Impact of succession on performance: The case of the Italian family farms

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Abstract

In this paper we analyse whether the event of succession changes the performance of farms, for the case of Italian family farms during the period 2008-2014. We using data from the Italian Farm Accountancy Data Network (FADN) and several performance indicators. Analyses based on t-tests of equality of means and propensity score matching reveal that succession has a negative effect on performance indicators related to capital, revealing that the capital value has increased after succession. In addition, for farms with succession in the first years of the period considered, performance per hectare after succession is lower for those farms than for farms in which no succession occurred. But this negative effect of succession on performance per hectare is not systematically confirmed when performance is related per labour unit.

Keywords: family farms; succession; performance; propensity score matching; Italy

1. Introduction

Farm transfers are a key component of structural change in the farming sector. However, in the European Union (EU), according to the European Commission (2012) the transfer of farms to younger generation is too low. It is recognised that new farmers bring innovation and dynamism (Calus et al., 2008; European Commission, 2012). The transfer of farms from retiring farmers to new entrants, in particular young ones, rather than the farms' dismantling to enlarge existing farms, is therefore crucial for maintaining the competitiveness of the sector. However, another condition is that after succession, the farm survives and thrives.

Performance is a key element of farm survival. Zhengfei and Oude Lansink (2006) suggested that farm performance decreases during the adjustment period of the newly settled farmers, where the latter indebt themselves and invest to expand. However, some actions aimed at developing the farm and improving the performance, taken by the retiring farmer before transfer, may not only make the farm more attractive for successors (Lobley and Baker, 2012; Cavicchioli et al., 2015), it may also ensure the viability of the farm (Wheeler et al., 2012). Some authors confirmed that farm assets level and farm investments are influenced by the succession process, the soon-to-retire farmers may indeed implement some investments to prepare succession. This is what Kimhi et al. (1995) (quoted by Diwisch et al., 2009) called the 'shadow of succession'. For example, Gate and Latruffe (2015) reported, for their sample of French soon-to-retire farmers in Brittany (Western France) that many of them invested on their farm to develop it in a view of improving its performance after succession had taken place. Calus et al. (2008), Mishra and El-Osta (2008) and Potter and Lobley (1996) argued that farm investments increase when a farm successor is identified, even though the causality nexus between investments and the presence of a successor is not clear-cut and should be better clarified. In fact, it is uncertain whether the increase in farm investments occurs in preparation of the incoming succession (the designated successor may be involved in farm management before the official farm transfer), or whether succession is more likely to occur on thriving farms with a higher level of investments. For Mann et al. (2013) dismantling farm investments is a clear signal of farmer's retirement without succession. By contrast, Kazukauskas et al. (2013) considered disinvestments as a proxy for farm exit.

The impact of succession on performance has not been systematically studied, though some researches have addressed contiguous issues. For example, Carillo et al. (2013) evaluated the

difference in economic performance between inherited and non-inherited farms using cross sectional data from a sample of 11,000 Italian farms. Their results show that inherited farms tend to under-perform with respect to non-inherited farms. However, this work is not strictly focused on evaluating the effect of farm succession, and mainly represents a performance comparison between two modalities of farm succession. Furthermore, the use of cross-sectional data does not allow to evaluate the time effect of farm succession, and the information about the time elapsed from the succession event is not available. Laband and Lentz (1983) found the opposite result with inherited farms over-performing with respect to the non-inherited ones. Other studies found a direct relationship between the probability of succession and farm economic performance (Kerbler, 2008, Mishra and El-Osta, 2008; Glauben et al., 2009; Corsi, 2009; Cavicchioli et al., 2015; Bertoni and Cavicchioli, 2016).

Moreover, the presence of a successor tends to influence future farm strategies. Generally, younger farmers are more oriented toward a diversification of farm activities and a conversion to more sustainable agricultural practices (Zagata and Sutherland, 2010). Farms diversifying and converting toward sustainable farming methods are expected to be more appealing for a potential successor (Sottomayor et al., 2011; Stiglbauer and Weiss, 2000; Suess-Reyes and Fuetsch, 2016).

