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The Impact of Non-Agricultural Diversification on Financial Performance: Evidence from Family Farms in Italy

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Abstract: Diversification has been increasingly recognized as a rewarding farm strategy through which farmers produce on-farm non-agricultural goods and services. In doing so, farmers employ farm inputs (capital, labor, and land) in products other than agricultural goods, with the aim to sell them in the market and increase their income. While a significant body of literature has explored the drivers affecting the adoption of diversification activities, so far little attention has been given to the impact of such adoption on the technical and financial performance of farms. This article intends to provide empirical evidence on the impact of on-farm non-agricultural diversification on the financial performance of family farms in Italy, by using a nation-wide sample of agricultural holdings based on the Farm Accountancy Data Network (FADN) data. We estimated a fixed effects-instrumental variable panel model to deal with two potential sources of bias: self-selection in the diversification strategy and simultaneity, due to the fact that farmers often decide to diversify with outcome expectations in mind. Our findings show that in Italy the diversification strategy has a positive impact on the financial performance of family farms, which is second in magnitude only to that of land growth strategy. Our results also confirm the positive impact of efficiency and clarify that education has a positive return to investment when it is specialized in agriculture.

Keywords: non-agricultural diversification; financial performance; family farms; FADN

1. Introduction

Diversification is recognized as a strategy to increase the goods and services that are produced on-farm and are saleable to the market. It is becoming a key strategy for an increasing number of farms both in developed and developing countries, in order to improve farm results and farmers' income [1,2]. For example, farm households engaged in non-commodity entrepreneurial activities contributed almost 40% of the total value of U.S. agricultural production [3]. Similarly, at the EU level it is increasingly recognized that the allocation of household labor to on-farm diversified activities represents one of the main strategies to pursue viability of rural areas. Diversification includes the on-farm process of primary goods as well as non-agricultural services, such as on-farm tourism, and the production of energy. Diversification is also a central issue in the debate surrounding the Common Agricultural Policy (CAP) reform, as well as in the EU Horizon 2020 strategies [4,5]. During the 2014–2020 programming period, EU countries have allocated 7.4% on average of total public expenditure to the measures dedicated to farm and business development, which includes, inter alia, support for farm diversification [6].

This paper focuses on the diversification in on-farm non-agricultural activities, consisting of a highly and rapidly expanding set of heterogenous activities adopted by farms. Such activities were originally confined to the storage, processing, and sale of farm products and to contract work. However, they have then expanded in response to changes in demand for food and landscape [7] and to the emerging needs of shifting towards the bio-based economy [8]. The former changes in demand have enlarged the set of production activities performed by farmers, which now includes a large array of recreational, educational, and social services (e.g., care farming) [9,10]. Such enlargement has moved along the concept of broadening, originating from the seminal work of Van der Ploeg and Roep [11] and referring to activities that allocate farm production factors outside the main agricultural activities. The shift towards the bio-based economy, mainly related to the on-farm production of energy from renewable sources (wind, solar, and biomass), moves along the concept of agricultural deepening coming from the same authors and provides further scope for diversification along the primary production and the agri-food-energy system. During the last few decades, the adoption of income diversification strategies based on renewable energy production has been largely fostered by targeted specific policy support [12,13]. Such targets aim also at stimulating a generational renewal in agriculture, attracting younger and more educated farmers in the primary sector [14].

In this evolving scenario, a significant body of literature has explored the drivers affecting the adoption of diversification activities [5,15–17] as well as their intensity, i.e., the level of involvement in on-farm non-agricultural activities [4] while little attention has been given to the impact of such adoption on the technical efficiency [9,18,19], economic viability [1], and financial performance of farms [16,20].

This article intends to add to this stream of literature by performing an instrumental variable panel model to account for potential endogeneity biases and identify the causal relationship between diversification and financial performance of farms. When assessing this causal relationship, we cannot simply compare the performance of diversified and non-diversified farms due to several potential sources of bias, such as self-selection in the diversification strategy and reverse causality. In order to cope with endogeneity, in this paper we estimate a fixed effects-iv panel model. Our results also contribute to a comparison of the role played by different strategies used by farmers in enhancing the financial performance of farms, namely farm size growth, efficiency, and education.

The article is divided in five sections, as follows. After this introduction, Section 2 sketches a background framework with an overview on the literature on diversification. Section 3 presents the estimation methodology, while Section 4 focuses on the presentation and discussion of the main results. Finally, in Section 5 some conclusions are drawn.

2. Background

Farm non-agricultural diversification was defined by Ilbery [21] as the development of income-earning activities outside the range of conventional crop and livestock enterprises employing farm inputs and resources. In particular, on-farm diversification in non-agricultural activities (hereafter only diversification) has been increasingly recognized as a successful business strategy in which a farmer produces non-agricultural goods and services by employing farm resources (capital, labor, and land), with the aim to sell them in the market [4,22].

