic compared to conventional farms. According to Flubacher *et al.* (2015), the most important factors in organic dairy farms are costs and depreciable capital endowments. Gillespie *et al.* (2008) agree on the relevance of production size and its growth for organic dairy farms, which, in our sample, have greater *farmland* and *inventories* elasticities than the conventional ones.

Finally, the low elasticity of *depreciable* is due to the negligible slope of the function and not to its weight on CAFFE, which, indeed, is greater than the relevance of *inventories*. In other words, while assuming an appreciable weight over FCFE, these investments fail to increase CAFFE. In accordance with the conclusions of Dono *et al.* (2021) and Pingali (2012) it can be assumed that even organic farms find it difficult to take full advantage of the new technologies, most IoT, embedded in the most innovative and expensive capital. Raimondo *et al.* (2021) come to a different conclusion attributing considerable importance to the depreciable capital equipment for the technical efficiency of organic *olive growing* farms. These farms are among the most equipped with these capitals in our study as well, although less than in conventional and always with low levels of elasticity compared to them. Ultimately, our study shows that organic farms generate much more cash flows from the use of these three types of capital than conventional ones do. It should also be said, however, that organic farms are more endowed with these types of capital than conventional farms; and that this is especially true in the *poor and medium sustainability* clusters.

3.2.2. Influence of the variables that contribute to compose the cash flow

CAFFE's responsiveness to *investments* is generally low, and in conventional TFs it is higher than in organic TFs: thus, the latter invest a smaller portion of the generated liquidity or, conversely, require more liquidity to generate the same amount of investment. This is true in the cluster with *poor* and *medium sustainability*, while in *high sustainability* cluster it is the opposite and organic farms show a greater propensity to invest CAFFE. Finally, *investments* subtract 91% of their amount, i.e., 9% of their value returns to CAFFE. This raises the question of how much these cash flow returns are due to productivity gains related to the renewal or expansion of capital endowments or simply to the refunds of public support, which, moreover, with the RDP measures returns more than 9%, even if not to all farms.

CAP I and *CAP II* payments have a different impact and weight on organic and conventional farms. The slope of the function, i.e., the part of the payments that converts to CAFFE and, conversely, the farm costs of the policy, is similar in the two methods. This suggests that organic farms do not cope more easily with the payments conditionality, suffering appreciable burdens even to fulfil the green or environmental commitments of the policy[12]. Krause et Spicka (2017) note that organic farms are more dependent on payments; Lakner et Breustedt (2017) also highlight their great influence over production decisions. Sgroi *et al.* (2015b), Brožová et Beranova (2017) and Mohamad *et al.* (2014) conclude that, on equal terms, the financial situation of organic farms could get much worse without the liquidity contribution of public payments. They estimate that the price of their products, which is already higher, would have to increase by 35% to compensate for the subtraction. Our analysis shows that payments are higher for organic farms but in average result in higher liquidity, mostly in the clusters with *poor* and *high sustainability*. On the other hand, the relevance of *CAP I* and *CAP II* on CAFFE is different fort the two methods: the former affects more conventional farms; the latter includes specific aids for organic farms and affects more their CAFFE generation.

A significant difference between organic and conventional farms concerns the impact of Δ*WCC*. The balance of market relationships with customers and suppliers increases the liquidity of organic farms that are more sensible to its variation. This is especially true for the cluster with *poor sustainability* where the weight Δ*WCC* on CAFFE is 0.26, versus 0.27 of CAP I and 0.11 of CAP II. On the other hand, the Δ*WCC* elasticity in this cluster is even greater than *CAP I* and *CAP II* ones, indicating that for this group of TFs, and especially for the mixed typologies, improving the balance of relationships with customers and suppliers increases liquidity more than an analogous increase in those public aid. This balance indicates the willingness of the system to grant credit to organic farms, immediately paying for the purchased goods and willing to wait longer for the balance of the production factors' bills. The similarity between the advantage constituted by this credit and that due to public payments suggests that it may be interesting to investigate the joint effect of these variables. In other words, to evaluate how much the credit granted to the sector is due to the climate of confidence in it, and how much it is related to the injection of liquidity that is attributed to public support.