In the non-agricultural sector, Diwisch et al. (2009) analysed the effect of succession on the growth of firms in Austria and found that succession had a significant positive effect on employment growth. Several studies have investigated the effect of a change in chief executive officer (CEO) on firms' performance and reported mixed findings (see the review in Karaevli, 2007). Other authors studied the link between succession and performance for firms, but comparing the performance of firms for which management was kept by family heirs (intra-family succession) and of firms for which management was transferred to managers outside the family. Some authors reported a lower performance of firms with intra-family succession compared to firms with extra-family succession (e.g. Cucculelli and Micucci, 2008, in Italy, and Wennberg et al., 2011, in Sweden).

In this context our paper aims at investigating the impact of succession on performance in Italy. According to Eurostat, in 2013 Italy counted about 1 million of farms, corresponding to 9.3% of EU-28 farms. The average physical dimension of Italian farms is about 25% lower than the European one, with only 12 hectares (ha) of utilised agricultural area (UAA) per farm. The same holds for the average labour dimension, that limits to 0.8 annual working unit (AWU) (i.e. full time equivalent workers) per farm. On the opposite, the standard output[1] per farm is 41% above the EU-28 average, while the standard output per AWU is 54% above average. Nevertheless, the Italian farming sector productivity is not comparable with other economic sectors; in fact, for example, the agricultural value added per worker is 33.5% lower than the industrial sector's one and 38% less with respect to trade and services sector's workers.

An important part of the Italian farms are operated as family farms, where the farmer's household is directly engaged in the farm business management. In fact, in 2013 a high share of 77.4% of farm labour came from farm household members. In 2010 the share of farms where children of the farm holder worked on the farm was only 17.3%. The ratio between the number of children aged between 20 and 40 working on the farm, and the number of farm

[1] According to the European Commission Regulation 1242/2008, standard output is the average monetary value at farm-gate price of each agricultural product in a given region. At farm level the standard output of each product is calculated by multiplying the number of hectares of crops or heads of livestock by their specific regional standard output, while the total farm standard output is calculated by summing the standard output of each product. standard output is calculated excluding direct payments.

holders, was only 15.8%. For each child aged between 20 and 40 working on the farm, there were 2.2 members of the same category not working on the farm.

The Italian farming sector is not young: about 40% of Italian farms were managed by a farmer of 65 years or older; such share is considerably higher than the EU-28 one (31%). On the opposite, farmers less than 35 years old were only 4.5% (6% in the EU-28). With an average UAA of only 65.5% of the national average, farms managed by the eldest farmers are generally smaller than other farms. Similarly, their standard output per farm amounts to only 55% of the national average. The picture regarding farmer's education is not glossy: in 2010 less than 30% of Italian farmers had a secondary school diploma at least, while only 6% had a degree. In farms managed by a farmer of 65 years or older these figures fall respectively to 11.5% and 3.6%.

Hence, when farms are transferred, there is an opportunity to improve farm performance by bringing 'fresh blood' from younger and more educated farmers. The link between farm succession and farm performance has not been studied so far. The main reason may be the lack of data: firstly, the same farms need to be observed for enough a long period, and secondly the event of success is rarely informed. Here we analyse whether the event of succession changes the performance of farms, for the case of Italian family farms during the period 2008-2014.

The paper is structured as follows. Section 2 explains the data used and the methodology. Section 3 describes the farms and Section 4 presents the results. Section 5 concludes.

2. Data and methodology

2.1. Source of data

Our analysis uses data from the national Farm Accountancy Data Network (FADN) Italian database over the period 2008-2014. This is an annual accountancy database for commercial farms that are representative of regional productions and that have a minimum economic size, namely 4,000 Euros of annual standard output. The database is an unbalanced panel sample, with the farm rotating rate within the database being about 16%.

The Italian FADN database contains detailed farm-level data on farm structure (land owned and rented, family and hired labour, investments in buildings, machinery, equipment and livestock), production (land use, yield, quantity and value of production for each farm activity), accounting (subsidies, revenues, costs, income and profit), and financial characteristics (assets and liabilities). In addition, for each member of the farm, the information on age, education attainment, on-farm involvement, and off-farm employment (sector and income category) is available.

Only family farms are considered in this study. They are selected on the basis of the FADN variable defining the management type, and consist in farms managed by family members, with three possible types: farms with family members only; farms with a prevalence of family members; farms with a prevalence of hired workers. Among these family farms, only those having only one farm holder are selected, as, as explained later, the only way to identify the succession is the change in the birth age of the farmer.