According to the official statistics [23,24], all the returns from diversification represent a still small but rapidly growing share of the total farm income, and often offer job opportunities to the family members of the entrepreneur, but also to other skilled non-agricultural workers. Diversification can be a very important strategy, especially for farms that are owner managed and whose labor force is provided mostly by family members. The diversification strategy is particularly relevant in Europe, where this typology represents the vast majority of farms (96.2%). Moreover, in 2013 approximately three quarters (76.5%) of the EU-28's agricultural labor force was provided by family members [25].

In 2013, only 6.8% of EU-28 farms declared that they performed other gainful activities related to the property [26]. However, national figures vary significantly. In Italy, according to ISTAT, in 2016 around 8% of farms carried out at least one diversification activity. The most common activities were the processing of agricultural products (30% of diversified farms), agritourism (29%), renewable energy production (28%), and contract work (21%) [27].

Regarding the economic analysis carried out focused on Italy, Salvioni et al. [28], used a panel of data built on the basis of information collected by the Italian FADN between 2003 and 2009 to determine that diversified farms cover 6% of the total population of Italian commercial farms, with an additional 2% of farms using both product differentiation and income diversification strategies. They also found that diversified farms are the only group of farms showing an upward trend in income per unit of labor in the observed period. Rivaroli et al. [29] analyzed the diversification pathways in the Emilia Romagna Region, and showed that farms adopting at least one diversified activity (10% of the total) have a quite high average rate of revenues from diversified activities, roughly 40% of their total farm income. Similar results were obtained by Boncinelli et al. [5] for Tuscany, where diversification is demonstrated to be a relevant option for complementing farm incomes, although only 8% of farmers adopt at least one diversification activity.

In many cases, diversification can be seen as a response of farmers to adverse socio-economic conditions, which tend to reduce the capacity of agriculture to provide a sufficient income to the farm household, by helping farmers to sustain their businesses, maintain their rural lifestyles, and keep their farmlands [1,16,22,30,31]. From this perspective, it may be argued that diversification is usually related to a wider farming family and social context, including the need to provide gainful employment for family members, or to the desire to contribute to wider social and environmental objectives of the area where farms are located [32,33].

Indeed, although diversification activities are usually undertaken for economic reasons, some evidence also show that other factors not strictly related to the economic situation of the farm can play an important role, making the impact of diversification on the financial performance of farms less obvious [1]. In many cases, additional revenues coming from non-agricultural activities may be strategic to keep family farms in business, with benefits that go well beyond the farm gates, both to the local communities and to society [34]. For example, Schilling et al. [35], in examining the economic benefits of agritourism in New Jersey, show that a significant percentage of farms do not earn immediate income from such activity, therefore suggesting the presence of either nonmonetary or deferred economic benefits.

Similarly to crop diversification, non-agricultural diversification can be a risk management mechanism [36] and gives rise to scope economies [37] i.e., cost reduction associated with multi-output production processes. In addition to crop diversification, non-agricultural diversification has the advantage of providing a payoff that is uncorrelated to and often higher and more stable than farm income. Indeed, it has been demonstrated that diversification strategies by spreading the risk and creating income streams which are additional to income from agriculture, have great potential in increasing the resilience of family farms [38] and in many cases they may also positively influence the general commitment to continue farming in small households [33].

There is a wide literature that has investigated the determinants of diversification and has shown the relationship between the adoption of diversification activities and the socio demographic, economic, and geographical characteristics of farm holdings and farm households, see reference [5] for a summary of the main findings. Other studies have investigated the factors affecting the farmers' decision regarding the workdays dedicated to non-agricultural activities [5], the capacity of diversification to generate new jobs [39], the technical efficiency [9,18,19], and the economic viability [1] of diversified farms.

Despite a wide array of research in the field, there are still open questions and little evidence on the causal effects of diversification activities on the financial performance of farms, both inside and outside of the EU. Joo et al. [20] employed a propensity score matching method to correct for self-selection bias and estimate the average treatment effect of agritourism on the financial performance of farms, namely return to assets, total household income, and net farm income per dollar of owned assets in the US. They conducted three separate analyses for all farms, small farms, and large farms (valued at greater than $250,000). Their results revealed that while the impact of agritourism's effect on the financial performance is not statistically significant in large farms, it is positive and significant in small farms. Khanal and Mishra [16] assessed the impact of the engagement of farmers in either agritourism or off-farm work-or both the strategies-on the US farms' financial performance, namely on gross cash farm income and total farm household income, by employing the selectivity-based approach suggested by Bourguignon et al. [40] to estimate a multinomial logit model. They found that both gross cash farm income and total farm household income are higher for farm households running these activates than in a randomly chosen farm household.

