https://doi.org/10.17221/395/2022-AGRICECON

Towards diverging land prices in agricultural districts? Evidence from Italy before and after the great crisis

Emma Bruno[1], Rosalia Castellano[2], Gennaro Punzo[1], Luca Salvati[3]*

[1]Department of Economic and Legal Studies, University of Naples Parthenope, Naples, Italy
[2]Department of Management and Quantitative Studies, University of Naples Parthenope, Naples, Italy
[3]Department of Methods and Models for Economics, Territory and Finance, Faculty of Economics, Sapienza University of Rome, Rome, Italy

**Corresponding author: emma.bruno@studenti.uniparthenope.it*

Citation: Bruno E., Castellano R., Punzo G., Salvati L. (2023): Towards diverging land prices in agricultural districts? Evidence from Italy before and after the great crisis. Agric. Econ. – Czech., 69: 119–127.

Abstract: In recent decades, farmland markets have risen sharply due to their attractiveness as safe investment and savings allocation instruments. This growth has occurred globally at different rates due to the uneven expected returns, and potential land uses in different regions. This paper provides evidence of the convergence of Italian farmland markets between 1990 and 2019 by using data on average land prices with a geographically detailed resolution that considers both administrative and altitude aspects of territories. The analysis combines traditional economic convergence approaches with spatial data exploration techniques. The results are consistent and show that territorial disparities in Italian farmland markets tend to increase over the study period. This proves that divergence patterns reflect the well-established North-South dualism and disparities in socio-economic characteristics.

Keywords: convergence analysis; farmland markets; spatial autocorrelation; spatial clusters

The land is a major factor of production and the main component of farm fixed assets in the EU Member State (European Commission 2021), with a history of unique value durability and income levels, even in the presence of economic uncertainties and downturns. Moreover, land values are highly correlated with inflation but lowly correlated with other investments, making them a hedge against inflation and an effective way to reduce portfolio risk through diversification (Ashwood 2022). Consequently, land assets are attractive as a savings allocation and investment assets, as well as a factor of production. The mixture of these functions makes the dynamics of the land market complex and not always easy to interpret (Menzel et al. 2016).

Farm prices have risen sharply in recent decades due to their increasing attractiveness. The general uncertainty related to global crises and rising inflation has led to the (re)discovery of the agricultural sector and farmland as an attractive investment even by non-agricultural investors (Baker et al. 2014). Since land

https://doi.org/10.17221/395/2022-AGRICECON

markets influence the distribution of real incomes and economic efficiency, as well as having implications for welfare and social issues, their regulation is prominent in the policy debate because of its consequences in terms of equity and efficiency (Cheshire and Sheppard 2004). Moreover, as land is often used as collateral, well-functioning land markets are crucial for credit markets' development (Miao et al. 2015). Governments should monitor land prices and hinder the concentration of farmland in the hands of non-agricultural companies and investors. Most EU member states adopt and implement regulations on farmland quantity or price (Swinnen et al. 2016). In France, for example, regional organisations control local land markets by regulating the transfer of farmland to avoid speculation and ensure that land is only owned by farmers working to support land consolidation. Any farmland transaction needs to be approved, and although there is no maximum sale price, the transaction can only be accepted if the price is in line with the regional context or the type of land. Also, in Austria, Germany and Sweden, farmland transactions need to be registered and approved by local authorities. In Spain, Croatia, Hungary, and Bulgaria, there are residence conditions for the purchase of land or restrictions on the buyer's nationality in specific areas for reasons of national defence. In Austria and some Eastern European counties, there is a maximum amount of transitable land. Finally, in many countries, although there are limited regulations concerning the sale of land, farmers and neighbouring co-owners have the right of first refusal when purchasing agricultural land. This provision aims to reduce the fragmentation of land ownership (Vranlen et al. 2021). Based on these premises, the present study aims to assess whether there is evidence of economic convergence (divergence) among farmland markets in Italy by analysing annual average farmland prices (thousands EUR per ha) from 1990 to 2019. Italy represents an interesting case study as its farmland market is highly fragmented and has experienced strong increases in land prices in recent decades (Menzel et al. 2016). Land regulations in Italy aim to encourage land consolidation, primarily by enforcing pre-emption rights on land acquisition. Although land price growth has affected the entire country, northern and central-southern regions have experienced marked differences and uneven development in the growth rate of farmland prices, which could reflect the different expected returns and potential uses of farmland in these regions (Plantinga et al. 2002). Italy, indeed, witnesses uneven morphological, climatic, and socioeconomic characteristics between northern and central-southern areas. This means that the Italian context can also serve as a reference from a spatial perspective, as it can be used to examine whether local land markets are separated or integrated into such a diversified context, i.e. farmland prices converge in the long run.

