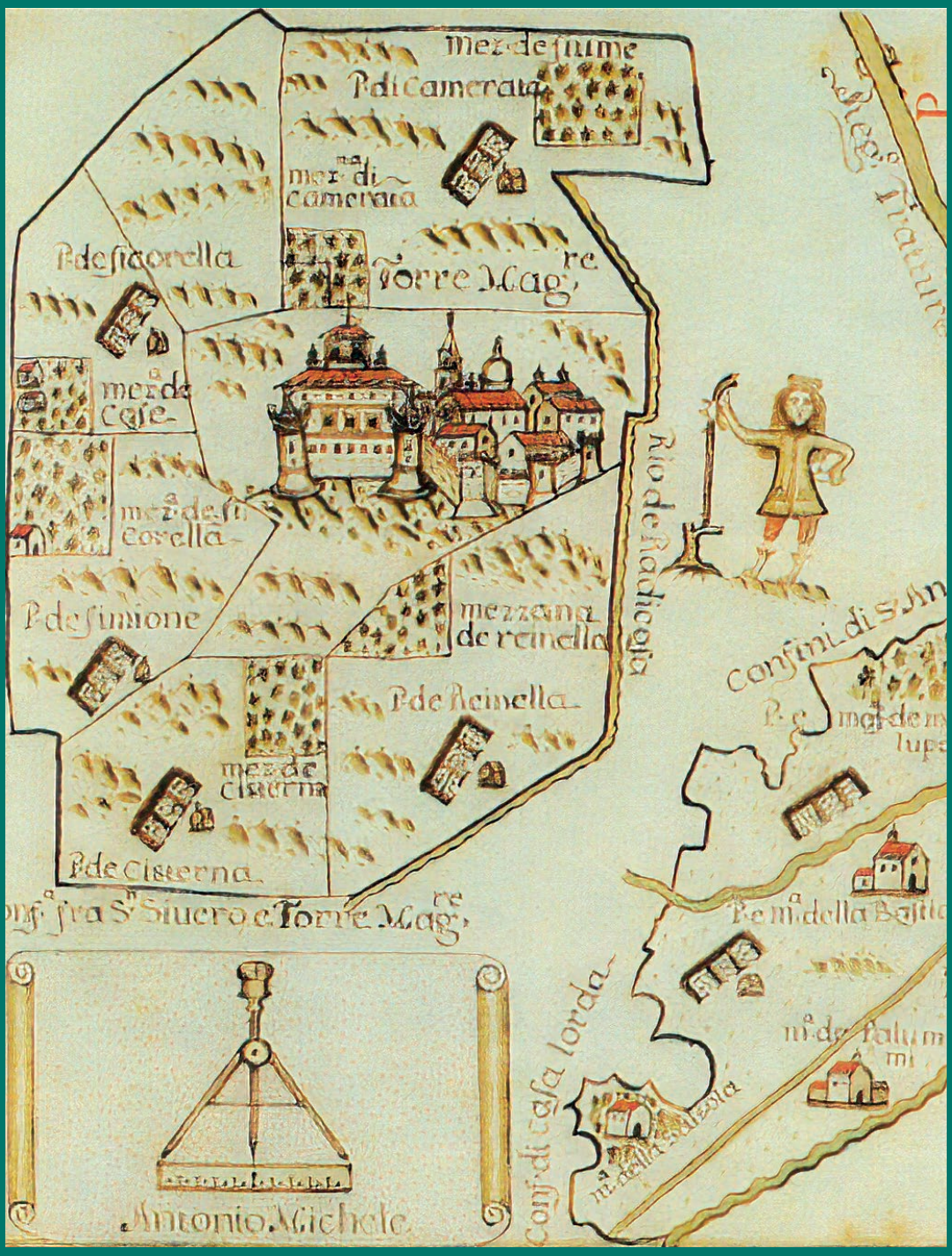
ISSN 1592-6117
www.fupress.net

AESTIMUM

CENTRO STUDI DI ESTIMO E DI ECONOMIA TERRITORIALE - Ce.S.E.T.

Vol. 80 – 2022



FIRENZE UNIVERSITY PRESS

AESTIMUM

CENTRO STUDI DI ESTIMO E DI ECONOMIA TERRITORIALE - Ce.S.E.T.

Vol. 80, 2022

Firenze University Press

Published by
Firenze University Press – University of Florence, Italy
Via Cittadella, 7 - 50144 Florence - Italy
http://www.fupress.com/substantia

Direttore Responsabile: **Romeo Perrotta**, University of Florence, Italy

Registrazione presso il Tribunale di Firenze n. 2875 del 17.07.1980

ISSN 1592-6117 (print)
ISSN 1724-2118 (online)

Versione elettronica ad accesso gratuito disponibile da:
http://www.fupress.com/ceset

AESTIMUM
CENTRO STUDI DI ESTIMO E DI ECONOMIA TERRITORIALE - Ce.S.E.T.

Firenze University Press
www.fupress.com/ceset

Original Articles - Appraisal and rural economics

Is the information sufficient to create a new market for digestate?

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Abstract. Unfamiliarity with a good reduce the chances to be used by consumers. This is the case of digestate which is an organic soil conditioner obtained as by-product of biogas chain. The use of digestate as alternative to traditional manure is still not very widespread due to the lack of knowledge among farmers. In our survey, we explored whether providing farmers with information about the digestate can affect farmers' willingness to pay for buying it instead of the traditional manure used by farmers as soil conditioner. By conducting a hypothetical multiple-price list experiment we show that information positively affects farmers' willingness to pay (WTP) for digestate but information alone is not sufficient to create a new market for it because at the same price farmers always continue to buy manure. This finding raises some questions when estimating the effect of information, which while positive does not shift farmers' decisions to use an unfamiliar good. This result suggests that information provided to farmers elicited a WTP not sufficient to replace traditional manure with digestate.

Keywords: Unfamiliar goods, Information, Willingness to Pay.
JEL codes: D80, Q19.

OPEN ACCESS

Citation: Selvaggi, R., Pecorino, B., Trovato, G., & Pappalardo, G. (2022) Is the information sufficient to create a new market for digestate?. *Aestimum* 80: 3-14. doi: 10.36253/aestim-13002

Received: April 8, 2022

Accepted: July 28, 2022

Published: October 17, 2022

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

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1. INTRODUCTION

In recent years, studies on energy supply have highlighted the importance of innovation applied to the production of energy from renewable energy sources. Currently, a strategic role is assumed by the use of agro-industrial by-products for the production of biomethane by anaerobic digestion and of the by-product that is generated by this process, that is the digestate. Actually, the process of the anaerobic digestion for the production of biogas is the most integrated at the farm level. In this rural context, great importance assumes the production and the use of the digestate as organic soil improvers (Dahlin et al., 2015).

The digestate contains organic and inorganic matters that could be risky contaminants to the environment if not properly treated, but at the same time

digestate is a potential renewable resource if adequately recovered (Herbes et al., 2020a; Wang and Lee, 2021).

In recent years, the amount of digestate produced worldwide has increased due to the increased number of anaerobic digestion plants and their production capacity. In fact, the new digesters for the production of biomethane have sizes upper than 1,000 kWh_{el}, to justify the costs for the upgrading system of the biogas (Selvaggi et al., 2021). This will lead to an increase in the amount of produced digestate raising the question of how to properly value the digestate (Monlau et al., 2015).

In the context of circular economy, the digestate could play an important role as it is able to close a virtuous cycle of production improving the sustainability of the entire agricultural production process (Mauceri et al., 2017; Tambone et al., 2009). In fact, digestate is a stabilized soil conditioner with excellent fertilizing characteristics due to the content of organic matter, micro and macro-elements of plant nutrition (Sogn et al., 2018). Although the anaerobic digestion process leads to several changes in the composition of the resulting digestate compared to the original feedstock, the digestate contributes to maintaining and improving soil quality (Hati et al., 2006; Möller and Müller, 2012).

Recently, the importance of the digestate as soil conditioner has been further enhanced because the input biomasses for the digester are principally by-products and not dedicated crops. Digestate thus represents a useful tool to return to the soil the nutrients consumed to produce agricultural products (oranges, olives, wheat and others). In this context, the digestate represents a low-cost source of natural fertilizer for the farmers able to increase soil yields and hydrologic stability. At the same time, using digestate decreases erosion process and the rate of soil salinity (Alburquerque et al., 2012). Finally, from an economic point of view, the digestate is an opportunity for the farmers both in terms of reducing costs and farmers' dependence on industrial fertilisers (Cerruto et al, 2016; Manetto et al., 2020; Selvaggi et al., 2018a).

Despite several benefits, the use if the digestate is still limited and many farmers have not even heard about it especially in those geographical areas where anaerobic digestion plants are still not widespread (Manetto et al., 2016). Moreover, Pappalardo et al (2019) noted that the willingness to pay (WTP) for the digestate depends on how much information is available among farmers. Although past studies have shown that farmers and/or consumers are willing to entry the digestate market (Dahlin et al., 2015; Herbes et al., 2020b), and purchase it (Selvaggi et al., 2021), understanding what drivers play a relevant role in the digestate purchasing process remains an open question, especially regarding the motivations that may influence its purchase instead of other soil conditioners like manure traditionally used and already well-known among consumers.

However, the effect of information on consumers' WTP for "unfamiliar" goods is still an opened question among scholars. In the case of the digestate, the established use of other soil conditioners like the cow manure and the "unfamiliarity" with new products like the digestate could make the choice of farmers to buy the digestate even more difficult.

"Unfamiliarity" with digestate makes it difficult to evaluate how much farmers are willing to pay for buying it and consequently find appropriate methods to capture the economic value of the digestate. Actually, "unfamiliarity" is a common problem when evaluating novel or new products mainly due to the "commitment costs" phenomenon (Bazzani et al., 2017; Zhao and Kling, 2001; 2004). In general, people overstate their preferences for familiar goods and understate their preferences for a relatively unfamiliar good (Cerroni, 2020). This gap is more accentuated between laboratory experiments and naturally occurring markets (Lusk and Norwood, 2009). According with the theory of commitment costs and with reference to the digestate, farmers' WTP also depends on how much time the farmer has to decide whether or not to buy the digestate (Pappalardo et al., 2018).

In order to reduce consumer's "unfamiliarity" with a good, an interesting approach is to refer not only to the effect of information on WTP but also to compare the "unfamiliar" good about which detailed information is provided with a similar substitutable good that is already known among consumers (Gilmour et al., 2019). Making comparisons between "unfamiliar" and "familiar" goods along with providing consumers with information on the "unfamiliar good" can reveal useful insights into whether consumers will actually buy the new and "unfamiliar" good instead of another good that is already well known among consumers (Ortega et al., 2020).

This is an under-explored approach in the scientific literature as most studies mainly focused on assessing willingness to pay and factors that influence it or alternatively which of two similar, substitute goods are chosen by the consumer. Rarely, it is evaluated whether the WTP placed by consumers on "unfamiliar" goods under the effect of detailed information is really able to shift consumer behaviours in favour of a new "unfamiliar" good instead of a similar good already in the market and commonly used among consumers. However, this is critical in understanding whether a new product that is still "unfamiliar" among consumers will be chosen by con-

sumers after they have received information about it and even after consumers have expressed a positive WTP for the "unfamiliar" good.

With this in mind, the goal of our survey was to explore whether providing farmers with information about digestate led them to have not only a positive WTP for digestate but also to understand whether the latter was higher or lower than the WTP for buying the cow manure. In fact, if the WTP for the digestate is lower than the WTP for the cow manure, buying digestate is unlikely to happen in the real market. In contrast, a higher WTP for the digestate in comparison with the WTP for the cow manure could indicate a real change in farmers' buying habits.

The comparison between the solid fraction of digestate and manure is possible because they are substitute goods that can be used in agriculture for the same purpose, namely as organic soil conditioners to improve soil structure and fertility.

To the best of our knowledge, this is the unique study carried out with farmers characterized by low exposure to the digestate which aimed to assess how information influences not only the WTP to buy the digestate but also whether the information leads to a real change in purchasing habits of farmers.

For this purpose, we used the multiple price list (MPL) method to assess farmers' willingness to pay for digestate which is "unfamiliar" among the farmers operating in areas where biogas plants are still not widespread in comparison with a well-known soil conditioner like the cow manure. MPL method is largely used for its ease of understanding among consumers and typically used in hypothetical surveys (Shew et al., 2017; Asioli et al., 2020). MPL method also allows to compare two substitute goods like we did in our survey in which we compared farmers' WTP between cow manure and digestate.

Our study focused on the Mediterranean area, where a new market for the digestate is required to have new income opportunities for plant owners (Gaviglio et al., 2014) and to reduce the typical dependence of the anaerobic digestion plants on public subsidies (Appel et al., 2016; Dahlin et al., 2017). In addition, the creation of a market for digestate appears to be an essential condition to promote in the Mediterranean area the production of biogas from agricultural biomass according to the sustainable principles of Biogasdoneright^{TM} without taking away agricultural land for food and feed production.

In our survey we evaluated farmers' WTP for the solid and palable fraction of the digestate in the Mediterranean area, where the number of plants is still low but is expected to increase in the coming years. Our research focused on the solid fraction of the digestate because it has an economic value and can be transported easily to farms not close to the production plants.

The results of our investigation expand the current literature on the factors that play a role in the digestate purchasing process with potential implications for expanding the sustainable biogas supply chain according to Biogasdoneright^{TM} principles.

2. MATERIALS AND METHODS

A hypothetical experiment was designed to assess the effects of information on farmers' WTP for solid fraction of digestate compared with cow manure.

At the end of 2020, a specific questionnaire was administrated by face-to-face interviews to a sample of 279 farmers (owners or managers). The survey was conducted in Sicily (Italy) in two different provinces (Enna and Syracuse) where there are no anaerobic digestion plants and farmers have no direct experience for the use of the digestate as soil conditioner. Farmers were recruited with the help of local agricultural unions and local cooperatives. Moreover, farmers were preliminary asked about their willingness to participate in the survey, and they were also asked some screening questions. More specifically farmers were asked if they were the owners or managers of the farm, if they were responsible for acquiring farm materials and if they already used soil conditioners on the farm or if they would be interested in doing. If all the answers were affirmative, those farmers were invited to take part in the survey.

Previous studies have explored whether information influenced farmers' WTP for digestate (Dahlin et al., 2015; Pappalardo et al., 2018; 2019) or farmers' willingness to entry digestate market (Selvaggi et al., 2021), but never have elicited willingness to pay of farmers put in front of the choice between digestate and cow manure. In our survey, we tested farmers' choices between a traditional soil conditioner and an innovative one, and we determined some variables correlated to the choices.

The experimental design was structured by randomly pooling participants in two groups: "control group" in which participants did not collect information on digestate and "treatment group" in which participants were provided with detailed information on digestate. The number of participants in the two group were different: 144 observations for the "treatment group" and 135 for the "control group".

The treatment was the provision of specific information on digestate and its attitude as organic soil conditioner (i.e., its physical and chemical properties, its

production chain and other). The information sheet provided specific information about the production process of anaerobic digestion plants from which digestate is obtained. In addition, a focus was made on the solid fraction of digestate (the subject of our research), specifying its chemical and physical properties as an organic soil conditioner, detailing its content in organic matter, moisture, nitrogen, phosphorus and potassium. Then, some information was provided regarding the systems and machines for its distribution. Finally, it was pointed out that, depending on the process from which digestate is derived, it can be used in organic farming.

The aim of the treatment was to reduce the lack of information that, according to the literature could create considerable uncertainty on the real value of the digestate (Pappalardo et al., 2018).

To elicit farmers' willingness to pay, the widely used multiple price list (MPL) format was applied. MPL is a popular method for elicitation of valuations in hypothetical experimental conditions (Andersen et al., 2007). MPL is an incentive-compatible valuation method in which participants are presented a column of ordered prices, and asked to respond with either "yes" or "no" for each price (Alfnes and Rickertsen, 2010; Andersen et al., 2006). Drichoutis and Lusk (2017) defined the principal advantage of the MPL the ease of use: the method is easy to use, and it is easy for participants to understand. Asioli et al. (2020), also found that MPL method is easier to understand for people and easy to decide on the responses than other method such as Becker–DeGroot–Marschak (BDM) method. However, Andersen et al. (2006) discussed the potential for choices in MPLs to be influenced by the ranges of values considered and Harrison et al. (2005) pointed out that inferences from MPLs can be influenced by order effects. Also, Andersen et al. (2007) put in evidence some disadvantages of MPL format linked to the possibility to elicit only interval responses and thus could be susceptible to framing effects.

The MPL approach allows to compare the answer of different subject between an array of ordered prices put in a table, one per row. We proposed a no traditional MPL, but we adapted the method to our necessity to compare two products. Respondents made a series of consecutive choices between two products. Researchers ask the participants to indicate "solid fraction of digestate" or "traditional cow manure" for each row with different prices for the two goods (Table 1).

Five different price combinations were proposed to each participant to elicit his/her WTP. So, every participant stated 5 preferences: one for every digestate-cow manure pair. The price for the cow manure was constant and equal to 10 euros per ton for every row in the list.

Table 1. Multiple price list used in the survey.

Digestate – Solid Fraction	Traditional Cow Manure
☐ 7.0 € / t	☐ 10.0 € / t
☐ 9.0 € / t	☐ 10.0 € / t
☐ 10.0 € / t	☐ 10.0 € / t
☐ 11.0 € / t	☐ 10.0 € / t
☐ 13.0 € / t	☐ 10.0 € / t

Instead, the five prices for the digestate were different and increasing from 7 to 13 euros per ton, because there is not a market for it. Prices for digestate were fixed considering both ± 10% and ± 30% discounts and surcharges on the market price of traditional cow manure (10 €/t). The choice between traditional cow manure and digestate was necessary for everybody, for every row in the table.