In addition, we removed farms with aberrant data, namely zero labour, zero or negative capital, and or negative value of total output. The full sample includes 3,163 family farms observed each year during 2008-2014.

2.2. Identification of succession

Farm succession is not recorded in the FADN database. Hence, here an event of succession is identified based on managers' age differences between years. We consider that farms with no succession are those for which the age of the manager increases by one year every year during 2008-2014. By contrast, a succession is said to have occurred on a farm between year *t* and year *t*+1 if the age of the manager in *t*+1 was at least 20 years greater than the age of the manager in *t*. Note that we removed farms for which the change in managers' age was more than one year but for which the age has decreased by less than 20 years old (very young entrants) or for which the age has increased (new entrants older than exiting farmers).

We only kept farms which remained family farms during the whole period. Farms which changed their status to non-family farms following succession were not considered here. Table 1 shows the final balanced sample used in this study: 3,114 farms, including 2,982 farms where no succession occurred during the period (the 'farms without succession') and 132 farms where one (and only one) succession occurred during the period (the 'farms with succession'). Most of the successions took place in 2011 (29.5% of the successions) and in 2012 (25%).

Unfortunately, such evidence from the constant FADN sample cannot be compared with the analogous phenomenon in the whole farm population in Italy, as official statistics (e.g. agricultural censuses) do not give information about farm succession. The phenomena can be only indirectly quantified by comparing cohorts of younger and elder farmers in each country (Zagata and Sutherland, 2015). A comparison on farm succession rate in Italy may be done only with previous studies, mainly site and sector-specific and based on surveys reporting farm succession likelihood based on farmers' and on farmers' heirs' judgement. For example, Cavicchioli et al. (2015) report a farm succession rate, measured as the new generation's willingness to take over the farm, of 26.5% among Northern Lombardy apple producers. Bertoni and Cavicchioli (2016) found a higher succession rate of 54% in a sample of Italian horticultural farms. Note that such succession rates may be not directly comparable with those computed in the FADN sample for different reasons. First, farm succession in previous works refers to specific sectors, while the FADN sample is representative of all sectors in a specific region. Secondly, survey data did not observe successions directly, but are based on expectations of subjects involved; it has been shown by Väre et al. (2010) that declared and actual succession may diverge significantly. Finally, the succession rate computed in our sample may be underestimated because it is based on the observation of a constant sample of farms over a time span that is relatively short when considering farm succession.

Table 1: Number of family farms in the sample used observed each year during 2008-2014

	Number of farms	Share of farms
All farms, including:	3,114	100%
Farms without succession	2,982	95.8%
Farms with succession	132	4.2%
Farms with succession, including:	132	100%
Farms for which succession occurred in 2009	10	7.6
Farms for which succession occurred in 2010	21	15.9
Farms for which succession occurred in 2011	39	29.5
Farms for which succession occurred in 2012	15	11.4
Farms for which succession occurred in 2013	33	25.0
Farms for which succession occurred in 2014	14	10.6

Source: the authors based on Italian FADN data

2.3. Computation of performance indicators

In the following, performance will be compared across farms, as explained in section 2.4. The following performance proxies will be used:

i. Total revenue: it includes the value of total output, the subsidies and other revenues;
ii. Total costs: they include all costs occurred by the farms, namely production costs (see below), long term costs (see below), the costs of external factors (see below), interest and other expenses;
iii. Total output: this is the value of output, including the output sold, the output stocked and the output self-consumed;
iv. Total subsidies: these are the value of subsidies received by the farms, including operational subsidies and investment subsidies, originating from regional, national and European sources;
v. Production costs: they include intermediate consumption and other direct costs such as processing or selling costs;
vi. Value added: this is calculated with total revenue minus production costs;
vii. Long term costs: they consist in capital depreciation
viii. Net output: this is calculated with value-added minus long term costs;
ix. External factors' costs: they include hired labour wages and land rentals;
x. Operating income: this is calculated with net farm output minus external factors' costs;
xi. Net income: this calculated with operating farm income minus interest and other expenses.

