

Farms' structural adjustment to the increasing competitive pressure: specialization vs. de-specialization in Italian agriculture

Concetta Cardillo - Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Daniela Fusco - ISTAT

Valerio Moretti - ISTAT

Carlo Russo - Università di Cassino e del Lazio Meridionale*

**Corresponding author: russocar@unicas.it*

Abstract

The paper provides an application of micro-data statistical analysis for agricultural economics studies. We use data from the 2000 and 2010 Censuses to build a short, two-year panel of 823.771 farms and we used the panel to describe specialization in Italian agriculture. We classified Italian farms into four groups according to their adoption of specialized Type of Farming (TOF) in 2000 and 2010 or de-specialized TOF in both surveys, or the change from a specialized to a de-specialized TOF or vice versa. The degree of specialization in Italian agriculture increased over the decade and the result was driven mostly by a relevant shift toward specialization of farms located in the mountain areas of central and southern Italy. We also found an association between the age structure of the family workforce and the choice of adopting a specialized TOF.

Keywords

Farm level data, agricultural Census, specialization

Introduction

Italian farms are exposed to increasing competitive pressure, due to social and economic factors (Russo, Sabbatini 2008). Changes in market structure, such as the consolidation of downstream and upstream industries, global sourcing, price volatility, increase in reservation wage of family labor are just examples of the determinants of such increasing pressure. Farmers must face the pressure and consequently are adjusting their business strategies and operations (Russo, Sabbatini 2010).

The data from agricultural censuses provide a detailed description of such adjustment process and the traditional approach is based on the simple comparison of the data of the two censuses to measure the trends in the agricultural sector. For example, in the decade 2000-2010, the number of farms declined by 32.4% (Agricultural Census, 2010) while the average tillable area increased by 30.4%. The number of breeding farms decreased by 41.3%, and the trend was particularly severe in central and southern Italy. Overall, the

agricultural sector underwent a deep restructuring due to competitive pressure (Spinelli, Fanfani 2012; Sotte, Arzeni 2013). Despite of the magnitude of the change, the nature of the adjustment remains still partially uninvestigated.

This paper provides an illustration of the changes in the structure of Italian farm due to the intense competitive pressure. We use a panel data from the V and VI agricultural census and we describe the adjustment in production, with a special focus on specialized farms. We want to test if there were difference in the adjustment path between specialized and non-specialized farms and if the increase in the competitive pressure triggered a specialization process in Italian agriculture or, on the contrary, de-specialized business model emerged. In fact, economic theory does not offer clear prediction of the effects of competitive pressure on specialization. On one hand, pressure might lead to specialization, in the attempt of achieving efficiency. On the other hand, de-specialization is a plausible strategy to reduce risk and lower fixed costs. The inherent empirical nature of the research question motivates the study.

Method

To address the study question, we used a two-period panel data of 823,771 farms. This database was obtained combining two independent data sources via statistical matching: the V and VI General Agricultural Censuses. In order to focus on the structural adjustment due to competitive pressure, we focused our attention to the units having the same person as head of operations during the study period. In this way, the variations can be considered as the consequence of structural adjustment only, without being affected by changes in management. As a consequence, farms with a passage of an inheritance or a change in legal form has been dropped excluded from the dataset. This approach underestimates the total effect of competitive pressure, as it does not account for exit (or entry), but gives a more precise assessment of the impact on ongoing businesses.

The V and VI Agricultural Census did not use the same farm identification system. Therefore a statistical matching across the two data sources was necessary. The linkage of the statistical units was based on three variables, which identify the farms:

1. Unique Code Farm.
2. Address of the headquarter.
3. Name of the farm.

The first step of the matching model selected for the linkage was to link the Unique Code applying a deterministic model of equality. Then the address and the name were linked by applying a function of the distance of the strings via an indicator normalized between 0 and 1. It measures how information contained in a cell (in this case, the address) is similar to the content of another cell. The value of the index is positively correlated with the degree of similarity in information.

Specialization was measured using the Community typology for agricultural holdings (REG EC 1242/2008), which allows us to classify farms according to the incidence of single production

over total gross income. Farms having more than 2/3 of their standard output¹ depending on a single production are defined as 'specialized'. We applied this classification in 2000 and 2010² and calculated the change in the typology for each individual farm. Based on this micro-level analysis, we produced aggregated statistics to describe the national trend.