Moreover, to evaluate the possible correlation between WTP and basic socio-demographic characteristics, and to define the profile of the farmer interested in digestate, some information were collected on gender, age, educational level, average income and typical agricultural production systems.

To study more in deep which factors influence farmers' WTP for digestate, an Ordered Logit Model was performed. Considering highest WTP values for digestate for each participant, an Ordered Logit regression was executed. The dependent variable of the model was an observed ordinal response variable (McCullagh, 1980) classified into six different rising levels. The coefficients of the linear combination cannot be consistently estimated using ordinary least squares. They are usually estimated using maximum likelihood. For this reason, Ordered Logit Models require sufficient sample size: how big is "big" is a topic of some debate, but they almost always require more cases than OLS regression (Bujang, et al., 2018).

The Ordered Logit Model is based on the cumulative probabilities of the response variable: in particular, the logit of each cumulative probability assumed to be a linear function of the covariates with regression coefficients constant across response categories (Grilli and Rampichini, 2003).

The model was built around the structural model for ordinal outcomes with a single continuous latent variable (Greene, 2012). The regression model is specified as:

$$OrWTP_i^* = X_i'\beta + \varepsilon_i \quad (1)$$

Where:

- $OrWTP^*$ is the latent variable continuous and ranging from -∞ to +∞ for the i-th subject;

- X_i' is the vector of the explanatory variables;
- β is a vector of coefficients;
- ε_i is the vector of error terms.

In the model, a set of coefficients ($\alpha_1 < \alpha_2 \ldots < \alpha_{j-1}$) with j-1 intercept terms as cut-points in the distribution of the latent variable *OrWTP** was also estimated. The cut-points represent the threshold values for moving from one category of the *OrWTP* variable to another one. Consequently, the observed ordered variable *OrWTP* is tied to the latent variable *OrWTP** as:

$$OrWTP_i = j \text{ if } \alpha_{j-1} < OrWTP_i^* \leq \alpha_j \quad (2)$$

We estimated an ordered logit model in which the dependent variable "*OrWTP*" is classified into six different rising levels: "Never" refers to those who have never chosen digestate from the proposed rows; "First Choice" refers to those who chose digestate only in the first row of the MPL (7 €/t); "Second Choice" refer to those who chose digestate both in the first and in the second row of the MPL (7 and 9 €/t); "Third Choice" refers to those who chose digestate up to the break-even price with manure (7, 9 and 10 €/t); "Fourth Choice" refers to those who chose digestate for all the first 4 rows in the MPL (7, 9, 10 and 11 €/t); "Fifth Choice" refers to those who have never chosen cow manure from the proposed rows and have expressed a willingness to pay all prices shown for digestate (7, 9, 10, 11 and 13 €/t).

The dependent variable *OrWTP* has been related to some independent sociodemographic variables of farmers and a dummy variable considered to test the effect of the information on the WTP. The list of explanatory variables is reported in Table 2.

Table 2. Explanatory variables employed in the Ordered Logit Regression.

Variable	Code	Type	Values
Gender	*Gen*	Dummy	0 = Male 1 = Female
Age	*Age*	Continuous	21-81
Educational level	*Edu*	Categorical	1 = Elementary school 2 = Middle school 3 = High School Diploma 4 = Bachelor's Degree
Income range (yearly)	*Income*	Categorical	1 = < 10,000 € 2 = 10,000 - 19,999 € 3 = 20,000 - 29,999 € 4= 30,000 - 39,999 € 5= ≥ 40,000 €
Category of farm specialisation	*Cat_Spec*	Categorical	1 = Extensive seed and livestock 2 = Extensive tree crops 3 = Intensive tree crops 4 = Horticultural systems
Treatment effect	*Treat*	Dummy	1 for who received the information before to ask him/her the willingness to pay 0 = otherwise

3. RESULTS

Table 3 shows the main socio-demographic characteristics of the sample under analysis. We present the results for the sub-samples (Control Group and Treatment Group) and we performed statistic tests to estimate significant differences.

To exclude significant difference between the two sub-samples, two different tests were performed: (a) Chi-squared tests for the variables gender, educational level, income range and category of farm specialisation; and (b) Student T test for the variable age. The results of these tests are showed in the Table 4.

In both sub-samples, female respondents are fewer than male ones, the prevalent range age is 18-39 (about 38%) and the most represented educational level is High School Diploma. The prevalent income range is 20,000–29,999 euros per year (with different percentage in the two sub-samples) but it prevails only by a few percentage points compared with the yearly range of 10,000–19,999 €. The prevalent type of farming is "Extensive seed and livestock": about 50% of interviewed has cereal and feed forage and livestock farm.

There was no statistically significant difference between the two sub-samples, according to the range of tests (Chi-Squared and T) performed.

For each of the two groups analyzed, the mean WTP values for digestate was determined. Table 5 shows the results of this elaboration.

The mean WTP value for digestate for the Treatment group (8.46 euros per ton) was higher than the mean WTP value for the Control group (6.96 euros per ton).

Although the positive effect of information, the medium WTP value for digestate of the Treatement group was lower than the price of cow manure (10 euros per ton).

Moreover, the effect of the treatment (information) on the mean WTP values was tested through a T-test. The result of this parametric test performed showed statistically significant difference between the mean WTP values of the two sub-samples (p-value < 0.001). For T-Test the null hypothesis is diff = 0 and Pr is (|T| > |t|).

Therefore, we can conclude that the effect of information is confirmed by the current research: more infor-

Table 3. Socio-demographic characteristics of the sample.

	Control Group (n. 135 participants)	Treatment Group (n. 144 participants)	Test performed
	%	%	
Gender			(a)
Male	83.0	76.4	
Female	17.0	23.6	
Age			(b)
18-39	38.5	38.9	
40-49	31.1	29.9	
50-65	23.0	20.1	
> 65	7.4	11.1	
Educational level			(a)
Elementary school	6.7	5.5	
Middle school	28.9	18.1	
High School Diploma	42.9	51.4	
Bachelor's Degree	21.5	25.0	
Income range (€/year)			(a)
< 10,000	16.3	13.9	
10,000 - 19,999	27.4	22.9	
20,000 - 29,999	28.2	24.3	
30,000 - 39,999	17.0	20.1	
> 40,000	11.1	18.8	
Category of farm specialization			(a)
Extensive seed and livestock	56.3	50.0	
Extensive tree crops	33.3	37.5	
Intensive tree crops	9.7	11.1	
Horticultural crops	0.7	1.4	

Table 4. Results of tests performed to exclude statistically significant difference between groups.

	Test performed			
	Chi-Squared	Pr	*T-Test*	*Pr* *
Gender	1.85	0.17		
Educational rate	5.07	0.17		
Income range	4.28	0.37		
Category of farm specialization	1.28	0.73		
Age			0.08	0.94

* For T-Test the null hypotesis is diff = 0 and Pr is (|T| > |t|).

Table 5. Mean WTP values for digestate, for both sub-samples, and T-Test result (*).

	Observations [n.]	WTP values [€/ton]	Standard Error	Standard Deviation
Control Group	135	6.96	0.35	4.02
Treatment Group	144	8.46	0.28	3.39
	Mean WTP differences	p-value		
T-Test	1.50	< 0.001 ***		

(*) In the determination of the mean WTP values for digestate, the answer of who never buy digestate (who checked only cow manure in the MPL) was considered as 0 (zero).

mation about digestate increases willingness to pay but the price offered by farmers is always lower than manure one.

Table 6 shows the frequencies of the six categories of the dependent variable (*OrWTP*) used to estimate the effects of the explanatory variables on WTP values for digestate, in the Ordered Logit model.

The most of respondents stated that they are willing to pay for digestate at most 10 euros per ton (25.81%). Of the remaining part of the sample, only about 16% of the participants stated they are willing to pay more for digestate than for manure: 12.19% were willing to pay 11 €/t for digestate and only 3.94% were willing to pay 13 €/t for it.

Table 6. Frequencies of the categories for the dependent variable (*OrWTP*) of the Ordered Logit model.

Categories	Frequencies	
	[n.]	[%]
Never	47	16.85
First Choice	57	20.43
Second Choice	58	20.79
Third Choice	72	25.81
Fourth Choice	34	12.19
Fifth Choice	11	3.94

About 20% of the total sample stated their willingness to pay for digestate only at lower prices than for manure.

Approximately 17% of participants in the experiment did not choose to buy digestate, since the first combination of prices offered (7 €/t for digestate and 10 €/t for manure). This percentage of subjects who have never expressed willingness to pay for digestate, is distributed differently between the two groups of the sample: in the Treatment group, after providing information on digestate, only 11% of participants have never chosen digestate. This value rises to 23% in the Control group.

This confirms the effect of information on the probability of entering the digestate market, already investigated in the studies mentioned above.

In Table 7, the estimated coefficients of the Ordered Logit Model are reported, considering as regressors the variables collected in the questionnaire (socio-demographic characteristics) and the variable referred to the treatment. The relative statistical significance is reported for every variable considered.

To improve the reading of the model result, the categorical variable related to the category of farm specialization (*Cat_Spec*) was represented using a set of 4 dichotomous variables (dummy, coded as 0 or 1). Specifically, to avoid the dummy trap, the number of dummy variables used in the model is 3 (one less than the number of categories). Moreover, the variables "Edu" and "Income" were made dummy to avoid loss of degrees of freedom (Migliore et al., 2022) and because we are not interested in studying the effect of each educational level or income range. In particular for "Edu" was considered 0 for not graduated farmers and 1 for graduate ones; for the variable "Income" the dummy was fixed as 0 for lower yearly income range (< 20 k€) and 1 otherwise.

The cut-points of the output indicate where the latent variable is cut to make the six groups that we observe in the experiment.

Table 7. Results of the Ordered Logit Model.

Indipendent variables	Coefficients	Standard error	p-value
Gen	- 0.034	0.274	0.900
Age	- 0.004	0.008	0.601
Edu	0.044	0.148	0.765
Income	0.638	0.096	<0.001***
Cat_Spec_1	1.500	0.892	0.093*
Cat_Spec_2	1.758	0.897	0.050**
Cat_Spec_3	0.597	0.939	0.525
Cat_Spec_4	omitted		
Treat	0.764	0.220	0.001***
cut1	1.773	1.075	
cut2	2.966	1.0823	
cut3	4.022	1.099	
cut4	5.643	1.123	
cut5	7.3001	1.158	

Number of observations: 279.
*, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

The likelihood ratio chi-square of 72.40 with a p-value of < 0.001 tells us that this model as a whole is statistically significant, as compared to the null model with no predictors. The pseudo-R-squared of 0.2770 is also given.

Some coefficients for the independent variables are statistically significant. In particular, the coefficients for the variables "Treat", the categorical variable for the income range and two of the dichotomous variables created for the category of farm specialisation, have positive signs and are statistically significant. All the other coefficients are not.

Also, the results of the ordered logit regression performed confirms the positive effect of the information on the WTP. In fact, the positive coefficient of the variable "Treat" statistically significant indicates that "information" can be considered a driver to increase respondents' WTP.

Moreover, the higher the income level the greater the willingness to pay. The result obtained for the income range is common in all market analysis. If farmers have high income their WTP increase.

In ordered response model both the sign and magnitude of coefficients are not directly interpretable (Greene and Hensher, 2010). So, we define the interpretation of the ordered logistic regression in terms of marginal effects. Marginal effects show the change in probability when the independent variable increases by one unit. For continuous variables (such as "age" in this model) this represents the instantaneous change given that the 'unit'

Table 8. Marginal effects for the statistically significant variables.

Indipendent variables	OrWTP categories					
	Never	First Choice	Second Choice	Third Choice	Fourth Choice	Fifth Choice
Income (*)	0.072	0.069		0.086	0.523	0.016
	<0.001 ***	<0.001 ***		<0.001 ***	<0.001 ***	0.001 ***
Cat_Spec_1 (*)		-0.146		0.186	0.122	
		0.043 **		0.045 **	0.101 *	
Cat_Spec_2 (*)	-0.172	-0.170		0.180	0.171	
	0.032 **	0.018 **		0.001 ***	0.087 *	
Treat (*)	-0.088	-0.080	-0.015	0.101	0.063	0.019
	0.001 ***	0.001 ***	0.011 **	0.001 ***	0.002 ***	0.013 **

Values in italic are p-value. *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.
(*) dy/dx is for discrete change of dummy variable from 0 to 1.

may be very small. For binary variables, the change is from 0 to 1, so one 'unit' as it is usually thought.

In Table 8, marginal effects (dy/dx) are shown. Only marginal effects for the statistically significant coefficients are reported and only variables with at least one statistically significant coefficient were reported.

Since the dependent variable in this ordered logit model consists of six categories, the table shows six sets of marginal effects that describe the impact of a change in the covariates on the predicted probabilities. Technically, if the predicted probabilities obtained from the regression are different across the categories of the dependent variable, the marginal effects can be used to estimate their increase or decrease.

The variable "Treat" was the only one found to be always statistically significant, for each category of the dependent variable. The negative sign for the first three categories (never, first choice and second choice) indicates a lower likelihood that "informed" participants will be willing to pay more than "not informed" ones. For example, the probability that "informed" will willing to spend 9 €/t for the digestate (second choice in the table) is about 1.5% lower than for the "not informed".

For the highest prices for the digestate, the marginal effects for the variable "Treat" assumes a positive sign, indicating a higher probability that treated group will pay more than control group. When the price for the digestate is equal to that for manure, the probability that "informed" will willing to spend 10 €/t for the digestate instead of for manure is about 10% higher than for the "not informed".

Looking at the categorical variable "Income", the sign is positive for all the categories. Therefore, we can assume that those with higher incomes are more likely to have a higher willingness to pay than those with lower incomes. For example, the probability that famers with high level of income are willing to pay 11 €/t for the digestate (fourth row in the MPL) is 52.3% more than farmers with a low-income level. The result obtained for the "never" category is ambiguous. In particular, the significance of the "income" variable and the positive sign of the marginal effects coefficient cannot be easily explained. One possible explanation could be related to the "price" variable: the lower MPL limit set in the research (7 €/t) may have played a disincentive role for product choice. In fact, lower prices than those normally found in the market may induce mistrust in the consumer who chooses not to buy the commodity at a low price.

As regards the category of specialization, marginal effects have different signs according to the different categories of the dependent variable. Owners of more specialized crops than "extensive seed and livestock" are less likely to be willing to pay 7 euros for digestate. On the other hand, the same subjects are more probable to pay 10 euros and 11 euros per tonne, 18.6% and 12.2%, respectively, than the owners of "extensive seed and livestock".

Finally, participants with different crops than "Extensive tree crops" are less likely to be willing to pay 7 €/t for digestate and not to choose digestate from the first line of the MPL. In both cases, the probability is lower than 17%. As with the previous variable, the same individuals are 18.0% and 17.1% more likely to pay 10 euros and 11 euros per ton, respectively than owners with different specialization categories.

4. DISCUSSION AND CONCLUDING REMARKS

Previous studies have shown the existence of a positive farmers' willingness to pay for digestate especially

when farmers are provided with information on it (Pappalardo et al., 2019; Selvaggi et al., 2021). Our survey confirms what already shown in the past literature since the farmers' WTP for buying an "unfamiliar" good like the digestate was higher when participants were provided with information on the good itself (e.g., Aanesen et al., 2015; Börger and Hattam, 2017). However, our survey went beyond the current literature as the farmers' willingness to pay for digestate was compared with the willingness to buy a similar product already on the market and well-known among farmers. Indeed, after providing the farmers with the information on digestate, only 11% of the participants in the treatment group never chose digestate over manure, compared to 23% of participants in the group without information. The positive and statistically significant variable 'Treat' confirms that the effect of the treatment on farmers' WTP was statistically significant probably because in this case the commitment costs are lowered (Corrigan et al., 2008; Zhao and Kling, 2001; 2004).

Our results appear interesting as the willingness to pay for a good does not necessarily imply that a market for that good will occur especially when the good is "unfamiliar" among consumers. In fact, the willingness to pay for a good, even if positive, may be lower or equal than for similar and substitute goods already on the market and "familiar" among consumers. When this occurs, despite the existence of a positive willingness to pay, a market for the unfamiliar good may not occur. In this regard, in our survey we showed that although the positive effect of information, farmers have predominantly stated that they are willing to pay to buy digestate but only when it is priced below or at the limit equal to the price of cow manure. This result goes beyond the scientific literature on digestate market (Herbes et al., 2020; Pappalardo et al, 2019; Selvaggi et al., 2021) since providing information to farmers can improve their WTP for digestate but the information alone seems to be not sufficient to create a digestate market. Our findings seem to suggest that conventional practices or habits among framers are stronger than innovation like introducing the digestate as new soil conditioner.

With reference to the categories of specialization, the owners of arable and extensive crops are less inclined to innovation because they do not face problems related, for example, to the distribution of soil improvers. Their technical solution is the use of the manure spreader and the use of manure for them represents an ordinary, traditional and established practice. On the other hand, farmers with specialized tree crops or horticulturists do not traditionally use manure for obvious technical reasons related to the impossibility of using manure spreaders on their fields (in the case of tree crops) or inside greenhouses (for horticulturists). In addition, especially horticulturists, face health problems related to the bacterial load of unripe manure, which could contaminate vegetables in the field, while the solid digestate proposed in the research would ensure safety from this microbiological point of view.