In order to control for size, the proxies will be related to size variables. Since farms have various production orientations, there is no uniform size measure. For this reason, the eleven performance proxies will be related in turn to UAA, to labour and to capital. Thus, the performance indicators used are indicators per ha, per AWU and per unit of capital.

2.4. Methodology for assessing the impact of succession on performance

We aim at assessing whether farm performance changes after succession. On the one hand, farm performance may be positively impacted by succession. Indeed, there may be an increase in performance due to the new impetus given by the entering farmer. On the other hand, farm performance may be negatively impacted by succession: a drop in performance would occur due to adjustments of the new farmer on the farm.

To test which hypothesis is valid and/or prevalent, we will compare, for farms with succession, their performance before and after succession. In a first step this will be performed with t-test of equality of means for the various performance indicators listed above. However, this approach does not assert with certainty that changes observed are due to the succession event. Changes may due to modifications in the economic environment: these modifications are then faced by all farms, including those where no succession happened. In addition, there may be selection effects, in the sense that farms with succession may present some specific characteristics and that the probability of succession may not be random. Hence, in order to better capture the effect of succession and to control for potential selection bias, propensity score matching (PSM) is employed here in a second step.

PSM can help estimating causal treatment, that is to say the effect of a treatment of an agent on an outcome for this agent. The technique is popular in medical research where medical programmes are evaluated in experiments with a group of treated patients and a group of untreated patients. However, it has also been widely used in a variety of fields, to study the effect of a policy measure or of a decision of the agent on a specific outcome such as profitability or wage (Caliendo and Kopeinig, 2008). In agriculture it has for example been used to study the effect of implementing direct selling on Italian farms' profitability (Caracciolo et al., 2015), the effect of adopting organic technology on United States' farms' technical efficiency (Mayen et al., 2010), or the effect of agri-environment programmes on German farms' input use and output (Pufahl and Weiss, 2009). One can also note, outside agriculture, the article by Diwisch et al. (2009) which studies the effect of Austrian family firms' succession on their growth using PSM.

In the PSM approach, since only the outcome under the treatment scenario is observed, the potential outcome in the no-treatment scenario is built counterfactually. For this, counterfactual outcomes are constructed with similar agents who do not participate in the programme. The similarity of agents is assessed on the basis of characteristics that are not affect by the treatment. The propensity score is the probability of participating in the treatment programme given these characteristics. It helps select agents with identical characteristics before comparing their outcome.

Here several outcomes are studied, namely the various performance indicators listed above. The treatment is succession, that is to say we investigate the causal effect of succession on performance. With PSM we will compare the performance of a farm after succession (that is to say between T and 2014, where T is the date where succession took place), with the performance of a similar farm which experienced no succession during T and 2014. The average treatment effect of the treated will be computed, showing the difference in the expected performances with and without succession for those farms where succession took place.

3. Farms' description

3.1. Description of the structure of the farms

Table 2 describes the sample and compares the sub-samples (farms without succession vs. farms with succession) during the full period (i.e. including the periods before and after succession for farms with succession). The sample farms operated on average 27.1 ha of UAA and used 1.7 annual AWU of labour. They rented in on average 33.8% of their land and 11.3% of their labour force was hired. They received on average 490 Euros per ha of UAA, equivalent to 8.2 thousand Euros per AWU. They were mostly specialised in horticulture, field crops and grazing livestock (31.2%, 23.4% and 21.9% of the sample respectively). Half of them were located in less favoured areas (LFA) and 21.9% in mountainous areas.

Comparing the sub-samples show that farms on which succession occurred were larger in terms of land, labour, capital and value of output produced (e.g. 35.4 ha of UAA on average vs. 26.7 ha for farms without succession) during the total period 2008-2014, and resorted less to rented in land. The sub-sample of farms with succession counts less field crop and horticulture specialised farms, but more grazing livestock and mixed cropping specialised farms, than farms without succession. It also counts more farms with a female head, more organic farms, more farms with other gainful activities (such as processing, selling, tourism, catering) and less farms localised in mountainous areas, than farms without succession.