Panel description

The result was a panel of 823,771 farms that are present in the censuses of 2000 and 2010. The comparison between the Universe (the 1,620,884 Italian farms detected by the sixth agricultural census 2010) and the subgroup of 823,771 farms survived since 2000 highlights the overall representativeness of the subgroup in reference to his total.

Figure 1 reports the sample coverage at township level, showing the high representativeness of the sample even at local level.

The result is the same if we consider as comparison features main variables as management system, the utilized agricultural area (UAA), the total area (TA), the working days and the standard output (SO).

Regarding to the management system, in the 2010 census 95.9% of farms are directly managed by the farmer, 3.6% declare a management with wage earner staff and the remaining 0.5% is characterized by other forms of management.

The subset of the farm survived from the 2000 census shows a breakdown by form of management almost comparable to the total with 95.4% run directly by the farmer, 4.1% run with salaried personnel and 0.5% by other form of management.

The analysis of the characteristics related to the size of the farms, shows that the survivors have values slightly higher than the total number of farms in 2010 with an average UAA of 8.9 hectares against 7.9 hectares of the total and an average SAT of 12 hectares (10.5 hectares to the total in 2010). The coefficients of variation also allow us to highlight how the distributions of the land variables too exhibit variability stackable.

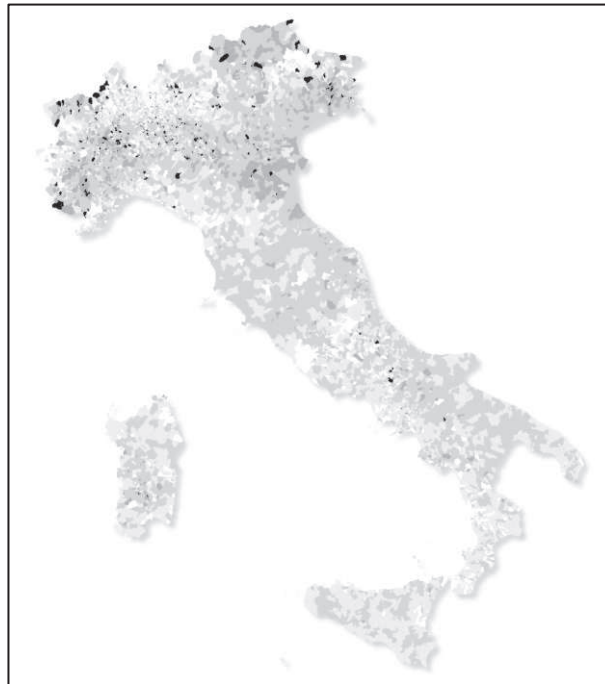
The economic variables (number of working days and standard output) the comparison remains unchanged, with the farms that survived were slightly more active than the total from 2010 - 197 working days on average against 183 - and economic values slightly above - SO average of 32,856 against a SO of 30,514. Even in this case, the variation coefficients allow to highlight that the distributions appear to have similar variability.

According to the hypothesis of specialization of Italian agriculture, the percentage of specialized farm in our sample increased from 82.0% to 88.9%. For the specialized farms the percentage of total standard output grow from 87% to 91% and the livestock unit from 89% to 92%.

¹ Standard output is the monetary value of agricultural production at farm-gate price, corresponding to the average value of a five years period and in a given region, which is calculated on the basis of the crop area and the number of livestock. Standard output does not include VAT, other taxes on products and direct payments.

² In order to make the results comparable we applied the same coefficients of Standard Output for year 2007 both to 2000 and 2010 database.