3. Materials and Methods

3.1. Empirical Strategy

When assessing the causal impact of the engagement in non-agricultural activities on the financial performance of farms, we cannot simply compare the performance of diversified and non-diversified farms due to several potential sources of bias.

Bias may result, first, from self-selection of farmers in the diversification strategy i.e., from the way in which farmers make choices regarding assignment into the mutually-exclusive treatment (diversified) and non-treatment groups [4,5,16,20]. To test and correct for the potential self-selection, we exploit the panel structure of our sample and estimate a panel data model that allows us to control for time-invariant unobserved heterogeneity that, in turn, may lead farms to self-select and could explain variation in outcomes. In other words, we control for unobserved farm specific characteristics, such as farmer ability or size and composition of the farm household, that may affect self-selection in on farm non-agricultural diversification. By assuming these unobservable attributes are fixed over the relatively short periods of time under observation, we can employ a fixed effect panel data model to alleviate self-selection issue. The main rationale behind this assumption is that when farmers decide to engage in a non-farming activity, the farm need to undergo an often slow, deep adaptation process during which these unobserved factors do not change. Furthermore, it is assumed the structural change to have happened before the observed period started, that is, before the diversification choice was made, hence characteristics remained fixed after the uptake of the income diversification activity.

The fixed effect panel data model assumes that the variables explaining the self-selection decision are exogenous. Indeed, farmers often take the decision to self-select in the on-farm non-agricultural diversification strategy with outcomes expectations in mind. If farmers' decision to diversify depends on their anticipated performance changes, the assumption that the confounding factors are exogenous is incorrect and fixed effect estimation may be biased and inconsistent. In order to address the problems of simultaneity i.e., the dependence of the decision to self-select on outcomes and the dependence of outcomes on the self-selection decision, we employ an instrumental variable (iv) approach.

In order to handle the possible endogeneity bias due to self-selection and simultaneity where participation in non-agricultural activities causes changes in the farm financial performance and vice versa, we employed a fixed effects-iv panel model.

The model we estimated is

$$y_{it} = Y_{it}\gamma + X1_{it}\beta + \mu_i + \nu_{it} = Z_{it}\delta + \mu_i + \nu_{it}$$

where:

- y_{it} denotes the observed financial performance for farm i at time t;
- Y_{it} is an$_1 \times g_2$ vector of observations on g_2 endogenous variables included as covariates, which are allowed to be correlated with the ν_{it};
- $X1_{it}$ is an$_1 \times k_1$ vector of observations on the exogenous variables included as covariates;
- $Z_{it} = [Y_{it}\ X_{it}]$;
- γ is a $g_2 \times 1$ vector of coefficients;
- β is a $k_1 \times 1$ vector of coefficients; and
- δ is a $K \times 1$ vector of coefficients, where $K = g_2 + k_1$.
- ν_{it} are serially and cross-sectionally uncorrelated errors.

- μ_i are the fixed effects.

To conduct iv estimations, we need to have valid instrumental variables, i.e., (i) uncorrelated with the error term (orthogonality condition), (ii) partially and sufficiently strongly correlated with the exogenous variables once the other independent variables are controlled for (relevant). The key challenge is to identify valid instruments i.e., variables that are correlated with the decision to engage with on farm nonagricultural diversification, but not directly related to the farm financial performance. We use woodland and forest area (WFA) and the length of farmer participation in diversification (Length) as instruments. WFA refers to woodland area, i.e., forests, plantations, including nurseries that is not included in Utilized Agricultural Area (UAA). WFA does not contribute to the financial performance of farming because this portion of land cannot be utilized for growing crops and livestock. As a consequence, it is credible that the presence of WFA encourages farmers aiming at increasing their income opportunities to diversify into non-agricultural activities. This is particularly true in the case of agritourism and renewable energy production. In our sample, WFA on average is almost 4 hectares in diversified farms, while it is less than 2 hectares in non-diversified farms (Table 1). In addition to WFA and similarly to Läpple et al. [41], we also use the length of farmer participation in diversification to address the endogeneity concerns associated with evaluating the causal impacts of diversification on farm financial outcomes.

Table 1. Definition of variables and units of measurement.

