

## **Agricultural Spatial Differentiation vs. Homogenisation: Some Empirical Evidences in Central Italy <sup>1</sup>**

*Liano Angeli and Saverio Senni*

### **Abstract**

This paper focuses on changes related to the cropping pattern which occurred during the eighties in Tuscany, a region in Central Italy. More specifically the intent is to determine whether these changes have led toward spatial homogenisation or differentiation of agricultural cropping patterns. Municipality data describing the cropping patterns have been processed using cluster analysis techniques and dispersion measures. The study shows that in the eighties Tuscany's agriculture has experienced a spatial differentiation process which has led to the constitution and/or consolidation of some zones with highly specialised cropping patterns.

### **Problems and objectives**

A common opinion among scientists believes that in the last decade rural areas have experienced increasing specialisation in agricultural production patterns due to endogenous factors such as local endowment in natural and human resources and to the increasing competition in the global economic system which implies the exploitation of local comparative advantages.

On the other hand an opposite trend could also have occurred. This view emphasises the role of the Common Agricultural Policy (CAP) in inducing similarities along the space with respect to cropping patterns. The CAP, as a matter of fact, has been dominated by the price support policy based on two key points: the price level for protected crops was significantly higher than the world price and the price system was the same for all the EU regions. A second factor suggested in favour of cropping pattern spatial homogenisation is technological change. The diffusion of process innovations in the agricultural sector has increased the degree of flexibility in the "what to produce" choices, relaxing some constraints related to the local natural resources endowment. If technological change has had this effect, and if the CAP price regulation system worked as a "landmark" for farmers in choosing what to produce, why should we not expect a trend toward spatial homogenisation of agricultural cropping patterns?

Several studies have been carried out in Italy, with reference to the seventies and the eighties, in order to answer this question and to verify if the spatial distribution of agricultural production activities has moved toward geographical differentiation or homogenisation.

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<sup>1</sup> The study (RAISA publ. n. 2711) has been carried out within the CNR-RAISA finalized project.

In general these types of studies have been based on large scale territorial units: regions, or in a few cases, provinces. We believe that in a country like Italy, with highly diversified rural territories, analysis of this kind, when founded on spatial aggregated data, could generate vague results thus hiding important processes occurring at local level.

## Materials and methods

### Territorial Unit

The territorial unit adopted in the study is the municipality, which is the smallest administrative unit for which Census data are made available. The Region of Tuscany includes 287 municipalities. Two small islands where agriculture barely exists have not been included in the analysis, which has therefore considered a total of 285 municipalities.

### Variables selected

The study compares the spatial framework of cropping patterns in Tuscany in 1982 with the framework in 1990. The data used to represent cropping patterns are drawn from the third (1982) and fourth (1990) General Agricultural Census. For each municipality, the total agricultural Standard Gross Margin (SGM) has been calculated for both years by multiplying Census data concerning agricultural land use and livestock numbers per race with the unitary SGM "1990" series calculated by the National Institute of Agricultural Economics. The economic importance of each crop, or group of crops, has been measured as a percent of the whole municipality's SGM. Eleven variables (cereals, vegetables, flowers, other annual crops, olives for oil, wine grapes, fruits, nurseries, cattle, sheep, other livestock activities) have been taken into account.

### Statistical method

The changes in the spatial distribution of agricultural production activities between 1982 and 1990 have been measured using a measure of dispersion and cluster analysis techniques. The measure of dispersion (standard deviation) has been calculated for each variable and summed up in order to synthesise into a scalar the overall regional variability. Cluster analysis includes several methods and algorithms that can be useful in data exploration (Chatfield and Collins, 1980). In this study it has been used as a zoning procedure in order to identify homogenisation or differentiation trends at sub-regional level. The general idea is that, keeping constant the number of groups generated by the clustering algorithm, small statistical "distances" between groups indicate "high" similarities among the observations (the 285 Municipalities in our case) and vice versa. The cluster technique adopted is non-hierarchical, based on the *K-means* algorithm (Hartigan, 1975).

The comparison between 1982 and 1990 has been based on partitions with the same number of groups. At each moment Tuscany's municipalities have been grouped in 3 to 10 clusters. For each pair the proportion of the total sum of squares which remains within the groups has been considered, according to the general equation (Anderberg, 1973):

$$T = W + B$$

$T$  = Total sum of squares

$W$  = Within groups sum of squares

$B$  = Between groups sum of squares

The number of groups being equal, the lower the  $B/T$  ratio the higher is the overall homogeneity degree of the data.