Figure 3: Sample coverage (township level)



Source: own elaboration on Census data

Results

Spatial analysis

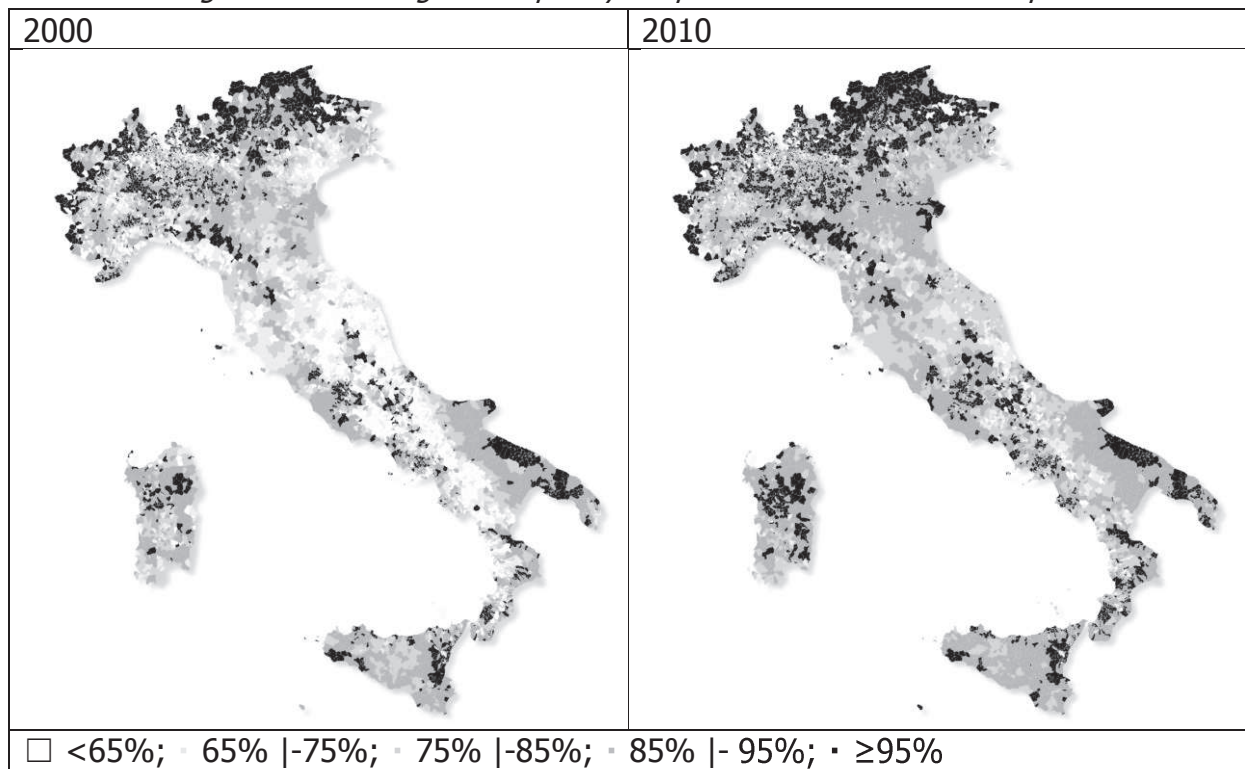
The increase in competitive pressure is associated to an increase of the degree of specialization in Italian agriculture. As stated in the panel description section, this result is conditional to the survival of the farm. A business surviving the competitive pressure is more likely to be specialized at the end of the study period than it was at the beginning.

The data was the result of a composite trend. In the study period 13.0% of the farm in the sample moved from a de-specialized type of farming (TOF) to a specialized TOF. In the same period, 6.0% moved from specialized to de-specialized. Figure 4 reports the mapping of percent frequency of specialized farms on the total sample. Visual inspection suggests that local trends may be heterogeneous. These data stress the diversity of the Italian farm system and called for a more detailed analysis.

The segmentation by OECD classification of rural areas (urban, semi-rural, rural areas) did not explain the difference in trends. Rural areas exhibited a more rapid specialization process, but in general all areas moved in the same direction.

Interestingly, rural areas presented a lower incidence of specialized farm in 2000 than urban and semirural, but the difference was not significant anymore in 2010.

Figure 4: Percentage of frequency of specialized farms in the sample.