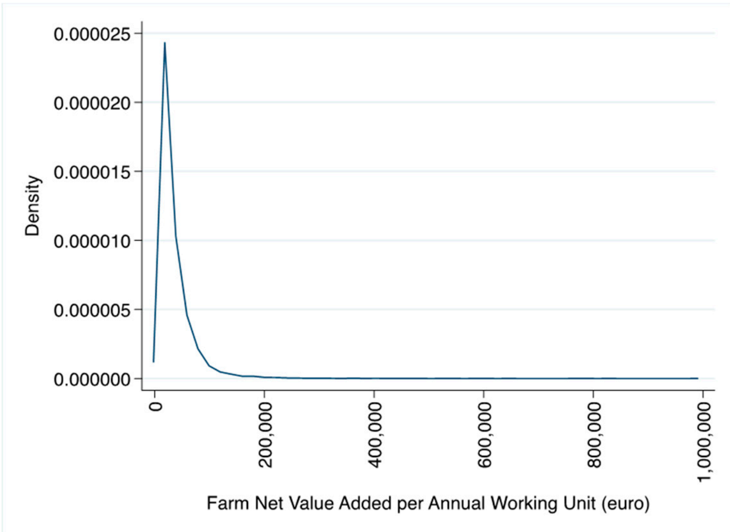
Variable	Unit of Measure	Definition
Dependent Variable		
lFNVA_AWU	euros	Farm Net Value Added to Annual Working Units ratio (in logarithms)
Farmers Traits		
Age	years	Age of the farmer in years.
Gender	1 = male, 2 = female	Gender of the farmer.
Professional	dummy	A farmer with education in agriculture
Compulsory	dummy	A farmer with compulsory education only (eight years)
Covariates		
Diversification	ratio	Revenues from diversification to total farm revenues ratio
UAA	hectares	Agricultural utilized area
UAA2	hectares	Squared Agricultural utilized area
Efficiency	ratio	Efficiency in farming: agricultural revenues over variable costs.
Arable_d	dummy	Specialization in arable crops
Permanent_d	dummy	Specialization in permanent crops
Granivorel_d	dummy	Specialization in granivore livestock
Grazingl_d	dummy	Specialization in grazing livestock
WFA	hectares	Woodland and forest area
Length	years	Number of years in diversification

3.2. Data and Descriptive Analysis

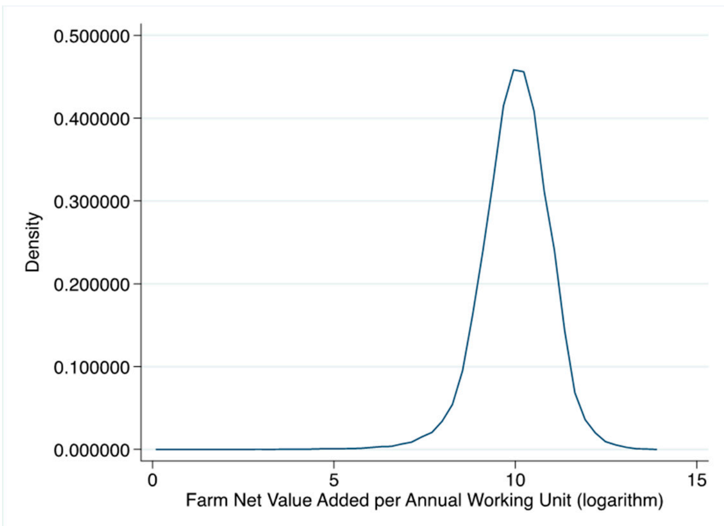
This study used data from the Italian Farm Accountancy data Network (FADN). We built an unbalanced panel of more than 15,917 Italian commercial family farms observed over the period from 2010 to 2016, translating in more than 63,338 observations. We defined family farms as farms which are totally or partially operated by family members. Regarding the diversification activities, the Italian FADN database includes agritourism, contract work, land rents, services, and energy production.

We used Farm Net Value Added per Annual Working Unit (FNVA_AWU), i.e., a measure of partial labor productivity, as a measure of the farm financial performance. Farm net value added (FNVA) is one of the FADN's main income indicators. It is equal to gross farm income minus depreciation costs. It represents the remuneration of the fixed factors of production (labor, land, and capital), whether they be external or family factors. In line with what is usually done in the EU Commission studies, we have chosen to use FNVA rather than other measures of farm income, since in the case of FNVA agricultural holdings can be compared regardless of whether family or non-family factors of production are used. It is worth noting though that FNVA and net income are highly correlated in our sample. Finally, FNVA is expressed per Annual Working Unit (AWU) to better account for the structural diversity in farms. More in detail, we use a logarithmic transformation of FNVA_AWU so that extreme values become much less extreme and reduce the risk that outliers bias our estimates. The effect of this transformation on the probability distribution of the variable FNVA_AWU can be appreciated in the density plots reported in Figure 1a,b that refer to the variable FNVA_AWU as observed (Figure 1a) and transformed in logarithms (Figure 1b), respectively. Recall the y-axis in a density plot refers to the probabilities of occurrence of different possible values of the variable under analysis. The data in Figure 1a show that average FNVA_AWU is highly concentrated in the left tail of the distribution with a mean equal to 33,207.30 and a median equal to 23,067.19 euros.