Implications of our survey can be relevant for the owners of digestion plants, who need to sell digestate to improve their cash flow. Although the digestate is a good substitute of other organic soil conditioners like the cow manure, farmers do not know it and their decisions are influenced by the low level of knowledge about digestate properties. Providing only information on the benefits of digestate could be insufficient or even ineffective. Therefore, it would be necessary to think about the ways in which the information should be provided to farmers in order to increase its effectiveness.

The research shows that farmers are interested in entering the digestate market, so incentive policies to get this product out there would be desirable.

As recommendations for policy makers and operators in the biogas supply chain, our findings suggest enhancing technical information both among farmers for the benefits of digestate to soil fertility and among biogas producers for the positive economic impact that digestate has for the anaerobic digestion companies that convert a waste into an economic resource. Then, as in the real market happens for any commodity, farmers may or may not purchase this good after being sufficiently informed about it. But thanks to the information they receive, they will be able to consider buying it as a substitute for traditional manure.

Despite the care taken by the researchers in providing only objective and general information about the chemical and physical characteristics of the product, without extolling its merits or flaws, it is to be expected that the results were affected by the type of information provided to farmers. Future research should explore different approaches of how to provide information to farmers and in particular the design of the information intervention, e.g. providing participants with quantitative information like official statistics (e.g. Kuziemko et al., 2015) or reporting anecdotal evidence, stories, and narratives providing participants with qualitative information which closely resembles case studies (e.g. La Ferrara et al., 2012) or tailoring information to individuals (e.g. Roth and Wohlfart, 2020). Moreover, it could be interesting to define the reasons for the differences between the WTP values for digestate and other similar soil conditioners like the cow manure. Finally, future research could deepen the degree of farmers' propensity

for introducing innovation within the farm such as the digestate.

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The assessment of the forced sale value in the Italian residential market

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Abstract. The present research has focused on the development and experimentation of a model for the forced sale value determination. With reference to six study samples consisting of residential properties sold through judicial auctions between November 2020 and May 2021 and each of them located in an Italian region, the forced sale price, the market value assessed by a judicial valuer and the main influencing factors have been detected. The implementation of an econometric technique has allowed to obtain models for the forced sale value assessment and for the analysis of the factors that mostly influence the final hammer price and, therefore, the discount between the market value evaluated and the judicial price. In the context of the existing literature, the study represents the first attempt that proposes a quantification of the discount/premium coefficient based on the specific factors of the property, in order to provide a reliable assessment of the forced sale value.

Keywords: Auction market, Forced sale value, Econometric methods.
JEL codes: R31, R15, K25, D81.

Citation: Di Liddo, F., Tajani, F., Amoruso, P., Ranieri, R. & Anelli, D. (2022) The assessment of the forced sale value in the Italian residential market. *Aestimum* 80: 15-32. doi: 10.36253/aestim-12953

Received: March 25, 2022

Accepted: May 16, 2022

Published: October 17, 2022

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

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1. INTRODUCTION

The volume of real estate investments in Italy, although in contraction due to the impact of the Covid-19 pandemic, reveals the crucial role of the sector in the national economy (Locurcio et al., 2021; Morano et al., 2019). The macroeconomic situation had an impact, albeit partial, on purchase intentions, supported by the low interest rates applied to bank loan agreements and by forms of government support. Among the various real estate sub-markets, the judicial auction sector suffered an immediate repercussion due to the suspension of bankruptcy judicial procedures, which resulted in a significant reduction in offers. However, there was an increase in user interactions compared to auction ads, favoured by the progressive digitalization

of the sector as well as by its attractiveness due to savings offered by the sector (Nomisma, 2021). The extraordinary elements of the auction sub-market were linked to *i*) the excessive length of the procedures, thus aggravating the obsolescence of properties placed as collateral; *ii*) greater conditions of uncertainty related to obtaining a bank loan compared to buying and selling on the free market; *iii*) the scepticism of potential buyers due to lower levels of information transparency; *iv*) the absence of warranty for hidden defects; *v*) the risk of the auction market itself. These factors combine to determine a final hammer price which is significantly lower than the market value estimated by the valuer engaged by the court Judge, i.e. the "judicial valuer" (Italian Banking Association, 2018).

Recent macroeconomic conditions have had an effect on sector trends recorded last year since the health emergency from Covid-19 resulted in a court activity general suspension. A total of 95,329 lots were auctioned off in Italy in 2020, for a total of 117,376 auctions, with each lot accordingly put up for auction on average 1.23 times, resulting in impoverishment of the sale value. In fact, procedures determine that in the situation of a deserted auction, the asset is put up for auction again, usually after approximately six months, with the value reduced further compared to the initial minimum bid value. A comparison with data related to 2019 showed an overall reduction of 40.6% in the number of lots on auction and a decrease of 53.9% in auctions held, due to the protracted inactivity of the courts. However, two months prior to the outbreak of the pandemic an increase of the 15% in the volumes of scheduled auctions compared to the previous year has been observed, indicative of an initial increase in judicial system efficiency. The impact of the measures adopted to deal with the Covid-19 pandemic caused an 86% decrease in auctions set for the period between March and September compared to the same period in 2019. From October to December, although activity had fully resumed, there was a decrease of 24% compared to the same period of the previous year. Against a minimum value of the lots at auction of € 11.6 billion – determined as the sum of the minimum bids -, an estimated loss of € 1.1 billion was generated in 2020, considering the related write-down at auctions which were deserted (Report Reviva, 2020).

The data related to the first half of 2021 have shown a recovery in the sector, with a total number of 93,129 auctions held, approximately equivalent to the total number of auctions held throughout 2020, although with a permanent decrease of 29% compared to the same semester of 2019. The economic value of auctions held in the first six months of 2021, given by the total of minimum bids, was equal to € 12 billion, confirming a new growth phase following on from the initial impact of the pandemic. However, the contraction of the residential asset class persists, as a result of suspension of judicial procedures of "first home" properties – i.e. those linked to the buyer by the existence of specific requirements, as envisaged until 31 October by the Italian "Refreshments" Decree – with a reduction of 22% compared to the first half of 2019. A variation in auction sales methods, with an increase in asynchronous and synchronous telematic approaches, in line with restrictions imposed in recent months, has also been detected (Reviva, 2021).

The worsening of the uncomfortable conditions induced by the emergency has underlined some limits relating to auction procedures, characterized by excessively prolonged and complex sales times for goods under guarantee. In order to reduce procedural time and limit the uncertainty related to the discrepancy between market value and hammer price, relevant legislation has introduced significant initiatives since 2015, with law no. 132/2015 containing "Urgent measures in bankruptcy, civil and civil procedural matters and the organization and functioning of the judicial administration", amending art. 568 cpc. This initiative has established the maximum reduction of "minimum" offers at 25% (art. 13, par. 1, lett. R of Law No.132/2015) compared to the base price indicated in the sales order, thus generating a greater depreciation of properties on auction, although the primary purpose has concerned the expansion of the number of potential investors. In addition, it has extended the settlement-price term of the property awarded in the auction from sixty to one hundred and twenty days, with the aim of favouring the potential obtainment of a bank loan. Higher disclosure transparency has also been promoted, in order to attract ordinary investors through online platforms where legal advertising of real estate auctions banned in Italy can converge, by limiting the speculative behaviour of restricted groups of professional operators who dominate the sub-market, even if this phenomenon is a recurring factor in foreign contexts as well (Donner, 2017; Fontana and Vigorito, 2007). However, the achievement of the expected results was strongly influenced by the volume of the previous stock of goods at auction, which inevitably slowed down the liveliness of the sub-market. A further limit to the attractiveness of the sector is applied by the time required to obtain the assets sold at auction, typically postponed in reference to the time of the award.

The aforementioned criticalities have found an initial confirmation in the National Recovery and Resilience Plan (PNRR) which includes two proposals on

this topic: *i*) to implement the obligation of property abandonment by the debtor, even before the award of the property on auction; and *ii*) to encourage the direct sale of the property by the debtor. The twofold objective is to protect the creditor and to support sales and prices in anticipation of an increase in the supply of properties at auction in the face of a contraction in demand due to the economic crisis.

On the other hand, with the aim of continuing to protect creditors in the recovery of the amounts due, out-of-court alternatives have already been promoted since 2015, in order to avoid excessive reductions in the properties' market value as collateral and to reduce the volumes of auctioned goods. In this regard, the legislator has introduced securitization (Law no.130 of 30 April 1999, – Provisions on the securitization of credits, amended by Law no.8 of 28 February 2020). In particular, here the real estate version is a typical form of financing aimed at the purchase of Non Performing Loans (NPLs) portfolios, through the establishment of a vehicle company (Special Purpose Vehicle – SPV), which finances the purchase of assets by using funds raised by the issue of securities called Asset Backed Securities (ABS). The cash flow generated by the sale of the properties provides the necessary coverage for reimbursement of securities. Thus, assets subject to disposal are segregated with respect to the remaining real estate portfolio of the company. Following the changes introduced by the D.L. no.50/2017 and subsequent amendments pursuant to Legislative Decree no.34/2019 – "Growth" Decree -, the use of Real Estate Owned Company (ReoCo) is contemplated in securitization structures. These are defined as support vehicles for the SPV aimed at increasing credit recovery, promoting the acquisition, management and enhancement of real estate assets (e.g. restructuring, urban conversion, development and renegotiation of lease contracts) in order to guarantee securitized credit.

Given the initiatives promoted over the last decade, social repercussions of the real estate auction sector can be summarized in terms of a double aspect: *i*) creditors' difficulty in recovering sums due; *ii*) difficulty in recovering a certain amount beyond the resolution of the debt position if the final realization price is excessively lower. The position of the debtor is at times burdened by the social function that the property fulfils – if it is the principal residence of the debtor rather than a place of work.

On the basis of what has been clarified, the limits connected to the judicial procedure understood as a solution to the recovery of credits with real estate guarantee, not only have a purely economic character connected to the destruction of value, but also represent an element of social disadvantage, if considered in terms of the function that the asset has for the debtor and the resulting consequences for this subject, currently already at a disadvantage due to an uncertain economic and social context.

2. AIMS AND PARTS OF THE WORK

The present research is part of the framework outlined. The aim concerns the development and experimentation of a model for the determination of the forced sale values. The analysis has been carried out with reference to six study samples – each related to an Italian region (Lombardy and Piedmont for the Northern Italy, Tuscany and Lazio for the Central Italy and Campania and Apulia for the Southern Italy and Islands) – and by considering the housing properties sold through judicial auctions between November 2020 and May 2021. In particular, for each residential unit, the forced sale price, the market value assessed by the judicial valuer and the main influencing factors have been detected. The choice to consider the three macro-areas in which commonly the Italian territory is divided is aimed at verifying the existence of differences in influencing factors on final selling prices and at examining the different contributions of variables on the differential of value.

The implementation of econometric analysis allows to point out the contribution of explanatory factors in the forced sale processes for each Italian region considered. In addition to the assessment of the forced sale value, the models obtained could also be used to analyse the factors that mostly influence the final clearing hammer price and, therefore, on the discount between the judicial valuer's assessed value and the final hammer price.

It should be outlined that the present study constitutes an innovative attempt aimed at the quantification of the differential coefficients – in terms of discount/premium – in the forced sale values, by taking into account the specific property factors. In this sense, the analysis is intended to provide a model for reliable assessments of the forced sale value able to support the definition of adequate hammer prices in the judicial auction market context. Thus, the model obtained allows to identify the influencing determinants in the buyers and seller's decision processes in order to make more transparent the dynamics related to the real estate auctions. Furthermore, the mathematical form in which the model is expressed makes it possible a continuous and rapid check of the forced sale values trend and, at the same time, the verification of the relevance between the value

assessed by the appraiser with reference to a potential sale in the free market and the final hammer price.

Therefore, the regressive model obtained can be a support for the investors and judges activity in determining the forced sale value in order to define a tool for monitoring the final selling prices starting from the market value estimated by the judicial valuer. This model could be used by the subjects involved in real estate judicial procedures to assess a likely clearing value on the basis of the intrinsic characteristics of the property (total area, presence of exclusive and condominium appurtenances, etc.), of the urban area in which the property is located and the duration of the procedure. Specifically, the proposed tool will be able to support *i*) the judicial authorities, at the start of the auction procedures, to operate the rational reduction of the market value estimated by the judicial valuer, and to monitor the offers during the entire procedure, so as not to reach a hammer price too far from the value obtained with the methodology proposed in this work; *ii*) the participants in the auctions, to strategically weight the offers and have a reference on the convenience threshold of the hammer price, based on the profitability and risks of the reference market; *iii*) the court consultants, in the situations in which an indication of the forced sale value is also requested by the judge. It is also specified that a hypothesis introduced for the elaboration of the proposed model regards the value assessed by the judicial valuer that actually represents the most likely market value of the property and therefore that the assessed value constitutes a reliable indication, as a starting point for the parties involved in the auction procedures.

The paper is structured as follows: in Section 3 an analysis of the existing literature related to the most influencing factors on the discount/premium definition is carried out. In Section 4 the case study relating to the six property samples located in the three macroareas mentioned is introduced: the explanatory variables considered are presented and the main descriptive statistics are analysed. Furthermore, with reference to the collected data, a descriptive analysis is illustrated in order to provide a framework of discounts (or premium) according to *i*) the city, *ii*) the urban area, *iii*) the property maintenance conditions, *iv*) the presence of specific characteristics and *v*) the range of duration of the judicial procedure. In Section 5 the methodology adopted for the analysis is described and its application to the case study is illustrated. Moreover, the results are interpreted and the functional relationships between the factors considered in the analysis and the final price are examined. Finally, in Section 6 the conclusions of the work are discussed.

3. BACKGROUND

In Italy, the real estate auction sector has historically been characterized by a constant downward trend compared to the initial assessed market value, with the determination of a certain discount on the final hammer price as a recurring aspect in foreign contexts as well. For this reason, in existing literature numerous studies have examined the possible causes at the origin of the mechanism for forming the discount / premium on the final forced sale price.

Given the uncertainty related to the discrepancy between estimated market value and hammer price, the Royal Institution of Chartered Surveyors (RICS) on 2017 and successively also on 2020 has introduced the definition of "forced sale value", i.e. a market value that is generated in a particular condition of sale with a limited amount of time available, in which the seller is subject to external legal or commercial factors, and the possible failure to conclude a sale affecting the determination of the realization price.

Although the discount on the assessed value in the judicial procedures is a recurring element in various international markets, the reference local regulatory context conditions the process of forming the final sale price (Donner, 2017). By comparing different international markets, Susilawati and Lin (2006) have shown that in most cases analysed a discount on the hammer price is detected, with the exception of the Australian and Irish contexts, characterized, instead, by the formation of a value bonus in the selling price. The relationship between the forced sales segment and the free market has often been examined in literature in an attempt to understand the dynamics behind the formation of the award price in terms of premium / discount (Mayer, 2003; Marcus, 2001; Quan, 2002).

Specifically, by comparing the Australian and US markets, Dotzour et al. (1998) have shown that in the US market the investor perceives this sector as characterized by a lack of transparency, thus resulting only in the competence of professional operators. The hostility attributed to the auction market is identified as the main reason for the creation of a discount. On the other hand, Lusht (1996) has examined the Australian market and attributed the origin of the creation of a "premium" on the estimated value to the nationwide diffusion of the sub-market of real estate auctions: since investors consider this segment to be equal to the free market, the volumes of sales at auction are equivalent to free trading.

Analysis of the markets characterized by "discounted" hammer prices have revealed that this circumstance negatively affects the value of properties that fall within

areas – up to 0.05 miles – neighbouring the location of the properties at auction (Campbell et al., 2011). With reference to the specificities of the assets, many Authors have investigated the effects of the properties physical characteristics on the final hammer price (Carroll et al., 1997; Clauretie and Daneshvary, 2009; Forgey et al., 1994; Hardin and Wolverton, 1996), by noting as potential discriminating factors *i*) the intended use, in particular the negative effects generated on sales times by atypical properties (Ong, 2006); *ii*) the maintenance state (Allen and Swisher, 2000). On the other hand, Wong (2017) has studied the influence exerted by the specific urban context and other extrinsic factors, showing that proximity to the city centre and numbers of potential investors (Hungria-Gunnelin, 2013) have a positive correlation with the final sale price.

With reference to the Italian context, existing literature has often focused on the analysis of local market segments, and it is thus strongly dependent on specific urban areas.

Canesi et al. (2016) have analysed the discount existing between estimated and forced sale values, implementing an empirical survey based on a sample of properties awarded at auction in Northern Italy. In a later study (2017), the same authors have examined the executive procedures in the Veneto region, by pointing out a systemic nature of the discount on final sale price. When selecting the variables, the Authors have considered, on the one hand, factors specific to the properties and the sub-market referred to, and, on the other hand, to elements that distinguish the urban and social context within which the assets are located: *i*) socio-economic aspects and demographic factors (location, profitability in terms of employment, number of normalized transactions, population, real estate market intensity index); *ii*) intrinsic factors of the assets (state of maintenance, technological characteristics, gross area); *iii*) aspects relating to the auction sector (days spent at auction, number of auctions, discount, premium and evaluation dates).

A recent study conducted on the national market by the Bank of Italy (Loberto, 2021) has led to results which are similar to those highlighted by Campbell (2011), by underling the negative influence given by the real estate auctions sector on properties offered for sale in the free market, in terms of reducing the asking price. This result goes beyond the traditional interpretation of the sector as a distinct segment, at the same time giving it a competitive character, although to the detriment of the real estate sector performance.