Source: own elaboration on Census data

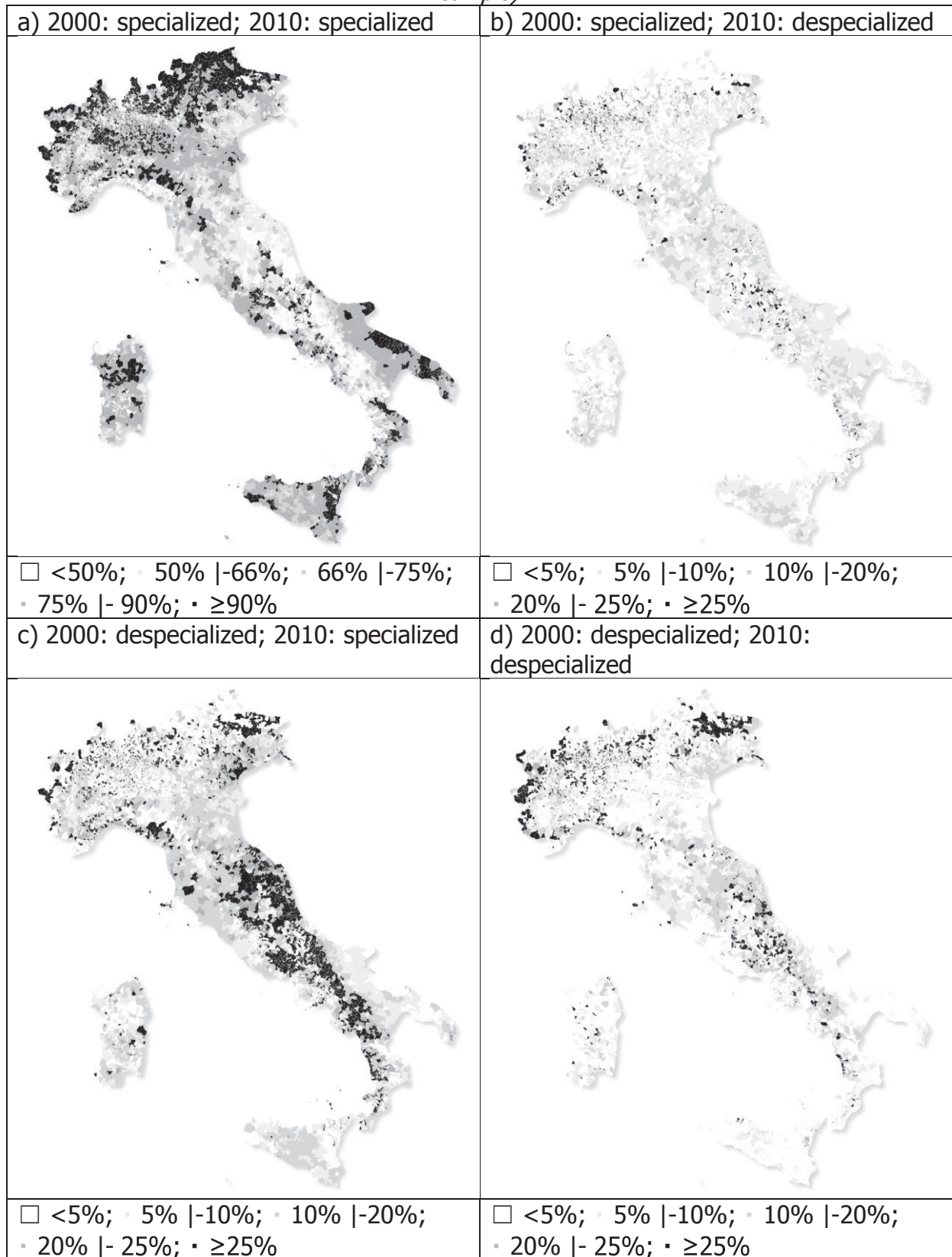
Figure 5 illustrates the spatial distribution of specialization and specialization trends. Figure 3.a shows that the majority of Italian farms (75,9%) were specialized in 2000 and preserved such orientation in 2010. These farms are located mainly in Northern Italy, Lazio, Campania, Puglia, Sicilia and Sardegna.

A non-negligible number of farms (13,0%) moved from a de-specialized orientation to specialization. They are located mainly in mountain areas of central and southern Italy, where more than 25% of farms moved into specialization (Figure 3.c).