The convergence assessment assumes a negative relationship between changes in farmland prices over a time span and the level of the same prices at the starting point (Arbia et al. 2008). Essentially, convergence analysis allows us to measure the average change in farmland prices over time concerning their initial value, assuming that units with the lowest prices will change faster than units already close to (or above) the average (Salvati and Zitti 2008). The stronger this negative relationship, the more likely it is that the values of all units are converging around the average.

Literature review. Farmland plays a crucial role in societal and economic development. Well-functioning land markets are a prerequisite for sustainable growth, generating a wide range of economic, environmental, and social benefits. Furthermore, the significant increases in farmland prices over the past decade have led to discussions on the need for regulatory intervention (Menzel et al. 2016). Hence, farmland valuation and understanding the evolution of the local land market is a research topic that must be investigated jointly by academia and policymakers because of its consequences in terms of equity and efficiency. Over the last century, much research has been conducted on the main factors influencing farmland prices.

According to traditional economic theory, farmland values are determined by discounted future rent streams. However, given the breadth and complexity of factors influencing farmland values (for a review, see Tavares et al. 2022) and the possibility of converting farmland into alternative uses, traditional economic theory can only value farmland partially. Since the late 1990s, the hedonic price approach has been widely used to value farmland (Aksu and Karaman 2022). Studies based on this approach have provided insight into the differences between local land markets by showing that a wide range of factors affect the value of farmland, in addition to those that determine soil quality and generate a certain cash flow. In the last decade, a number of contributions have evaluated the integration of land markets by applying the theory of economic convergence. Carmona and Roses (2012) tested the convergence of farmland prices across Spanish provinces, interpreting the results from the land market in-

https://doi.org/10.17221/395/2022-AGRICECON

tegration and efficiency perspective. Yang et al. (2017) attempted to identify 'convergence clubs' of regional land markets in the German state of Lower Saxony that exhibit the same price trends. By referring to the law of one price, they verified the spatial integration of the agricultural land market. Grau et al. (2020) also discussed the German land market, providing evidence of a relative convergence in farmland prices. Tomal and Gumieniak (2020) combined the traditional σ- and β-convergence approaches with log t regression to assess the convergence process of farmland prices across Polish provinces. However, aside from the aforementioned contributions and despite the implications such studies might have in terms of land market integration, empirical analyses on the convergence of farmland prices are limited.

This paper aims to contribute to this literature by assessing whether and to what extent Italian farmland prices converge by integrating traditional convergence approaches with spatial data exploratory techniques. To the best of our knowledge, this is one of the first studies to assess the convergence of farmland prices in Italy, also considering the spatial structure of the data, that is, the distribution of farmland prices is not confined to geographical/administrative boundaries of local territories. Italy can be a reference for all contexts characterised by a high heterogeneity of land characteristics and a highly fragmented land market, where land regulation is needed to achieve the goal of a more integrated land market.

MATERIAL AND METHODS

Study area. This study focuses on Italy, a northern Mediterranean peninsula covering over 300 000 km^2. It is a very diversified territory, most rugged and mountainous, with marked pedological differences among plains (23%), hills (42%) and mountains (35%). The Italian territory's high climatic, geological and ecological variability explains the great heterogeneity of land characteristics. The geography of Italy is delineated by considering three macro-regions (North, Centre, and South), which present substantial disparities in population density, urban form, availability of natural resources, topographical characteristics and economic well-being. The economic profile in the North of Italy is similar to that of the most developed European countries, while development gaps persist in the South. In central Italy, there are both areas with flourishing businesses and economically disadvantaged zones (basically, rural and mountain areas).

The Italian farmland market reflects the North-South dualism. Although physical characteristics explain the differences in farmland values in absolute terms, it is necessary to consider other factors to understand land market trends in recent decades fully. Farmland prices are likely characterised by a different perception of the uncertainty of returns on land investments across regions since the difference in average land prices between the North, and the South of the country has increased considerably in the last two decades.

