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The Land Cadastre in Italy and some fiscal implications: a case study

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Abstract. The Land Cadastre, as an inventory of all relevant real estate in a territory, and most importantly, as a national tax system is, or at least should be, the protagonist of fiscal, social and civil implications affecting the Italian context. According to unitary farmland incomes, the last revision dates back to 1978-1979, a period that no longer reflects the country's current socioeconomic situation and does not consider the changes the land market has undergone over the years. Through the analysis of 183 purchases and sales of agricultural land in two districts in western Sicily, this research aims at verifying the adequacy or inadequacy of the current cadastral tariffs. Based on the prices surveyed and the cadastral farmland incomes, some indicators were constructed showing, on the one hand the absence of a strict correspondence between these two values and on the other hand the actual presence of fiscal inequality for all the crop qualities examined; and, consequently, the need for revising cadastral tariffs or for reforming tax system of Italian Cadastre by replacing tariffs with market values.

Keywords: Land values, Equity, Tax policy.
JEL codes: H21, H31, R38, R51.

1. INTRODUCTION

In 1861 – at the time of the establishment of the Kingdom of Italy – 24 land registers already existed, each structured differently (Magni, 2002).

"The heterogeneity of the various land registers posed a major obstacle for a necessary and urgent reorganization of the finances by the nascent Italian government". (Colombo, 2003, p. 11). In 1886, Law No. 3682, known as the Land Equalization Law, was passed, which resulted in the establishment of the 'New Land Cadastre', the first national land cadastre[1] (Zangheri, 1980).

A succession of four phases marked its establishment over 70 years: Establishment; Publication; Activation; and Management. In the first phase,

[1] At the same time the Urban Building Cadastre was established.

the operations of measurement and appraisal led to the formation of the 'New Land Cadastre'.

The appraisal procedures were distinguished as follows: qualification, classification, grading and tariff calculation. In order to determine the latter, a farm balance sheet was drawn up on typical land parcels in the municipality in question, from which the Land Cadastral Taxable Income prior to 1886 was obtained.

In later years, the Land Cadastre underwent four revisions: the first revision dates back to 1923 and updated the tariffs and the reference census time period (1904-1913); the second one took place in 1939 (R.D.L. 4 aprile 1939, n. 589) and entailed the splitting of the cadastral taxable amount into Farmland Income and Agrarian Income – quantified on the basis of balances drawn up no longer on standard plots but on actual and ordinary farms – and the updating of the census reference time period (1937-1939); the third revision concerned only the updating of tariffs to a new census time period (1978-1979), excluding any new definition or updating of crop qualities and related productivity classes. Finally, the fourth, which provided for the updating of the Farmland Income and Agrarian Income and the census period of reference to the two-year period 1988-1989, was authorized by Ministerial Decree No. 3/355 of 20 January 1990, but was never implemented.

With "old born" cadastral tariffs, the agricultural sector could only be characterized by "taxable incomes determined in a totally conventional way with values that are very far from the Italian scenario both in magnitude and in the distribution among the various crop qualities" (Cristofaro, 2015). As of now, the Italian Land Registry is not legally authoritative as it does not provide legal proof of ownership and real rights. In fact, in order to ascertain the legal ownership of a property, it is necessary to possess official documents such as sale deeds or succession deeds or to carry out a mortgage survey.

Since 2001, the Land Registry has come under the jurisdiction of the "Agenzia del Territorio" (*Land Registry Agency*) which, in turn, was merged with the "Agenzia delle Entrate"[2] on 1st December 2012. Currently, professionals and authorised users are able to access cadastral data via the *SISTER* online platform, which is directly connected to the "Agenzia delle Entrate" database.

Thanks to the computerisation process, cadastral document request operations have been simplified and waiting times have been significantly reduced, marking an important turning point for the cadastral system.

In addition, in accordance with the European Directive INSPIRE (INfrastructure for SPatial InfoRmation in Europe), the "Agenzia delle Entrate" provides two services for the consultation of cadastral cartography: the cadastral cartographic consultation through the Web Map Service (WMS) and the Cadastral Cartographic Geoportal.

The process of computerisation and the use of new topographical instruments have only partially solved the problems related to measuring operations that took place many years ago and were never updated, except through the direct intervention of the professionals appointed by the owners or possessors of the real estate and through AGEA for the update of crop variations surveyed in relation to the Single Payment Scheme (SPS) (Decreto Legge 03/10/2006 n. 262).

In fact, according to a survey carried out by the "General Directorate of Cadastre" and of the "Technical Revenue Services", about a quarter of all cadastral maps (recognised as official state cartography by Law no. 68 of 2nd February 1960) show an inadequate geometric representation (Coletta et al., 2009). According to Zanchi et al. (2018), the practical use of cadastral cartography – and its continuous feedback on the territory thanks to the use of modern topographic and aero-photogrammetric techniques – has highlighted its evident inadequacy in responding to increasingly complex and operational urban planning needs (identification of individual properties on the ground). This inadequacy is due to the dated nature of the land survey, the obsolescence of the instruments used, the wear and tear on paper cadastral maps, and the deformation of maps caused by the use of scanners to digitalise them. In this regard, by way of example, the images shown in Figure 1 represent two distinct map sheets concerning the territory of Santa Flavia (PA) municipality, whose representations are doubled and shifted; hence it is impossible to obtain simple information (such as the cadastral parcel number) and, above all, reliable information.

It is necessary, therefore, to consider a revision of the Land Cadastre that concerns not only the tariffs, the classification and the grading but also the cartography aspects (Ribaudo, 2001). Physical and appraisal aspects are closely linked, since having an adequate cartography makes it possible to have a suitable description of the physical base useful for assessing taxable income (Coletta et al., 2009).

It is clear that the cadastral mapping sector needs a thorough reformulation, perhaps with the help of innovative tools that can, in some way, simplify the difficulties in surveying, processing, and therefore managing, a large number of cadastral maps.

In this regard, Ferrante and Garnero (2016) provide a new and innovative perspective on the restructuring of the cadastral mapping sector: they hypothesise the

[2] The Italian Internal Revenue Service.

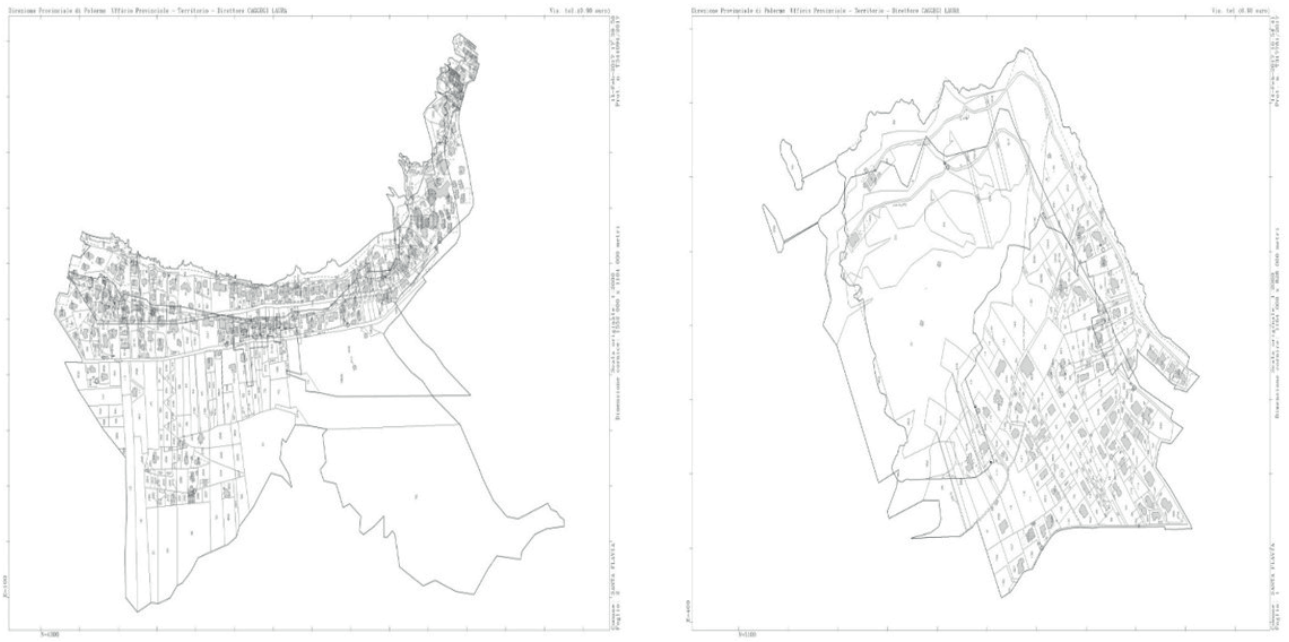

Figure 1. Map sheets of the municipality of Santa Flavia (PA) (source: Agenzia delle Entrate – SISTER).

use of innovative instrumentation such as drones for the cartographic updating of individual maps and, thus, of restricted portions of the territory.

This would allow a plano-altimetric representation capable of fully capturing the territorial geomorphologic characteristics, and therefore parcel characteristics that can influence both the value and profitability of land ownership.

With reference to the tax aspect, the last revision of the unitary farmland incomes dates back, as already pointed out, to more than 40 years ago. Since then, there has been no further change, even though Presidential Decree No. 917 of 22 December 1986 and Article 2 of Law No. 75 of 24 March 1993 establish, respectively, that every ten years there should be a revision of the tariffs and that new criteria for the classification and determination of cadastral unitary rents should be defined, considering the productive potential of the land. This shows self-awareness on the part of the State of the malfunctioning of the cadastral system as it is structured. Over the years, the only implementation intervention has concerned the revaluation of the unitary Farmland Income and the Agrarian Income, using percentage rates with no connection to the reference market trend[3].

As also argued by Simonotti (2008), the valuation method (by classes and tariffs) of Italian Cadastre appears to be as a rigid system, which is not able to adapt to the dynamics of the real estate market, is not compliant with international valuation standards and does not have its own standard.

The problem, therefore, lies not only in the obsolescence of the cadastral farmland unitary rents but also in the procedure adopted for their determination, related to the 1939 classification, which is no longer adequate to the national socio-economic situation as it does not respond to the production systems and current structural conditions of the agricultural sector (Pierri, 2015). Moreover, changes in quality and classes do not always take place, so it is advisable to verify the actual correspondence between the cadastral certificates and the state of the places.

Furthermore, as Colombo (2003) argues, the concept of ordinariness that underlies the procedure for determining cadastral taxable incomes has long been distorted and outdated 'due' to a constantly evolving national and EU regulatory framework where entrepreneurs are constrained by the EU incentive or disincentive system that affects their production choices.

Similarly, it is important to point out that the succession over time of various changes in the economic, financial, social and environmental spheres has led to profound changes in the relationship between property and labour, in the form of tenure and land use. With

[3] For IRPEF purposes, the Farmland Income and Agrarian Income have been increased by 80.0% and 70.0% respectively (since 1998, with a further increase of 15.0% since 2013 and 30.0% since 2016); for IMU (formerly ICI) purposes, the Farmland Income has been increased by 25.0%.

reference to the latter and as reported by Schimmenti et al. (2013), when, as a result of economic development, agriculture does not contribute substantially to the formation of national income, investors' interest in non-agricultural land uses increases. In this way, land is not only seen as a factor in agricultural production but also as a commodity to be used in different sectors such as tourism, industry and with different uses such as residential, recreational, etc. (Grillenzoni, 1970). Over the years, the guidelines of the Common Agricultural Policy (CAP), also aided by 'Climate Change', have led agricultural entrepreneurs to modify their land-use choices, favouring the concept of multifunctionality and the rapid spread of crops that were previously completely absent, and causing the sharp reduction of others that were once representative of vast rural areas of Italy (Colombo, 2003).