The opposite trend (from specialization to de-specialization) concerned 6.0% of sample. The trend is approximately homogeneous across Italy, with a spatial concentration in Liguria and Abruzzo. On the other hand, Puglia, Sardegna and Bolzano province exhibit remarkably low de-specialization (Figure 3.b).

The data suggest that the gap in specialization between Northern and Southern Italy is shrinking. Such result is due to a relevant structural change of farms in the areas where de-specialized agriculture was dominant in 2000.

Figure 5: Specialization and despecialization in Italian farms (percentage of frequency in the sample)



Source: own elaboration on Census data

Demographics

The demographic characteristics of rural family may influence the production decisions (Russo and Sabbatini 2005). Our analysis found that the age structure of the family in 2000 exhibit a statistically significant association with the specialization or de-specialization processes.

To investigate this topic we broke down the sample into seven classes depending on the age of the farmer and the age of the family workers in 2000. We categorized farmers into three groups: young (farmers of age 40 or less), mature (between 40 and 60) and elder (older than 60). Each group was divided into two sub-groups: mono-generation and inter-generation farms. Mono-generation farms do not mix farmers and family work of different generations.³ Intergeneration farms use a combination of young and non-young labor. A residual 'others' group collects all observations such that the classification is not applicable (mainly, incorporated businesses). Table 1 reports the sample distribution, by demographic class and production orientation (specialized vs. de-specialized) in 2000 and 2010. In particular the first block of data represents those farms that were specialized in 2000 and that in 2010 remained specialized (column 1) or became de-specialised (column 2). The second block instead includes those farms that were de-specialized in 2000 and became specialized in 2010 (column 3) or remained de-specialised (column 4). In general it appears that the number farms that become specialized is usually double compared to the number of those that remain de-specialized and this difference is even more evident in the case of mono-generation Elder farms. Regarding the farms that were specialized in 2000, the table show that only a little percentage of them become de-specialized.

Table 1: Specialization of farm operations and age structure of rural families: number of farms

	Specialized 2000		De-specialized 2000		Total
	Specialized 2010	De-specialized 2010	Specialized 2010	De-specialized 2010	
Inter-gen. Young	25,495	2,084	4,515	2,304	34,398
Mono-gen. Young	75,018	6,104	9,715	4,231	95,068
Inter-gen. Mature	81,060	6,101	13,483	6,022	106,666
Mono-gen. Mature	270,822	21,665	47,042	18,119	357,648
Inter-gen. Elder	19,668	1,368	3,862	1,485	26,383
Mono-gen. Elder	121,064	9,517	25,098	7,977	163,656
Other	32,652	2,753	3,186	1,361	39,952
Total	625,779	49,592	106,901	41,499	823,771

Source: own elaboration on Census data

³ The label 'Mono-generation Young farms' discriminates the farms where a young farmers employs young or no family labor. The label ' Mono-generation Mature (Elder) Farms' indicates farms where a Mature (Elder) farmer employs no young family labor.

A simple χ^2 test rejected the hypothesis of independent distribution of the two variables, suggesting an association between changes in the degree of specialization and the age structure of the family.

To investigate this association further, we calculated a typical association index a between the realization i of the variable 'age structure in 2000' and the realization j of the variable 'change in production orientation'⁴:

Table 2 reports the indices. With respect to production orientation, farms have been grouped according to two criteria: the degree of specialization in 2000 and 2010 and the adoption (or non adoption) of changes in TOF.

Table 2: Association indices between changes in production orientation and age structure in 2000

		Inter- gen. Young	Mono- gen. Young	Inter- gen. Mature	Mono- gen. Mature	Inter- gen. Elder	Mono- gen. Elder	Other
Spec 2000/ Spec 2010	No Changes in TOF	0.99	1.03	1.02	0.99	0.99	0.97	1.10
Spec 2000/ Spec 2010	Change in TOF	0.88	1.14	0.86	1.02	0.90	1.02	0.91
Spec 2000/ De-spec 2010	Change in TOF	1.01	1.07	0.95	1.01	0.86	0.97	1.14
De-spec 2000/ Spec. 2010	Change in TOF	1.01	0.79	0.97	1.01	1.13	1.18	0.61
De-spec 2000/ De- spec. 2010	No Changes in TOF	1.35	0.91	1.11	1.00	1.10	0.95	0.76
De-spec 2000/ De- spec. 2010	Change in TOF	1.29	0.83	1.14	1.02	1.14	1.01	0.50