Data. The data are drawn from the INEA (National Institute of Agricultural Economics) database and cover the entire Italian territory from 1990 to 2019, the last year for which data are available. The dataset contains annual average land prices expressed in current terms (thousands EUR per ha) for the total utilised agricultural area (UAA) aggregated at the level of 287 Italian provincial altimetric areas. The areas were obtained from the intersection between the administrative unit of the province (NUTS-3 level of the Eurostat classification) and five altitude levels (inland mountain, coastal mountain, inland hill, coastal hill, plain). According to altitude above sea level thresholds, Istat (National Institute of Statistics) classifies Italian municipalities into five zones. Altitude zones are distinguished into mountain, hill, and plain zones. A mountain altimetric zone is defined as a territory characterised by the presence of considerable masses with altitudes, as a rule, not less than 600 m above sea level in northern Italy and 700 m in central-southern and insular Italy. The hill altitude zone is istead characterised by widespread masses of less than 600 m in the North of Italy and 700 m in central-southern and insular Italy. The low and flat territories, with no masses, constitute the lowland altimetric zone. The mountainous and hilly altimetric zones have been subdivided into inland and coastal zones, respectively, to consider the influence of the sea on climate. This spatial detail considers both the administrative level and the geographical/natural characteristics of each territorial unit, making it easily interpretable even by non-technical users (e.g. policymakers and local authorities).

Econometric methodology. Three approaches were used to assess whether farmland prices converge or diverge in Italy. The first approach tests for absolute β-convergence (Barro and Sala-i-Martin 1992; Sala-i-Martin 1996; Dapena et al. 2016). By verifying whether there is a negative relationship between the initial level of farmland prices and their growth rates, i.e. whether units with relatively low initial farmland prices experience higher farmland price growth rates than units

https://doi.org/10.17221/395/2022-AGRICECON

with high initial farmland prices. The β-convergence model takes the form [Equation (1)]:

$$\ln\left(\frac{p_{i,T}}{p_{i,t_0}}\right)\frac{1}{T-t_0} = \alpha + \beta \ln\left(p_{i,t_0}\right) + \varepsilon_i \quad (1)$$

where: p_{i,t_0} and $p_{i,T}$ – average farmland price of the i^{th} local unit at time t_0 and T ($t_0 < T$); ε_i – error term and is assumed to follow a normal distribution with mean 0 and constant variance; α – model constant; β – slope coefficient.

Significantly negative values of β imply a negative correlation between the growth rates of farmland prices and their initial values, which argues in favour of convergence in farmland prices. Conversely, significantly positive values of β denote that farmland prices in the study area tend to diverge.

The second approach examines inequalities or differences in the farmland market among local areas and, in particular, whether or not the dispersion of the distribution of farmland price decreases over time. In this case, the σ-convergence concept (Sala-i-Martin 1996; Furceri 2005) is used, assuming the presence of convergence (divergence) if the standard deviation of farmland prices decreases (increases) over time.

The third approach assesses the presence and strength of spatial dependence in Italian farmland markets through the Moran's *I* and Geary's *C* indices (Lin 2022) in their global and local configurations [Equation (2) and (3)]:

$$I = \frac{N}{\sum\sum w_{ij}} \times \frac{\sum\sum w_{ij}\left(x_i - \overline{x}\right)\left(x_j - \overline{x}\right)}{\sum\left(x_i - \overline{x}\right)^2} \quad (2)$$

$$C = \frac{\left(N-1\right)}{2\sum\sum w_{ij}} \times \frac{\sum\sum w_{ij}\left(x_i - \overline{x}_j\right)^2}{\sum\left(x_i - \overline{x}\right)^2} \quad (3)$$

where: N – number of spatial units indexed by i and j; x – variable of interest; $\overline{x}$ – mean of x; w_{ij} – generic element of the non-negative and non-stochastic $N \times N$ spatial weights matrix (W) that defines the spatial relations among the areal units.

The combined use of Moran's *I* and Geary's *C* allows for a more complete picture of the structure of autocorrelation in Italian farmland markets, as by using different criteria of attribute similarity, each can identify spatial pattern specificities that the other may not capture.

Moran's *I* usually ranges from –1 to 1. Positive (negative) values indicate a spatial clustering of similar (dissimilar) values, the stronger, the closer *I* is to 1 (–1). Geary's *C* varies between 0 and 2. If *C* is equal to 1, there is no evidence of spatial autocorrelation in farmland prices. Values lower that 1 suggest a cluster pattern, i.e. positive spatial autocorrelation, the stronger, the closer *C* is to 0. Values higher than 1 denote negative spatial autocorrelation; the stronger, the closer *C* is to 2. Global measures of spatial association offer average values, checking the clustering pattern of farmland prices, but do not show where the clusters are located. Therefore, local Moran's *I* and local Geary's *C* are also used to detect significant spatial clusters of farmland markets, identifying 'hot' (high-high), and 'cold' (low-low) spots, i.e. areas with high (low) prices are surrounded by areas with high (low) prices.