Table 2: Descriptive statistics of the family farm sample used (2008-2014)

	All farms			Farms without succession	Farms with succession	
Number of farms	3,114			2,982	132	
	Mean in the period	Min.	Max.	Mean in the period	Mean in the period	t-test of equality of means
UAA (ha)	27.1	0.1	1,731.3	26.7	35.4	-2.7***
Labour (AWU)	1.7	0.05	51.2	1.7	1.8	-2.6***
Capital (ths Euros)	625.9	0.51	21,701.2	616.9	773.3	-3.1***
Total output (ths Euros)	107.3	0.15	7,189.7	105.6	147.4	-2.2**
Share of rented in land (%)	33.8	0	100	34.4	21.8	11.2***
Share of hired labour (%)	11.3	0	100	11.2	12.5	-1.7*
Age of the farm head (years)	54.6	19	92	54.6	54.2	-0.9
		Share of observations in the period		Share of observations in the period	Share of observations in the period	Test of equality of proportions
Farms with female head		17.8		17.6	21.3	-2.9***
Type of farming						
Field crops		23.4		23.6	17.1	4.6***
Horticulture		8.4		8.6	4.2	4.6***

Permanent crops	31.2	31.1	33.9	-1.8*
Grazing livestock	21.9	21.6	29.2	-5.5***
Granivores	3.1	3.1	3.1	-0.02
Mixed cropping	6.3	6.2	8.2	-2.5**
Mixed livestock	0.7	0.7	1.0	-0.8
Mixed crops-livestock	5.0	5.1	3.3	2.5**
Organic farms	3.19	3.1	4.3	-2.0**
Farms with other gainful activities	27.4	27.0	35.6	-5.8***
In LFA	50.3	50.4	48.2	1.3
In mountains	21.9	22.1	18.9	2.2**
In regions				
North-West Italy	35.7	36.1	26.5	6.0***
North-East Italy	25.0	24.7	33.4	-6.0***
Central Italy	11.3	11.5	6.8	4.4***
Southern Italy	22.7	22.5	26.5	-2.8***
Islands	5.3	5.2	6.8	-2.2**

Notes: The second part of the table report the share of farm-year observations and not the share of farms, as some farms may change their type after succession. The last column reports t-values and significance for the test with null hypothesis of means equality, and z-values and significance for the test with null hypothesis of equality of shares (proportions). ***, **, * indicate 1%, 5%, 10% significance respectively. AWU indicates annual working units (i.e. full-time equivalent workers).

Source: the authors based on Italian FADN data

3.2. Evolution of the structure of the farms with succession

Before investigating how performance has changed for farms after succession took place on them, we study whether their structure has changed. Table 3 shows that, although size in terms of land, labour and output does not change in the period following succession compared the period before succession, the farm's capital value largely increases (from 671.8 to 861.4 thousand Euros). This suggests that farmers taking over a farm implement investment so as to modernise the equipment, comply to standards or develop a new activity. This is confirmed by the subsidies received within the Rural Development Programme (RDP) of the Common Agricultural Policy (CAP): after succession, farms received much larger subsidies for investment aimed at farm modernisation or supporting young farmers setting up. The share of rented in land also increases (from 19.6% to 22.9%) after succession compared to before succession, suggesting that investments are not in land, but rather in equipment or machinery.

As expected and conform with the way we identified farms where succession occurs, the age of the farm head decreases (from 69.8 to 22.9 years). A large number of women took over the farms, as the share of farms with female heads the year before succession occurred is 15.9% while the share in the next year (i.e. when succession occurred) is 23.5%.

Finally, there is no highly significant change in terms of type of farming, in terms of organic or conventional production, and in terms of implementation of other gainful activities.

Table 3: Comparison of characteristics pre- and post-succession for those family farms which had a succession