In a study carried out on the segment of judicial auctions in Southern Italy, Amoruso et al. (2020) have started from the analysis of a sample of properties awarded at auction in the Apulia region to identify the excessive length of judicial procedures as the main cause of the erosion of value at auction. Del Giudice et al. (2020) have implemented an analysis of the real estate auction sector in the Campania region, including variables that described the scenario generated following the Covid-19 pandemic – unemployment rate, family and per capita incomes, real estate dynamics – and evaluating their impact on medium and short-term trends in residential property prices, recording a reduction of 4.16% in the short term and 6.49% in the medium term (late 2020-early 2021). An initial experience aimed at determining a model for estimating forced sale value based on risks inherent in the reference market of various Italian macro-areas has been carried out by Tajani et al. (2021). The analysis has been implemented by applying Ellwood's logic to the real estate sector, by integrating it with the investment risk assessment approach of the Real Options Analysis.

4. CASE STUDY

The case study concerns six samples constituted by total 918 residential properties sold through judicial auction procedure between November 2020 and May 2021 and distributed on the Italian territory as follows: Lombardy and Piedmont for the Northern Italy, Tuscany and Lazio for the Central Italy and Campania and Apulia for the Southern Italy and Islands. Within each Italian region considered, the existing law-courts are analysed. In Figure 1 the six Italian regions are highlighted and the related law-courts are reported.

4.1 Variables

For each residential unit, the unit final selling price expressed in €/m^2 (P) related to the judicial procedures concluded in the Italian context – obtained by consulting the real estate auctions website (*Public Sales Portal*) – and the main intrinsic and extrinsic factors that characterize the properties and considered by buyers and sellers in the auction negotiation phases have been detected. These factors constitute the main characteristics reported in each property website paperwork related to its conditions and location. The variables considered are listed and described below:

- the total surface [S] of the property, expressed in m^2 of gross floor area of the property;
- the presence of the lift [L]. In the model this variable is considered as a dummy variable, where the absence of the service is indicated with the value

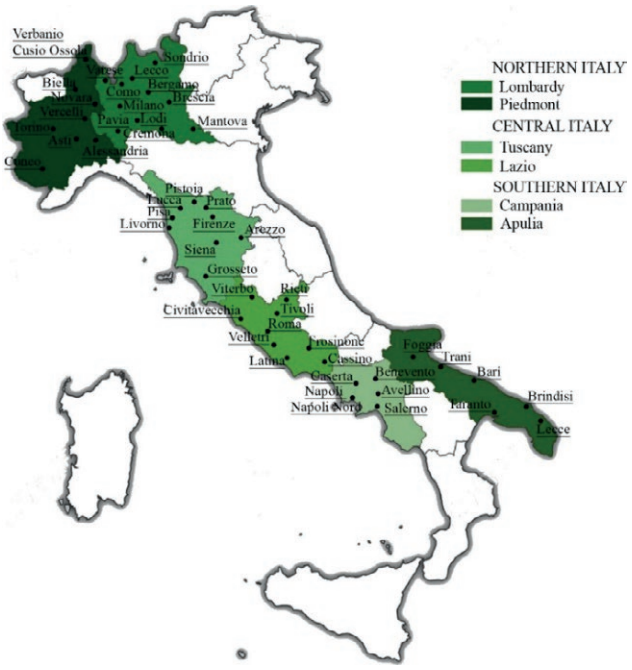

Figure 1. The law-courts located in the six Italian regions considered in the analysis.

"zero", whereas the presence is represented by the value "one";

- the presence of private appliances [Se], i.e. car box, outdoor parking space, storage room, attic, own garden and courtyard. The variable is assessed as a dummy variable, by which the vale "one" indicates the presence of at least one service, whereas the value "zero" the absence of all of them;
- the presence of condominium areas [Co], i.e. common courtyard, atrium, external green spaces and common laundry room. If for the dummy variable the "zero" value is reported, the presence of one service is shown, vice versa if the "one" value is included the presence of one or more condominium appliances is verified;
- the property maintenance conditions, assessed according to the rating "to be restructured" [Mb], "normal" [Md], "good" [Mg] and "excellent" [Me]. The score "one" indicates that the specific conservative state is present, whereas the score "zero" is assigned to the other conditions. In this sense, among the variables considered, the "to be restructured" property state is not included, as the presence of all three variables "zero" implies these maintenance conditions;
- the time on auction [T], measured in days and determined as the temporal difference between the first day of bidding and auction clearing date;
- the municipal trade area in which the property is located, considering the geographical distribution developed by the Italian Revenue Agency (http://www.agenziaentrate.gov.it). By taking into account that the different location characteristics contribute to the formation of the selling prices, three of the five Italian Revenue Agency trade areas are analysed: "central" [C], "semi-central" [Sc], "peripheral" [P]. For each property, the score "one" is assigned if the property belong to the specific trade area, whereas the score "zero" is reported for all the remaining locational factors. The values "zero" for all trade areas imply the property localization in suburban or extra-urban ones;
- the market value [Vm], assessed by the judicial valuer, included in the expert estimate in which is expressed in €.

Table 1 shows the main descriptive statistics of the final total selling prices and the influencing factors for the six Italian regions analysed. In particular, some considerations related to the total hammer price and the quantitative factors (Vm, S and T) can be useful. The data analysis highlights that the maximum value of final selling price is detected for the Lazio region (= 750,630.00 €) followed by the region of Campania (= 660,500.00 €), whereas the minimum value of final selling price is detected is observed for the study sample collected in the Piedmont region (= 7,500.00 €) and, immediately after, in Lombardy (= 10,510.00 €). With reference to the average values of the hammer prices, the range recorded is [49,505.12 €; 102,914.85 €], with the minimum boundary found in the Piedmont region and the maximum one in the territory of Lazio, by attesting the coherence with the minimum and maximum values identified in absolute terms. In line with the average values of the final selling price, the average market values assessed by the judicial valuer vary from 154,786.80 € in Lazio region and 89,860.20 € in Piedmont. However, the maximum assessed market value is noted for the Campania study sample (= 1,545,534.72 €) and the minimum one for the Piedmont (= 15,000.00 €), differently to what shown for the final selling prices for which the maximum value is observed in the Lazio region.

Regarding the "total surface of the property" variable, it should be noted that the highest arithmetic mean value is collected for the sample located in Tuscany region (= 112.43 m^2), whereas the lowest average value is reported in the Italian region of Lazio (= 98.07 m^2). For the "time on auction" factor, the minimum days number between the first day of bidding and auction clearing date is pointed out for Tuscany (= 63 days) and the maximum one is revealed for Campania region (= 6,530 days). In particular, it should be highlighted that the

Table 1. Descriptive statistics variables for the six Italian regions analysed.

Variable		Lombardy	Piedmont	Tuscany	Lazio	Campania	Apulia
Final selling price [€]	Mean	65,668.53	49,505.12	76,005.72	102,914.85	85,497.64	65,261.42
	Standard deviation	55,514.57	38,953.24	53,219.29	97,665.54	88,837.28	64,646.35
	Minimum value	10,510.00	7,500.00	16,580.00	11,151.60	12,450.00	10,750.00
	Max value	450,000.00	220,000.00	310,000.00	750,630.00	660,500.00	328,000.00
Total surface of the property [m^2]	Mean	103.33	108.34	112.43	98.07	108.06	106.02
	Standard deviation	47.26	66.52	99.61	56.23	45.74	62.44
	Minimum value	35.00	25.00	32.00	31.23	14.48	31.95
	Max value	378.90	367.30	924.91	498.70	336.95	440.30
Presence of the lift	Mean	0.23	0.32	0.22	0.45	0.37	0.34
	Standard deviation	0.42	0.47	0.42	0.49	0.48	0.48
Presence of private appliances	Mean	0.79	0.86	0.88	0.67	0.49	0.58
	Standard deviation	0.41	0.34	0.40	0.47	0.50	0.50
Presence of condominium areas	Mean	0.43	0.47	0.40	0.28	0.55	0.38
	Standard deviation	0.50	0.50	0.49	0.45	0.49	0.49
"To be restructured" maintenance conditions	Mean	0.21	0.21	0.21	0.14	0.19	0.18
	Standard deviation	0.41	0.40	0.40	0.31	0.39	0.38
"Normal" maintenance conditions	Mean	0.35	0.27	0.27	0.21	0.45	0.17
	Standard deviation	0.48	0.45	0.44	0.41	0.50	0.38
"Good" maintenance conditions	Mean	0.42	0.50	0.45	0.63	0.30	0.57
	Standard deviation	0.50	0.50	0.50	0.48	0.46	0.50
"Excellent" maintenance conditions	Mean	0.02	0.02	0.07	0.02	0.06	0.08
	Standard deviation	0.14	0.13	0.26	0.15	0.24	0.28
"Central" urban area	Mean	0.65	0.29	0.27	0.17	0.30	0.21
	Standard deviation	0.48	0.45	0.44	0.38	0.46	0.41
"Semi-central" urban area	Mean	0.08	0.26	0.09	0.15	0.20	0.22
	Standard deviation	0.28	0.44	0.28	0.35	0.36	0.42
"Peripheral" urban area	Mean	0.18	0.30	0.21	0.08	0.31	0.31
	Standard deviation	0.38	0.46	0.41	0.28	0.46	0.46
Time on auction [days]	Mean	517	583	662	552	948	867
	Standard deviation	446	487	523	474	943	817
	Minimum value	70	67	63	69	74	78
	Max value	2,653	2,648	2,173	2,583	6,530	3,546
Market value assessed by the judicial valuer [€]	Mean	92,684.50	89,860.20	126,778.21	154,786.80	138,202.20	119,755.85
	Standard deviation	54,657.41	65,500.99	89,603.95	128,892.48	154,061.31	115,198.83
	Minimum value	30,000.00	15,000.00	28,800.00	22,500.00	22,000.00	17,000.00
	Max value	418,216.36	351,680.00	870,000.00	1,000,000.00	1,545,534.72	668,000.00

minimum values range is limited, i.e. contained between two close values (from 67 days detected in Tuscany to 78 in Apulia), whereas that of the maximum values is larger (from 2,173 days in Tuscany to 6,530 in Campania).

4.2 Sample data analysis

In Figures 2 and 3 the distribution on the national territory of the unit final selling prices and of the discounts between the assessed market value and the final price are represented. In particular, for each Italian regional law-court studied the average unit final selling price and the percentage differential between the forced sale prices and the market values deducted from the valuation reports associated with each dataset property have been determined. This operation can provide a framework of the auction clearing prices in the six Italian regions and, in general, in the national context.

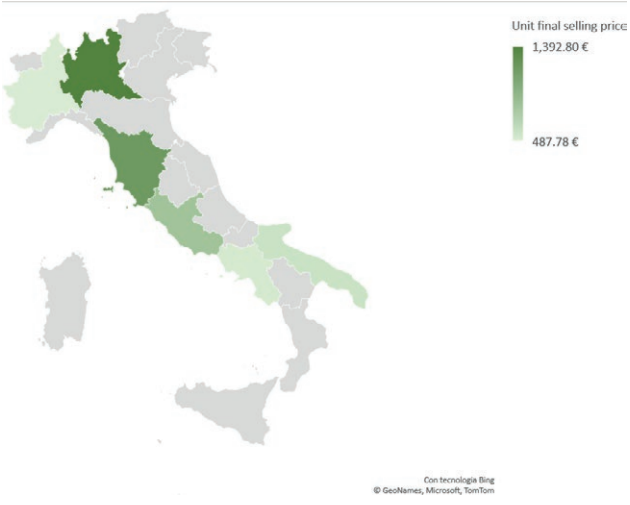

Figure 2. Distribution on the national territory of the unit final selling prices.

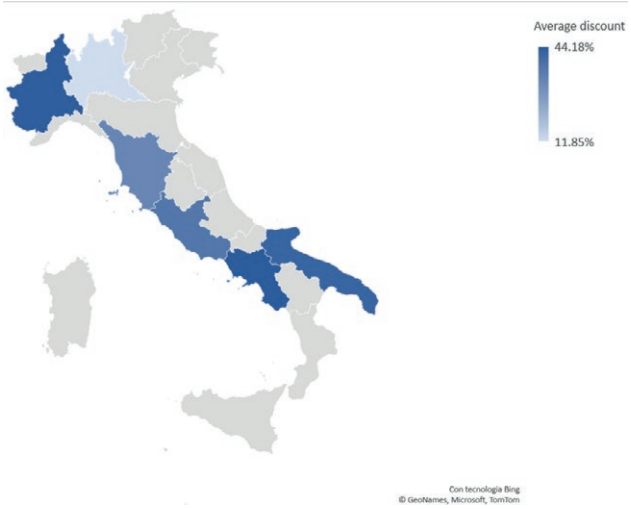

Figure 3. Distribution on the national territory of the discounts between the assessed market value and the final price.

The analysis of the unit final selling prices within each law-court studied shows that within the macro-area of Northern Italy (Italian regions of Piedmont and Lombardy), the law-court of Milan is characterized by the maximum unit final selling prices, equal to 3,743.56 €/m^2, whereas Vercelli is the provincial capital for which the lowest unit final selling prices are recorded (267.47 €/m^2). For the macro-area of Central Italy consisting of the region of Tuscany and Lazio, the maximum unit final selling price of 2,475.72 €/m^2 is recorded in the city of Florence, which differs by +86% compared to the lowest unit final selling price found in the capital of Cassino in the Lazio region, equal to 335.92 €/m^2, and shows a difference of +59% compared to the average unit final price of the macro-area (1,004.48 €/m^2).

Finally, the macro-area of Southern Italy and Islands has the maximum unit final selling price in the city of Naples with 931.57 €/m^2, equal to +83% compared to the lowest one, recorded for the city of Caserta (157.49 €/m^2), and different of +42% compared to the average unit data of the macro area (543.70 €/m^2). At national level, this city is also the one for which the minimum average final selling price, equal to 157.50 €/m^2 is found.

With reference to the discount between the market value assessed and the final selling price, for each law-court the average percentage one is calculated. In particular, according to the study samples detected, the highest average discount is found for the residential properties collected in the city of Caserta located in the region of Campania (+60.10%), that is +26.48% compared to the average discount observed at regional level (+ 44.18%).

Furthermore, for the Apulia the average discount found with regards to the study sample collected is equal to +41.85% and the city of Bari is the city for which the lowest discount is detected (+3.41%).

The macro-area of Central Italy has the maximum discount in the city of Cassino for the region of Lazio (+58.43%) and of Pisa for the region of Tuscany (43.06%). Finally, with reference to the macro-area of Northern Italy, for the law-court of Vercelli in Piedmont region the highest discount is determined, different of +23.89% compared to the average regional value (+43.77%) and of +79.40% compared to the average discount observed for the Lombardy region (+11.85%). In Table 2 the average values found for each law-court are specified.

5. THE METHODOLOGY

In the present research the methodology applied – called Evolutionary Polynomial Regression (EPR) – uses a genetic algorithm and integrates the best features of the numerical regression with the genetic programming. Furthermore, this data-driven method generates models characterized by polynomial structures by using the simple genetic algorithm engine. Each term included in the mathematical expression is the combinations of the input variables selected by the user with numerical coefficients. The Equation (1) reports the general symbolic expression generated by EPR:

$$Y = \sum_{i=n}^{l} [a_i \cdot (X_n)^{(i,n)} \cdot \ldots \cdot (X_j)^{(i,j)} \cdot f((X_n)^{(i,j+n)} \cdot \ldots \cdot (X_j)^{(i,2j)})] + a_0 \qquad (1)$$

where l is the number of additive terms, a_i are numerical parameters to be valued, Xi are candidate explanatory

Table 2. Average values observed for each law-court analysed.

Region	Law-courts	Average unit final selling price	Average differential between the assessed market value and the final price
Lombardy	Bergamo	659.3 €/m²	33.2%
	Brescia	665.5 €/m²	33.9%
	Mantova	502.9 €/m²	33.5%
	Milan	3,743.6 €/m²	-53.2%
Piedmont	Asti	428.1 €/m²	48.5%
	Cuneo	580.4 €/m²	48.6%
	Novara	453.5 €/m²	40.8%
	Vercelli	709.5 €/m²	57.5%
	Turin	267.5 €/m²	23.5%
Tuscany	Florence	2,475.7 €/m²	10.7%
	Livorno	863.5 €/m²	33.9%
	Pisa	749.0 €/m²	43.1%
	Pistoia	654.8 €/m²	42.0%
Lazio	Latina	764.1 €/m²	38.8%
	Rome	1,640.4 €/m²	21.6%
	Cassino	335.9 €/m²	58.4%
	Civitavecchia	1,023.4 €/m²	29.5%
	Frosinone	420.5 €/m²	54.6%
	Rieti	718.9 €/m²	19.5%
	Tivoli	782.2 €/m²	27.6%
	Velletri	900.2 €/m²	43.7%
Campania	Santa maria capua vetere	414.9 €/m²	42.2%
	Naples	931.6 €/m²	35.9%
	Salerno	554.0 €/m²	38.6%
	Caserta	157.49 €/m²	60.1%
Apulia	Bari	767.1 €/m²	30.4%
	Taranto	499.5 €/m²	48.0%
	Trani	681.1 €/m²	31.3%
	Foggia	344.0 €/m²	57.7%

variables, (*i, n*) – with $n = (1, ..., 2j)$ – is the exponent of the *n*-th input within the *i*-th term in Equation (1), selected by the user from a set of real numbers, *f* is a function selected by the user between a set of different mathematical expressions.

The outputs of EPR implementation are represented by different models whose functional form is the best combination of the explanatory variables X_i, defining for each one the exponents (*i, n*) and the numerical coefficients a_i. Among the several models identified by the technique, the "best" one is chosen for the analysis of the phenomenon to examine by taking into account *i*) the algebraic complexity and *ii*) the statistical performance of each equation. In particular, the first condition depends on the maximum number of terms and on the possible exponents through which the variables are elevated, set during the preliminary phase of the EPR technique.