Source: our elaboration on Census data

The data provide a detailed insight of the association between production decisions and age structure. The most interesting result is the sharp differences between Mono-generation and Inter-generation farms. In the case of Young and Mature farmers, the sign of the association is opposite in almost all realizations. For example, Young, Mono-generation farms (column 2) exhibit a positive association with specialization and a strong attitude towards changing

$$^4 a_{i,j} = \frac{n_{i,j} / n_{..j}}{n_{i.} / n_{..}}$$

where n_{ij} is the number of observations exhibiting traits i and j simultaneously, $n_{.j}$ is the total number of observations exhibiting trait j , $n_{i.}$ refers to the total number of observations with trait i and $n_{..}$ is the total sample. If a is greater than 1, we assume a positive association between the two realizations, if the value is less than 1, we assume a negative association.

TOF. Young Inter-generation farms (column 1) follow an opposite trend. In this case, the role of the mature or elder family worker appears to be critical in the production decision.⁵ Column 3 shows that specialized farms tend to don't change the TOF. In the case of elder farmers (columns 5 and 6) there is usually an higher association with a process of specialization, but this result could not be always positive and it depends on the strategy adopted. For example the farmer could choose to move forward a kind of specialization that is less labor intensive or that allow to minimize the cost but this not means that it comes more profitable.

Conclusions

This paper provides an example of the great potential of statistical analysis of massive farm-level dataset. We used Census data collected in 2000 and 2010 to create a short, two-period panel of 823.771 farms. In this way, we were able to observe the changes in the economic and production behavior at individual level.

We used the dataset to describe the specialization process of Italian agriculture. Census data report that the relative frequency of farms with a specialized production orientation increased between 2000 and 2010. Using our panel we were able to study the spatial and demographic aspects of the phenomenon.

We concluded that the increasing specialization is due mostly to important changes in production orientation of farms in central and southern Italy. In 2000, data supported the existence of a 'gap' in specialization. In 2010 such gap appeared attenuated. The result is driven by the vast adoption of specialized TOF in mountain areas. However, the change was based on the adoption of specialized cereal, common grapes or olive operations. This circumstance may imply that such specialization in labor-extensive productions is due to the difficulties in facing the competitive pressure and it is driven by a cost-minimizing perspective.

As, expected we found that demographics have a significant impact on production choices. Our contribution to the existing literature lies in the analysis of the role of family work, without limiting ourselves to considering the farmer only. We found that 'inter-generation' farms, on average, adopt different production decision and that the presence of a young family worker does not necessarily increase the propensity to moving from a de-specialized to a specialized TOF.

In this paper, as example, we took into account the link between age structure and farm's specialization but many other aspects could be investigate in future works. Therefore, the analysis that we realized represent only an attempt to offer a method to analyze the changes in the structure of the farms and should be used after future release of the farm register or other important database of agricultural statistics.

⁵ A possible interpretation of this result is that in many cases there were only a formal change in the ownership of the farms but not in their management, yet the available data do not allow for a formal test of such hypothesis and further studies in this direction are needed.

References

Agricultural Census (2010) <http://dati-censimentoagricoltura.istat.it/?lang=en>

Commission Regulation (EC) No 1242/2008 of 8 December 2008 establishing a Community typology for agricultural holdings.

Russo C, Sabbatini M. (2008): "Pressione competitiva ed adattamenti strategici delle strutture agricole" in *Economia e Diritto Agroalimentare*, vol 2.

Russo C., Sabbatini M. (2010): "La conduzione diretta in Italia nel periodo 2000-2007: resistenza passiva o adattamento strategico?" in *Economia e Diritto Agroalimentare*. vol 3.

Sotte F., Arzeni A. (2013): "Imprese e non-imprese nell'agricoltura italiana" in *Agriregionieuropa*, 9(32).

Spinelli L., Fanfani R. (2012): "L'evoluzione delle aziende agricole italiane attraverso cinquant'anni di censimenti (1961-2010)" in *Agriregionieuropa*, 8.