In this situation, the concept of ordinariness is inappropriately applied in the cadastral area, and consequently in the taxation field. In this sense, the problem of calculating tariffs does not only concern the drawing up of financial statements on ordinary farms. Indeed, once the farm balance sheet had been drawn up and the relevant tariff quantified, the appraisal procedure for typical values was applied. Following this procedure, the surveyor's task was, firstly, to assign a score to the study plot (based on its cultivation quality and relative class) and, only afterwards, he could extend the results obtained to all the other plots falling within the same municipality, by means of the so-called connecting scales. In this way, the reference parcel constituted the starting point for the determination of the scores for all the other plots (merit scales), through a comparative procedure, carried out with "empirical and subjective criteria" (Simonotti, 2002, p.576).

In fact, if a cadastral parcel was considered worse or better than the reference one then it was given a lower or higher score respectively, in comparison to the estimated score for the reference land parcel.

In this regard, it is worth recalling that in traditional valuation, the method is only one, i.e. comparison, an aspect that could, to some extent, justify the procedure adopted to calculate land rents. However, it is also true that appraisal is a discipline that tends towards objectivity without ever achieving it precisely because appraisal judgments are formulated on the basis of practical-theoretical knowledge and affected by the appraiser's discretion. The latter, as a matter of professional ethics, should implement procedures aimed at reducing the degree of subjectivity to zero. For this reason, appraisal by typical values is often a fallback to be taken into account only in the absence of market price data, while compensating for the limitations of this procedure with excellent knowledge of the real estate market (Simonotti, 2002).

At present, therefore, the tax base provided by the cadastral system is inadequate due to the calculation system and progressive evolution of the agricultural sector (Coletta et al., 2009) and unreliable while reliability is an indispensable component of taxation (Colombo, 2003). The result is a systematic inequality in taxation due to the discrepancy between the unit incomes – actual and cadastral – of real estate in the same productivity class, which, in turn, leads to the underestimation and overestimation of the assets themselves (Simonotti, 2008).

A few research studies have showed the presence of inequality at national level (Agnoletti et al., 2020) and in a territorial context (Cenciarelli, 2006) with regard to buildings and in a specific territorial context (Asciuto et al., 2008) concerning agricultural land.

However, despite the lack of fairness mentioned above, the Italian Cadastre obtains the favour of taxpayers who, in this way, do not have additional expenses and tax inspections and the tacit approval of public institutions who are guaranteed not only simplicity in carrying out control operations but also peace of mind in their relations with taxpayers, avoiding in this way the emergence of numerous tax disputes (Coletta et al., 2009). Proposals for the reform of cadastral tariffs, so far found in the literature, are divided into two different lines of thought:

a) maintenance of the cadastral tariffs, always determined on the basis of farm balance sheets, while proposing an appropriate and radical renewal;

b) taxation based on market values so as to reduce the gap between cadastral and market values.

a) Maintenance, upon remodulation, of the current method by classes and tariffs

A Cadastre where fiscal system is based on tariffs is utilised, besides in Italy, in other four EU countries (Austria, Belgium, Hungary, Portugal), illustrated in section 2. Guerrieri (2003) proposes that the Land Registry be left with only its civil functions, thus making it probative, and suggests that the new tariffs (average annual farmland income per hectare) are determined from the product between average land prices, grouped by homogeneous areas and specific crop qualities, and an interest rate called 'cadastral rate', variable according to the profitability of the various crop qualities. However, the difficulty in determining an adequate capitalisation rate is now widely recognised in the valuation field and it is strongly conditioned by the appraiser's discretion.

According to Ragni and Luccarini (2003), the income values of areas characterised by productive isopotentiality – called micro-zones – could be calculated on the basis of larger areas called macro-zones. Other authors (Seroglia and Tellarini, 2003; Tellarini and Seroglia, 2003) propose, on the other hand, a modification of the census areas, of the analytical crop account and above all of the crop qualities. The latter would be drastically reduced from 116 to 13 homogeneous "aggregates" from the income point of view in order to make the taxation system more adherent to the current reality of Italian agriculture and the new tariffs, in place of the Farmland Income and Agrarian Income, would be calculated analytically on the basis of data from the Agricultural Accountancy Information Network (RICA).

b) Taxation based on market values

The alternative to maintaining tariffs, albeit reformed, could be the introduction of a Cadastre with a tax system based on market values as is the case in several EU countries (Cyprus, Denmark, Estonia, France, Germany, Latvia, Lithuania, Poland, Romania, Slovenia, Spain). As early as the mid-1980s, Schifani (1985) pointed out that in Italy land taxation – based on the income parameter – did not consider two important factors (as opposed to market price). These factors are the proximity to population centres and the availability of land susceptible to be made suitable for the crops characterizing a given area. Therefore, Schifani implicitly suggested the adoption of a taxation system based on market values. In this regard, Simonotti (2008) calls for the rapid decentralisation of the valuation function to municipalities so that they entrust 'cadastral valuers', qualified professionals with a broad and precise knowledge of the real estate market and possessing specialist skills consistent with the Property Valuation Standards, with the delicate task of ensuring taxpayers fiscal fairness, transparency and organisational efficiency in valuations. The decentralisation of cadastral functions from the "Agenzia del Territorio" to the municipalities was sanctioned by the Ministerial Decree, on 14 June 2007[4] (published in the Official Journal no. 154, of 5 July 2007), with the aim, among others, of carrying out a census of real estate and complete retrieval of cadastral data to be integrated into the relevant database (Asciuto et al., 2010).

The determination of market values would be done through the application of large-scale valuation methodologies recognised by the International Valuation Standards (IVS), as is the case in modern cadastral systems. These methodologies, called "Mass Appraisal", represent a flexible system as they allow the use of all valuation procedures: empirical and rational, single and multi-parametric, synthetic and analytical.

Considering the problems highlighted so far and the lack of response from public institutions, the aim of this research is to verify the current level of the link between market prices and farmland incomes, through the concrete case of two districts in western Sicily (South of Italy). This research also aims at verifying the fiscal equalisation or the inequality of the system of land registry tariffs in Italy, through the construction of indicators to be submitted to public decision-makers in order to verify the fulfilment of the conditions of horizontal and vertical equity[5].

The research is composed of a preliminary analysis of the fiscal aspects adopted by EU countries for the land cadastre; a description of the study area; a description of the methodology for the analysis of the collected data; an analysis and discussion of the results obtained and some final considerations.

2. THE FISCAL FUNCTION OF THE LAND REGISTER IN EU COUNTRIES

The European Union (EU), as can be seen from its founding treaties, has no direct competence in cadastral matters. However, through the CAP, environmental policy, pre-accession programmes, etc., it has oriented its member countries to develop multi-purpose cadastres, given the wide availability of data and the development of information systems, which have extended the use of cadastral information also to the consolidation of the spatial data infrastructure indispensable for eGovernment in the member countries (Permanent Committee on Cadastre in the European Union, 2018).

Various cadastral models can be found in the EU countries, depending on their historical, cultural and traditional diversity, from what we can define as traditional models, developed since the late 19th century to a greater extent in Western European countries, to the more modern ones in the former communist countries

[4] The Regional Administrative Court of Latium, in its sentence no. 4259 of 15 May 2008, had censured only the part of the decree in which the municipalities were entrusted with the authoritative power to proceed with the grading and therefore with the definition of the relative cadastral income. Only this specific option should have been annulled. However, the Regional Administrative Court emphasised the need to reformulate the decree, a reformulation that never took place.

[5] According to the principle of horizontal equity, two goods with the same market price should have the same tax value and thus the same amount of tax for taxpayers; whereas according to the principle of vertical equity, two goods with different market values should be subject to different taxes.

Table 1. Groups of EU countries according to cadastral function (Source: our elaborations).

Group I (non-fiscal function)	Group II (fiscal function)		
	Section I (area)	Section II (income)	Section III (value or price)
Bulgaria, Croatia, Finland, Greece, Ireland, Luxemburg, Malta, Netherlands, Sweden	Czech Republic, Slovakia	Austria, Belgium, Hungary, Portugal, Italy	Cyprus, Denmark, Estonia, France, Germany, Latvia, Lithuania, Poland, Romania, Slovenia, Spain

of Eastern Europe. For these latter, Osskó and Hopfer (1999), emphasise that the transition from a planned economy to a market economy made the development of modern Land Registry systems necessary to develop an active real estate market that can support sustainable development.

A comparison of national Land Registri's shows, as Iovine et al. (2006) argue, that the historical origin is linked to the ascertainment of property ownership and the application of land tax; in fact, in most countries the Land Registry is directly or indirectly connected to property taxation, since it may contain the valuation of real estate and other data used by the tax authorities to calculate tax, as well as the identification of the property and the owner (legal land registries).

Therefore, taking into consideration the official documents of the Permanent Committee on Cadastre in the European Union (PCC) on the cadastral systems of the EU member states (Permanent Committee on Cadastre in the European Union–- Cadastral information system: a resource for the E.U. policies overview on the cadastral system of the E.U. member states Rome, 2008; Prague, 2009; Gävle, 2009; Sofia, 2010) the twenty-seven countries are here divided into two groups, in relation to the absence or presence (9 and 18 countries respectively) of the cadastral tax function (Tab. 1).

The first group, made up of countries where the Cadastre is not used for tax purposes, includes: the Netherlands, where the Cadastre over the years has lost importance in relation to this function but has mainly improved the technical aspects, although for statistical purposes it includes the price of the real estate transaction (Muniz Perez, 2012); Croatia, which since 1998 (Bacic, 2004), repealed the cadastral annual tax with the consequent loss of the cadastral fiscal function; Bulgaria and Finland which exempt farms and forestry from property tax; Greece where the value of a property is not stored in the cadastral database, although the price of the purchase and sale is archived and linked to the property; Luxembourg, which has not used the Land Registry for valuation and taxation since 1945; Sweden, where the Taxation Authority deals with the valuation of property; and finally Ireland and Malta which do not have a Tax Registry (Tab. 1).

The second group, which includes all countries with a tax-related cadastre, was further divided into three sections – area, income, value or price respectively – according to the data used to determine the tax base for land tax purposes.

In the Appendix 1 a brief description of the methodology adopted in the EU countries of the second group is reported.

3. MATERIALS AND METHODS

3.1 Study area

The study area (Fig. 2) includes two different districts, both located in western Sicily (in the Province of Trapani, Zone 1, and in the Province of Palermo, Zone 2, respectively). The first one includes territories of the coastal hills (Municipalities of Valderice, Erice, Custonaci, Buseto Palizzolo, San Vito Lo Capo) and of the plains (Municipalities of Paceco and Trapani). The second zone includes municipalities of the inland mountains (Godrano), the inland hills (Caccamo, Baucina, Ciminna, Bolognetta, Marineo, Mezzojuso, Villafrati, Ventimiglia di Sicilia, Cefalà Diana, Misilmeri, Campofelice di Fitalia, Santa Cristina Gela, Piana degli Albanesi), the coastal hills (Casteldaccia) and the plains (Palermo and Partinico).