The statistical accuracy of each model is determined by calculating by the Coefficient of Determination (COD), that is defined in Equation (2). It varies between the value 0 and the value: the fitting of a model is higher when the COD value is close to the unit value:

$$CoD = 1\text{-}\frac{N-1}{N}\cdot\frac{\sum_{N}(y_e - y_d)^2}{\sum_{N}(y_d - mean(y_d))^2} \quad (2)$$

where y_e are the values of the dependent variable assessed, y_d are the detected values of the dependent variable, *N* is the sample size considered.

Finally, the most suitable model among those generated by EPR is selected according to the specific aim of the analysis, the knowledge of the phenomenon and the type and quantity of experimental input data collected and included.

5.1 Implementation of the EPR methodology

The EPR methodology has been implemented six times, by considering the following inputs: for all models *i*) a static regression is carried out, *ii*) the structure of the generic model is that identified in Equation (1) without function *f* selected, *iii*) the maximum number of terms is equal to 8, that is, the number of independent variables, *iv*) the set of candidate exponents of the independent variables are positive and belongs to the range (0; 0.5; 1; 2), *v*) no bias included. In Table 3 the main different basis assumptions for the EPR implementation for each study sample are reported.

Each model obtained is constituted by a mathematical expression in which the additive monomial terms are combination of the explanatory variables *Xi* raised to the proper numerical exponents. At the end of the processing carried out, the CoD levels and the algebraic form of the several models generated have been analysed and compared in order to allow to select the best model for each study sample related to an Italian region.

In particular, the six models chosen between those provided by the EPR technique are shown below in the Table 4.

To determine the influence of each independent variable on the formation of the selling price according to the EPR models, the function shown below has been applied:

Table 3. Main different basis assumptions for the EPR implementation for each study sample.

Model setting	Lombardy model	Piedmont model	Tuscany model	Lazio model	Campania model	Apulia model
Dependent variable – unit final selling price	Y = LN(P)	P	Y = LN(P)	P	Y = LN(P)	P
Indipendent variable – market value assessed by the asset valuer [Vm]	$LN(Vm_{unit})$	Vm_{unit} normalized to the maximum value detected	$LN(Vm_{unit})$	Vm_{unit} normalized to the maximum value detected	$LN(Vm_{unit})$	Vm_{unit} normalized to the maximum value detected

Table 4. Six models chosen for the study samples.

Lombardy	$Y = 1.0494 \cdot Vm - 2.1463 \cdot T^2 \cdot C^{0.5} + 0.0092356 \cdot Mg^2 \cdot Co \cdot T^{0.5} \cdot Vm^2 - + 0.27834 \cdot S^{0.5} \cdot Vm + 2.6144 \cdot S \cdot Se^{0.5} \cdot T^{0.5}$
Piedmont	$P = 2284.0962 \cdot Vm + 931.1367 \cdot T^2 \cdot P^{0.5} - 2097.0845 \cdot L \cdot T \cdot Vm + 4810.0006 \cdot L^2 \cdot Se^{0.5} \cdot T^{0.5} \cdot Vm^2 + + 8668.7819 \cdot Mg \cdot Co^2 \cdot T^{0.5} \cdot Sc \cdot Vm^2 - 11016.2758 \cdot S^{0.5} \cdot T \cdot Vm^2 - 189.0699 \cdot S$
Tuscany	$Y = + 0.94342 \cdot Vm + 0.59547 \cdot T^{0.5} \cdot Vm^{0.5} + 0.2607 \cdot Se^2 \cdot T \cdot Vm^{0.5} - 9.2464 \cdot S^{0.5} \cdot T^{0.5} + + 0.049221 \cdot S^{0.5} \cdot T \cdot P^{0.5} \cdot Vm^2 + 3.5453 \cdot S - 0.11583 \cdot S \cdot Md \cdot Co^{0.5} \cdot Se \cdot T^{0.5} \cdot Vm^2$
Lazio	$P = + 3265.4651 \cdot Vm - 1284.3963 \cdot Co \cdot P^2 \cdot Vm^2 + 1085.228 \cdot L \cdot Sc \cdot Vm - + 3247.4747 \cdot S^{0.5} \cdot T^{0.5} \cdot Vm + 3423.1418 \cdot S^{0.5} \cdot L \cdot P^2 \cdot Vm + 21097.8687 \cdot S \cdot Co^{0.5} \cdot Se^{0.5} \cdot T \cdot Vm^2 - + 5667.2263 \cdot S \cdot Mg^2 \cdot L^2 \cdot Se^2 \cdot Vm^2$
Campania	$Y = + 0.94844 \cdot Vm - 0.048992 \cdot T \cdot Vm^2 + 0.19626 \cdot T \cdot C^{0.5} \cdot Vm + 0.052527 \cdot T^2 \cdot Sc^{0.5} \cdot Vm^2 + + 7.2587 \cdot S^2 \cdot L^{0.5} \cdot Co^{0.5} \cdot T^{0.5}$
Apulia	$P = + 1399.0734 \cdot Vm^{0.5} - 1971.1142 \cdot Se^{0.5} \cdot T \cdot Vm^{0.5} - 3630.2467 \cdot Mg^{0.5} \cdot L^{0.5} \cdot Vm^2 + + 390.001 \cdot Md^{0.5} \cdot Se^2 + 19377.3491 \cdot S^{0.5} \cdot T^2 \cdot Vm^2 + 2219.931 \cdot S^{0.5} \cdot Me \cdot T^{0.5} - + 1572.7074 \cdot S^{0.5} \cdot Md^{0.5} \cdot Vm^{0.5} + 176554.2012 \cdot S^2 \cdot Mg^2 \cdot L^{0.5} \cdot Se^{0.5} \cdot Vm^2$

$$Y_{EPR}(Xi) = f(X_1, X_2, X_3, \ldots, X_l, X_8)$$

where Xi represents the explanatory variable to be analyzed, X_l is the constant and average value of the other variables in the variation interval in the observed sample. Therefore, the contribution of each input factor has been determined by taking into account an exogenous approach and the differential variation in the values range detected for each variable for each database has been calculated.

The models chosen are characterized by a different COD level, equal to 65.44% for the Lombardy region, 79.77% for Piedmont, 79.29% for Tuscany, 80.75% for Lazio, 73.97% for Campania, 79.52% for Apulia.

For each model the factors included in the equation among those analyzed, have been specified and the functional relationships between the dependent variable (unit final selling price) and the independent variables have been studied. It should be highlighted that the variables simultaneously selected by the methodology for the six Italian regions as the most influential on the final selling prices are the market value assessed by the valuer (Vm), the total surface (S), and the time on auction (T).

The other variables selected for each Italian region considered in the present research, in addition to the previous ones, are specified in the Table 5.

5.2 Results interpretation

The verification of the empirical coherence of the functional relationships between the unit final selling prices and the factors selected by each model has been carried with reference to the expected market phenomena and the signs of the coefficients of explanatory variables have confirmed the existing residential auction market dynamics.

Firstly, with reference to the variable related to the time on auction (T), according to the six models generated, the functional correlations between the dependent variable (unit selling price) and this factor attest an inverse link for which an increase in the days between the first day of bidding and auction clearing date determine a decrease in the property final price. Moreover, as expected, for all samples collected, a growth in the dependent variable values is associated to the increase of

Table 5. Variables selected by the EPR technique for each study sample.

	Lombardy	Piedmont	Tuscany	Lazio	Campania	Apulia
Presence of the lift [L]		●		●	●	●
Presence of private appliances [Se]	●	●	●	●		●
Presence of condominium areas [Co]	●	●	●	●	●	
"To be restructured" property maintenance conditions [Mb]						
"Normal" property maintenance conditions [Md]			●			●
"Good" property maintenance conditions [Mg]	●	●		●		●
"Excellent" property maintenance conditions [Me]						●
Central urban area [C]	●				●	
Semi-central urban area [Sc]		●		●	●	
Peripheral urban area [P]		●	●	●		

properties forced sale prices: in fact, a direct relationship is observed between the market values determined in the expert estimate analyzed (Vm) and the corresponding final prices. The trends that express the selling price evolution for an increase of the property surface are heterogeneous: for the samples related to the regions of Lombardy, Piedmont, Tuscany, Lazio and Apulia a decrease in unit selling prices is found in correspondence of the increase of property surface (S), whereas for the region of Campania an opposite functional relationship is recorded, for which the smallest property of the study sample selected are characterized by the highest unit selling prices. This trend could be justified by taking into account that there may be other property factors – positional, socio-economic and technological – that can be more relevant on the final prices' formation processes compared to the property size. In this sense, in the sample collected for the region of Campania the smallest properties (with a surface less than 50 m^2) are characterized by *i*) "to be restructured" or "normal" conservative state (Mb or Md = 1), *ii*) the absence of lift, *iii*) the lack of condominium areas.

For all models related to the Italian regions for which the presence of the lift (L), the private appliances (Se) and of the condominium areas (Co) are among the most influencing factors on unit selling prices, an increase in selling prices is detected in correspondence of these services presence. In addition, the models indicate that for a property maintenance conditions improvement a growth in selling prices is observed. In particular, the passage from a worse conservative state to a better one determines a unit selling prices rise for all study samples, by pointing out that the residential units characterized by aesthetic and construction high quality, likely affected by recent renovation initiatives (Me = 1), are those mostly appreciated by potential buyers in the Italian housing auction market.

Among the contributions provided by the characteristics of the urban context in which the property is located (extrinsic factors), such as the presence of green spaces, the accessibility, the security level, etc. a significant positive influence is given by the property localization in central area (C) compared to the semi-central (Sc) or peripheral ones (P) of the regions of Piedmont, Lazio, Campania, Conversely, for the regions of Lombardy and Tuscany an inverse correlation between the variable related to the central urban area localization and the final selling prices is found, by attesting a residential auction market preference for properties in semi-central or peripheral urban contexts.

The analysis of the models obtained through the implementation of the EPR technique has allowed to determine the percentage marginal contribution of the different factors selected on the unit forced sale prices, i.e. for the quantitative variables (Vm, S and T) in terms of an increase of *i*) one euro for the variable related to the market value (Vm), *ii*) one m^2 of property surface (S), *iii*) one day for the variable concerned the time on auction (T), whereas for the dummy ones (Co, Se, L, Md, Mg, Me, C, Sc, P) by considering the already calculated percentage variations between the value 0 and the value 1. Furthermore, for all the quantitative variables analyzed in the research, the average marginal contribution of the influencing factors considered on selling prices formation has been calculated, by weighting the percentage values on 100 in order to *i*) identify the marginal contribution compared to the sum of the marginal contributions related to the two variables categories (dummy and quantitative) and *ii*) analyze the incidence of the different factors among them, i.e. of each variable in relation to others.

By taking into account the distinction between the quantitative variables and the dummy ones, for each Italian region considered, the graphs of Figures 4, 5, 6,

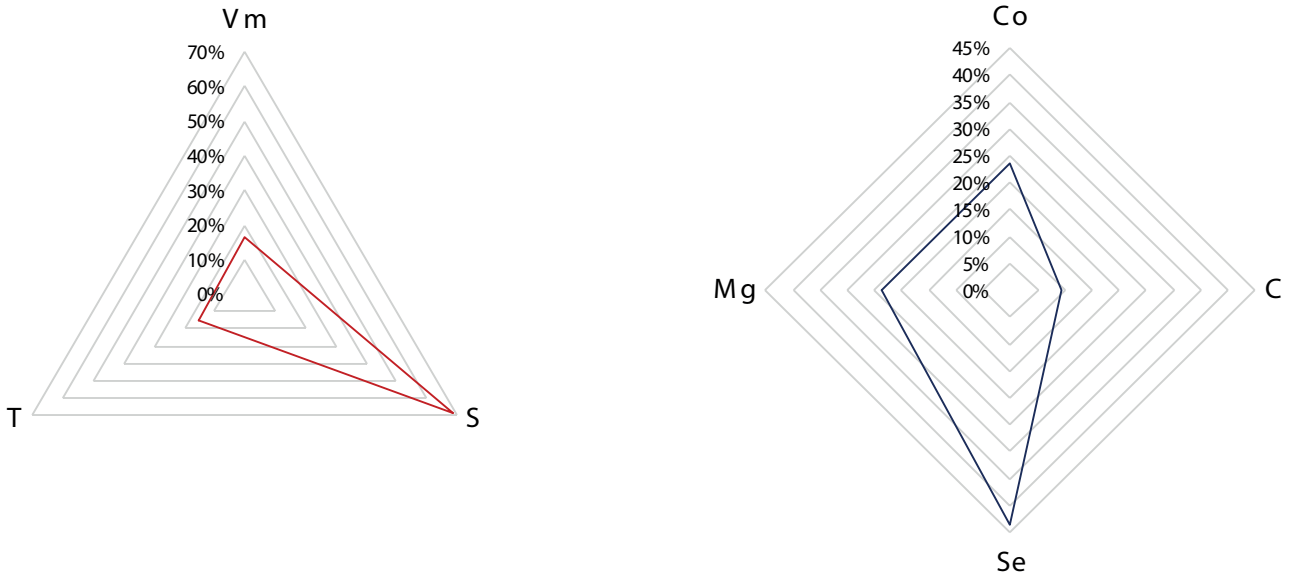

Figure 4. Average percentage marginal contribution of the quantitative variables (red line) and dummy ones (blue line) selected by the model for the region of Lombardy.

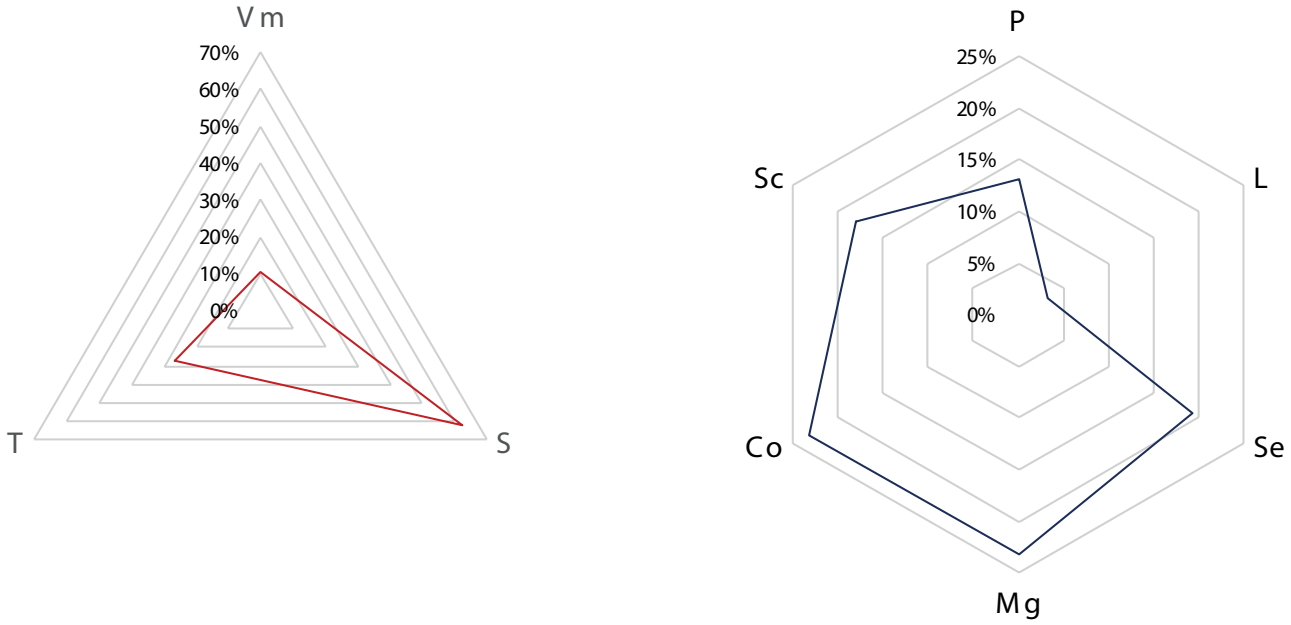

Figure 5. Average percentage marginal contribution of the quantitative variables (red line) and dummy ones (blue line) selected by the model for the region of Piedmont.

7, 8 and 9 show the average marginal influence of the quantitative and dummy factors selected by the models on the unit forced sale prices for each region considered and expressed in percentage terms.

Moreover, for each explanatory variable included in the analysis, the average marginal percentage contribution on final prices formation dynamics is reported in graphs of Figures 10 (quantitative variables) and 11 (dummy variables).