3.2.3. Influence of economic and productive results variables

Organic farms are less efficient than the others, but they are also less responsive to a change in *ROI*, given its lower incidence in determining

12. *Mixed crops and livestock* are a relevant exception with lower costs for policy conditionalities in organic farming.

the value of CAFFE. This mainly reflects the condition of mixed TFs. In contrast, in the *high sustainability* cluster, *ROI* affects CAFFE more, which makes organic farms relatively more sensitive to changes in efficiency[13]. Ultimately, a cluster-level comparison does not reveal a specularity between the responsiveness to changes in *ROI* and to changes in *CAP I* and *CAP II* aid. In other words, there is no indication that lesser (greater) reactivity to changes in *ROI* is accompanied by greater (lesser) reactivity to public aid.

For the great part of farms, and their production GMO, losses prevail due to lower-than-average prices and yields. Organic farms were expected to obtain product yields lower than the arithmetic average of the areas in which they operate. It was less obvious that even a prominent part in organic production receives prices below the average of the areas in which farms operate, an average which includes the conventional prices. Still, the greater CAFFE production of organic farms mitigates the impact of the GMOs loss compared to conventional farms and also reduces the *price (dis) advantage* elasticity. However, the impact increases in organic cluster with *high sustainability* due to the higher weight of this (dis)advantage. The same applies to the *yield (dis)advantage*, whose responsiveness increases in the same cluster. Finally, the slopes of the function indicate that, for both organic and conventional farms, it is cheaper to increase CAFFE by reducing the GMO loss due to the yield disadvantage than to operate to reduce the loss due to the price disadvantage.

About price conditions, Acs *et al.* (2009) underline that the prices of organic products are more volatile than conventional ones because the substitutability of organic products with the former is greater than the opposite. Therefore, the policy support to convert should be higher to cover the market risk. Pietola and Lansink (2001) highlight the key role of prices and yields and policy support both in the decision to convert to organic and in the economic and financial performance of organic farms. Many authors stress the relevance of the combination of these three factors, where the higher prices obtained by organic products in the market should compensate for the lower yields (Sgroi *et al.*, 2015a, 2015b; Flubacher *et al.*, 2015; Acs *et al.*, 2007; Mohamad *et al.*, 2014; Tudisca *et al.*, 2014; Pimentel *et al.*, 2005; Offerman and Nieberg, 2000). Various authors claim that this is not always the case, especially for livestock products and some vegetables, as well as under specific soil conditions (Seufert *et al.*, 2012; Krause et Spicka, 2017; Berentsen *et al.*, 2012; Hafla *et al.*, 2013 Krause et Machek, 2017). Finally, Abele *et al.* (2007) and Bennett and Franzel (2013) point out that the benefits of selling organic products largely go to traders and middlemen and

13. Interestingly *poultry* farms are more efficient and responsive under organic than in conventional.

not to farmers. Our results seem to support the latter conclusion when they highlight that, even in the organic cluster with highly sustainable TF, there is a significant price disadvantage. In other words, most organic farms receive prices for their products that are lower than the average for the geographic areas in which they operate.

4. Conclusions

The analysis shows that financial sustainability is, on average, greater for organic than conventional TFs, and in several cases the level reached by the former is very high. This applies to all clusters analysed. An interesting result concerns the cluster defined as *poor sustainability* based on the general situation of its TFs in our sample. Most of the conventional TFs, which represent an important part of the farms in our sample, are far from the financial sustainability condition that we are considering, while the organic TFs achieve it, even with large margins. Approaching to organic farming can thus increase the financial sustainability of many farms that operate in this cluster and that have more difficulty in adopting the specialization and technological adaptation solutions of the so-called *agriculture 4.0*. The organic conduction also prevails in the *medium sustainability* cluster, while conventional farms are barely sustainable. Finally, organic farming is largely sustainable in the *high sustainability* cluster, even if the result of conventional farms is better.