In Figure 2, we report the violin plots of FNVA_AWU in non-diversified and diversified farms. Violin plots are similar to a box plot, where the median is displayed as a short horizontal line and the first-to-third interquartile range as a narrow shaded box, with the addition of a rotated density plot on each side.



(**a**)



(**b**)

Figure 1. (**a**) Density plot of Farm Net Value Added per Annual Working Unit–FNVA_AWU. (**b**) Density plot of Farm Net Value Added per Annual Working Unit (logarithms)–1FNVA_AWU.

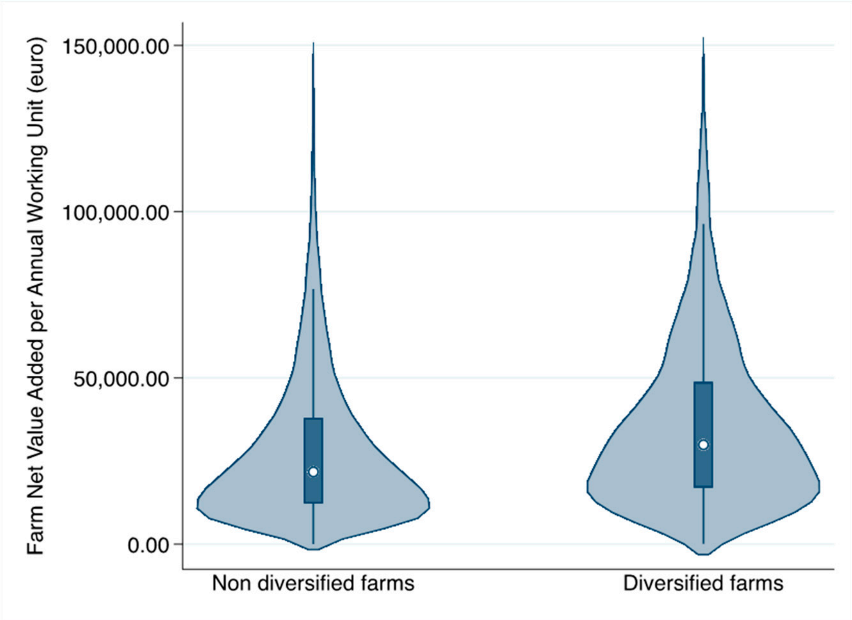


Figure 2. Violin plots of Farm Net Value Added per Annual Working Unit in non-diversified and diversified farms.

Figure 2 shows that although the median is just slightly better in diversified farms than in the rest of the sample, the distribution of financial performance of diversified farms presents a heavier upper tail in respect to farms that do not diversify. This means that the quota of farms that presents medium and medium-high incomes is higher in diversified farms than in the rest of the sample.

Participation in diversification in our sample was 13.28%. In diversified farms, the average quota of revenues from diversification over total farm revenues was 0.27, with a median value of 0.13 (Figure 3).

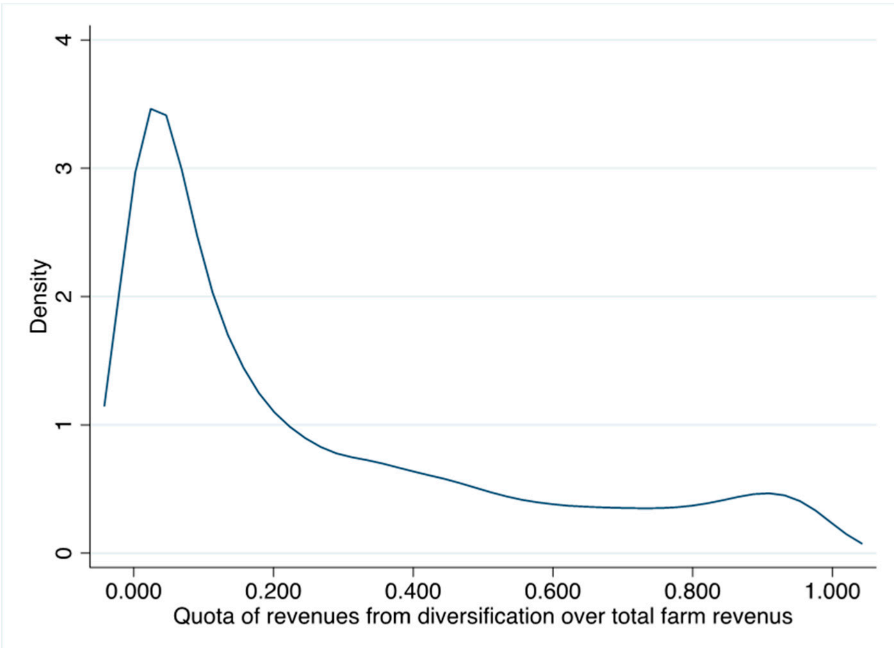


Figure 3. Density plot of the quota of revenues from diversification over total farm revenues in diversified farms.