The municipalities classified as "Rural Areas" o "Sparsely populated Areas"[6] in Zone 1 represent 42.8%, while in Zone 2 they make up 58.8% of the total number.

In order to outline the structural characteristics of agriculture and the relative forms of tenure and ownership present in the two territorial areas, some data published with the 6th General Agricultural Census 2010[7]

[6] Since 2011, Eurostat classifies municipalities according to the degree of urbanization (DEGURBA). This indicator identifies three levels of urbanisation (high, medium and low) in relation to the criteria of geographical proximity and thresholds of minimum population. The classification identifies three typologies of municipalities: 1) "Cities" or "Densely Populated Areas"; 2) "Small Cities and Suburbs" or "Medium Population Density Areas"; 3) "Rural Areas" or "Scarcely Populated Areas".

[7] To this day, data from the 7th Agricultural General Census are not available since ISTAT is still processing the information collected. The

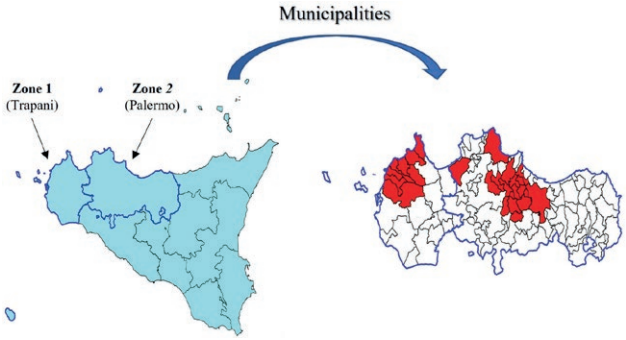

Figure 2. Study area.

were analysed, from which the indicators shown in Table 2 were extrapolated.

Zone 1 (Trapani area)

According to reports from the 6th General Census of Agriculture 2010, there are a total of 6,214 farms falling within the municipalities in the surveyed area. Total Farm Area (TFA) and Utilized Agricultural Area (UAA) occupy 56.0% and 52.6% of the total land area, respectively. Relating TFA and UAA to the number of farms, it is showed that each farm owns, on average, about 5.7 and 5.4 hectares, respectively.

With reference to the classes of UAA, as many as 31.7% of the farms have a UAA of less than 1.00 hectare; 19.8% of the farms have a UAA between 1.00 and 1.99 hectares; 11.6% between 2.00 and 2.99 hectares; 13.5% between 3.00 and 4.99 hectares; 11.4% between 5.00 and 9.99 hectares; and finally, 12.0% have a UAA of more than 10.00 hectares. The UAA of the district covers 33,397 hectares, of which 17,015 hectares are arable lands (50.9% of the total UAA). More in detail, cereals for grain production, with 7,627 hectares, represent 22.8% of the UAA; fallow lands represent 18.0% of the UAA (with 6,003 hectares), forage crops approached 4.9% (1,626 hectares), and dry legumes and vegetables occupy 2.6% and 2.4% (857 and 808 hectares), respectively.

Arable lands are followed by agricultural tree crops that occupy 37.9% of the UAA with 12,660 hectares. Among these, grapevine is the most widespread crop quality with 7,933 hectares, accounting for 23.7% of the total UAA; it is followed by olive, which represents 13.5% of the UAA with its 4,515 hectares. On the contrary, the incidence of areas with citrus and fruit trees on the UAA is barely significant (overall 0.5%). In addition, permanent meadows and pastures represent 9.7% of the total UAA with an area of 3,226 hectares; family-size vegetable gardens, on the other hand, are not very widespread in the area, occupying only 0.4% (119 hectares) of the UAA.

According to the form of farm management, the gap between the various categories present is even larger, since as many as 97.3% of farms are managed directly by the farmer, 2.4% are managed by hiring outside employees, and only 0.3% are managed in another way.

In terms of legal form, the majority of farms in the district (99.3%) are sole proprietorships, while a small proportion are part of holding-groups (0.7%).

Table 2. Main structural indicators of farms in the two districts (Source: Our data elaboration from the 6th General Agricultural Census 2010).

Indicators		Zone 1	Zone 2
TFA/land area (%)		56.0	47.8
TFA/no. of companies (Ha/company)		5.7	4.5
UAA/ Territorial area (%)		52.6	44.4
UAA /TFA (%)		94.0	92.9
UA /no. of companies (Ha/company)		5.4	4.2
Arable crops/*UAA* (%)		50.9	49.3
Permanent crops/*UAA* (%)		37.9	26.9
Vine/UAA (%)		23.7	4.5
Olive/UAA (%)		13.5	15.6
Other Fruit trees/UAA (%)		0.5	6.7
Permanent grasslands and pastures /UAA (%)		9.7	23.5
Incidence no. of owned farms (%)		76.3	80.0
Incidence no. of individual farms (%)		99.3	99.2
Incidence no. of farms with direct farmer management (%)		97.3	97.5
Percentage incidence class of UAA	Ha	%	%
	Up to 0.99	31.7	41.6
	1.00-1.99	19.8	20.6
	2.00-2.99	11.6	9.8
	3.00-4.99	13.5	9.9
	≥ 5.00	23.4	18.1
Degree of farm fragmentation	No. parcels	%	%
	1	33.4	44.3
	2	24.3	26.4
	3-5	29.4	23.5
	6-10	10.4	4.8
	≥ 11	2.5	1.0

6th Census, however, is able to portray the situation of the agricultural sector in the period (2005-2017) when sample sales took place.

As for land tenure, however, 76.3% of the farms in the area are located on land owned by the entrepreneur, farms operated on land that is partly owned and partly in free use account for 13.3%, while 1.2% of the farms are conducted exclusively on land that is leased. The remaining percentage (9.2%) can be attributed to the unmentioned combinations of land tenure titles. Regarding the degree of farm fragmentation, it appears that about 33.4% of the farms consist of a single farm body. In contrast, the rest of the farms are divided into multiple bodies: 24.3% into 2 bodies; 29.4% into 3-5 bodies; 10.4% into 6-10 bodies; and 2.5% into 11 or more bodies.

Referring to the Provincial Landscape Plan of Trapani, the area was characterized according to its use (Assessorato dei Beni culturali e dell'Identità siciliana, 2010).

In the municipal areas of Trapani and Paceco, traditional agricultural crops (olive groves, vineyards and arable lands) in the peri-urban areas – where there is a fragmented agrarian-pattern – are endangered by the expansion of industrial and residential settlements and by road and rail infrastructure. The traditional agrarian landscape is more continuous in inland areas with limited scattered settlements.

In the municipality of Erice, settlement transformations have affected the coastal plain, resulting in the abandonment of traditional agro-pastoral activities on the mountain slopes and the exodus of inhabitants to the valley.

In the coastal plain between Custonaci and Valderice, vast areas of cultivated land alternate with large areas of abandoned and built-up areas. In the hilly area of Custonaci, phenomena of landscape degradation caused by intense mining activities are evident.

The open-field agricultural landscape of arable lands, vineyards, and olive groves, punctuated by cores and threadlike rural centres branching along roads, such as Buseto Palizzolo, is predominant. On the coastal area of San Vito Lo Capo, the obvious processes of degradation of the rural landscape are mainly due to the intense seasonal tourism that causes congestion and inappropriate transformations of places for second homes. Degradation factors include abandonment of agro-pastoral activities and fires that destroy the natural environment.

Zone 2 (Palermo area)

There are a total of 10,437 farms in the municipalities of Palermo zone which participate in the survey.

The TFA and the UAA account for 47.8% and 44.4% of the total land area, respectively. Relating the TFA and UAA to the number of farms, it is possible to note that each farm covers an average of about 4.5 and 4.2 hectares, respectively.

In terms of farm size, the UAA per farm is distributed as follows: 41.6% of the farms have a UAA of less than 1.00 hectare, 20.6% between 1.00 and 1.99 hectares, 9.8% between 2.00 and 2.99 hectares, and 9.9% and 9.0% fall in the classes between 3.00 and 4.99 and between 5.00 and 9.99 hectares, respectively. Farms owning UAA over 10.00 hectares are only 9.1% of the total.

The territorial UAA of the district covers 44,041 hectares: arable land is the most widespread land use, with about 21,696 hectares, accounting for 49.3% of the total UAA, followed by agricultural tree crops, covering about 11,836 hectares – corresponding to 26.9% of the UAA – and permanent meadows and pastures, which occupy 23.5% of the total UAA with their 10,359 hectares; family-size vegetable gardens (149 hectares) represent only 0.3% of the UAA.

With regard to arable lands, UAA accounts for 25.1% of cereals for grain production (with 11,052 hectares), for almost 15.6% of forage crops (6,866 hectares), for 1.6% of dry legumes and vegetables, and 1.5% of the UAA (693 and 663 hectares). In addition, fallow land, with 2,230 hectares, accounts for 5.1% of the total UAA.

In contrast, in terms of agricultural tree crops, olive is the most represented crop with 6,877 hectares, accounting for 15.6% of the total UAA. It is followed by grapevine, which accounts for 4.5% of the UAA with its 1,971 hectares; citrus and fruit-growing areas account respectively for 3.8% and 2.9% of the UAA.

In terms of farm management, 97.5% of the farms are directly managed by the farmer, while the remaining farms either use temporary employees (2.4%) or have a completely different form of management (0.1%).

From the point of view of legal form, 99.2% of the farms in the area of Palermo, are sole proprietorships, while only 0.8% are part of holding-groups.

Furthermore, 80.0% of the farms in the area are located on land owned by the entrepreneur; 7.3% of the farms are run on land that is partly owned and partly in free use; while 2.1% of farms are run exclusively on leased land. The remaining percentage (10.6%) can be accounted for the unmentioned combinations of land tenure titles. With reference to the degree of farm fragmentation, most of farms, about 44.3%, consist of a single body. Within the remaining farms, 26.4% are divided into 2 bodies; 23.5% into 3-5 bodies; 4.8% into 6-10 bodies; and only 1.0% into 11 or more bodies.

The Provincial Territorial Plan describes the area, highlighting its strong contrasts (Provincia Regionale di Palermo, 2004).

Agrarian landscape surrounding Palermo – once known as the "Conca d'Oro" – is characterized by so-called "gardens" (lemons and tangerines above all), culti-

vated on artificial terraces made on the hillsides, and by corridors from the valleys inward.

The proximity of the capital city in the past favoured the development of this type of agriculture, which, however, requires services, capital and, not least, labour. The latter contributed to its decline in recent decades. With the massive establishment of vacation housing in Palermo and the consequent loss of land used for citrus farming, the most fertile countryside close to the sea has become highly urbanized. On the other hand, agriculture in the Partinico plain is still characterized by intensive cropping systems (orchards, open fields vegetables, vineyards, etc.) despite the strong imbalances caused by uncontrolled urbanization. Away from the coast and past the hills that abut it, the landscape changes drastically, as altitude exacerbates climate conditions: barren rocky ridges dominate over hilly humps, typical of the old latifundia, now generally replaced by a fragmented ownership, where promiscuous crops are also common.

In most of this territory, which connects with the interior plateau, the cultivation of durum wheat dominates.