Organic farms produce more cash flow than conventional farms with the same endowment of various capitals, which reduces their relative elasticity. The growth of *farmland* endowment has major effects; still, it is evident that these are of greater importance in conventional than organic farms. This suggests that the structural endowment is more balanced in organic farming activities, and the need to increase the operational size for better financial results is less than in conventional farms. An exception is the highly sustainable cluster, where the *farmland* endowment influences the liquidity production more in organic than in conventional farms. This aspect is worthy of further study, as the small size of the farms still considerably limits the results of Italian agriculture, and organic farms seem less bounded by this constraint. These works should use other functional forms to represent the studied relationships, as well as examine the condition of the size classes that make up the various aggregates.

A major part of the sustainability of organic farms is certainly due to EU payments, mainly of CAP II type. Payments are, in fact, relatively higher for the organic TFs and result in higher liquidity especially in mixed organic farms (*poor sustainability* cluster). The result is not the same in terms of generated liquidity in *medium* and *high sustainability* clusters, which are more sensitive to these payments. This could suggest that relying on this aid could reduce the responsiveness of organic farms to changes in efficiency (Lakner, 2009), which is lower than in conventional farms when measured as ROI elasticity. Still, we found no evidence that greater sensitivity to public aid is accompanied by less responsiveness to changes in efficiency. This problem certainly requires further investigation, maybe to calibrate the supports to the sector differently.

Another strong point of organic farms lies in the relationships with customers and suppliers which allows to increase CAFFE almost as much as the total amount of public aid received, especially in the *poor sustainability* cluster. The benefit generated by this credit is contextual and of a similar level to public payments. It is interesting to investigate how the climate of trust and market appreciation and the security of solvency due to the liquidity injection provided by public aid interact in generating this credit. Obviously, if the good reputation of the sector has these tangible and positive effects on cash flows, all efforts must be dedicated to its preservation, guaranteeing the factors that generate it. Still, this does not change the volatility of the variable since the additional liquidity comes from ΔWCC and not from its absolute level. In other words, this variable has a positive effect only if the balance of willingness to credit by customers and suppliers grows progressively. This makes it of interest to evaluate how to increase, as well as how to best capture this appreciation. In this regard, it could be studied how to develop forms of participation in investments and in the productive activities of the organic sector, such as *crowdfunding*. This can add important financial resources to support investments which, as our analysis has highlighted, are undertaken by organic farms only with higher liquidity levels than those required by conventional farms.

These results could be supported by efforts to improve pricing and yield conditions, as much of the GMO is achieved with below-average results for both variables. The existence of an appreciable *price disadvantage* contradicts the widespread opinion that all organic farms get higher prices for their products. Our result shows that this ability is prerogative of a minority of producers, whose relevance in the production is even less than what happens for conventional farms. Moreover, our analysis indicates that reducing this gap might also be very expensive to increase cash flows for a wide range of farms, both organic and conventional. In fact, despite in some cases the large disadvantages for prices or yields, the elasticity remains low except for the organic TFs of the highly sustainable cluster, whose yield disadvantage is enormous compared to the territorial and altimetric averages.

Our analytical approach can be used by Countries using the FADN, or similar sampling systems on accounting data, to assess the situation of their agriculture and help specify policy measures. In this regard, it would be useful to refine the representativeness of the FADN sample by extending it to better cover the farms in conversion. The analysis carried out highlights that the level of financial sustainability of the small group of farms operating at this stage is insufficient. However, the number of observations examined is too limited to support these conclusions or to satisfactorily assess the problems that arise at this stage, which is crucial to gain access to the organic method.

At last, the remarks on sustainability resulting from the analysis should be considered precautionary: in fact, calculating the depreciation on the current replacement value of capital, while providing a stronger signal on the sustainability of those systems, could reveal a more precarious situation for many areas, given the age of the capital of many Italian farms. Our analysis can be further deepened by considering altitude level and geographical areas, as well as productive dimension and engagement in direct selling, food processing and farm holidays, which can provide useful hints.