The choice of the covariates was driven by two main criteria, namely the link with the aforementioned literature and the availability of data in the dataset. The list of covariates can be classified in two main groups: (i) farmers' and (ii) farms' characteristics. Definitions of the variable are reported in Table 1 and descriptive statistics are provided in Table 2.

Table 2. Descriptive statistics.

Variable	Non-Diversified Farms (54,928)		Diversified Farms (8409)	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	55.364	13.694	52.292	12.727
Gender	1.184	0.388	1.164	0.371
Professional	0.130	0.337	0.169	0.375
Compulsory8	0.596	0.491	0.491	0.500
lFNVA_AWU	9.970	0.940	10.249	0.877
Diversification	0.000	0.000	0.261	0.287
UAA	29.896	50.746	41.156	63.964
UAA2	3468.874	23,617.780	5784.730	29,430.660
Efficiency	3.037	3.904	2.959	2.383
Arable_d	0.259	0.438	0.209	0.407
Permanent_d	0.302	0.459	0.241	0.428
Grazingl_d	0.227	0.419	0.223	0.416
Granivorel_d	0.026	0.158	0.159	0.365
Length	0.000	0.000	3.013	1.727
WFA	1.960	11.595	4.962	31.640

The group of farmers' characteristics include age, gender, and level of education. The age of the farmer is expected to have a negative impact on the financial performance of farms since younger farmers are usually more risk tolerant than older farmers and invest in more profitable activities. At this regard it is interesting to note that farmers of diversified farms are younger than other farmers. We have no clear expectations for the sign of the variable gender of the farmer, still it is interesting to note that in the whole sample 81.8% of farms have a male farmer, while the percentage is slightly lower in diversified farms. This is probably due to fact that the percentage of female farmers is higher among farms with agritourism (24%). We also introduce age squared to capture possible nonlinear association of age with the farm performance.

Education is expected to positively influence the financial performance of the farm. Much of the economic research on the value of educational investment originated from the work of Becker [42] who proposed to treat investment in education as a capital investment. Various arguments have been proposed to explain the mechanism leading education to affect agricultural productivity [43]. Well educated farmers first are capable of using available information more competently, second, they have better access to required information and, third, they are more likely to adopt new technologies or products earlier since they have superior access to related information, are more capable of distinguishing between promising and unpromising innovations, and are more willing to adopt riskier production technologies if these technologies provide higher expected returns. Education is usually proxied by years of schooling or a dummy variable showing a minimum threshold level [44], as both these approaches measure the quantity of schooling and hence the level of education [45]. In this paper we control for both general and agricultural specific education. The effect of general education is measured by the variable compulsory denoted by farmers with only eight years of schooling, which is expected to negatively influence farm results. In contrast, the effect of specific training in agriculture is expected to boost productivity and results from farming as found in recent research [46]. It is interesting to note that on average in our sample, there is a higher percentage of better educated farmers and farmers with specific training in agriculture among diversified farms than in the rest of the sample.

Moving on to the farms' characteristics, farm size is much larger in diversified farms than in the rest of the sample. We expect a positive relationship between farm size and farm returns, we also introduce land squared to capture possible nonlinearities in the relationship between farms size and returns. Efficiency in farming, defined as revenues from crop and livestock production over total variable costs [47], is expected to positively influence total farm income i.e., income obtained by both agricultural and non-agricultural activities. Finally, in consideration of the observed farm results, we expected the sign of the farm specialization in crops (arable and permanent) to be negative, while we expected that of granivores (pigs and poultry) and grazing livestock to be positive.

4. Results

To estimate the causal impact of diversification on the financial performance of farms, we first fitted an instrumental-variable pooled OLS model by using two-stage least squares (results not shown but available on request) and ran the Wu-Hausman and Durbin tests of endogeneity that allowed us to reject the null hypothesis that the variables are exogenous and confirm the existence of an endogeneity bias, meaning OLS are not appropriate (Durbin (score) chi2(1) = 272.565 (p = 0.0000); Wu-Hausman F (1,63,317) = 273.656 (p = 0.0000). We then estimated a fixed effects panel data model to control for unobserved heterogeneity. The small p-value of the joint significance of the fixed effects intercepts (F (15916, 47410) = 8.12; Prob > F = 0.000) rejected the null hypothesis and confirmed we need to use fixed effects. Finally, we estimated a fixed effects panel data models within a 2SLS/IV framework to handle endogeneity biases of the model. The tests performed on the first and second stage regression (see Tables A1 and A2 in the Appendix A) confirm that the instruments are valid, i.e., relevant and exogenous, and strong (not weak). We report the estimated coefficients of the fixed effects SLS/IV panel data model in Table 3.