	Before succession	After succession	
Number of farms	132	132	
	Mean in the period	Mean in the period	t-test of equality of means
UAA (ha)	35.7	34.9	0.3
Labour (AWU)	1.8	1.8	1.0
Capital (ths Euros)	671.8	861.4	-2.9***
Total output (ths Euros)	139.5	146.1	1.2
Share of rented in land (%)	19.6	22.9	3.2***
Share of hired labour (%)	13.3	11.6	1.6
Age of the farm head (years)	69.8	22.9	39.3***
CAP investment subsidies for farm modernisation			
per UAA (ths Euros/ha)	11.4	83.6	-2.0**
per labour (ths Euros/AWU)	58.4	1,149.2	-2.3**
per capital	0.00002	0.003	-2.5**
CAP investment subsidies for young farmer setting up			
per UAA (ths Euros/ha)	8.2	108.6	-2.2**
per labour (ths Euros/AWU)	84.6	956.0	-2.6**
per capital	0.0008	0.003	-2.1**
	Share of farms in the year before succession	Share of farms in the year of succession	Test of equality of proportions
Farms with female head	15.9	23.5	-1.5
Type of farming			
Field crops	15.9	15.1	0.2
Horticulture	4.5	4.5	0.0
Permanent crops	33.3	31.8	0.3
Grazing livestock	29.5	32.6	-0.5
Granivores	3.0	3.0	0.0
Mixed cropping	9.0	11.4	-0.6
Mixed livestock	0.8	0.8	0.0
Mixed crops-livestock	3.8	7.6	1.6*
Organic farms	3.8	3.8	0.0
Farms with other gainful activities	34.0	41.7	-1.3

Notes: The second part of the table report the share of farm-year observations and not the change of farms, as some farms may change their type after succession. The last column reports t-values and significance for the test with null hypothesis of means equality, and z-values and significance for the test with null hypothesis of equality of shares (proportions). ***, **, * indicate 1%, 5%, 10% significance respectively. AWU indicates annual working units (i.e. full-time equivalent workers).

Source: the authors based on Italian FADN data

4. Results on the effect of succession on farm performance

4.1. Comparing pre- and post-succession performance for farms with succession

We investigate how performance changes for those farms who experienced succession. We firstly report the results from t-tests of equality of means on the performance pre- and post-succession for those farms which had a succession. Table 4 shows the t-tests results for the eleven performance proxies, related to land, labour and capital.

Results indicate that after succession total revenue per ha increases on average (from 6,141.6 to 7,081.5 ths Euros) but so do total costs (from 3,059.9 to 3,505.1 ths Euros) and production costs. This could explain why the profit indicators (value added, net output, operating income, net income) do not significantly change after succession.

When relating the performance proxies per labour, we can see that only the costs of external factors changes (it increases on average after succession compared to before succession) as well as the value of total subsidies (also increases). As for performance related to capital, they all decrease after succession, confirming that capital size has increased following succession.

Table 4: Comparison of performance pre- and post-succession for those family farms which had a succession: results from t-tests of equality of means

		Before succession	After succession	
Number of farms		132	132	
		Mean	Mean	t-test of equality of means
Total revenue	per UAA (Euros/ha)	6,141.6	7,081.5	-1.7*
	per labour (Euros/AWU)	51,544.9	56,174.2	-1.5
	per capital	0.201	0.154	3.1***
Total costs	per UAA (Euros/ha)	3,059.9	3,505.1	-2.0**
	per labour (Euros/AWU)	29,178.4	31,353.1	-1.1
	per capital	0.116	0.088	2.5***
Total output	per UAA (Euros/ha)	5,825.6	6,524.6	-1.3
	per labour (Euros/AWU)	49,775.8	54,081.6	-1.5
	per capital	0.194	0.147	3.1***
Total subsidies	per UAA (Euros/ha)	267.4	278.5	-1.0

	per labour (Euros/AWU)	4,771.5	5,870.5	-1.8*
	per capital	0.015	0.012	2.0**
Production costs	per UAA (Euros/ha)	1,995.4	2,467.0	-3.1***
	per labour (Euros/AWU)	20,847.0	23,401	-1.6
	per capital	0.075	0.062	2.1**
Value added	per UAA (Euros/ha)	4,146.1	4,614.5	-1.0
	per labour (Euros/AWU)	30;697.8	32,773.3	-1.0
	per capital	0.126	0.092	3.2***
Long term costs	per UAA (Euros/ha)	543.2	509.5	1.3
	per labour (Euros/AWU)	4,486.7	4,082.9	1.3
	per capital	0.015	0.012	4.4***
Net output	per UAA (Euros/ha)	3,602.9	4,105.0	-1.1
	per labour (Euros/AWU)	26,211.1	28,690.4	-1.2
	per capital	0.111	0.081	2.9***
External factors' costs	per UAA (Euros/ha)	660.1	749.5	-1.3
	per labour (Euros/AWU)	5,168	5,994.5	-2.2**
	per capital	0.0305	0.020	1.7*
Operating income	per UAA (Euros/ha)	2,942.9	3,355.5	-1.0
	per labour (Euros/AWU)	21,043.4	22,695.9	-0.8
	per capital	0.081	0.061	3.1***
Net income	per UAA (Euros/ha)	2,988.0	3,401.7	-1.0
	per labour (Euros/AWU)	22,423.4	24,603.4	-0.9
	per capital	0.085	0.066	2.7***