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Table A1 - Variable elasticities in each TF and cluster of TFs for Organic (O) and Conventional (C) farms

	Farmland		Inventories		Depreciable		Investments		CAP I		CAP II		ΔWCC		ROI		Price Advantage		Yield advantage	
	O	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**
Mixed Crops and Livestock	0.36	1.37	0.15	0.59	0.003	0.005	-0.05	-0.62	0.12	0.33	0.01	0.07	0.33	0.07	-0.00	-0.49	-0.08	-0.04	-0.01	0.02
Extensive Beef Cattle	0.63	0.68	0.30	0.58	0.001	0.002	-0.25	-0.34	0.31	0.29	0.20	0.10	0.00	0.02	-0.25	-0.48	-0.09	0.04	-0.03	-0.01
Mixed Crops	0.80	1.42	0.05	0.15	0.004	0.003	-0.56	-0.35	0.19	0.25	0.12	0.06	0.24	-0.08	-0.44	-0.62	-0.20	-0.12	-0.02	-0.09
Mixed Fruits	0.78	1.12	0.03	0.03	0.001	0.002	-0.12	-0.49	0.18	0.08	0.11	0.02	0.00	0.02	-0.23	-0.16	-0.04	-0.06	-0.02	0.03
Arable Crops	0.90	1.71	0.09	0.16	0.003	0.005	-0.35	-0.58	0.29	0.50	0.12	0.08	0.13	0.05	-0.14	-0.48	-0.01	-0.07	-0.03	-0.04
Sheep	0.79	0.57	0.15	0.16	0.002	0.002	-0.29	-0.28	0.25	0.18	0.20	0.11	0.00	-0.01	-0.11	-0.18	-0.02	0.00	-0.01	0.00
Dairy Cattle	0.86	0.59	0.51	0.29	0.020	0.006	-0.76	-0.47	0.18	0.12	0.31	0.07	-0.08	0.02	-0.02	-0.02	-0.02	-0.03	-0.06	0.01
Vineyards	0.52	1.02	0.19	0.35	0.002	0.001	-0.27	-0.38	0.09	0.05	0.06	0.04	0.00	-0.05	-0.02	-0.15	-0.01	-0.03	-0.03	-0.03
Mixed Livestock	2.26	0.73	0.98	0.68	0.001	0.003	-5.63	-0.68	0.61	0.23	0.66	0.10	0.14	-0.06	-0.04	-0.54	-0.01	-0.09	0.17	-0.02
Greenhouses Vegetables	0.06	0.24	0.00	0.15	0.015	0.002	-0.11	-0.22	0.00	0.01	0.00	0.02	0.02	0.03	-0.34	-0.08	0.01	-0.05	0.21	0.20