The outputs obtained are consistent with the expected ones. Firstly, with reference to the quantitative variables selected by the models, all factors considered in the

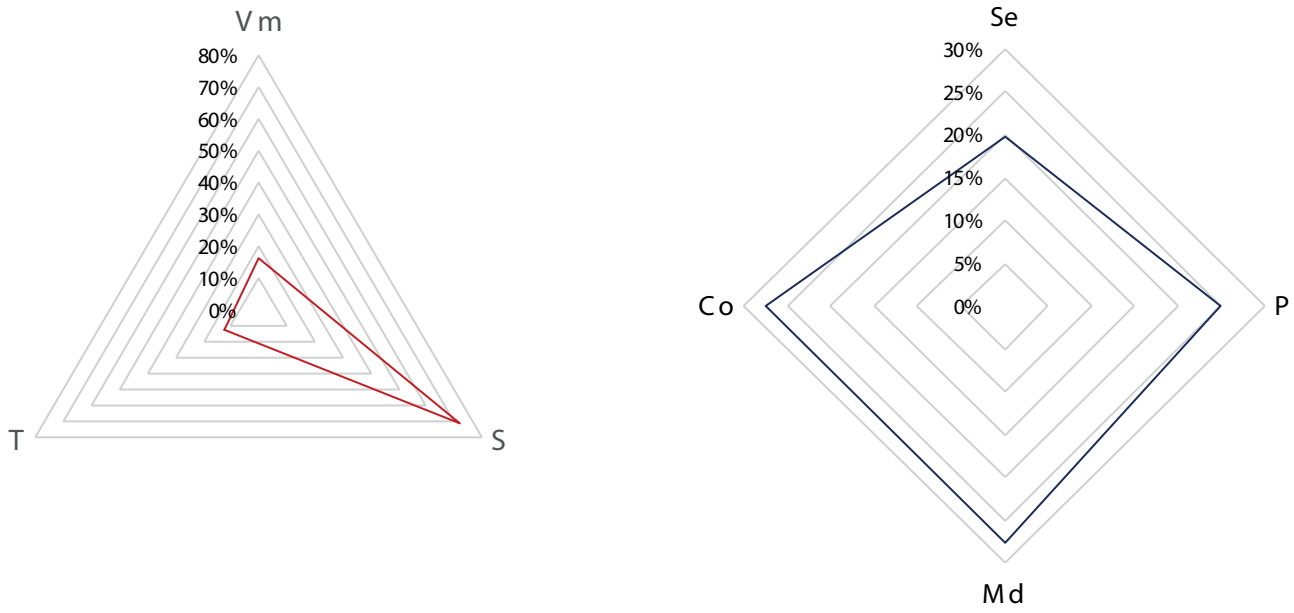

Figure 6. Average percentage marginal contribution of the quantitative variables (red line) and dummy ones (blue line) selected by the model for the region of Tuscany.

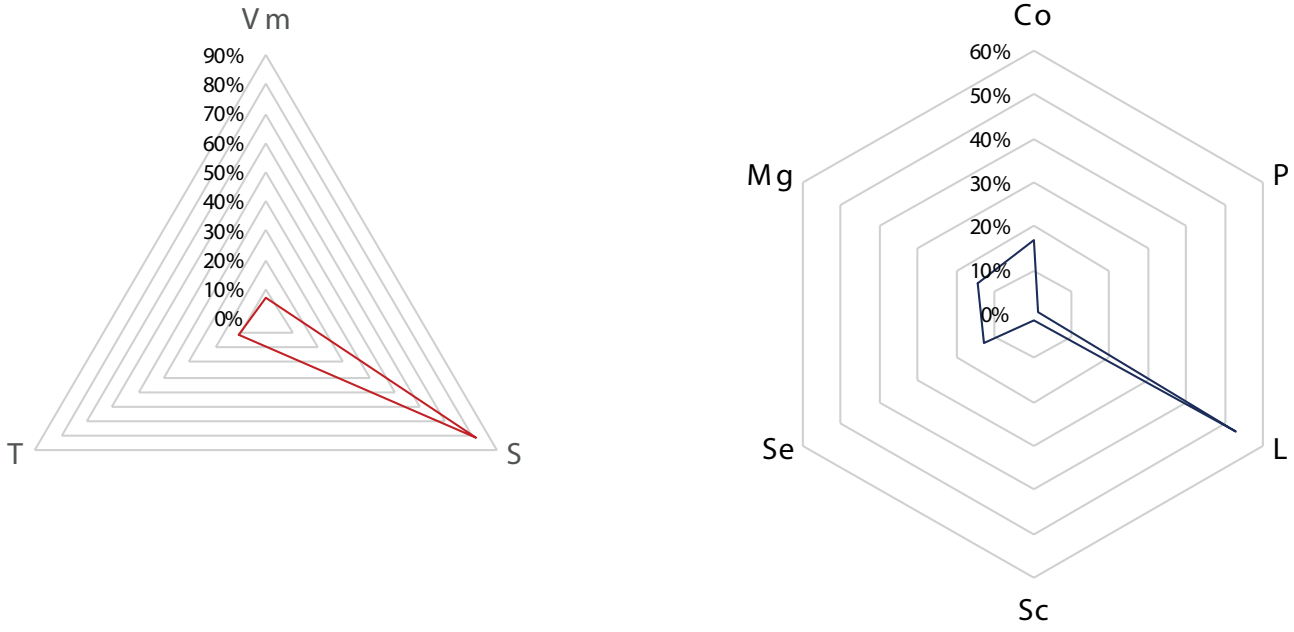

Figure 7. Average percentage marginal contribution of the quantitative variables (red line) and dummy ones (blue line) selected by the model for the region of Lazio.

analysis (S, Vm and T) are included in the models generated by the EPR implementation. Then, for all models, the property surface (S) represents the most influencing factor among those belonging to the quantitative category. It should be noted that for the region of Campania the highest average weighted marginal contribution of this factor on selling prices compared to the other variables influences has been observed (91.64%), whereas the lowest influence is recorded for the region of Piedmont (62.34%). For the study sample detected for this region,

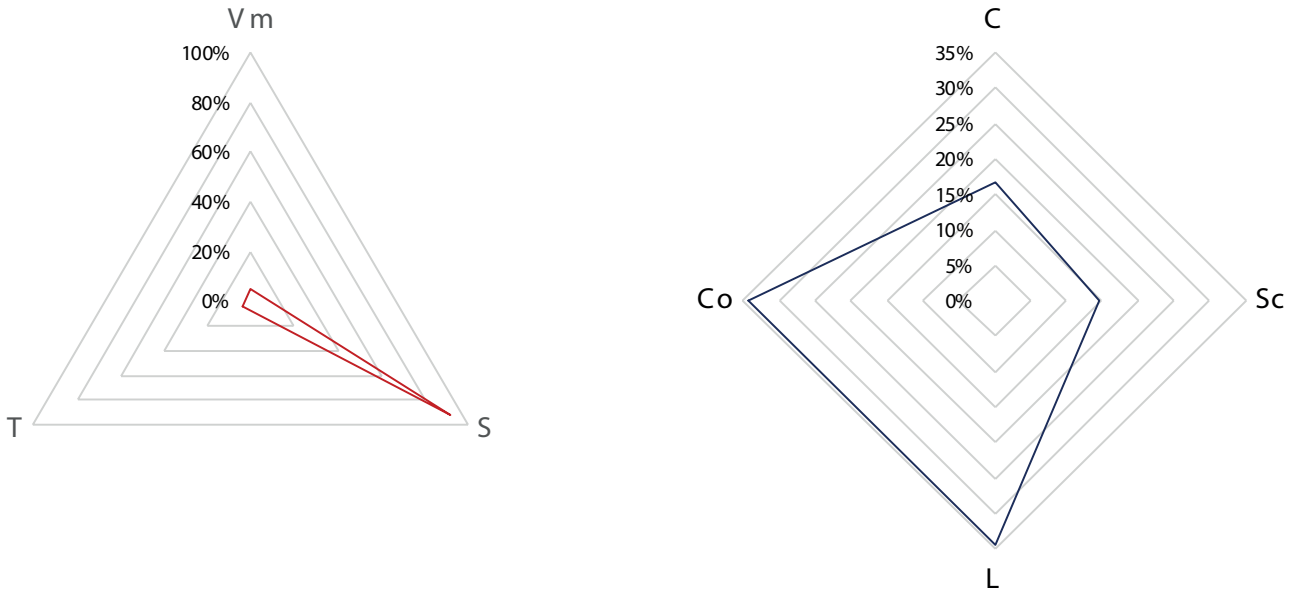

Figure 8. Average percentage marginal contribution of the quantitative variables (red line) and dummy ones (blue line) selected by the model for the region of Campania.

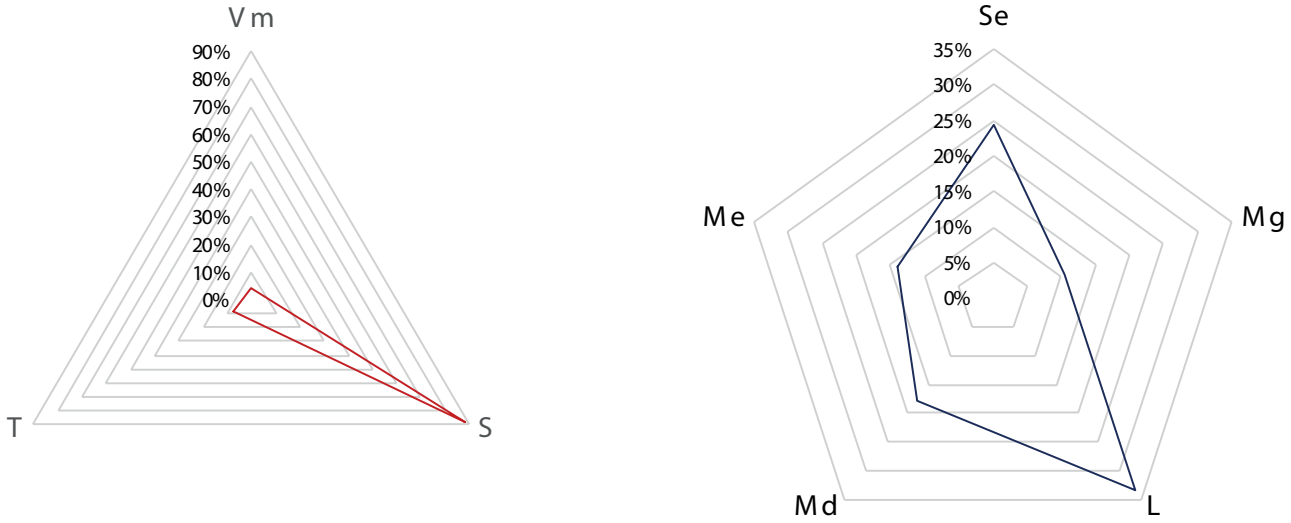

Figure 9. Average percentage marginal contribution of the quantitative variables (red line) and dummy ones (blue line) selected by the model for the region of Apulia.

the time on auction (T) constitutes a relevant factor on final prices (26.88% compared to the other quantitative factors analyzed), by attesting a significant variation in terms of depreciation in selling prices in correspondence of longer auction time. It should be highlighted that this output is consistent with the existing geopolitical differences among the Italian macro-areas: the variable "time on auction" shows a higher weight in the territories in which the judicial procedures are quicker (North-Western Italy, characterized by an average value of T equal to 4 years), compared to those in which an "addicted market behavior" to the ordinary procedural delays (in particular Southern Italy and Islands, with an average value of T equal to 6.5 years) can be generally detected (Cerved Group Spa and La Scala – società tra avvocati).

Finally, the results analysis outline that the market value (Vm) is the factor for which the highest average weighted marginal contribution found is equal to 16.45%

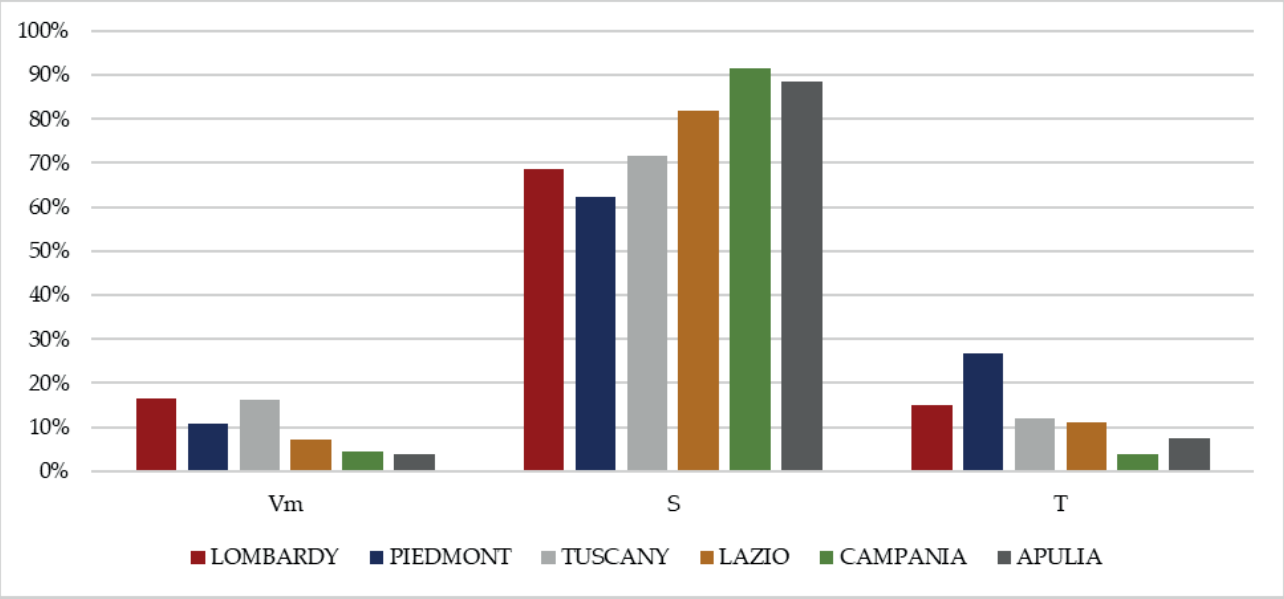

Figure 10. Comparison between the average percentage marginal contributions of the quantitative variables selected by the models on the unit forced sale prices.

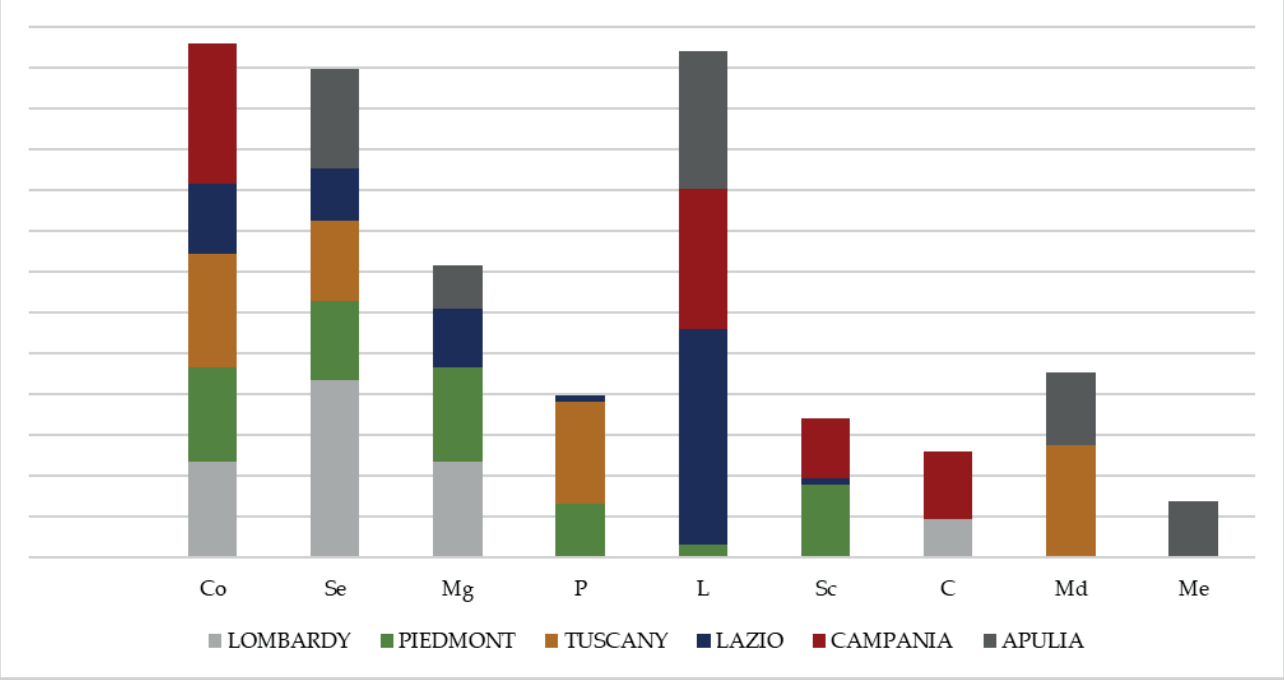

Figure 11. Comparison between the average percentage marginal contributions of the dummy variables selected by the models on the unit forced sale prices.

for the region of Lombardy. The lowest average value of the weighted marginal contribution of this variable is verified for the region of Apulia (4.00%), for which the lowest values have been also detected at national level.