The area is affected by widespread hydrogeological disruption caused by adverse weather conditions, which poses a serious threat to the agricultural sector and to road infrastructure, further accentuating the isolation of rural areas. This marginalization is especially perceived due to the lack of basic services. Many outlying areas are, in fact, unreachable: they lack road infrastructure, broadband, and are often subject to critical environmental issues, such as fire risk.

3.2 Methods

The work carried out involved the use of primary data and secondary data in the two districts examined within the Zone 1 and Zone 2. The primary data, collected directly from a few notary offices, were extracted from deeds of sale signed in the period 2005-2017. The choice of considering two different spatial areas is motivated by the need to verify in both cases the current level of the link between market prices and cadastral farmland incomes, as well as the fiscal equalisation or inequality due to the calculation methods of the Farmland Income tariffs envisaged by the cadastral system of the "Agenzia delle Entrate". The secondary data (6th General Census of Agriculture – ISTAT, 2010), described in the section 3, were used to verify the sample representativeness with reference to the structural characteristics of the farms.

In particular, the following elements were collected for each purchase and sale: date the contract was stipulated, cadastral identifiers (municipality, map sheet, parcel, crop quality, profitability class, Farmland Income, area), sale price, presence or absence of kinship ties between buyers and sellers, ownership share and the Homogeneous Territorial Zone. At this stage, therefore, only deeds relating to agricultural land and with no kinship ties between the parties involved were taken into consideration in order to avoid sampling bias (potential outliers).

The analysis of the land market was based on a sample of 176 deeds of purchase and sale of agricultural land, distributed between Zone 1 (No. 57 deeds) and Zone 2 (No. 119 deeds). Within each deed, it was checked whether there was a single price or more than one sale price; in the latter case, the number of sales corresponded to the number of prices indicated in the deed. From this count, the sample consisted of 183 observations, of which 57 in the Trapani area and 126 in the Palermo area. The following characteristics were initially analysed, both for the entire study area as well as separately for the two study areas:

- average and median values for the total price paid, the average unit price and the land area bought and sold;
- the spatial distribution of observations by municipality in Zone 1 and Zone 2, with particular reference to their number, to total and average area bought and sold (sq. m.), and crop qualities found;
- the distribution by area classes (Ha) of land bought and sold and the corresponding average unit price paid (€/Ha) matched to each area class;
- the distribution of the number of sales and purchases according to the average unit price paid (€/Ha).

In order to determine whether the sample observations reflected actual conditions, the characteristics listed above were compared with census data.

It was, therefore, taken into account the regulatory developments for taxation purposes (Personal Income Tax "IRPEF", Municipal Property Tax "ICI", Municipal Single Tax "IMU" by applying to the Cadastral Farmland Income calculated for each purchase and sale the respective revaluation rates in force at the time of the signing of the deed. In this regard, it should be noted that, according to the objectives of this research, only the Farmland Income was considered within the cadastral tariffs.

To calculate the IRPEF taxable base, the Farmland Income (expressed in €/Ha) stated in each deed was revalued by 80.0% for purchases and sales between 2005 and 2011, and by 15.0% and 30.0% for purchases and sales between 2012 and 2014, and between 2015 and 2017.

Instead, for the calculation of the taxable base for ICI and IMU, the Farmland Income was revalued by 25.0 percent.

All percentages applied are consistent with the updates provided by the sector regulations.

In order to answer the research question, two groups of indicators were subsequently constructed: the first group aims to simulate the capitalization rate[8], while the second group aims to analyse the relationship between market price and tax value for ICI and IMU purposes. With reference to the first group of indicators, the ratio of the revalued Farmland Income of the land bought and sold to the relative market price observed was calculated for each sample observation. This is used to understand whether the Farmland Income adequately performs the function that is normally a prerogative of the Land Benefit (LB) since the Farmland Income represents the pre-tax LB.

In order to estimate market value through capitalization of continuous annual average incomes, the inverse formula was applied (known as Analytical Appraisal, Eq. 1). In fact, for each surveyed trade, it is possible to derive its specific capitalization rate (r_{cap}) from the ratio of LB to market value (V) (Eq. 2).

$$V = \frac{LB}{r_{cap}} * 100 \quad (1)$$

$$r_{cap}\ (\%) = \frac{LB}{V} * 100 \quad (2)$$

This procedure was applied to both the Farmland Income used for calculating the IRPEF tax base (Eq. 3a) and that one adopted for calculating the tax base for ICI and IMU purposes (Eq. 3b). As a result of the considerations above, the percentage indices resulting from the application of equations (3a) and (3b) were found to be similar to r_{cap}.

$$r_{IRPEF}\ (\%) = \frac{F.I_{\ IRPEF}}{MP} * 100 \quad (3a)$$

where $F.I_{IRPEF}$ represents the Farmland Income revalued for IRPEF purposes; MP is the market price of each observation; and r_{IRPEF} is the indicator assimilated to the capitalization rate.

$$r_{ICI,IMU}\ (\%) = \frac{F.I_{\ ICI,IMU}}{MP} * 100 \quad (3b)$$

Where $F.I_{ICI,IMU}$ represents the Farmland Income revalued for ICI and IMU purposes; MP is the buying and selling price of each observation; and $r_{ICI,IMU}$ is the indicator assimilated to the capitalization rate. The results obtained through the application of equations (3a) and (3b) were compared with what emerged from the literature review on an acceptable range of r_{cap} values for farmland, related to the economic performance of farmland. A further comparison was made with the rates of return of the Multi-Year Treasury Bonds (BTPs) net of inflation rates. For this purpose, both the average annual rates of return on 30-year BTPs and the average annual inflation rates were collected for the entire period under observation (2005 – 2017). The former were obtained from the website of the Ministero dell'Economia e delle Finanze (2022), the latter derived from the website of the Federal Reserve Economic Data (FRED) (2022).

In view of the appraisal literature (Amicabile, 2018; Gallerani, 2011; Michieli, 1993), because land assets are characterised by a different risk class than government bonds, an adjustment to net BTP rates was made, conservatively assessed at 0.5% due to the lack of specific guidelines.

The second group of indicators, on the other hand, is the ratio between the market price of a landed property and its cadastral value for ICI and IMU purposes, the latter obtained by construction by multiplying the revalued Farmland Income by a coefficient periodically set by the legislature.

The unit Farmland Income's (expressed in €/Ha) of each purchased land in the sample were revalued – in accordance with the development of tax legislation – to calculate the tax value, which is the taxable base for the payment of ICI (until 2011) and IMU (formerly ICI starting in 2012). In particular, the Farmland Incomes were revalued by 25.0%. Then, to calculate the taxable base for ICI, they were multiplied by a coefficient of 75 for all purchases and sales that occurred between 2005 and 2011. Instead, to calculate the taxable base for IMU these were multiplied by a coefficient of 110 for purchases and sales in 2012 and finally by a coefficient of 135 for those concluded between 2013 and 2017 (from 2018 to the present, the multiplier coefficient has remained unchanged and equal to 135)[9].

Tax values were calculated with reference to both the date the purchase and sale was concluded – applying the relevant revaluation coefficients in force – and to the present day by employing the current multiplier coefficient (equal to 135) for all observations. The latter calculation was based on the assumption that the purchase

[8] In the appraisal discipline, the capitalisation rate relates the owner's continuous average annual income (Land Benefit, LB) to the value of the land capital that generated it.

[9] It should be noted that this paper does not consider the benefits (exemptions or reductions) provided for territories, or parts thereof, located in mountainous or hilly areas, for minor islands and for the figures of farmer and professional agricultural entrepreneur regardless of location.

and sale prices of the land in the sample (referring to the period 2005-2017) can be considered valid to date.

Including the present Tax Value was motivated by the need to determine whether or not the increased multiplier coefficient (135) has bridged the gap with the buying and selling prices. Considering a methodological perspective, we should have also updated the prices from the dates of purchase and sale to the present through the application of price variation rates. Nevertheless, due to the lack of studies on this topic, in this research prices have not been "updated" to the present day in order to avoid applying rates with no link to the real market.

From the above data, the indicators i (Eq. 4a) e i_0 (Eq. 4b) derived respectively from the ratio of purchase and sale price (MP) to tax value for ICI and IMU ($FV_{ICI,IMU}$) purposes and the ratio of MP to tax value for IMU purposes with reference to present (FV_{IMUo}), respectively, were calculated.

$$i = \frac{MP}{FV_{ICI,IMU}} \quad (4a)$$

$$i_0 = \frac{MP}{FV_{IMU_0}} \quad (4b)$$

Through these computations it was possible to assess the extent of the variance between the two terms and to verify whether or not the cadastral values, calculated from the FIs, were connected with the trend – in the years examined – of the land market in the two case study land areas.

The indicators obtained were analysed by calculating key descriptive statistics both with reference to the entire study area and later separately for Zone 1 and Zone 2. As a result, the initial sample "*n*" of 183 trades was subdivided into two sub-samples: the first includes Zone 1 trades (*n* = 57), and the second includes Zone 2 trades (*n* = 126).

Successively within each zone, municipalities characterised by the same tariffs – crop quality and productivity class being equal – were identified.

For each sub-sample observations were divided into homogeneous groups based on the above-mentioned criterion.

Based on these groups, for each of the two subsamples, the percentage divergence (Δ%) between the unit cadastral values for the payment of ICI and IMU referred to the date of purchase and sale (ICI and IMU Unit Tax Value) and the average unit prices observed (Average Unit Market Price) was calculated. Both are expressed in €/sq.m, in order to demonstrate the actual presence or absence of tax inequality (Eq. 5a).

$$\Delta\,(\%) = \frac{\text{ICI and IMU unit tax value} - \text{Average unit market price}}{\text{Average unit market price}} * 100 \quad (5a)$$

The above procedure was repeated by substituting the unit cadastral values for ICI and IMU purposes for those in force for IMU payment (IMU_0 Unit Tax Value) by applying Eq. 5b.

$$\Delta_0\,(\%) = \frac{\text{Unit tax value } IMU_0 - \text{Average unit market price}}{\text{Average unit market price}} * 100 \quad (5b)$$

The results indicate whether taxpayers own real estate with asset values greater than, less than, or equal to the cadastral value. In fact, a Δ% result with a positive sign would mean that to date the taxpayer is being taxed more than the actual value of his/her land should suggest. On the other hand, numerical values of Δ% with a negative sign would indicate that the taxpayer is paying less in relation to the actual value of his property.

Additionally, tax equalization was verified by comparing the market prices of land with identical fiscal values.

With reference to the two procedures described above, the crop quality most examined was arable land of Class I, II, III, IV and V, given that it represents the most frequent agricultural use for both Zone 1 and Zone 2. In addition, limited to few observations of Zone 1 the analysis was carried out for other crop qualities such as arboreal arable land, vineyards and olive groves. A significant proportion (about 35.0% of the total) of purchases and sales in our sample involved several cadastral parcels with different crop qualities but all having the same buyer, which we call "mixed crop qualities."

As a result, the transaction involves several parcels of different cultivation systems for which a single price was paid and a single sale deed was stipulated. Since it was not possible to extrapolate the unit price paid for each crop quality involved in the transaction, the above procedure for tax equalization testing could not be applied to the above trades by adopting Equations (5a) and (5b).

4. RESULTS AND DISCUSSION

The study sample analysed, as already mentioned, consisted of 176 notarial deeds and 183 observations[10] of which 57 referred to Zone 1 and 126 to Zone 2.