Olive Growing	1.04	1.83	0.13	0.16	0.003	0.004	-0.22	-1.03	0.42	0.86	0.20	0.06	-0.02	0.10	-0.56	-0.91	-0.01	-0.01	-0.03	-0.14
Swine	0.13	0.54	-	1.24	0.000	0.008	-0.02	-0.19	0.02	0.08	0.01	0.01	0.03	-0.24	0.05	-0.02	0.01	-0.57	-0.03	0.00
Other	0.52	0.37	0.31	0.16	0.001	0.001	-0.23	-0.18	0.04	0.01	0.07	0.02	-0.05	-0.03	-0.09	-0.12	0.07	-0.38	-1.83	-0.79
Poultry	0.38	0.22	0.23	0.21	0.003	0.004	-0.68	-0.10	0.06	0.03	0.05	0.01	0.07	0.01	0.23	0.08	-0.01	-0.11	-0.01	0.00
Citrus Fruits	0.59	0.76	0.01	0.02	0.000	0.001	-0.03	-0.10	0.19	0.16	0.16	0.02	-0.07	0.10	-0.29	-0.31	-0.06	-0.03	-0.02	0.00
Open Field Vegetables	1.17	0.38	0.15	0.02	0.004	0.001	-0.23	-0.11	0.16	0.12	0.19	0.02	-0.10	0.00	0.00	-0.09	-0.37	-0.22	-0.52	-0.02
Fruits in Shell	0.42	0.22	-	0.03	0.001	0.001	-0.26	-0.22	0.04	0.08	0.06	0.06	0.01	0.01	0.02	0.10	0.00	0.06	-0.04	-0.02
Intensive Beef Cattle	2.72	0.31	0.47	0.83	0.002	0.001	-0.26	-0.13	0.38	0.33	0.36	0.01	0.05	0.16	-0.21	-0.05	0.14	0.03	-0.07	0.00
Poor sustainability	0.72	1.19	0.14	0.21	0.002	0.004	-0.19	-0.49	0.17	0.29	0.08	0.07	0.19	0.02	-0.11	-0.32	-0.07	-0.05	0.72	1.19
Medium sustainability	0.81	1.01	0.18	0.33	0.003	0.002	-0.42	-0.44	0.26	0.12	0.14	0.05	0.00	-0.03	-0.30	-0.23	-0.01	-0.04	0.81	1.01
High sustainability	0.71	0.37	0.09	0.42	0.001	0.002	-0.16	-0.14	0.14	0.11	0.14	0.02	-0.05	0.00	-0.15	-0.05	-0.08	-0.23	0.71	0.37
Total	0.74	0.88	0.14	0.30	0.002	0.003	- 0.23	- 0.36	0.19	0.20	0.10	0.05	0.12	0.01	- 0.15	- 0.21	- 0.06	- 0.11	- 0.06	- 0.06