With reference to the dummy variables, it should be highlighted that the highest weighted contribution is observed for the variable related to the presence of the lift in the building in which the property is located

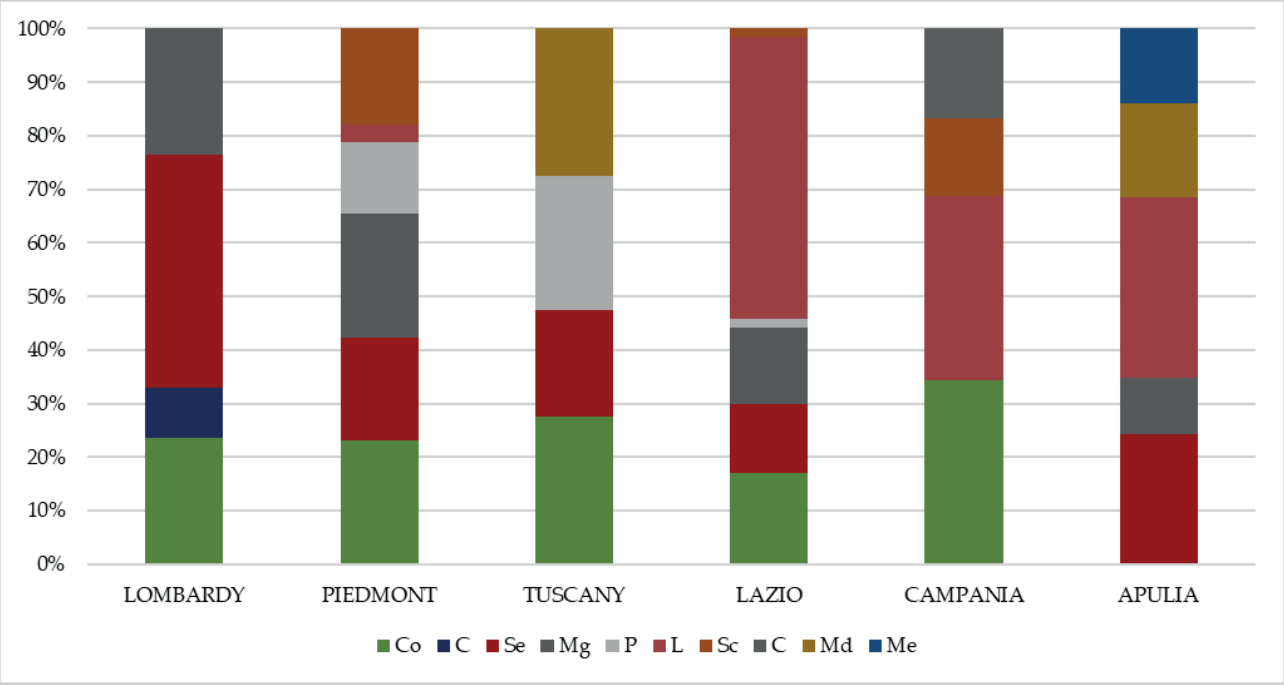

Figure 12. Distribution of the average percentage marginal contributions compared to the 100% of the dummy variables for each Italian region.

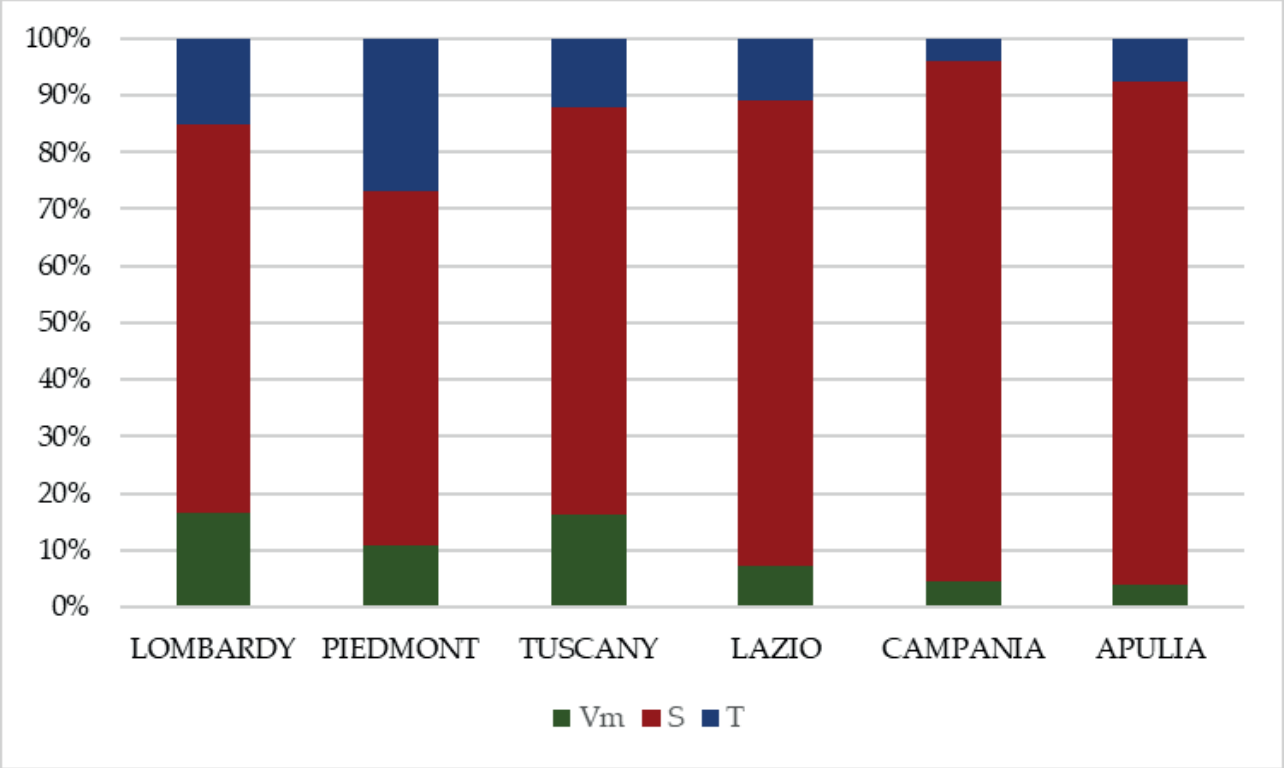

Figure 13. Distribution of the average percentage marginal contributions compared to the 100% of the quantitative variables for each Italian region.

(L) for the region of Lazio (52.86%), whereas the lowest influence obtained concerns the region of Apulia and the incidence of the variable of the "excellent" maintenance conditions (Me) in relation to the others selected by the model (13.88%).

With reference to the two categories of variables considered in the analysis (dummy and quantitative), for each Italian region the distribution of the contributions compared to the 100% are reported in Figures 12 (dummy variables) and 13 (quantitative variables).

6. CONCLUSIONS

In the context of the residential property auctions market segment, the difference between the forced price and the market value assessed by the judicial valuer represents a relevant issue, particularly discussed in the international context.

With reference to the Italian territory, six study samples constituted by total 918 residential properties sold through judicial auctions between November 2020 and May 2021 and each of them located in an Italian region of Lombardy and Piedmont for the Northern Italy, Tuscany and Lazio for the Central Italy and Campania and Apulia for the Southern Italy and Islands have been collected.

For each property, the unit final selling price expressed, the market value assessed by the judicial valuer and the main quantitative and dummy factors have been detected for the implementation of an econometric analysis. The research has intended to develop a model for the assessment of the forced sale value able to determine the functional relationships between the final selling prices and the factors considered.

Among the models provided by the proposed methodology, the six ones selected respectively for the Italian regions have allowed both to identify the most influencing factors on the auction clearing prices and, therefore, those that mainly affect the discount between the market value and the forced sale price. With reference to each model chosen for each Italian region, the most relevant variables have been studied in terms of the (average and marginal) contribution on the unit forced sale prices.

The results of the research could represent a useful reference for monitoring the housing auction market trend in terms of *i*) the auction prices, *ii*) the discounts between the market values and the final prices, and *iii*) the auction time. Furthermore, the analysis could support the judicial authorities, at the start of the auction procedures to check the amount in the reduction of market values assessed by experts and to avoid relevant variation that could cause unreliable discount dynamics and the presence of unsold properties. The significance of the present work concerns the definition of immediate reading models for the assessment of the forced sale value by which the analysis the most influencing factors on the final hammer price can be carried out. In this sense, on the basis of the specific property factors the model obtained – as a valid practical tool – allows to define the reliable forced sale value and its relevance with the market value assessed by the appraiser and, therefore, to help to make more transparent the dynamics underlying the real estate auction market mechanisms.

Future insights of this research may concern the application of the same methodology proposed to other territorial contexts to investigate the heterogeneity of the auction market and the relative main dynamics. Moreover, the analysis could be iteratively implemented with reference to the same territory in order to compare the outputs obtained in different times and to update the corresponding results (Tajani et al., 2015).

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Forecasting housing prices in Turkey by machine learning methods

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Abstract. In this study, decision tree regression, artificial neural networks (ANN) and support vector machines (SVM) methods are applied by using monthly data for the period 2013-2020 in the estimation of housing sales in Turkey. In the analysis, the volume of individual mortgage loans offered by banks, the average annual interest rate of mortgage loans from macroeconomic and market variables, the consumer price index (CPI), the BIST 100 index, the benchmark bond interest rate, gold prices and the values of the US dollar and Euro Turkish lira and the housing sales price per square meter in Turkey are used. As a result of the analysis carried out on the model created house sales prices in the Turkish housing market have been successfully estimated and in the light of these estimates, it is determined that banks can guide banks in the creation of various credit packages and appropriate loan targets to support the housing sector.

Keywords: Home sales price prediction, Decision tree regression, Artificial neural networks, Support vector machines.
JEL codes: O18, R33.

OPEN ACCESS

Citation: Kayakuş, M., Terzioğlu, M., & Yetiz, F. (2022) Forecasting housing prices in Turkey by machine learning methods. *Aestimum* 80: 33-44. doi: 10.36253/aestim-12320

Received: November 19, 2021

Accepted: March 9, 2022

Published: October 17, 2022

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

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1. INTRODUCTION

The need for housing, as well as a durable consumer good and an investment vehicle, is an important feature that distinguishes the housing market from other markets (Lacoviello, 2000). The revival in housing sales in the housing market will positively affect the development of the construction sector. Mobility in the construction sector will have a domino effect and affect its sub-sectors and contribute to the economic growth of countries. Therefore, it is important that demand and supply changes in the housing market are accurately predicted. In terms of financing, forecasts for demand and supply in the housing market will guide the banking sector in establishing credit and product targets to support the housing market. By taking advantage of these forecasts, banks will be able to help the housing market grow steadily by creating new low-cost and affordable

product packages and credit campaigns for the needs of the housing market.

In addition, the housing market has been affected in different dimensions in the COVID-19 global pandemic that has affected the whole World. In line with the restrictions experienced during the epidemic process, it is seen that households who have to spend more time in housing have started to prefer detached garden houses and this trend is thought to increase in the future. This will lead to increases in demand for different types of housing. In addition, it is foreseen that the supply-side problems experienced during the epidemic process will continue. Inflationary pressures, especially in countries, and the resulting cost and interest rate increases on mortgage loans are among the significant problems of housing supply. These changes expected after the epidemic in demand and supply make it inevitable to make demand predictions using current methods for housing markets in developing countries, especially in Turkey.

The housing market is both an important indicator of the economy and an important indicator of consumer spending and total prosperity (Greenwood and Hercowitz, 1991). The housing sector has a close relationship with other sectors and the vitality of the sector drives other sectors (Öztürk and Fitöz, 2009, p.23). For these reasons, it is important to estimate the housing market. In the literature, Abidoye and Chan (2017), Mohd Radzi et al. (2012), Nguyen and Cripps (2001), and Zainun et al. (2010) used artificial neural networks in their studies of the housing market. One of the objectives of our study is to evaluate the results of decision tree regulation, support vector machines and artificial neural networks methods in the forecast of the housing market in Turkey. In addition, it is to emphasize the importance of incentives and policies to improve this sector due to the importance of the housing market in the economy. Another goal is to guide the financial and banking sector in the development of new products and services for the housing market.

In the study, a preliminary estimate of housing sales prices was made by using the importance of the housing market in the economy, bank mortgage loan volume and some macroeconomic and market indicators as variables. In the study, decision tree regression, artificial neural networks and support vector machines methods and the estimation of housing sales prices were investigated using Turkey's monthly data for the period 2013-2020. In the data set of the model, consumer price index (CPI), volume of individual mortgage loans of banks, average annual interest rate of mortgage loans, benchmark bond interest rate, gold prices, Euro and US dollar Turkish lira value, BIST 100 index and average Turkish housing sales price per square meter variables were preferred. The number of scientific studies that emphasize the importance of the housing market in terms of economic structure and research the structural characteristics of the housing market for the Turkish economy is limited in the literature.

When some of the limited studies were examined, Özkan et al. (2007) used artificial neural networks and regression methods for housing price estimation in Selçuk district of Konya. In Selim (2009) study, he used hedonic regression and artificial neural networks methods to estimate house prices using 2004 household budget survey data for Turkey. Temür et al. (2019) estimated housing sales in Turkey using 124 months of data for the period 2008-2018.

In the study, the conceptual framework related to the importance of housing finance and the financial support provided by banks to the housing market will be examined, and research on housing market sales and sales price will be included in the literature section. In the ongoing sections of the study, the methods and methods used in the forecasting of housing sales will be examined and evaluations and recommendations will be made in the result section. Another purpose of this study is to support the policies of regulatory and supportive institutions for the housing market thanks to this model. In this way, these institutions will be able to perform actions that will bring households together with more predictable house prices.

2. HOUSING FINANCE AND ITS PLACE IN THE ECONOMY

Housing finance is the way to direct those who need funds to obtain housing from those who have surplus funds, i.e. from the resources of savers. In other words, it is the meeting of those who offer funds for housing purchase and those who demand funds (Kömürlü and Önel, 2007). A good housing finance system created in accordance with the needs is expected to both increase housing supply and improve housing quality (Berberoglu and Teker, 2011).

It has come to the fore that the costs of housing investments are quite high and that people who want or demand housing needs do not have the savings to cover this cost with their income at a time, and that there should be a form of financing that they can easily finance by spreading their payments over the long term. In this context, mortgage loans that are used by showing the housing guarantee requested in exchange for loans

and establishing mortgages on them form the basis of housing finance (Ayan, 2011).

The indirect or direct effects of the housing market on the economy are realized by housing investments. Housing investments directly affect the economy by increasing employment opportunities, while increased demand for construction materials and other durable consumer goods indirectly affects the economy. Housing investments in the housing market contribute to economic growth through their impact on employment, labor productivity, total savings and investments (Harris and Arku, 2006). Residential manufacturing in the construction sector and other related sectors are accelerating economic growth.

3. LITERATURE RESEARCH

The factors in the formation of house prices and the studies aimed at estimation are mainly divided according to the use of micro and macro variables.

In studies using micro variables, the properties of the housing unit are used. These include variables such as the number of rooms (such as the number of halls and bathrooms), space it covers, parking lot it has, the gym, spa, garden and children's entertainment areas, etc. In addition, variables such as the distance of the dwelling to the city center, the characteristics of the region you are in, the proximity to the metro, etc. are also used. Abidoye and Chan (2016), Abidoye and Chan (2017), Deng et al. (2018), Ecer (2014), Jayasekare et al. (2019), Pai and Wang (2020), and Yilmazel et al. (2018) have tried to estimate housing prices using the microvariability listed above.

The impact of the above-mentioned micro variables in the forecast of house prices, as well as the economic fluctuations experienced by countries, i.e., macroeconomic variables and changes in market indicators, on house prices is undiscussable. In our study, we wanted to test the ability of these macro variables to predict house prices. For this purpose, macro variables, which are subject to studies as a second aspect in the literature, should predict housing sales and prices and studies on the effect of these variables on house prices are given in detail below.

Cho (1996), Mankiw and Weil (1989), Painter and Redfearn (2002), Poterba (1991), and Rapach and Strauss (2007) investigated the effectiveness of the housing market using some variables showing housing market and macroeconomic sizes in their work. In these studies, the importance of demographic factors, consumer price index, real income, borrowing restriction, unemployment rate, construction costs, etc. were emphasized in explaining the mobility in house prices.

In Painter and Redfearn (2002), which examined the effects of interest rates on housing rates and housing starts, they investigated U.S. housing markets. Some demographic and economic variables selected by house prices, interest rate, income were used in the data set. Peer integration tests and Vector Error Correction model were analysed with quarterly data from 1965-1999. According to the results obtained, there was a negative-directional relationship between housing rates and housing starts in the short term, while the effects of interest rates on housing starts decreased in the long term.

Wong et al. (2003) in his study for Hong Kong examined the effects of interest rates on house prices for both inflationist and deflationist periods. As a result of the study using the granger causality method, a positive relationship was found between interest rates and house prices in the deflationary period, while it was found that there was a negative-directional relationship in the inflationary period.

In his study, Leung (2004) emphasized a strong correlation between macroeconomic factors and the housing market. He stated that the cycles experienced in the housing market in many years will change the macroeconomic structure of the countries. He stated that globalization and financial integration and housing market performance, especially in emerging economies, will shape the housing market finance and capital markets of these economies and this should be investigated for years to come.

Goodhart and Hofmann (2008) analysed the relationships between loan and house prices and monetary variables. Panel data analysis method was used in the study by using the quarterly data of 17 industrialized countries for 1976-2006. It has been determined that there is a positive and strong relationship between housing prices and mortgage loan and growth in monetary variables. A bi-directional Granger causality relationship was found between house prices and other variables.

Priemus (2010) investigated the effects of the mortgaged housing market crisis on the credit markets and housing market in 2008. In the study, the data of the Dutch housing market for the years 1998-2009 were examined. It was concluded that the Dutch housing market was significantly affected by the crisis, housing construction activities decreased significantly during the crisis, and even housing prices decreased significantly.

Duan et al. (2018) used subject prices as dependent variables, and macroeconomic variables such as personal disposable income, real interest rate, unemployment rate, mortgage loan volume, current account balance and

housing investment amount as independent variables in their study using dynamic spatial panel data method. They stated that the degree of change in macro variables not only determines the degree and direction of market real estate price movements, but also has the ability to affect the global housing market balance.

Temür et al., (2019) estimated the house sales in Turkey with 124 monthly data for the period of 2008-2018 in their study. In the study, by a hybrid model consisting of ARIMA (Autoregressive integrated moving average) and LSTM (long short-term memory) methods, it was concluded that the housing sales in the housing sector were estimated to be as close as possible to the real value.

In the studies conducted in the field of the housing sector with machine learning in the literature, it is seen that these methods are successful in estimating house prices close to the truth. These studies are listed below.

Nguyen and Cripps (2001) examined the estimation of house sales using micro variables by comparing the method of artificial neural networks and multiple regression analysis. Sales prices, area of the apartment, age of the building, number of rooms and bathrooms were used in the study. In the present study, it has been determined that the artificial neural network method is more successful if the correct data are selected.