For Zone 1, the largest number of sales, again with reference to the sample size, refers to agricultural land

[10] Although the sample is made up of 183 sales, for some calculations a smaller one (n=179) was used, net of 4 observations whose land sold was located in more than one municipality and for which a single price was paid.

located in the municipalities of Valderice (17.3%), Erice (7.3%) and Custonaci (6.1%). In Zone 2, the distribution of agricultural land bought and sold is most concentrated in the municipalities of Baucina and Marineo, with a percentage incidence of 17.9% and 13.4%, respectively. In other municipalities, however, the incidence of land sales is significant, especially in Villafrati (4.5%), Ciminna (3.9%) and Ventimiglia di Sicilia (3.9%).

Principal key descriptive statistics were calculated for some parameters, showing that for the entire sample size the mean (μ) and median (Me) values for the total price (€) amount to 9,816 € and 5,000 €, respectively. In the two study areas, the above central tendency indices take substantially different values (μ_{Zone1}: 11,521 €; M_{eZone1}: 6,000 €; μ_{Zone2}: 8,899 €; M_{eZone2}: 4,800 €). Taking into consideration the average unit price (€/sq.m), the sample μ is 3.00 €/sq.m, while the Me is 1.31 €/sq.m; again, the two areas investigated present different situations: an average price of 4.31 €/sq.m was paid for land falling in area 1, while the corresponding average price of land falling in area 2 is 2.30 €/sq.m. The median values of the two sample distributions are both significantly lower than the average values described above, and specifically 1.48 €/sq.m (Zone 1) and 0.94 €/sq.m (Zone 2). The areas being bought and sold averaged 8,955 sq.m (n=183) with a median value of the sample distribution of 3,340 sq.m. The average figures for the two sub-samples are again markedly different from each other: the areas bought and sold in Zone 1 are on average (5,756 sq.m) significantly smaller than those in Zone 2 (10,675 sq.m.), while the relative medians are very similar in the two distributions (3,165 sq.m and 3,573 sq.m.) and also to the sample median value 3,340 (sq.m). The total area bought and sold amounts to about 1.5 million sq.m (154 hectares), distributed at the municipal level as follows: for Zone 1, Valderice (8.4%), Erice (6.1%) and Custonaci (5.3%) are still the municipalities with significantly higher percentage values than the others in the same zone to which they belong; in Zone 2, Casteldaccia is the municipality with the highest area bought and sold (24.4%), followed by Mezzojuso (12.7%), Baucina (9.8%) and Marineo (7.1%).

The remainder of the municipalities in Zones 1 and 2 not mentioned so far have a lower incidence value in terms of number and area bought and sold of 3.5% and 4.2%, respectively. From the results obtained, the average unit area bought and sold for the entire sample is 8,611 sq.m (n=179). This result is in line with the census data shown in Table 3, from which it can be seen that most farms in both Zone 1 and Zone 2 have an average farm size of less than 1 hectare. Therefore, on the basis of this comparison, it can be asserted that, in terms of size, the sample is fairly representative of the farms in the areas considered.

Table 3. Comparison of the percentage distribution by size classes between collected and census data (%).

Area class (Ha)	Collected data		Census data	
	Zone 1	Zone 2	Zone 1	Zone 2
until 0.99	79.6	82.4	31.7	41.6
From 1.00 to 1.99	17.2	13.4	19.8	20.6
From 2.00 to 2.99	1.6	0.8	11.6	9.8
From 3.00 to 4.99	1.6	0	13.5	9.9
≥ 5.00	0	3.4	23.4	18.1
Total	100	100	100	100

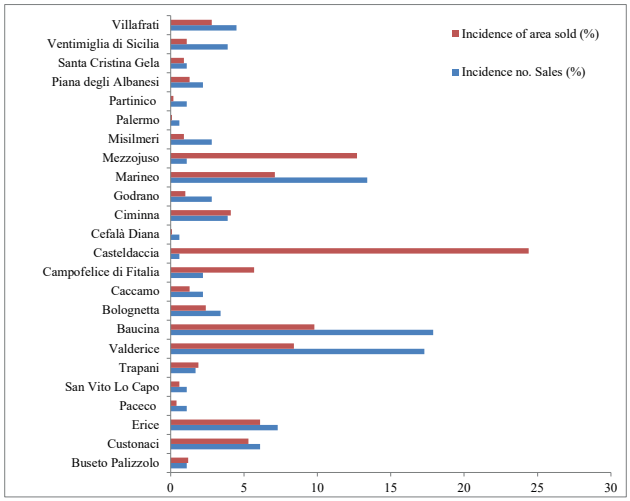

Figure 3 Incidence of area sold and no. of sales by municipality in the study area.

Due to the relatively small size of the land purchased, it seems likely that buyers are either agricultural entrepreneurs, including young ones, seeking to expand their farm base, or non-farm buyers who engage in farming for family consumption in their spare time.

The results described heretofore are reported in Figure 3 and schematised in Appendix 2 (Tab. 1a).

Figures 4 and 5 – which summarized data reported in Tab. 2a (Appendix 2) show the percentage incidences calculated as a function of the number of observations and the area bought and sold, distributed by the crop qualities found in the municipalities of both study areas. The crop qualities included are as follows: arable crops, permanent crops, permanent pastures and meadows, and mixed crop qualities.

The item "arable land" groups arable and arboreal arable land; within the item "permanent crops" olive

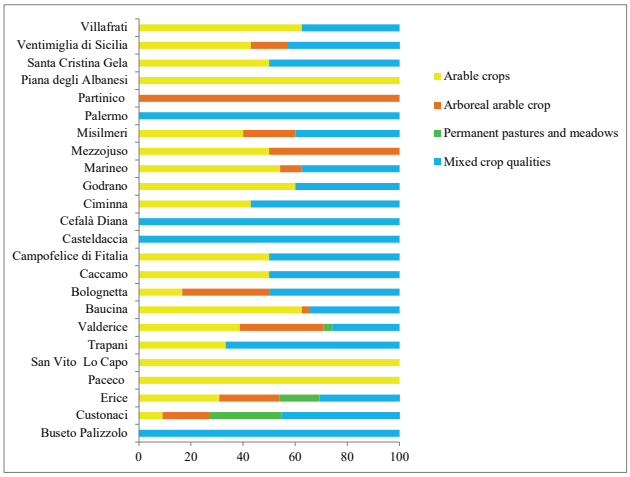

Figure 4. Number of sample sales by municipality and crop quality (%).

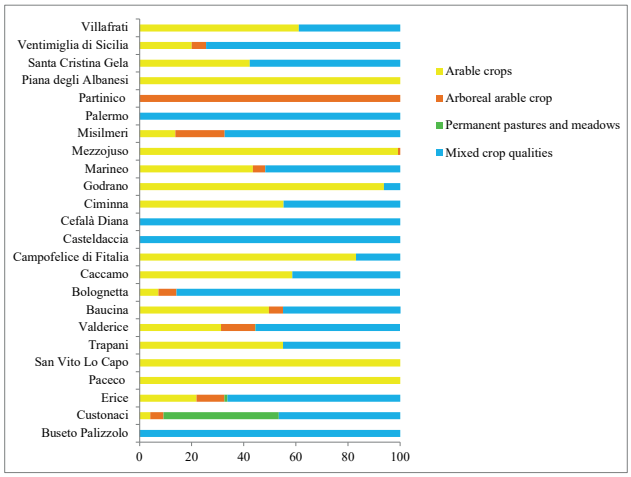

Figure 5. Area of sample sales by municipality and crop quality (%).

groves, vineyards and other fruit trees have been considered; the item "permanent pastures and meadows" encompasses pastures and arboreal pastures; finally, mixed crop qualities represent a heterogeneous item within which fall less common crop qualities and trades involving more than one crop quality and therefore not classifiable within a specific crop category.

The results obtained show that mixed crop qualities have a high percentage incidence in terms of the trades' number (amounting to 66) and of the area bought and sold (amounting to 839,144 sq.m), since, as mentioned above, they encompass multiple crop qualities ascribable to a single selling price. It should, however, be noted that most of the plots bought and sold are arable lands.

Within the mixed crop qualities category, arable lands are the most bought and sold in the two districts (no. equal to 82), totalling 608,608 sq.m. These are followed by permanent crops, whose area purchased amounts to 56,154 sq.m for a total of 25 sample observations, and more in detail: olive groves (no. equal to 9 and 19,501 sq.m sold), vineyards (no. equal to 10 and 24,011 sq.m sold) and other fruit crops (no. equal to 6 and 12,642 sq.m sold). Permanent pastures and meadows represent, with 6 observations and 37,414 sq.m, only a small part of the sample.

Analysing and comparing the sample data and the ISTAT data, it emerges that, for both sources examined, the most bought and spread crop quality for the two study areas is arable land, which is characteristic of extensive systems such as cereal and cereal-forage, in the face of a rather limited average farm economic size in the area. This validates again the representativeness of the sample. Table 4 shows the distribution of sales by land area classes (for Zone 1, Zone 2 and for the total of the entire study area) and the corresponding average unit price paid. The results show that 81.4% of the land sold (79.6% Zone 1 and 82.4% Zone 2) had an area of less than 1.00 hectare and were paid an average of 18,947 €/Ha; 14.7% of the sample had an area between 1.00 and 1.99 hectares (17.2% Zone 1 and 13.4% Zone 2) and an average unit price of 11,613 €/Ha; on the other hand, the presence of land from 2.00 up to 2.99 hectares (incidence of 1.1% and average unit price paid of 8,505 €/Ha), from 3.00 to 4.99 hectares (0.6%; 12,450 €/Ha) and over 5.00 hectares (2.2%; 4,993 €/Ha) is less significant. Table 4 shows that size class distribution is also consistent with the corresponding one related to census data, so the sample data reflect the agricultural situation of the surveyed areas and are representative of the statistical population of farmland.

Furthermore, Table 4 shows that average unit prices tend to decrease as the area bought and sold increases[11]: for the smallest class (up to 0.99 Ha) the average unit price is about 19,000 €/Ha; instead, for the largest class (over 5.00 Ha) land is priced at about 5,000 €/Ha.

The assertion of Simonotti (2011) that the total price curve is increasing with the area sold, while average and marginal prices are decreasing, corroborates this trend. According to the study area, average prices for Zone 1 are higher for all acreage classes; this can be attributed to a higher incidence of non-agricultural purpose in the sample purchases of Zone 1.

[11] The only conflicting figure is the average unit price of 12,450 €/Ha referring to the class ranging from 3.00 to 4.99 hectares. However, the figure refers to a single observation so it was reported in the table since it is part of the sample but, for the purpose of statistical inference, it is not significant as opposed to the other values shown in Table 3.

Table 4. Area classes of land sold and relative average unit price.

Area class (Ha)	Incidence (%)			Average unit price (€/Ha)		
	Zone 1	Zone 2	Study area	Zone 1	Zone 2	Study area
until 0.99	79.6	82.4	81.4	23,274	17,061	18,947
From 1.00 to 1.99	17.2	13.4	14.7	20,626	5,399	11,613
From 2.00 to 2.99	1.6	0.8	1.1	9,256	7,815	8,505
From 3.00 to 4.99	1.6	0.0	0.6	12,450	-	12,450
≥ 5.00	0.0	3.4	2.2	-	4,993	4,993
Total	100.0	100.0	100.0			

Table 5. Classes of average unit price and percentage incidence of sales.