As W has to be specified in advance, in this study, as suggested by Stakhovych and Bijmolt (2009), we initially consider the simplest configuration of spatial weights matrix, i.e. the first order binary contiguity matrix (W_1), and then a more complex configuration, i.e. the k-nearest neighbour matrix (*knn*), using different values of *k*. In the binary contiguity matrix, $w_{i,j}$ are set to 1 if *i* and *j* share a boundary of non-zero length and to 0 otherwise. The *knn* matrices are based on the *k* closest neighbours, whose elements are 1 if *j* is among the *k* nearest neighbours of *I* and to 0 otherwise.

RESULTS AND DISCUSSION

The empirical results allow us to outline the convergence dynamics of farmland markets on a local scale over time. Table 1 shows the descriptive statistics of farmland prices and their growth rates. On average, farmland prices have grown from 1990 to 2019. In the first time span (1990–2000), an average growth rate of 26% is observed, with farmland prices rising from an average of 11.96 to 15.44 thousand EUR per ha. The second time span shows a more moderate growth trend in farmland prices (13%), while in the last period (2009–2019), the growth rate increased sharply, with an average land price of 20.27 thousand EUR per ha in 2019. The highest skewness and kurtosis in the distribution of farmland prices were observed in the 2000s, during the economic expansion and after the introduction of the EUR (Table 1).

The increasing trend of the variability indices (coefficient of variation and standard deviation in Table 1) shows that farmland prices tend to diverge according to the σ-convergence approach. The dispersion of the

https://doi.org/10.17221/395/2022-AGRICECON

Table 1. Descriptive statistics of farmland prices

Descriptive statistics	Farmland prices				Change in farmland prices		
	1990	2000	2009	2019	1990–2000	2000–2009	2009–2019
Mean	11.96	15.44	17.94	20.27	0.26	0.13	0.28
Min	0.91	1.12	1.22	1.32	–0.77	–0.10	–0.83
Max	68.25	128.22	137.25	138.68	2.97	0.82	5.77
Q1	6.00	6.62	6.89	8.34	0.03	0.03	–0.08
Q3	14.77	19.69	22.08	24.53	0.45	0.19	0.26
Median	9.77	10.94	11.84	13.16	0.23	0.11	0.02
(Max–Min)/Mean	5.63	8.23	7.58	6.78	14.38	7.08	23.57
SD	9.38	14.72	17.48	20.05	0.37	0.14	0.86
CV	0.78	0.95	0.97	0.99	1.42	1.08	3.07
Skewness	2.51	3.29	2.73	2.93	1.46	1.71	3.60
Kurtosis	12.06	19.96	14.28	15.01	12.60	7.36	18.65

Q1, Q3 – first and third quartile, respectively
Source: Authors' elaboration based on INEA Database

price distribution increases over time, highlighting a 'divergence path' in farmland markets. This evidence is consolidated by the results of the β-convergence model (Table 2). The slope coefficient [Equation (1)] shows significant and positive values for the first (1990–2000) and second (2000–2009) time spam. Specifically, the values of 0.0130 and 0.0051 indicate that spatial units with relatively high farmland prices experience higher growth rates than spatial units with relatively low farmland prices, thus increasing disparities across the Italian territory. The divergence trend observed in the first two periods can be attributed to the high fluctuation levels in agricultural commodity markets and the 2008 financial crisis, which had a strong impact on land markets (Tomal and Gumieniak 2020). For the latest period (2009–2019), the slope coefficient becomes insignificant, reflecting stagnation without a specific convergence/divergence path in Italian farmland markets.

Moving on to the analysis of spatial dependence in Italian farmland markets, the results of global and local analyses are presented. The global Moran's *I* and Geary's *C* indices (Table 3) were computed for each time point (1990, 2000, 2009, 2019) using four configurations of the spatial weights matrix, that is, the first-order binary contiguity matrix (W_1) and the *k*-nearest neighbour matrix where *k* is set equal to 4 (W_2), 5 (W_3), and 6 (W_4). All four spatial matrices were in row-standardised form.