Table 3. The second-stage regression results.

Variable	Coefficients	Standard Error	P > z	Standardized Coefficients
Age	−0.001	0.001	0.125	
Gender	0.016	0.039	0.686	
Professional	0.099	0.045	0.026	0.034
Compulsory education	0.003	0.034	0.938	
Diversification	0.901	0.124	0.000	0.158
UAA	0.004	0.000	0.000	0.205
UAA2	0	0.000	0.000	
Efficiency	0.022	0.001	0.000	0.081
Arable_d	−0.039	0.018	0.033	−0.017
Permanent_d	−0.059	0.021	0.005	−0.027
Grazingl_d	0.061	0.022	0.005	0.026
Granivorel_d	0.318	0.045	0.000	0.064

Among the personal traits of the farmer age, gender and levels of education of the farmer are not found to be statistically significant after controlling for endogeneity, while the impact of specific education in agriculture is statistically significant and positive. The impacts of the variables referred to the education of the farmer offer us the opportunity to discuss the role of human capital strategies on the financial performance of farm. As noted in previous sessions, we control for the impact of both general and agricultural specific education. We find that while general education does not have influence on the financial performance of farms, agricultural specific education has a positive impact on the farm results.

As for the structural traits of the farm, the coefficients of farm size and squared farm size, diversification and efficiency are statistically significant and positive. The zero coefficient of the squared land suggests that there is not a non-linear relationship between land size and the financial performance of the farm. All the estimates of the four dummies referred to the specialization in the production of specific agricultural products are statistically significant. In greater details, as expected, the specialization in production of livestock, both granivores and grazing livestock is positive, while the coefficient of arable and permanent crops is negative. The positive effect of livestock, with respect to the base sector, is positive since such a sector in Italy is usually characterized by a high level of intensification, especially for granivores, which leads to unitary results that are higher than average. In contrast, more extensive sectors such as arable and permanent crops usually show lower than average unitary results that explain the negative impact recorded by the model.

The central finding of our study is that on-farm diversification has a large, positive, and statistically significant impact on FNVA_AWU. Such a result is in line with what found in other research that estimates the causal effects of specific diversification activities, namely agritourism, on the financial performance of US farms [16,20].

In order to compare the magnitude of the impact of diversification in non-agricultural activities to that of the other strategies that farmers can adopt to increase the financial performance of their farm, we have calculated the standardized coefficients that allow us to account for the differences in unit of measure used for different variables. After standardizing, the variable with the largest impact on the farm financial performance is land size, followed by diversification, efficiency, and education in agriculture. The large magnitude of the standardized coefficient referred to farmland suggests that strategies based on physical farm size growth are the best strategies farmers can use to improve the financial performance of the farm. As explained by the economic theory, farm size growth allows farmers to reap the benefits of economies of scale that may reflect in an increase in the financial performance of the farm. In fact, the rigidity of the land market in Italy on one side and the large percentage of hill and mountain area on the other side limit the chance of benefiting from agglomeration of farmland and scale economies. Under such circumstances the impact of diversification, though smaller in magnitude than the impact of an increase in land size, can be of great help. Farmers who do not have the opportunity to increase their farm size can improve the financial performance of their farms through the exploitation of the economies of scope, namely the cost advantages that result when farms use their physical indivisible assets to produce a variety of products in addition to agricultural products. As expected, efficiency in farming plays an important role in the financial performance of farms. The higher the efficiency in farming, the better the financial performance of the farm will be. This is because high levels of efficiency imply that farm resources are optimally allocated, and that wastes are minimized. Finally, the positive return to agricultural education confirms that participation in formal agricultural education is a good investment for farmers and for society [46].

5. Conclusions

Among the large body of literature on diversification, only a small number of studies have investigated the economic and financial effects of diversification at the farm level. Existing studies mainly refer to a single diversification activity—often agritourism—and they usually have a local or regional focus. This article provides additional evidence on the role of diversification at a national scale, by focusing on the impact of non-agricultural activities on the financial performance of family farms in Italy.

To accomplish the above objective, we used a nation-wide sample of agricultural holdings based on FADN data, and estimated a fixed effects-iv panel model to deal with two potential sources of bias: self-selection in the diversification strategy and simultaneity, due to the fact that farmers often decide to diversify with outcome expectations in mind.