Class of average unit price (€/Ha)	Incidence (%)		
	Zone 1	Zone 2	Study area
until 7,500	14.1	42.0	32.2
7,501 – 17,500	37.5	23.5	28.5
17,501 – 30,000	10.9	16.0	14.2
30,001 – 50,000	23.4	7.6	13.1
> 50,000	14.1	10.9	12.0
Total	100.0	100.0	100.0

Further elaborations (Tab. 5) concerned the distribution of the number of trades in relation to the average unit price paid. This showed that for most of the plots (32.2%) an amount up to 7,500 €/Ha was paid, and only for 12.0% of the observations the price paid was greater than 50,000 €/Ha. Trapani (Zone 1) has higher unit prices on average than Palermo (Zone 2). According to Zone 2, 81.5% of sales fall into the first three price classes, with generally lower average unit prices than in Zone 1.

Through the analysis of the main descriptive statistics of the sample, the results regarding the determination of capitalization rates for each sample observation by relating the Farmland Income – revalued for IRPEF and ICI or IMU purposes – to the land sale price (eq.3a and 3b), can be summarized as follows.

With reference to r_{IRPEF} (eq.3a), the range of variation (R) was found to be between the values- minimum and maximum – of 0.0022% and 3.16%. Instead, the main measures of position, namely μ and M_e, are 0.84% and 0.73%, respectively. Among the dispersion measures, the standard deviation (σ) of the sample is 0.69%.

The results for the shape measures, kurtosis (K) (1.0088) and skewness (s) (0.9761), show that the curve of the sample rates is positively skewed (with tails on the right-hand side) with a greater concentration of values on the left-hand side, far from the Gaussian normal distribution.

Taking a closer look at the results obtained separately for the two zones under study, it can be seen that for Zone 2, in terms of r_{IRPEF} (3a), the values of μ and M_e are quite similar . In Zone 1, μ and M_e are equal to 0.74% and 0.60%, respectively.

The coefficient of variation (CV) shows a greater distribution variability for Zone 1 than for Zone 2.

Comparing the data for both zones, a two-sample t test for the difference of means has been carried out. The null hypothesis (the means are equal) has not been rejected thus confirming that this central tendency measure of r_{IRPEF} is not statistically different for the two zones.

With reference to $r_{ICI,IMU}$ (3b), the R was found between the values of 0.002% and 2.190%. On the other hand, the main measures of position, namely μ and M_e, are 0.56% and 0.48%, respectively. Among the dispersion measures, the σ of the sample is 0.47%.

The results for the shape measures, K (1.5638) and s (1.1074), show that the curve of the sample rates is positively skewed (with tails on the right-hand side), and with a greater concentration of values on the left-hand side, far from the Gaussian normal distribution.

Zone 1 is characterized by lower μ and M_e values than Zone 2.

Differently from the previous indicator (r_{IRPEF}), from the two-sample t test for the difference of means, it comes out that the $r_{ICI,IMU}$ for two zones are characterized by statistically different means.

The calculated Coefficients of Variation (CVs) are identical to the previous ones, which means that the sample distribution of Zone 1 is more dispersed than Zone 2.

The above results were compared with the net yield rates of 30-year BTPs and with the capitalisation rates found in the appraisal literature. The former, collected for the period 2005-2017, range from a minimum of 1.8% to a maximum of 4.5%. This makes them significantly higher than the ranges of the rates obtained in this research. Just as the 3.40% average figure for the period – with the 0.50% adjustment – is far higher than those ones calculated for zones 1 (0.74% and 0.44%, respectively) and 2 (0.90% and 0.63%).

The same applies to capitalization rates that can be retracted from the appraisal literature, which vary between 1.0% and 3.0-4.0% depending on profitability, management riskiness, production system and location (Gallerani et al., 2004; Grillenzoni and Grittani, 1994; Michieli and Michieli, 2002), and can take values up to 6.0% and even more for livestock enterprises with an

Table 6. Descriptive statistics of the four indicators by Zone 1, Zone 2 and study area.

	Zone 1							Zone 2							Study area					
	R	μ	M_e	σ	s	K	CV (%)	R	μ	M_e	σ	s	K	CV (%)	R	μ	M_e	σ (%)	s	K
r_{IRPEF} (%)	2.4	0.7	0.6	0.6	0.7	-0.6	86.5	3.2	0.9	0.9	0.7	1.1	1.4	79.3	3.2	0.8	0.7	0.7	1.0	1.0
$r_{ICI,IMU}$ (%)	1.6	0.4	0.3	0.4	0.9	0.3	86.4	2.2	0.6	0.6	0.5	1.1	1.4	79.3	2.2	0.6	0.5	0.5	1.1	1.6
i	246.9	14.9	2.7	37.7	4.7	24.6	252.9	864.9	13.5	2.1	79.6	10.5	113.5	589.4	864.9	14.0	2.5	67.8	11.2	138.3
i_0	246.9	12.4	2.2	36.4	5.2	29.9	294.1	480.5	7.5	1.2	44.2	10.5	113.5	589.4	480.5	9.2	1.5	41.6	9.3	96.9

industrial configuration (Grillenzoni and Grittani, 1994).

In order to answer the research question, the other indicator adopted is the ratio of the sale price to the tax value. The latter was calculated with reference to both the transaction date, i (4a), and to present, i_0 (4b).

The results obtained for the sample (n = 183), related to indicator *i*, are reported below describing the main descriptive summary statistics. Among central tendency measures, μ of the sample stands at 14.0, M_e is 2.53. The sample variability is quite pronounced, as shown by the figure regarding σ, which was found to be 67.85. Results regarding the shape measures of the data distribution, namely K (138.26) and S (11.25) indicate substantial distance between the sample curve and the Gaussian normal curve, respectively. They also indicate the presence of a significant tail of observations in the right-hand side.

The σ is large for both territories but is far higher in Zone 2 than in Zone 1. Such high values of σ affect the CV, showing a higher dispersion of Zone 2 distribution than Zone 1, as confirmed by F test.

Regarding statistical elaborations on the ratio of price to tax value calculated with reference to present, i_0 (4b) for IMU purposes, according to the results obtained the values of μ and M_e stand at 9.21 and 1.55, respectively. The σ (41.63) indicates again a high degree of dispersion in the sample data.

In terms of shape indices, the distribution has a K index of 96.90 and a positive S index of 9.32. The values obtained indicate that the sample distribution is not Gaussian and that these data are more concentrated on the right side of the curve.

Compared with the previous situation (i), the differences in terms of i_0 (4b) between Zone 1 and Zone 2 are more pronounced, especially for the values of μ and M_e. Contrary to this, the differences between the σ calculated for the two areas are smaller and according to the F test the ratio between the variances is statistically equal to one. CVs maintain the same magnitudes and confirm that data for Zone 1 are more dispersed than those related to Zone 2.

In both cases (i and i_0), according to the two-sample t test the statistical difference between the means is equal to zero for the two zones.

All the results above mentioned are reported in Table 6.

To sum up, in relation to the evolution of tax-related revaluations, the results show that r_{IRPEF} takes on higher values than $r_{ICI,IMU}$. The same applies to the ratio of Price to Tax Value, which decreases using the tax value calculated at the present time while remaining far from equality or similarity with the Market Price. Ultimately, despite the revaluations of tax values (IMU) over the years, the spread with prices is still apparent. In addition, it is worth noting that the distance between the two magnitudes could have been even greater if prices had been updated to current time. Such a high dispersion around the mean of i and i_0 indicates how the price is dependent on countless variables, which cannot be standardized for tax purposes.

This further demonstrates the inadequacy of the tax value. This is derived from outdated incomes that are disconnected from the current scenario and is "normalized" through the application of multiplier coefficients that are the same for all land assets, regardless of the characteristics that each of them may have.

Figure 6 relates the ICI and IMU Tax Values (€) to the Sale Prices (€) of each sample observation. It shows a marked difference in non-correlation their magnitudes and a high degree of dispersion in the data. If the points were located on the line – which represents the bisector of the I quadrant (y = x) – then there would be a correspondence between the ICI and IMU Tax Values and the Sale Prices. In contrast, in situations where the points are above and below the bisector, the Tax Values are respectively lower and higher than the Prices. The point cloud (Fig. 6) appears to be most concentrated above the bisector, and only few points are located at or below it[12].

[12] It should be noted that in figs. 6 and 7, due to problems related to a significant difference in the intervals assumed by the two quantities (Price and Tax Value) on the two Cartesian axes, all sample observa-

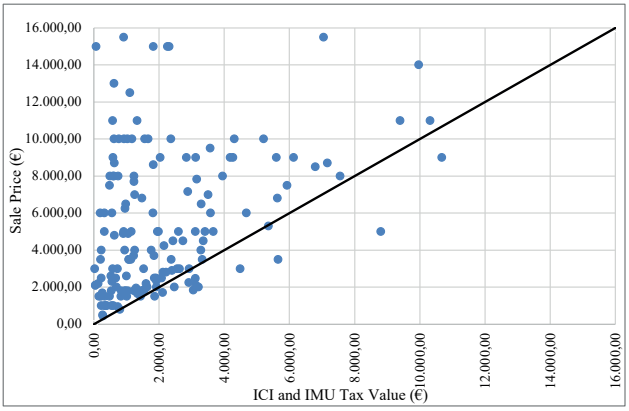

Figure 6. Comparison between Sale Prices and Tax Values (ICI and IMU) for the sample observations.

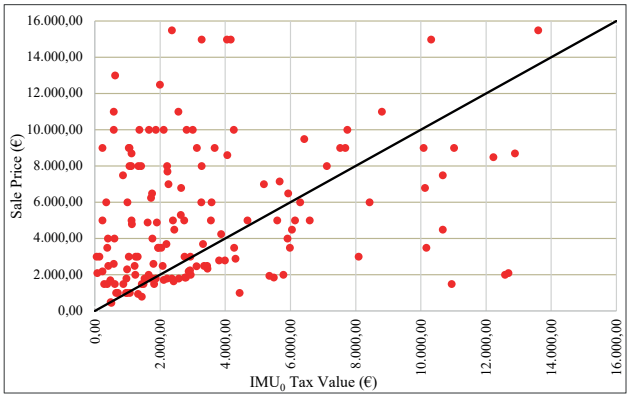

Figure 7. Comparison between Sale Prices and IMU_0 Tax Values for the sample observations.

Similarly, Figure 7 shows a comparison between IMU_0 Tax Values and Sale Prices. In fact, there is a slight improvement at the graph compared to the previous situation (Fig. 6), which is fully justified considering that IMU_0 Tax Values are, as of 2013, always higher than ICI and IMU Tax Values, due to the increase in the multiplier coefficient applied.

In Figures 6 and 7, the magnitudes of the two economic indicators on the axes do not vary proportionally because Price follows the laws of the land market instead of Tax Value which is the result of policy decisions made and adopted.

There are few studies in the appraisal literature that investigate the tax fairness of the Italian cadastral system through an examination of taxable incomes – cadastral rent for buildings and Farmland Income for lands – which are compared with the corresponding market prices. Among them, referring to surveys conducted at the national and regional levels, the following pieces of work are worth mentioning.