Table A2 - Slope of the function for every TF and cluster of TFs for Organic (O) and Conventional (C) farms

	Farmland		Inventories		Depreciable		Investments		CAP I		CAP II		ΔWCC		ROI		Price Advantage		Yield advantage	
	O	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**	**O**	**C**
Mixed Crops-Livestock	0.05	0.10	0.39	0.42	0.007	0.001	-0.91	-0.91	0.76	0.64	0.64	0.63	0.73	0.72	163,1	161,9	0.12	0.14	0.20	0.20
Extensive Beef Cattle	0.10	0.10	0.42	0.42	0.001	0.001	-0.90	-0.90	0.65	0.64	0.65	0.63	0.72	0.72	162,0	161,8	0.14	0.14	0.20	0.20
Mixed Crops	0.09	0.09	0.43	0.43	0.002	0.001	-0.91	-0.90	0.64	0.64	0.64	0.63	0.72	0.72	160,4	160,8	0.14	0.14	0.20	0.20
Mixed Fruits	0.09	0.10	0.43	0.43	0.001	0.001	-0.90	-0.91	0.64	0.63	0.64	0.63	0.72	0.72	161,8	162,7	0.14	0.14	0.20	0.20
Arable Crops	0.09	0.09	0.43	0.43	0.002	0.002	-0.91	-0.91	0.66	0.65	0.65	0.63	0.72	0.72	162,1	161,2	0.14	0.14	0.20	0.20
Sheep	0.10	0.10	0.43	0.43	0.001	0.001	-0.91	-0.90	0.64	0.64	0.65	0.63	0.72	0.72	162,8	162,5	0.14	0.14	0.20	0.20
Dairy Cattle	0.10	0.10	0.42	0.42	0.003	0.002	-0.91	-0.91	0.64	0.64	0.65	0.63	0.72	0.72	163,3	163,3	0.14	0.14	0.20	0.20
Vineyards	0.09	0.09	0.42	0.42	0.002	0.001	-0.91	-0.91	0.64	0.63	0.64	0.63	0.72	0.72	163,2	162,7	0.14	0.14	0.20	0.20
Mixed Livestock	0.09	0.10	0.42	0.42	0.001	0.001	-0.91	-0.90	0.65	0.63	0.67	0.63	0.72	0.72	163,3	162,1	0.14	0.14	0.20	0.20
Greenhouses Vegetables	0.10	0.10	0.43	0.43	0.005	0.001	-0.90	-0.90	0.63	0.63	0.62	0.63	0.72	0.72	157,8	162,8	0.14	0.14	0.20	0.20
Olive Growing	0.09	0.09	0.43	0.43	0.002	0.001	-0.90	-0.91	0.66	0.66	0.65	0.63	0.72	0.72	159,4	160,4	0.14	0.14	0.20	0.20
Swine	0.10	0.09	0.43	0.39	0.000	0.004	-0.90	-0.91	0.63	0.64	0.63	0.63	0.72	0.72	163,7	163,2	0.14	0.13	0.20	0.20
Other	0.10	0.10	0.42	0.43	0.001	0.001	-0.90	-0.90	0.63	0.63	0.63	0.63	0.72	0.72	162,8	162,8	0.14	0.14	0.18	0.19
Poultry	0.10	0.10	0.43	0.42	0.001	0.003	-0.91	-0.90	0.63	0.63	0.63	0.63	0.72	0.72	164,4	164,4	0.14	0.14	0.20	0.20
Citrus Fruits	0.09	0.10	0.43	0.43	0.001	0.001	-0.90	-0.90	0.65	0.64	0.66	0.63	0.72	0.72	160,4	161,6	0.14	0.14	0.20	0.20
Open Field Vegetables	0.09	0.10	0.42	0.43	0.002	0.001	-0.91	-0.90	0.64	0.64	0.65	0.63	0.72	0.72	163,4	162,5	0.14	0.14	0.19	0.20
Fruits in Shell	0.09	0.10	0.43	0.43	0.001	0.001	-0.91	-0.91	0.63	0.64	0.64	0.63	0.72	0.72	163,7	164,4	0.14	0.14	0.20	0.20
Intensive Beef Cattle	0.09	0.09	0.42	0.39	0.001	0.002	-0.90	-0.91	0.65	0.69	0.66	0.63	0.72	0.72	162,4	162,3	0.14	0.14	0.20	0.20
Poor sustainability	0.09	0.09	0.42	0.43	0.002	0.001	-0.91	-0.91	0.65	0.64	0.64	0.63	0.72	0.72	162.0	161.9	0.14	0.14	0.20	0.20
Medium sustainability	0.09	0.10	0.42	0.42	0.002	0.001	-0.91	-0.91	0.65	0.63	0.65	0.63	0.72	0.72	160.9	162.3	0.14	0.14	0.20	0.20
High sustainability	0.09	0.10	0.43	0.42	0.001	0.001	-0.90	-0.90	0.64	0.64	0.65	0.63	0.72	0.72	162.1	162.9	0.14	0.14	0.20	0.20
Total	0.09	0.10	0.42	0.42	0.002	0.001	-0.91	-0.91	0.65	0.64	0.65	0.63	0.72	0.72	161.8	162.2	0.14	0.14	0.20	0.20