The highly significant and consistent values of Moran's *I* and Geary's *C* ($P < 0.01$) point to the presence of positive spatial autocorrelation in Italian farmland markets due to the spatial fixity of land and locations (Irwin 2010; Punzo et al. 2022). Farmland prices in each area, therefore, directly depend on the price patterns in the neighbouring regions. For each spatial weights matrix, the results indicate the highest spatial autocorrelation of farmland prices in 2009, followed by a stabilisation in the last period with an overall decrease in the values of the global indices. As the highest values of both global indices are obtained using the first-order binary contiguity matrix (W_1), this configuration is used to calculate the local versions of Moran's *I* and

Table 2. Results of the β–convergence model

Variable	1990–2000		2000–2009		2009–2019	
	coefficient	SE	coefficient	SE	coefficient	SE
Intercept	–0.0062	0.0063	0.0005	0.0022	0.0258**	0.0105
$\ln\left(p_{i,t_0}\right)$	0.0130***	0.0027	0.0051***	0.0009	–0.0056	0.0039

, * significant at 5 and 1%, respectively; $\ln\left(p_{i,t_0}\right)$ – logarithmic transformation of the average farmland price of the i^{th} local unit at time t_0
Source: Authors' elaboration based on INEA Database

https://doi.org/10.17221/395/2022-AGRICECON

Table 3. Global spatial association measures of farmland prices

Year	Moran's *I*				Geary's *C*			
	W1	W2	W3	W4	W1	W2	W3	W4
1990	0.478***	0.409***	0.408***	0.362***	0.495***	0.563***	0.567***	0.617***
2000	0.454***	0.410***	0.405***	0.376***	0.516***	0.562***	0.571***	0.610***
2009	0.489***	0.446***	0.442***	0.411***	0.480***	0.532***	0.541***	0.578***
2019	0.416***	0.401***	0.402***	0.370***	0.601***	0.562***	0.585***	0.633***

*** significant at 1%; W1 – first-order binary contiguity matrix; W2, W3, and W4 – *k*-nearest-neighbour matrices, where *k* is set equal to 4, 5, and 6, respectively

Source: Authors' elaboration based on INEA Database

Geary's *C*, which provide spatially disaggregated estimates of the dependency relationship. Positive values of local indicators of spatial association detect significant spatial clusters of similar values, identifying 'hot' and 'cold' spots. Conversely, negative values indicate groups of local units with dissimilar values, i.e. areas with high farmland prices are surrounded by areas with low farmland prices and vice versa.

Local Moran's *I* and Geary's *C* are mapped in Figures 1 and 2, respectively. In both maps, a distinct cluster of high values (labelled as high-high) can be seen in Italy's North (particularly in the Northeast) that becomes more pronounced over the study period. In 1990, small clusters of areas with high farmland values can be detected in other parts of the country, such as the coastal areas of the provinces of Naples and