Notes: The last column reports t-values and significance for the test with null hypothesis of means equality. ***, **, * indicate 1%, 5%, 10% significance respectively. AWU indicates annual working units (i.e. full-time equivalent workers).

Source: the authors based on Italian FADN data

4.2. Comparing performance of farms with succession and farms without succession

The above findings show changes between the period before succession and the period after succession but, as explained above, the changes may be due to other events than succession. In addition, there may be a selection bias for farms with succession. For this reason, the performance of farms after succession is compared to what could be the performance of these farms if no succession had taken place, using counterfactual farms and PSM.

In a first step, farms with succession are matched with farms without succession that are identical (counterfactual farms). The matching is based on covariates, which are characteristics that do not change with the treatment (succession). Based on Table 3 showing that there are not many significant changes in the structure before and after succession, here we match farms based on their UAA, their labour, their share of hired labour, their type of farming, whether they have other gainful activities, as well as the region where they are located. The year is also added within the covariates so that a succession farm is matched with a no-succession farm observed the same year. In a second step, the average treatment effect on the treated is calculated. This effect indicates by how much performance has been changed due to the succession event.

Table 5 reports the average treatment effects on the treated for all eleven performance indicators, and depending on the period of observation (between *T* and 2014, *T* being the succession date). The first thing to note from the results is that not many indicators are significantly different between farms without succession and farms with succession when the latter took place in 2013 or in 2014, that is to say when succession was recent.

For farms for which succession took place earlier, i.e. in 2009, 2010, 2011 or 2012, total revenue per ha of UAA is lower on farms with succession than on farms without succession; however, total costs are also lower. Similarly, total output per ha of UAA is lower on farms with succession than on farms without succession; however, production costs are also lower. The negative effect of succession on revenue and also on costs confirm results obtained in section 4.1. In the latter, succession had no significant effect on profit indicators, due to the opposite effect on revenue and on costs. By contrast, with PSM we find that farms for which succession occurred in 2009, 2010 and 2011 have a lower value added per ha and a lower net output per ha after succession, compared to similar farms in which succession did not take place. The negative effect of succession is also seen on operating income per ha and net income per ha but for farms for which succession took place in early dates, namely 2009 or 2010.

The last thing to note is that performance proxies related to labour are in general not significantly different between farms with succession and farms without succession, but that performance proxies related to capital are almost all significantly lower in farms with succession, confirming that capital value has risen on these farms after succession.

Table 5: Comparison of performance of family farms which had a succession and family farms which had not succession: results from propensity score matching

		Average treatment effect on the treated					
		Succession in 2009	Succession in 2010	Succession in 2011	Succession in 2012	Succession in 2013	Succession in 2014
Total revenue	per UAA (Euros/ha)	-4,293**	-3,278***	-2,759**	-2,669**	-6,514	-442
	per labour (Euros/AWU)	-7,142**	-5,255	-4,972	-9,778**	-14,201**	-8,211
	per capital	-0.038***	-0.049***	-0.022***	-0.045***	-0.016*	-0.040
Total costs	per UAA (Euros/ha)	-2,886**	-1,889***	-1,671**	-2,344***	-3,275	-423
	per labour (Euros/AWU)	-5,400**	-3,882*	-3,886	-8,743***	-6,616*	-9,439*
	per capital	-0.036***	-0.034***	-0.018***	-0.035***	-0.012	-0.034*
Total output	per UAA (Euros/ha)	-4,257**	-3,397***	-2,848**	-2,690**	-6,462	-633
	per labour (Euros/AWU)	-6,750**	-5,314	-4,909	-9,286**	-13,207**	-8,487
	per capital	-0.038***	-0.052***	-0.024***	-0.044***	-0.013	-0.026*
Total subsidies	per UAA (Euros/ha)	4.9	-7.0	-9.7	-8.4	-25.0	11.1
	per labour (Euros/AWU)	-53	-405	-574	-534	-789	-620
	per capital	-0.003**	-0.007***	-0.004***	-0.004***	-0.002	-0.002
Production costs	per UAA (Euros/ha)	-1,832**	-1,448***	-1,130**	-1,849**	-2,389	-472
	per labour (Euros/AWU)	-3,394*	-2,337	-2,869	-7,083**	-5,583*	-7,319*
	per capital	-0.018***	-0.020***	-0.010**	-.0246***	-0.008	-0.026*
Value added	per UAA (Euros/ha)	-2,460***	-1,830***	-1,629*	-821	-4,124	30
	per labour (Euros/AWU)	-3,749*	-2,919	-2,103	-2,695	-8,617*	-892