Our findings first of all suggest that in Italy, the diversification activities have a significant and positive impact on the financial performance of Italian family farms in line with what was already found in previous studies estimating the causal impact of agritourism on the financial performance of US farms [16,20]. In addition, our results contribute to clarify and compare the role played by different strategies used by farmers in enhancing the financial performance of farms. Farm size growth is confirmed to be the strategy with the largest impact. Diversification is second in terms of impact, still it can play an essential role in helping farmers to improve their incomes, especially in the presence of rigid land markets. Diversification can be then interpreted as specific business strategy developed by the most structured and market-oriented family farms, which re-allocates the production factors in a more efficient way in order to diversify (and to increase) income sources, thus reducing the instability of the total family income and other sources of risks which are always present in the agricultural-related business. Efficiency in farming, in line with the previous literature, is found to have a positive impact on the financial performance of farms. Finally, we also found a positive effect of specialized education in agriculture.

This evidence can be particularly relevant from a policy perspective. As for the finding about diversification, at the EU level policy support for farm diversification has been implemented through the introduction of 'diversification into non-agricultural activities' and 'encouragement of tourism activities' measures in the context of Rural Development Policies, since diversification has been increasingly recognized as a key strategy for balanced territorial development. However, one could argue that policy intervention should look beyond the mere implementation of diversification measures in the context of RDPs. Second, our finding on the impact of agricultural education suggests the need to implement effective policy instruments that have the potential of expanding educational opportunities on agriculture for young farmers, new entrants and future entrepreneurs. Since the high level of a farmer's education is positively related to their willingness to take innovation risks [17,48], policies should be able to create specific educational opportunities that are required by a modern and competitive farming sector. A more targeted focus of EU policies on agricultural education could also permit new entrepreneurial non-farming skills to emerge, by promoting the ability to engage in diversification activities and, above all, to better incorporate such activities in the farms' business story and strategy.

Finally, we point out some limitations of this study. Due to collinearity, the research did not include a territorial differentiation of farms (e.g., between North and South of Italy or amongst Regions). In addition, our model did not account for the effect of variables related to mechanization or other characteristics of the production technology as well as participation in policy measures, since these decisions may be endogenous to the financial performance of family farms. As a consequence, they increase the number of potential sources of biases that need to be controlled. In spite of this, the paper still adds significant elements to the existing body of literature and future research should continue to address the complex set of structural, context-related, technological, social, and institutional conditions that determine the financial performance of family farms.

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Appendix A

For the first-stage regression (Table A1) we first performed the test of excluded instruments. The small p value of the F statistic allows us to reject the null hypothesis that the instruments are not relevant. Second, we performed the under-identification test using the Anderson canonical correlation likelihood ratio statistic. Even in this case the p value of 0.000 allows us to reject the null hypothesis of the matrix being under identified. The same result is obtained through the Cragg-Donald (Wald) statistic. Third, the p-value of 0.000 of the Anderson-Rubin and of the Stock-Wright LM test of joint significance of endogenous regressors allow us to reject the null hypothesis that the over-identifying restrictions are valid.

Table A1. First-stage regression statistics.

Variable	Shea Partial R2	Partial R2	F(2, 47,407)	*p*-value
div_te1	0.1476	0.1476	4103.88	0.0000
Underidentification tests				
Anderson canon. corr.	Chi-sq(2) = 6998.50		*p*-val = 0.0000	
Cragg-Donald Wald statistic	Chi-sq(2) = 8210.18		*p*-val = 0.0000	
Weak-instrument-robust inference				
Tests of joint significance of endogenous regressors B1 in main equation				
Ho: B1 = 0 and overidentifying restrictions are valid				
Anderson-Rubin Wald test	F(2, 47,408) = 27.47		*p*-val = 0.0000	
Anderson-Rubin Wald test	Chi-sq(2) = 54.96		*p*-val = 0.0000	
Stock-Wright LM S statistic	Chi-sq(2) = 54.89		*p*-val = 0.0000	

For the second-stage IV regression (Table A2), we first performed the Sargan test. The large *p*-value allow us to conclude that we cannot reject the null hypothesis that instruments uncorrelated with error term and the excluded instruments are correctly excluded from the estimated equation. The large value of the Cragg and Donald statistics (identification) allows us to conclude that the instruments are strong enough. Finally, the *p*-value of 0.000 of the Anderson's canonical correlation test allows us to reject the null suggesting the instruments are adequate to identify the equation.

Table A2. Second-stage regression statistics.

Underidentification test	Anderson canon. corr. LM statistic	6998.500	Chi-sq(2) *p* val = 0.0000
Weak identification test	Cragg-Donald Wald F statistic	4103.963	
Overidentification test of all instruments	Sargan statistic	2.316	Chi-sq(1) *p* val = 0.1281

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