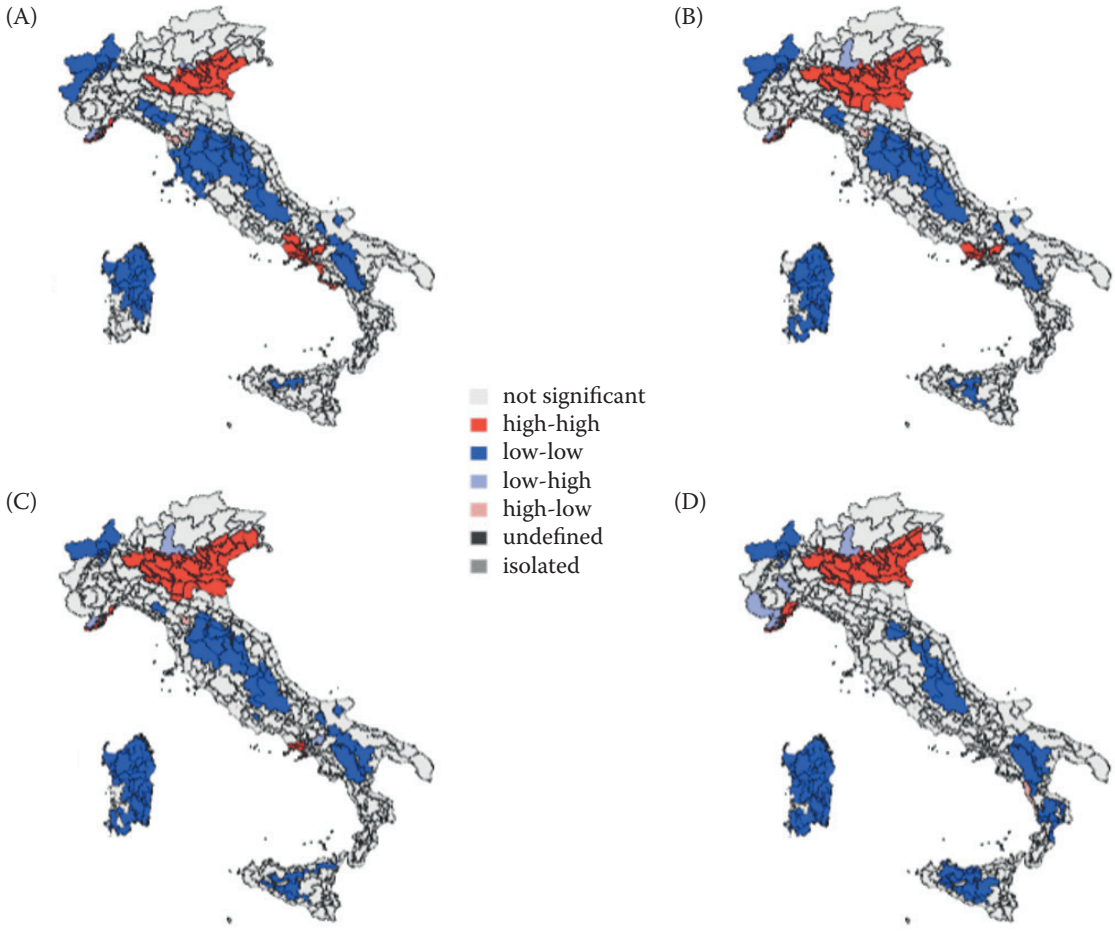

Figure 1. Local Moran's *I* in (A) 1990, (B) 2000, (C) 2009, (D) 2019

Source: Authors' elaboration based on INEA Database

https://doi.org/10.17221/395/2022-AGRICECON

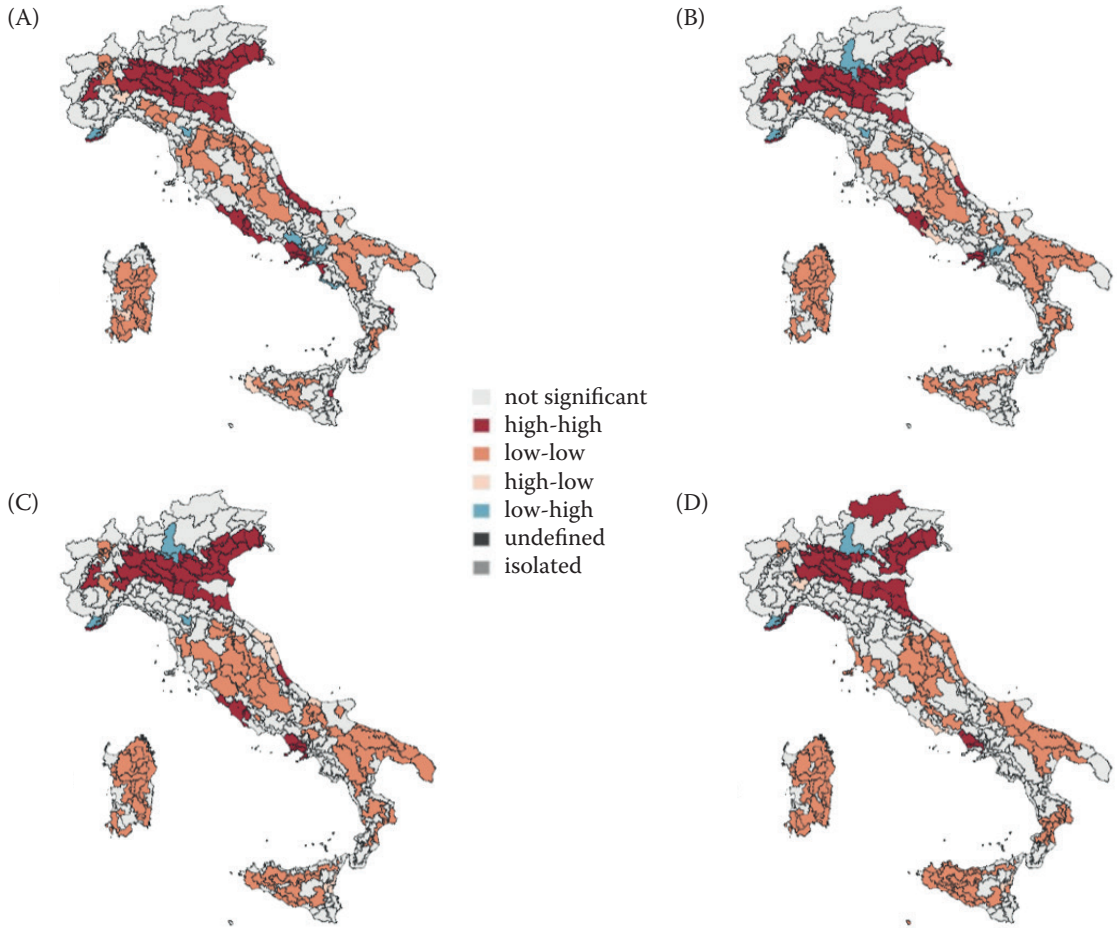

Figure 2. Local Geary's *C* in (A) 1990, (B) 2000, (C) 2009, (D) 2019

Source: Authors' elaboration based on INEA Database

Salerno (Figures 1 and 2) and some areas of central Italy (Latium, Molise and Abruzzo) (Figure 2). However, the high-high clusters lose significance ($P > 0.05$) over time, becoming non-significant according to the local Moran's *I* and almost entirely non-significant according to the local Geary's *C* in 2019. Clusters of areas with low farmland prices (labelled low-low) are increasingly pronounced in the centre-south and islands, confirming the insight of Menzel et al. (2016), who identified two submarkets of farmland, one in northern Italy and the other encompassing the rest of the peninsula (Centre, South, and islands), in line with the well-known socio-economic and infrastructural gap between the northern and central-southern regions.

In 2019, there is a general reduction in the areas for which local indices are significant (graphically, grey areas on the maps increase). This confirms the already observed tendency of Italian farmland markets to diverge over time, moving from a more heterogeneous distribution in the 1990s to a strong polarisation in 2009 stabilising in 2019.

These results demonstrate that the Italian land market does not follow the pattern of convergence or relative convergence experienced by other European contexts discussed in previous studies. It may be due to the excessive autonomy granted to local authorities in land management and the lack of national regulations. Furthermore, unlike the previous studies, the unit of analysis is a fine spatial detail which, going beyond the mere administrative divisions, also considers the geophysical characteristics of the territory. This enables a better understanding of differences in land prices within the same province (Menzel et al. 2016).

CONCLUSION

By analysing average annual farmland prices from 1990 to 2019, this research proved the tendency of Italian farmland markets to diverge over time. Besides

https://doi.org/10.17221/395/2022-AGRICECON

advancing the literature discussed, this topic also highlights the need for an integrated and efficient farmland market regulation in Italy.