	per capital	-0.020*	-0.030***	-0.012*	-0.020***	-0.008	-0.015
Long term costs	per UAA (Euros/ha)	-257**	-151**	-151	-76	-143	-180
	per labour (Euros/AWU)	-935***	-528*	-597*	-404	-933*	-1,790*
	per capital	-.00068***	-0.0024***	-0.0023**	-0.0010	-0.0004	-0.0040**
Net output	per UAA (Euros/ha)	-2,204***	-1,679***	-1,479*	-744	-3,981	-210
	per labour (Euros/AWU)	-2,813*	-2,390	-1,507	-2,291	-7,685**	898
	per capital	-0.013**	-0.027**	-0.010**	-0.020**	-0.007	-0.011
External factors' costs	per UAA (Euros/ha)	-821**	-412***	-476***	-475***	-809	-18
	per labour (Euros/AWU)	-672**	-798**	-282	-1,197***	-567	-49
	per capital	-0.011***	-0.012***	-0.005***	-0.010***	-0.004	-0.005
Operating income	per UAA (Euros/ha)	-1,383**	-1,267**	-1,003	-270	-3,172	-228
	per labour (Euros/AWU)	-2,142	-1,593	-1,225	-1,094	-7,118**	849
	per capital	-0.002	-0.015***	-0.005	-0.010*	-0.004	-0.006
Net income	per UAA (Euros/ha)	-1,262**	-1,216**	-961	-73	-2,943	634
	per labour (Euros/AWU)	-1,141	-775	-382	324	-4,746	2,861
	per capital	-0.0003	-0.0124***	-0.0016	-0.0053	0.0029	-0.0012

Notes: ***, **, * indicate 1%, 5%, 10% significance respectively. AWU indicates annual working units (i.e. full-time equivalent workers).

Source: the authors based on Italian FADN data

5. Conclusion

This paper analysed the effect of succession on farm performance, for a constant sample of family Italian farms in the Italian FADN database over the period 2008-2014. The analyses showed several findings. Firstly, the capital value has increased after succession, with the consequence that all performance indicators related to capital are lower after succession than before succession, and are lower for farms with succession compared to farms without succession. Secondly, PSM revealed that, for farms with succession in the first years of the period considered, performance per ha of UAA after succession is lower for those farms than for farms in which no succession occurred. Thirdly, this negative effect of succession on performance per ha after succession is not systematically confirmed when performance is measured per labour unit. Fourthly, for farms with recent succession (in 2013 or 2014) there is not significant effect of succession on performance after succession.

This analysis is one of the rare contributions to the issue of how farms perform after succession. Findings could inform policy-makers on whether specific policies need to be targeted to retiring farmers a few years before transfer so as to ensure the farm's viability post-succession. Our findings reveal that this depends on the performance indicators that are considered as the most important ones by policy-makers, for example whether performance per ha or per unit of labour is deemed as more crucial for the farm's survival. One thing, however, that is clear from our analysis, is that the profit indicators do not increase following succession; at best, they do not change, at worst, they decrease.

This investigation was carried out on a short time (between one and six years). Analyses over a longer period are however needed, as adjustments of the new farmer after succession may take time. Also, it would be preferable to investigate the issue per type of farming (e.g. dairy farms, field crop farms, etc.), but for this a bigger sample of farms with succession would be needed.

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