### Results and discussion

The evolution on the spatial distribution of cropping patterns in Tuscany has been analysed at two levels: at overall regional level, using a measure of dispersion, and at sub-regional level through a cluster analysis procedure. Table 1 shows the 1982 and 1990 standard deviations for each variable. The last column shows the total standard deviations calculated as sum of the single variable standard deviations.

Table 1: Standard deviations ( $\sigma$ ) in 1982 and 1990

	Cereals	Vegetables	Other annual crops	Olives for oil	Wine grapes	Fruits
$\sigma_{82}$	0,155	0,092	0,072	0,146	0,174	0,041
$\sigma_{90}$	0,143	0,098	0,084	0,154	0,166	0,049

  

	Nurseries	Flowers	Cattle	Sheep	Other livestock	TOTAL (sum of variable's $\sigma$ )
$\sigma_{82}$	0,103	0,125	0,122	0,077	0,058	1,163
$\sigma_{90}$	0,161	0,153	0,118	0,090	0,042	1,258

According to the Table 1 the overall variability of agricultural crops spatial distribution has increased during the eighties. This simple comparison appears to corroborate the hypothesis that a differentiation process of agricultural cropping patterns has occurred on the regional territory. A short look at the single variables' standard deviations indicates that the trend has

not had the same sign for all variables. Vegetables, other annual crops, olives for oil, fruits, nurseries, flowers and sheep have increased their spatial variability while cereals, wine grapes, cattle and other livestock activities appear to have a more homogeneous spatial distribution in 1990 than in 1982.

It is interesting to underline that crops whose distribution on the regional territory has become more homogeneous (i.e. decrease in the standard deviation value) have all reduced their importance within the regional agricultural economy. On the contrary, crops for which the spatial distribution looks less homogeneous have expanded their economic weight in Tuscany's agricultural sector. The higher spatial dispersion of these products reveals that circumstances of local specialisation have probably occurred. This result seems to be corroborated by the explorative use of a statistical grouping procedure, i.e. cluster analysis.

Table 2: Allocation of total sum of squares (T) between (B) and within (W) groups for partitions with increasing number of groups

Number of Groups	1982				1990			
	B	W	T	B/T	B	W	T	B/T
3	7,0	33,0	40,0	17,5%	13,7	32,8	46,5	29,4%
4	11,8	28,1	40,0	29,6%	21,7	24,8	46,5	46,6%
5	18,8	21,2	40,0	47,1%	23,9	22,6	46,5	51,4%
6	19,2	20,8	40,0	47,9%	24,4	22,1	46,5	52,6%
7	22,6	17,4	40,0	56,6%	27,8	18,7	46,5	59,8%
8	24,8	15,1	40,0	62,1%	31,4	15,1	46,5	67,5%
9	25,9	14,1	40,0	64,8%	32,8	13,7	46,5	70,6%
10	26,5	13,4	40,0	66,4%	33,6	12,9	46,5	72,3%

Table 2 shows the allocation of the total sum of squares (T) within groups (W) and between groups (B) for partitions based on 3 to 10 groups. If we look at the B/T ratio it appears that the 1990 set of data, for each partition, gives "better" results than 1982 set of data. In other words, the ratio is, *ceteris paribus*, higher in the 1990 data set than in the 1982 data set. According to this comparison the spatial distribution of cropping patterns was polarised more in 1990 than in 1982, revealing the presence in 1990 of sub-regional territories characterised by greater homogeneity within them and a larger difference between them.

This result supports the local "specialisation" hypothesis. In particular in Tuscany, during the eighties, two areas have strongly increased their crop specialisation: we are referring to the flowers and the nurseries industries, strongly concentrated in relatively small territories which

are highly specialised in these crops. A similar observation could be made to a lesser degree regarding olives for oil, vegetables and sheep.

## Conclusions

Forces pulling toward local cropping pattern specialisation have appeared to prevail in some Tuscan rural areas raising the overall spatial agricultural diversities. This process has mainly concerned areas characterised by crops that have not benefited, or have little benefited from CAP support. In these zones local factors, such as knowledge, human skills, external economies, have certainly played a relevant role in the development of the local rural sector.

Although the spatial specialisation process of cropping patterns that has prevailed in Tuscany during the eighties does not necessarily imply that the same trend has occurred at farm level, it is reasonable to believe that this likely has occurred. Considering that diversification of incomes in rural areas is becoming a key point in the new Common Agricultural Policy we believe that on this topic further empirical research needs to be done.

## References

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