In a survey conducted throughout Italy, Cenciarelli (2006) estimates a national average ratio between market values (based on data from the Osservatorio del Mercato Immobiliare, OMI) and cadastral values, equal to 2.93. At the provincial level, on the other hand, the author identified different classes (averaging data at the municipal level) of this ratio. In particular, for Trapani (covered by Zone 1) the class is between 2 and 2.5, while for the province of Palermo (reference territory for Zone 2) the range is between 3 and 3.5. In the latter case, the author points out that the figure for the provincial capital significantly influences the overall provincial result and that of the metropolitan hinterland. Although this is a survey aimed exclusively at the housing market and not at the land market, its conclusions can be considered fully consistent with the results of this paper.

Always in relation to buildings, Iommi and Marinari (2013) in Tuscany find a median value of 2.60 with a range between 1.5 and 5.7.

Agnoletti et al. (2020) in a more recent work, investigate the unresolved issue of the alignment between cadastral values, i.e., the tax base for IMU, and market values of buildings registered in the Cadastre. During their study, the authors examine vertical and horizontal equity in the Italian property taxation system. For this purpose, they resort to the ratio between OMI listings – used as a proxy for market prices – and tax values, the fiscal base subject to taxation. From their nationwide survey with data disaggregation at the municipal level, it comes to light that the actual value is on average one and a half times higher than the cadastral value. This ratio was found to be subject to significant variations rather than remaining constant in accordance with horizontal and vertical tax equity criteria.

To validate the findings of their research, the authors calculate the ratio of market value to cadastral value for typical residential properties with specific characteristics, obtaining values between 1.3 and 3.4. And they calculate it for several Italian localities. In conclusion, the study conducted by the aforementioned authors is perfectly in line with the results of the present research, albeit in different real estate fields (urban real estate versus landed property).

In the only work concerning the Italian Land Cadastre, Asciuto et al. (2008), aim at verifying the reliability of the cadastral tariffs in force for some crop qualities (vineyards and olive groves), and proceed to a

tions with prices above 16,000 euros (n = 22) were excluded to avoid distorting effects in the graphical representations such that the trend of the analyzed phenomenon would be visually unappreciable.

comparison of the market prices of a sample of land sold in the province of Trapani with the corresponding tax values. In this way, they reach results similar to those of the present study. In fact, tax values (for ICI purposes) are consistently lower than market prices, with percentage divergences ranging from 58.0% to 71.0% for olive groves and 53.0% to 69.0% for vineyard land. However, the authors do not have punctual property data and therefore have attributed a productivity class to each observation considered, based on certain surveyed characteristics.

The last step in the present research involved checking whether tax inequality actually exists in the land fiscal system. As already anticipated, this step was found to be possible only for trades characterized by a single crop quality, which in our case are mostly arable lands, by applying equations (5a) and (5b). Sample observations were grouped according to the location of land sold. Specifically, for municipalities with equal cadastral tariffs for given crop qualities and productivity classes.

Despite the high presence of mixed crop qualities, which strongly limited the sample size on which to carry out the comparisons, the elaborations are to consider able to provide an adequate answer to the initial research question.

The comparison between prices and tax values was made on a unit basis (€/sq.m). On the contrary, it would not have been possible to identify cases where taxpayers pay IMU less or more than the asset value of the property owned. It was preferred to use the current tax value for IMU purposes for the calculations since it is obtained through a higher multiplier coefficient, in order to be in line with the current situation (year 2022). In this way, it was possible to verify whether or not the increased multiplier coefficient (135) has bridged the gap with the buying and selling prices. In Zone 1, the crop qualities analysed were as follows: arable land, arable land with permanent crops, olive grove and vineyard.

With reference to arable lands, the comparisons covered land in all existing productivity classes except the first one. In most cases there was a significant discrepancy between the tax value and the price paid. This distance is expressed with the indicator of percentage divergence (Δ_0) (whereby with positive values the tax value is higher than the market price and vice versa for negative ones). It follows that the taxable tax burden on the owner- if the land were taxed in relation to its market value instead of its tax value – would be markedly different from that calculated on its Farmland Income. The Δ_0 calculated for all arable land in Zone 1, which was 16 observations, ranged from +29.0% (tax value higher than market price) to -99.0% (market price greater than tax value). The only exception is one observation whose market price was almost identical to the tax value.

When comparing the market prices of land with the same cadastral tariffs – which are thus matched by identical taxable income- the considerable magnitude of the variations in the prices paid (expressed in percentage terms) highlights the unequal treatment in which landowners incur. This occurs because of the marked differences in the market prices of the respective land assets.

In fact, the maximum percentage divergences within each productivity class range from +584.0% to +8,806.0%. This shows that if the current Land Cadastre were transformed into a Cadastre based on market values, the tax liabilities burdening landowners would vary between them. In particular, these would vary by the rates shown above, having taken the extreme values of each productivity class as benchmarks.

On the other hand, the observations concerning comparable arable land with permanent crops – only two 3rd class observations within the sub-sample – the Δ_0 between tax value and average unit price varies between about -43.0% and -78.0%; therefore, in a value-based cadastre the taxable income calculated on both lands would be significantly higher than at present. Alternatively, a cadastre based on market values would show a Δ_0 percentage difference of 156.0% between the two sample observations, and therefore an analogous divergence in the taxable incomes between the two owners (taxpayers), who are currently subject to the same taxable amount.

With reference to olive groves, verification was only possible on 4 sample observations of 2nd class olive groves. The calculated Δ_0 between current tax value and market price for IMU purposes was found to be between -5.0% and -61.0%, while in terms of taxpayer comparisons, the range between market prices (at the extremes) was roughly 147.0%, tax value being equal.

Finally, the vineyard lands under analysis were found to be only 4, two of which belonged to the second class and two others fell under the third class.

In the comparisons made for the second class, the Δ_0 between the current tax value for IMU purposes and the market price for each observation was not particularly high, varying between approximately -10.0% and +17.0%. In contrast, the comparison between the two observations showed a Δ_0 of approximately 31.0% between the two market prices.

For third-class vineyards, the Δ_0 between the current tax value and the market price ranged from -12.0% to +24.0%, while the prices of the two transactions diverge from each other by about 42.0%, again denoting a not insignificant tax inequality.

Ultimately, for the Trapani area, in both the inter- and intra-parcel comparisons, there is a rather significant difference for arable crops and a less marked one for tree crops.

In Zone 2, where arable crops are significantly present, it was only possible to verify them for parcels of the same productivity class (from first to fourth) in municipalities with the same Farmland Income tariff.

For first class arable crops, of which there are only three plots compared, the Δ_0 calculated between the tax value and the market price of each observation varies between +11.0% and +45.0%, while the comparison of plots with the same tax value leads to the identification of a market price variability of around 30.0%, calculated between the two extreme values of the variation interval.

Concerning the second productivity class arable crops, these were assigned to two homogeneous groups by Farmland Income; the results of the verification show for the first of the two (five plots) a wide Δ_0 between tax value and market price, ranging between +22.0% and-79.0%; while the inter-plot comparison shows a divergence between the sale prices of 604.0% – with the same tax value – which again implies a considerable inequality between plot owners. In the second group, the Δ_0 per sample observation is between approximately +31.0% and -73.0%, and the inter-parcel comparison results in a market price variability of approximately 386.0%.

There are a total of 23 observations concerning third class arable land, divided into three homogeneous groups. In particular, the first group includes 12 plots whose Δ_0 approximately varies from -84.0% to +189.0%, while the comparison of plot prices revealed a high variability of approximately 1,700%, with prices sometimes lower and sometimes higher, even by far, than the tax value.

On the other hand, the second group presents few observations (4) with a range of Δ_0 ranging from -9.0% to +43.0% and a divergence between the sale prices of 57.0%. In the third group (n=7) the Δ_0 is between -83.0% and -16.0%, while the comparison between the prices of the various observations – tax value being equal – showed a divergence between the sale prices of 400.0%. With regard to fourth class arable crops, only three observations were verified, showing variations in terms of Δ_0 approximately between -88.0% and -42.0% and with a percentage deviation of up to 393.0% in terms of market prices.

The last check on the potential correlation between market price and tax value was carried out with the aim to verify the vertical equity in the two areas by running the test for statistical correlation through the Pearson rank correlation coefficient. The analysis was performed on the arable lands falling into all the profitability classes, (n_{Zone1} = 16; n_{Zone2} = 35) due to a reduced sample size of the observations concerning the other crop qualities. The results obtained (α = 5%) for both areas indicate an absence of statistical correlation between the two indicators (the coefficients are -0.267 for Zone 1 and +0.304 for Zone 2) and consequently the failure to comply with the vertical equity principle.

In conclusion, the analysis described above shows, for all the arable land parcels in the Palermo area, a significant level of fiscal inequality with the current Land Register tariff system in relation to both the gap between the current tax value and the unit market price, and the range between market prices when comparing parcels with equal unit farmland income and therefore with the same tax value.

Calculating both i_0 and Δ_0 further demonstrated that, although the legislator has progressively increased the multiplier coefficients over time, resulting in a reduction of the deviation between tax value and price, to date tax inequality in Italy is a widespread and undeniable phenomenon.

The findings above described cannot be extended to the other crops (e.g. permanent crops as olive trees and vineyards) due to a reduced number of sample observations in both areas which does not allow to perform a valid statistical analysis.

5. CONCLUSION

The present study highlighted, for both zones of the study area, the lack of correspondence between the revalued farmland incomes and the actual landowners' incomes (land benefit). This was highlighted by the values of the capitalisation rates calculated in the sample examined. These rates are well below the lower limit of the range indicated in the literature for agricultural land and of the values interval obtained by the indirect method.

This evidence is also confirmed by the comparison between tax values and market prices, which showed a considerable discrepancy between the two economic parameters, demonstrating the erroneous quantification of the multiplier coefficients used to calculate tax values from the revalued farmland incomes.

Both findings show that the tariff system adopted by the Italian Land Cadastre for tax purposes is obsolete and should therefore be reorganised in order to make it representative of the current agricultural scenario, in continuous and progressive evolution.

An additional objective of the research was to verify the tax fairness of the current land tax system. The data processing showed, for all crop qualities and productivi-

ty classes analysed, that the conditions of horizontal and vertical equity were not met.

In light of these findings, it is clear that the current cadastral tax system is unfair, benefiting some taxpayers to the detriment of others.

Therefore, some of the proposals for revision, already mentioned in the introductory section – including a redetermination of the unitary farmland incomes and of the classification system (the latter still standing at the 1939 revision) – should be welcomed in order to realign them to the current socio-economic conditions of agriculture. However, such a system requires a periodic updating of production factors costs and of prices regarding farm goods and services. Besides numerous farm balances are needed, whose outcomes must be extended from the reference Municipality to the entire census circle. Likewise, the cartographic part of the Land Cadastre should be improved given the close link between physical and appraisal aspects.

Another more radical proposal concerns its transformation into a Cadastre based on market values, as it is already successfully done in several EU countries. With this approach, continuous and, above all, facilitated updating over time would be ensured, as well as the possibility of using Mass Appraisal techniques to process the considerable amount of data.

As a result, it would be advisable the creation of a market prices database for cadastral purposes to be made accessible to all land market operators. This way monitoring of the land market trends would be simplified by assuring at the same time the application of innovative techniques addressed to the appraisal of market values.