Political leaders should take action to ensure that stricter legislation is implemented regarding the regulation of land acquisition and possible changes in use. Due to the lack of a national reference legislation and the excessive autonomy granted to local authorities, municipal regulatory plans often pander to speculative trends by increasing the building indexes, thus driving up farmland prices. Farmland should be protected from speculative purchase and secured for agricultural use through effective policy measures. In such markets, speculative bubbles may lead to market segregation and/or hinder the convergence process (Tomal and Gumieniak 2020). Farm start-ups should be facilitated, and farmers should be given priority in purchasing land through measures that limit market access for investors who do not have agricultural interests (Grau et al. 2020).

A novelty of this study was the joint use of traditional approaches of economic convergence analysis (β-convergence and σ-convergence) with exploratory techniques of spatial data (global and local indices of spatial autocorrelation) at a homogeneous and geographically detailed spatial scale that considers both administrative and altitude aspects of territories.

Globally, there is evidence of a substantial positive spatial dependence of farmland prices, which is reflected locally in territorial differences along the altitude gradient among lowland, hill and mountain areas and along the latitudinal gradient between northern and southern Italy. The territorial differences in farmland prices along the altitude gradient are consistent with the usual depreciation of land moving from lowland to mountain areas due to the lower suitability of land for high-value-added agricultural crops in the more morphologically rugged areas. The differentiation in farmland prices along the latitudinal gradient reflects and consolidates the traditional economic, social, and demographic disparities between the North and South of Italy.

The results show the presence of clusters of agricultural districts, which are homogeneous from both a socio-economic and geophysical perspective. Districts with high farmland prices are in the central-eastern Po Valley and the most fertile areas of Veneto, Emilia Romagna, and the agricultural regions of Campania. Districts with low farmland prices are concentrated along the Apennine chain in central Italy, in Sardinia and, to a lesser extent, in Sicily and the Western Alps.

Although the study grafts and contributes to the existing literature, it suffers from some limitations that can be addressed by further research. The findings demonstrate divergence trends in Italian farmland markets and outline two distinct spatial clusters that confirm the country's deeply rooted North-South divide. However, it does not investigate or quantify socio-economic and environmental factors' role in farmland pricing and forming clusters. This would allow for an integrated and holistic understanding of the dynamics of farmland markets with reference to the socio-economic and geophysical characteristics of the territories to plan and implement policies to support land values.