Table A3 - Average value of each regressor divided by CAFFE value for each TF and cluster of TFs for Organic (O) and Conventional (C) farms

	Farmland		Inventories		Depreciable		Investments		CAP I		CAP II		ΔWCC		ROI$_{14}$		Price Advantage		Yield advantage	
	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C
Mixed Crops and Livestock	6.94	14.39	0.39	1.39	0.5	3.4	0.05	0.69	0.16	0.51	0.01	0.12	0.45	0.10	-0.02	-3.01	-0.66	-0.25	-0.07	0.10
Extensive Beef Cattle	6.56	7.07	0.70	1.37	1.0	2.1	0.28	0.38	0.47	0.46	0.31	0.16	-0.01	0.03	-1.54	-2.97	-0.61	0.27	-0.16	-0.05
Mixed Crops	8.48	15.08	0.11	0.36	2.1	2.4	0.62	0.39	0.30	0.39	0.18	0.09	0.33	-0.11	-2.76	-3.85	-1.40	-0.88	-0.11	-0.43
Mixed Fruits	8.28	11.83	0.07	0.08	1.1	1.9	0.14	0.54	0.27	0.12	0.17	0.04	0.00	0.03	-1.45	-0.96	-0.27	-0.42	-0.12	0.17
Arable Crops	9.70	18.26	0.22	0.37	1.5	3.0	0.38	0.64	0.44	0.77	0.19	0.13	0.18	0.07	-0.83	-3.01	-0.08	-0.52	-0.16	-0.19
Sheep	8.31	5.94	0.36	0.38	1.4	1.7	0.32	0.31	0.39	0.29	0.31	0.17	0.00	-0.01	-0.66	-1.13	-0.14	0.01	-0.06	0.01
Dairy Cattle	9.01	6.20	1.21	0.67	6.2	2.6	0.84	0.52	0.29	0.19	0.47	0.11	-0.11	0.03	-0.12	-0.10	-0.13	-0.22	-0.32	0.07
Vineyards	5.45	10.76	0.45	0.81	1.2	1.5	0.30	0.42	0.14	0.08	0.09	0.07	0.00	-0.07	-0.12	-0.91	-0.04	-0.22	-0.15	-0.16
Mixed Livestock	24.41	7.57	2.33	1.60	1.4	3.0	6.18	0.75	0.94	0.36	0.98	0.16	0.19	-0.08	-0.24	-3.36	-0.04	-0.64	0.82	-0.12
Greenhouses Vegetables	0.64	2.47	0.01	0.36	2.7	1.4	0.12	0.24	0.00	0.01	0.00	0.03	0.02	0.04	-2.14	-0.51	0.08	-0.37	1.02	0.97
Olive Growing	11.05	19.33	0.31	0.36	1.9	3.0	0.24	1.14	0.64	1.31	0.31	0.09	-0.02	0.13	-3.52	-5.70	-0.10	-0.08	-0.16	-0.70
Swine	1.28	5.70	-	3.14	0.3	2.2	0.02	0.21	0.03	0.13	0.02	0.01	0.05	-0.33	0.31	-0.11	0.07	-4.55	-0.13	0.01
Other	5.43	3.79	0.72	0.38	1.0	1.0	0.25	0.20	0.07	0.02	0.11	0.03	-0.07	-0.04	-0.58	-0.72	0.50	-2.74	-10.04	-4.06
Poultry	3.87	2.32	0.55	0.49	2.3	1.7	0.75	0.11	0.10	0.04	0.08	0.02	0.10	0.01	1.37	0.51	-0.05	-0.75	-0.06	0.00
Citrus Fruits	6.28	7.95	0.02	0.05	0.5	1.2	0.04	0.11	0.29	0.24	0.25	0.03	-0.09	0.14	-1.80	-1.95	-0.46	-0.20	-0.10	0.00
Open Field Vegetables	12.62	3.97	0.36	0.06	2.0	0.9	0.26	0.12	0.25	0.18	0.29	0.03	-0.14	0.00	0.01	-0.54	-2.71	-1.63	-2.67	-0.08
Fruits in Shell	4.51	2.32	-	0.06	0.5	0.8	0.29	0.24	0.06	0.12	0.09	0.09	0.02	0.01	0.09	0.59	0.02	0.40	-0.19	-0.08
Intensive Beef Cattle	29.97	3.26	1.12	2.13	1.8	0.6	0.29	0.14	0.59	0.47	0.54	0.02	0.07	0.22	-1.31	-0.33	1.01	0.18	-0.35	0.00
Poor sustainability	7.79	12.52	0.34	0.50	1.1	2.5	0.21	0.54	0.27	0.45	0.12	0.11	0.26	0.03	-0.66	-1.98	-0.51	-0.36	-0.10	-0.06
Medium sustainability	8.61	10.56	0.43	0.79	1.6	1.7	0.46	0.48	0.40	0.19	0.22	0.07	0.00	-0.04	-1.84	-1.44	-0.06	-0.25	-0.08	-0.11
High sustainability	7.53	3.82	0.21	1.01	1.0	1.2	0.17	0.15	0.22	0.18	0.21	0.03	-0.07	0.00	-0.91	-0.30	-0.59	-1.64	-1.81	-0.76
Total	7.91	9.26	0.34	0.71	1.1	1.9	0.25	0.40	0.29	0.32	0.15	0.08	0.17	0.01	-0.92	-1.33	-0.44	-0.78	-0.32	-0.31

1. The ratio of ROI over CAFFE is multiplied by 1,000,000.