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APPENDIX 1

Brief description of the methodology adopted in the EU countries of the second group (fiscal function Cadastre).

Section 1 (area)

This section includes two countries that are bound to use cadastral surface data for tax purposes. In particular, in the Czech Republic, the tax base is derived from the cadastral land area and varies depending on the quality of the land (agricultural, forest with a predominantly commercial function, etc.), while in Slovakia, the administration of the property tax system (municipalities) is obliged by law to comply with the property data in the cadastral system (common law, parcel identification number, surface area, nature, land use, location, etc.) and use the area to calculate the tax base.

Section 2 (income)

This section includes five countries (Austria, Belgium, Hungary, Portugal and Italy) that use income valuation to determine the tax base. In Austria, land taxation is based on the appraisal of the average annual yield; agricultural enterprises are assessed on the basis of their value of income capacity, which can be acquired in an average year, assuming a production capacity according to proper cultivation practices.

The main parameters for the evaluation are natural yield conditions (soil quality, topography, climate and water resources) and economic performance conditions for productivity (external and internal accessibility, farm size).

The yield value (called EMZ), resulting from the evaluation of the natural conditions of each parcel, is used to calculate for each farm the valuation index (total sum of all yield values divided by the total area), which indicates the average value for all crops.

The economic return conditions are used in the form of discounts and supplements to the valuation index. The rateable value is then derived from the farm index together with the total area.

In Belgium, property tax is based on the cadastral income, which indicates the normal average net income for a year; according to the official valuation procedure, it is assumed that the cadastral income corresponds to the income that can be obtained on average; that it is ordinary, since the highest or lowest income is not taken into account; and finally that it is net since a defined percentage can be deducted for the maintenance costs of land improvements. The cadastral income refers to 1975 and has been indexed since 1990.

The Hungarian cadastral system contains data on property income for agricultural land only. For each property it reports the 'Gold Crown' value, which does not show the real value, but expresses the value for the quality of the land. The valuation is based on an estimate of the average annual yield considering the different cultivation uses (arable land, pastures, forests, vineyards, etc.) and quality classes (between 1 and 8); the classification procedure is supported by a network of sample areas so that the characteristics of the land to be classified are compared with the corresponding sample area. The tax base for land tax purposes is the net cadastral rent.

In Portugal, the land tax is determined on the basis of the agricultural income (tax value of the parcel), which corresponds to the balance of an annual crop account in which the asset is the total revenue and the liability is the production cost defined by law.

Italy has already been mentioned in the previous chapter.

Section 3 (value or price)

The third section includes eleven countries that use the cadastral value or market price of property to determine the tax base.

The cadastral system in Cyprus shows the estimated value and the market price of the property, which are the basis for taxation. The former, determined by the Department of Land Registry, is used in the case when the property was acquired prior to 1st January 1980 (it is based on the general valuation of all real estate on the island), while the latter, applied in the case of a property acquired subsequently, is based on the purchase price.

In Denmark, land tax is calculated for all private property, according to the concept of cadastral ownership as defined by law, based on the estimated market value of land.

Also in Estonia, the land tax is based on the estimated value of land. Since 1997, the Land Board has been collecting transaction data in a database; the last periodic valuation in 2001 was mainly based on the information collected in this database. Land valuation is a mass valuation, i.e., based on the analysis of real estate transactions and land data, using statistical analysis methods. The result of the valuation is the division of land into homogeneous zones by price level.

A new periodic evaluation started in 2021, and by 2022 the results will be made public (Estonian Land Board, 2021).

The French Land Registry provides property valuation for the purpose of determining taxable value. The valuation of land properties follows several procedures based on rental contracts, on comparison, on market value and direct appraisal.

The preferred system is valuation by leases, based on rents paid for different crops and land productivity classes. Valuation by comparison is used to a greater extent for farms subject to certain operating regimes or for land leased under extraordinary conditions, for quarries, canals, railways, etc. Market value appraisal is usually carried out for building areas by applying a percentage rate to the sale price of the property.

The direct appraisal procedure is subsidiary to the others; the appraisal procedure involves calculating the gross yield per hectare and applying to it the crop selling price at the time of appraisal, from which the discounted production costs are to be subtracted. This procedure is frequently used for the valuation of vineyards and forests, and sometimes also for orchards.

The real estate cadastre in Germany contains the results of the last official land valuation, which dates back for the former West Germany to 1964 and for the former East Germany to 1935. Property tax (Grundsteuer) is divided into two types: 'A' for rural land and 'B' for buildings and urban building areas. The tax is calculated on the unit values (Einheitswert), with reference to the type of property, through the use of a federally fixed tariff related to the type of property and a multiplier that varies according to the different geographical areas. The unit value of properties does not correspond to the market value but is generally much lower.

Cadastral valuation in Latvia is performed on the basis of information on the real estate market and on real estate data registered in the Land Registry. Cadastral valuation is a mass appraisal and is regulated by national legislation that establishes the principles and indicates the order of cadastral valuation.

The cadastral value estimate is performed automatically in the Cadastre in the valuation section. In the event of changes to the good subject to appraisal, the data is updated. The tax base for rural land, since 1998, corresponds to the cadastral value, which refers to the zoning of values (map with homogeneous zones), to the base values of land used in agriculture for each quality group (six groups), and to the base values of forest land for each quality group (four groups). The appraisal to determine cadastral base values rests on the transaction comparison method (used for buildings and rural land) and the income capitalisation method (used for forest land).

The Lithuanian property valuation system ensures the collection of qualitative data and values on properties and explains why certain qualitative attributes have been established and what their value is. Since 2002, property tax takes the value of the property, which is derived from the mass valuation of land, as the tax base. The procedure is based on an economic approach and involves collecting all the necessary information according to the same standard, using up-to-date market data; it also allows for periodic re-evaluation taking market developments into account. If the value determined in the valuation of an individual property differs from the market price by more than 20 per cent, a mark-up may be applied to the value of the property (Muniz Perez, 2012). Based on the analysis of the real estate market and average market values, statistics are compiled for state and local institutions.

In Poland, the determination of the cadastral value of real estate, which is the basis for the calculation of the agricultural property tax (adopted in 1985), is based on the mass valuation according to the rules defined in the Act of 21 August 1997 on Real Estate Management (Journal of Laws, 2004).

Romanian National Cadastre Agency is required to provide necessary data to the tax system to calculate taxpayers' levies. The government programme for 2009-2012 emphasised the implementation of the necessary measures for the taxation of real estate on the basis of its market value. Therefore, actual data was collected on the properties bought and sold (characteristics, size, types and transaction price). Furthermore, through statistical processing of information on the sales prices of different types of properties located in a given area, it was possible to calculate the tax value of different properties.

A real estate mass appraisal system has also been developed in Slovenia for estimating the market values of all real estate registered in the land register in order to develop common criteria for determining land tax. The estimated market values are stored in the publicly accessible real estate register.

The Spanish cadastre, which does not cover the entire state area (four provinces have their own cadastre), has databases of cadastral values of rural areas and urban properties that form the basis for calculating property tax. The cadastral value is defined as an 'objectively determined' value based on the data held by the cadastre; in determining it, account is taken of location, construction cost, production expenses and revenues, taking the market value as a reference, which is its upper limit since the cadastral value of real estate cannot exceed the market value, that is the most probable price at which the property could be sold in the free market.

APPENDIX 2

Table 1a. Number and area of sample sales by municipality in the study area.

	Municipality	Sale (no.)	Incidence no. sales (%)	Sold area (sq.m)	Incidence of area sold (%)	Average area sold (sq.m)
Zone 1	Buseto Palizzolo	2	1.1	18,467	1.2	9,234
	Custonaci	11	6.1	81,538	5.3	7,413
	Erice	13	7.3	93,981	6.1	7,229
	Paceco	2	1.1	6,500	0.4	3,250
	San Vito Lo Capo	2	1.1	8,660	0.6	4,330
	Trapani	3	1.7	29,163	1.9	9,721
	Valderice	31	17.3	130,091	8.4	4,196
Zone 2	Baucina	32	17.9	151,815	9.8	4,744
	Bolognetta	6	3.4	37,012	2.4	6,169
	Caccamo	4	2.2	19,905	1.3	4,976
	Campofelice di Fitalia	4	2.2	87,904	5.7	21,976
	Casteldaccia	1	0.6	376,075	24.4	376,075
	Cefalà Diana	1	0.6	1,513	0.1	1,513
	Ciminna	7	3.9	63,773	4.1	9,110
	Godrano	5	2.8	15,863	1.0	3,173
	Marineo	24	13.4	109,668	7.1	4,570
	Mezzojuso	2	1.1	195,850	12.7	97,925
	Misilmeri	5	2.8	14,366	0.9	2,873
	Palermo	1	0.6	1,545	0.1	1,545
	Partinico	2	1.1	3,582	0.2	1,791
	Piana degli Albanesi	4	2.2	20,349	1.3	5,087
	Santa Cristina Gela	2	1.1	13,356	0.9	6,678
	Ventimiglia di Sicilia	7	3.9	16,622	1.1	2,375
	Villafrati	8	4.5	43,722	2.8	5,465
	Total Study area	179	100.00	1,541.320	100.00	8,611

Table 2a. Number and area of sample sales by municipality and crop quality.

	Municipality	Arable crops		Permanent crops		Permanent pastures and meadows		Mixed crop qualities	
		No. (%)	Area (%)	No. (%)	Area (%)	No. (%)	Area (%)	No. (%)	Area (%)
Zone 1	Buseto Palizzolo	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
	Custonaci	9.1	4.1	18.2	5.1	27.3	44.2	45.5	46.6
	Erice	30.8	21.8	23.1	10.8	15.4	1.2	30.8	66.2
	Paceco	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
	San Vito Lo Capo	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
	Trapani	33.3	55.0	0.0	0.0	0.0	0.0	66.7	45.0
	Valderice	38.7	31.3	32.3	13.1	3.2	0.2	25.8	55.3
Zone 2	Baucina	62.5	49.6	3.1	5.5	0.0	0.0	34.4	45.0
	Bolognetta	16.7	7.2	33.3	7.0	0.0	0.0	50.0	85.7
	Caccamo	50.0	58.6	0.0	0.0	0.0	0.0	50.0	41.4
	Campofelice di Fitalia	50.0	83.1	0.0	0.0	0.0	0.0	50.0	16.9
	Casteldaccia	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
	Cefalà Diana	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
	Ciminna	42.9	55.3	0.0	0.0	0.0	0.0	57.1	44.7
	Godrano	60.0	93.8	0.0	0.0	0.0	0.0	40.0	6.2
	Marineo	54.2	43.5	8.3	4.7	0.0	0.0	37.5	51.8
	Mezzojuso	50.0	99.2	50.0	0.8	0.0	0.0	0.0	0.0
	Misilmeri	40.0	13.7	20.0	19.0	0.0	0.0	40.0	67.3
	Palermo	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0
	Partinico	0.0	0.0	100.0	100.0	0.0	0.0	0.0	0.0
	Piana degli Albanesi	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
	Santa Cristina Gela	50.0	42.3	0.0	0.0	0.0	0.0	50.0	57.7
	Ventimiglia di Sicilia	42.9	20.0	14.3	5.5	0.0	0.0	42.9	74.5
	Villafrati	62.5	61.1	0.0	0.0	0.0	0.0	37.5	38.9