REFERENCES

Aksu B., Karaman S. (2022): Estimating the effect of a land parcel index using hedonic price analysis. Agricultural Economics, 68: 427–433.

Arbia G., Le Gallo J., Piras G. (2008): Does evidence of regional economic convergence depend on the estimation strategy? Outcomes from analysis of a set of NUTS2 EU regions. Spatial Economic Analysis, 3: 209–224.

Ashwood L., Canfield J., Fairbairn M., De Master K. (2022): What owns the land: The corporate organization of farmland investment. The Journal of Peasant Studies, 49: 33–262.

Baker T.G., Boehlje M.D., Langemeier M.R. (2014): Farmland: is it currently priced as an attractive investment? American Journal of Agricultural Economics, 96: 1321–1333.

Barro R.J., Sala-i-Martin X. (1992): Convergence. Journal of Political Economy, 100: 223–251.

Carmona J., Rosés J.R. (2012): Land markets and agrarian backwardness (Spain, 1904–1934). European Review of Economic History, 16: 74–96.

Cheshire P., Sheppard S. (2004): Land markets and land market regulation: Progress towards understanding. Regional Science and Urban Economics, 34: 619–637.

Dapena A.D., Vázquez E.F., Morollón F.R. (2016): The role of spatial scale in regional convergence: The effect of MAUP in the estimation of β-convergence equations. The Annals of Regional Science, 56: 473–489.

European Commission (2021): Agricultural and farm economics. Analyses and briefs on the economy of farms and rural areas based on the farm accountancy data network (FADN). Available at https://agriculture.ec.europa.eu/cap-my-country/performance-agricultural-policy/studies-and-reports/economic-analyses-and-briefs/agricultural-and-farm-economics_en (accessed Dec 15, 2022).

Furceri D. (2005): β and σ-convergence: A mathematical relation of causality. Economics Letters, 89: 212–215.

https://doi.org/10.17221/395/2022-AGRICECON

Grau A., Odening M., Ritter M. (2020): Land price diffusion across borders – The case of Germany. Applied Economics, 52: 5446–5463.

Irwin E.G. (2010): New directions for urban economic models of land use change: incorporatin spatial dynamics and heterogeneity. Journal of Regional Science, 50: 65–91.

Lin J. (2022): Comparison of Moran's *I* and Geary's *C* in Multivariate Spatial Pattern Analysis. Available at https://www.x-mol.net/paper/article/1597823185223995392 (accessed Dec 15, 2022).

Menzel F., Ghidoni A., De Noni I., Bahrs E., Corsi S. (2016): Factors influencing German and Italian farmland prices – A spatial econometric analysis. Journal of the Austrian Society of Agricultural Economics, 26: 189–198.

Miao J., Wang P., Zhou J. (2015): Asset bubbles, collateral, and policy analysis. Journal of Monetary Economics, 76: S57–S70.

Plantinga A.J., Lubowski R.N., Stavins R.N. (2002): The effects of potential land development on agricultural land prices. Journal of Urban Economics, 52: 561–581.

Punzo G., Castellano R., Bruno E. (2022): Exploring land use determinants in Italian municipalities: comparison of spatial econometric models. Environmental and Ecological Statistics, 29: 727–753.

Sala-i-Martin X.X. (1996): The classical approach to convergence analysis. The Economic Journal, 106: 1019–1036.

Salvati L., Zitti M. (2008): Regional convergence of environmental variables: empirical evidences from land degradation. Ecological Economics, 68: 162–168.

Stakhovych S., Bijmolt T.H. (2009): Specification of spatial models: A simulation study on weights matrices. Papers in Regional Science, 88: 389–408.

Swinnen J., Van Herck K., Vranken L. (2016): The diversity of land markets and regulations in Europe, and (some of) its causes. The Journal of Development Studies, 52: 186–205.

Tavares V.C., Tavares F., Santos E. (2022): The value of farmland and its determinants – The current state of the art. Land, 11: 1908.

Tomal M., Gumieniak A. (2020): Agricultural land price convergence: Evidence from Polish provinces. Agriculture, 10: 183.

Vranlen L., Tabeau E., Roebeling P., Ciaian P. (2021): Agricultural Land Market Regulations in the EU Member States. Luxembourg, Publication Office of the European Union: 132.

Yang X., Ritter M., Odening M. (2017): Testing for regional convergence of agricultural land prices. Land Use Policy, 64: 64–75.

Received: December 28, 2022
Accepted: March 10, 2023