Limsombunchai and Samarasinghe (2004) used an ANN model to predict house prices in a city in New Zealand. As a result, they reached an estimation result close to the real value.

Khalafallah (2008) predicted real estate sales with artificial neural networks using macro variables. The variables used in prediction; interest rate, time, change of sales over years, average sales period, change in unit value of sales compared to the previous year and transaction volume. As a result of the study, it reached the real value of sales with a tolerance of ± 2% with the method of artificial neural networks.

Li et al. (2009) tested the strength of the support vector regression method in predicting property prices in China. To this end, he compared the home price estimation performance of the support vector regression method with the performance of the back propagation neural network method using the macro variables of disposable income, real estate development investment amount, consumer price index, loan interest rates with quarterly data covering the period 1998-2008. They found that the support vector regression method performed better in estimating the house price.

Ghodsi et al. (2010), in their study on the estimation of Iranian housing prices, tested economic variables including income from oil, housing price index, general price index, cost of construction materials and gross domestic product (GDP) using artificial neural networks architecture. According to the test results, back propagation artificial neural network technique (MAPE- Mean Absolute Percent Error) 0.11698 has been formed. They considered successful the estimation of the relevant macro variables on subject prices.

Ecer (2014) made a house price estimation by using the data of 610 houses belonging to 2013 in Karşıyaka district of İzmir. He used the hedonic model and the MLP model, one of the artificial neural network models, in estimating the house price. The variables used in the model are 83 micro variables belonging to residences. When the results of the two models are compared, it is the result that artificial neural networks predict more successfully than the hedonic model. In the hedonic model, the size of the house, dressing room, shower cabin in the residence, en-suite bathroom, jacuzzi, cellar, built-in wardrobe, blinds, built-in kitchen, water heater, indoor garage, elevator, outdoor swimming pool, proximity to primary school, proximity to the pier and sea view were found to be the most important factors affecting house prices.

Demirel et al. (2016) conducted an application in Talas and Kocasinan municipalities in their studies for the province of Kayseri, and it was stated that artificial neural networks achieved very good results in the valuation of flat-type houses.

Using multiple linear regression, Grum and Govekar (2016) analyzed a model that uses macro variables to demonstrate the relationship between housing prices and macroeconomic indicators in different socio-culturally diverse regions in Sloveyna, Greece, France, Poland and Norway. They used the observable stock index, unemployment rate and industrial production index in these countries as macroeconomic indicators. As a result, they stated that there is a high correlation between macroeconomic indicators and house prices, especially in the unemployment rate and housing prices.

Li and Chu (2017) tried to predict the real estate price change in Taipei with macro variables by using back propagation and radial basis function neural network methods. In the period between 2005 and 2015, macroeconomic indicators such as gross domestic product, m^2 money supply, housing price index, gross national product, growth rate, housing prices / gross national product ratio, consumer price index, new housing loan volume They used it in the estimation of change. They concluded that the relevant macroeconomic variables were not sufficiently successful in predicting housing prices.

Abidoye and Chan (2017) used the artificial neural

networks method in property valuation in Lagos metropolitan real estate market. In the study, real estate sales transactions data (11 independent variables and property values) were obtained from real estate companies operating in Lagos, Nigeria. 370 data and 11 independent variables were used to estimate the house price in Nigeria. As a result, it is concluded that ANN models perform well in predicting house prices accurately and are suitable and reliable for property valuation.

In Yılmazel et al. (2018) artificial neural networks method was used in estimating house prices for sale in Eskişehir housing market in Turkey. Many different physical characteristics such as the size structure of the houses, the number of rooms, whether they are on the first floor, the total number of floors in the residence, whether there is central heating, the number of bathrooms and elevators, built-in kitchen, parking and fiber internet connections, the neighbourhood where the residence is located and the tramway Models with distance variables were established. As a result of the study, it was determined that the ANN method is an effective tool in estimating house prices.

Pai and Wang (2020) tried to satisfy Taiwan housing prices using the methods of least squares vector regression, decision tree, general regression neural networks and back propagation neural networks. In order to estimate house prices, 23 variables (number of rooms, distance to the city, park width, etc.) that determine the basic characteristics and location of housing types were used as independent variables. They concluded that the predictive power of the machine learning methods used in the results is applicable to house prices. However, these methods are quite successful in terms of the results of least-squares vector regression compared to other methods.

Ghodsi et al. (2010) used economic variables including income from oil, general price index, housing price index, gross domestic product (GDP) and cost of construction materials as independent variables in their study on the estimation of Iranian housing prices. They used artificial neural network architecture as a method. According to the test results, back propagation artificial neural network technique (MAPE-Mean Absolute Percentage Error) was 0.11698. They found the estimation on the subject prices of the relevant variables successful.

4. MATERIAL AND METHOD

In the study, artificial neural networks, decision trees regression method and support vector regression were used from machine learning methods to estimate the price of housing m^2 in Turkey. Statistical analysis methods were used to determine which of these methods was more successful.

4.1 Data Set

In this study, three different machine learning methods were used to estimate the price of residential m^2. These are artificial neural networks, decision trees regression method and support vector regression methods. In the models designed, 9 variables were determined as inputs to estimate the price of house square meters (m^2) in Turkey with output value. The study used the following data for 95 months between January 2013 and November 2020 as input variables:

- Central Bank of the Republic of Turkey (CBRT) House Price Index
- Mortgage Loan Average Annual Interest Rate
- Dollar/TL
- Euro/TL
- BIST 100 Index
- Consumer price index (CPI) (2003=100) (TURKSTAT) (Monthly)
- 2-Year Government Bond Indicator Interest (%)
- Gold ($1 Troy Ounces)
- Individual Mortgage Loans (Thousand TL)

4.2 Support Vector Regression

It is a machine learning algorithm based on supervised learning theory that uses statistical calculation methods recommended by Vapnik for the solutions of classification and regression problems (Vapnik, 1999). Support vector machines (SVM) are a type of machine learning tool which can solve classification, regression and innovation detection problems with better generalization compared to other learning algorithms. The type of SVM used in regression applications is called SVR (Support Vector Regression), and the type used in classification applications is called SVC (Support Vector Classification).

The principle of operation of the SVM is based on the estimation of the most appropriate decision function that can distinguish between the two classes, in other words, the identification of hyper-plane, which can most appropriately distinguish between the two classes (Kavzoglu and Çölkesen, 2010). SVM is divided into two according to the linear detachment and inability to separate the data set (Vapnik, 1999).

Linear support is called the optimal hyperplane in vector machines, which linearly divides the data set into

two. Although many decisions can be drawn correctly, the most important decision is to determine the right one.

If the training data consisting of a number of examples for the training of SVM in a linearly detachable two-class classification problem is considered $\{x_i, y_i\}10$, i=1,...,k, the optimal hyper-plane inequalities are as follows:

$$\begin{cases} w \cdot x_i + b \geq +1 & y = +1 \\ w \cdot x_i + b \leq +1 & y = -1 \end{cases} \quad (1)$$

Here $x \in R^N$ shows an N-dimensional space, w weight vector (normal of hyper-plane), $y \in \{-1, +1\}$ class labels and b trend value (Osuna, 1998). In order to determine the optimum hyper-plane, it is required to determine the two hyper-planes that will form the parallel and boundaries of this plane. The points that make up these hyper-plane are called support vectors, which are expressed as $w \cdot x_i + b = \pm 1$. Figure 1 show the linear support vector machine (Adar and Kilic Deli, 2019).

Nonlinear SVM are algorithms used if the data set cannot be separated by a linear function with a full or specific error. In real-life problems, it is often not possible to separate a data set linearly with the hyper-plane. In this case, the problem caused by the fact that some of the training data remain on the other side of the optimal hyper-plane is solved by the identification of a positive artificial variable (ξ_i). The balance between maxing out the limit and making misclassification errors minimum can be controlled by defining an editing parameter ($0 < C < \infty$) indicated by the positive values area and C. Nonlinear optimization problem here (Kavzoğlu and Çölkesen, 2010):

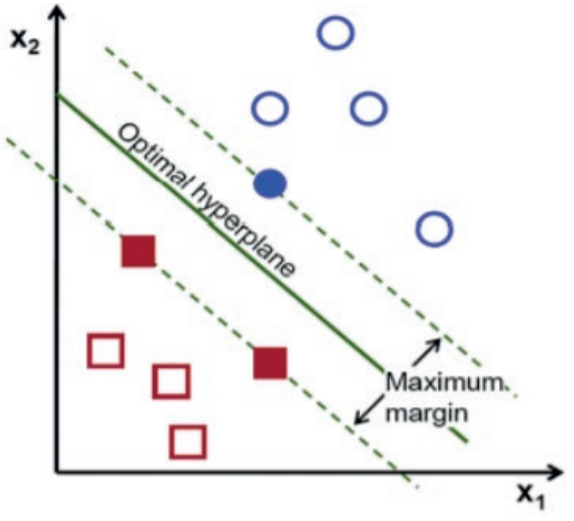

Figure 1. Linear support vector machine (Adar and Kilic Deli, 2019).

$$min\left[\frac{\|w\|^2}{2} + C \cdot \sum_{i=1}^{r} \xi_i\right] \quad (2)$$

Depending on the limitations:

$$y_i\,(w \cdot \varphi(x_i) + b)\text{-}1 \geq 1 - \xi_i \qquad \xi_i \geq 0 \; ve \; i = 1,\ldots,N \quad (3)$$

Support vector machines can make nonlinear transformations with the help of kernel function and in this way allow for high-size linear separation of data. Data that cannot be separated linearly in input space is displayed in a high-dimensional space defined as a property space. Thus, the data can be distinguished linearly and the hyper-plane between the classes can be determined (Kavzoğlu and Çölkesen, 2010).

It is essential to determine the kernel function to be used for a classification process with support vector machines (SVM) and the optimum parameters for this function. The most used polynomial function in the literature is radial-based function and normalized polynomial kernel functions.

4.3 Decision Trees Regression

The decision tree method is one of the important machine learning techniques used in forecasting and classification. In this method, it is a model that examines the relationships of arguments with each other and the dependent variable in the form of trees. In the tree model, decision-making points are called nodes. In the tree model, the starting node, which contains all the relationships between variables and is the most complex node, is called the root and begins with the tree structure. According to the relationship between the arguments, each time with a binary branching, the heterogeneous in the plot is divided into sub-nodes that are homogeneous in another (Takma et al., 2017).

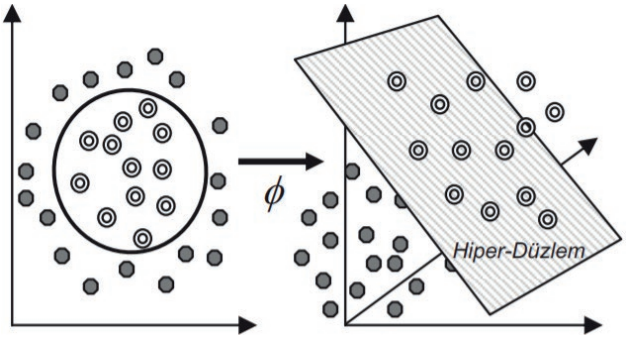

Figure 2. Conversion of data to a higher size with kernel function (Kavzoğlu and Çölkesen, 2010).

The decision tree ranges arguments according to information gain. When a value is asked to be learned from this range during the prediction, the average of the values in the range it learns during the training is found. That is why decision tree regression is cut, not continuous, like other regression models.

The decision consists of two basic stages: splitting and pruning. Splitting is a recurring stage that allows data in the data set to be divided into smaller sub-groups. The first phase begins with the root node containing the entire dataset. In the following stages, the nodes containing subsets of the data are processed. Variables are analysed and the best splitting process is selected after each split operation. After a tree is created, deforestation is used to find unwanted sub-trees or nodes. With the budding process, these can be removed, and the decision tree can be expressed in a more general way. The stop criterion includes several stop rules, tree-building algorithms. These rules are usually based on several factors, such as maximum tree depth, the minimum number of elements handled for partitioning on a node, and the minimum number of elements that should be in a new node (Shooting and Karasoy, 2013).

Decision Trees try to maximize information gain by making choices that reduce the entropy value of the current situation. To do this, it recalculates the error function on each node and selects the state with the lowest error. There are many decision tree algorithms developed to create the decision tree structure. Decision tree algorithms typically expected to create the most appropriate decision tree structure that minimizes generalization error (Aytuğ, 2015). One of the approaches used to create a decision tree is the use of criteria for node allocation. Chaid, Cart, Mars, Quest, Sliq, sprint, ID3, C4.5, and C5.0 are among the node allocation criteria used.

CART is a non-parametric statistical method that uses decision trees to solve classification and regression problems using both categorical and continuous variables. If the dependent variable is categorical, the method is called classification tree and continuously regression trees (Deconinck et al., 2005). The CART algorithm has a structure that creates binary decision trees by separating the relevant set into two subsets that are more homogeneous than another at each stage. The best argument is selected using impurity and variability in change measures (Gini, Twoing, smallest squares deviation). Here, the goal is to produce the most homogeneous subgroups of data possible for the target variable.

The CART algorithm, in which each node is divided into two at each stage, uses the Gini integrate from these impurity criteria developed to select the best division, such as Gini and Twoing, in determining each division point (Deconinck et al., 2005). $Gini_{left}$ and $Gini_{right}$ values are calculated for splits on the left and right sides in each attribute (Güner, 2014):

$$Gini_{left} = 1 - \sum_{i=1}^{k} \left(\frac{L_i}{T_{left}} \right)^2 \tag{4}$$

$$Gini_{right} = 1 - \sum_{i=1}^{k} \left(\frac{R_i}{T_{right}} \right)^2 \tag{5}$$

where k shows the number of classes, T shows the number of instances on a node, T_{left} shows the number of instances on the left node, T_{right} shows the number of instances on the right node, L_i shows the number of instances in the i category on the left node, R_i shows the number of instances in the i category on the right node.

The Gini index value is calculated by the following formula, n is the number of rows in the training data for each j attribute.

$$Gini_j = \frac{1}{n} \left(T_{left} \times Gini_{left} + T_{right} \times Gini_{right} \right) \tag{6}$$

4.4 Artificial neural networks

Artificial neural networks are inspired by the functioning of the biological neuron structure of organisms. Artificial neural networks (ANN) are a modelling tool used to solve complex problems that are accepted by many disciplines. Artificial Neural networks consist of a series of interconnected parallel structures known as neurons or nodes.

An artificial neural network consists of three basic functions: input, hidden and output layer. The input layer (x_1, x_2, ..., x_n) transmits the information they receive from the external environment to the nervous system. Input values taken into the artificial neural network model are multiplied by coefficients called weight (w_1, w_2, ..., w_n). Weights are coefficients that determine the effect of inputs through the nervous system, and appropriate values are available through trial and error. Entries are then multiplied by the weights to which they belong, and the threshold value is added to the result. The result is passed through the activation function and transmitted to the output. If the signal is below the threshold value, the output is not produced; output is produced on it. The output layer is the layer where the result is sent to the outside world (Diamond, 2018). Artificial neural network function:

$$NET = \sum_{i=1}^{n} w_{ij} x_n + \theta_j \tag{7}$$

where n is the number of inputs, x is the input neuron of the network, *wij i.* neuron with *j.* the weight of the connection between the neuron, θj represents the cell's threshold value and y the output value. The output value of the network is obtained by going through the activation function of the resulting value (y), as shown in Equation 8.

$$y=f(NET) \tag{8}$$

Activation function has linear and nonlinear forms: linear, step, sigmoid and tangent hyperbolic. When selecting the activation function, it is important to make the derivative easily calculable.

Artificial neural networks have two network architectures: forward-feed and feedback networks according to the direction of connections and flow within the network. Forward-feed networks consist of three layers: input, output, and at least one hidden layer. The number of nodes in the hidden layer and hidden layer varies according to the structure of the network. Each node in the input layer depends on each node in the hidden layer. The output values of each layer are called forward feeds to move toward the output so that the input value of the next layer is. The purpose of feedback networks is to optimize the error value by optimizing the weights. Input data is spread over the network to find out an estimate of the output. Weights are systematically updated according to the error information in the estimate. The network is trained by changing weights until the error between training data outputs and the network's predicted outputs is small enough (Hancke and Malan, 1998).

4.5 Evaluation Methods

Coefficient of determination (R^2), Mean Squared Error (*MSE*), Root Mean Square Error (*RMSE*), Mean Absolute Error (*MAE*), Mean Absolute Percentage Error (*MAPE*) methods were used to measure the success of predictions of the designed artificial neural network model. The equations for these methods are given below.

$$R^2 = 1 - \frac{\sum(y_i - x_i)^2}{\sum(y_i - y_{ave})^2} \tag{9}$$

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(y_i - x_i)^2 \tag{10}$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left|\frac{y_i - x_i}{Y_i}\right|^2} \tag{11}$$

$$MAE = \frac{\sum_{i=1}^{n}|y_i - x_i|}{n} \tag{12}$$

$$MAPE = \frac{\sum_{i=1}^{n}\left|\frac{y_i - x_i}{y_i}\right|}{n} \cdot 100 \tag{13}$$

where i shows the number of data, the actual value of y, the estimated value x. According to these criteria, high R^2 and lowest *RMSE*, *MSE*, *MAE* and *MAPE* values determine the most successful model.

5. RESULTS AND DISCUSSION

In the study, it was tried to estimate the price of residential m^2 in Turkey using machine learning methods. In the study, the normalization method was used to improve the performance of machine learning methods and increase accuracy. Since it gave the best result in this study, the original data was normalized with linear transformation in the range of 0-1 using the min-max normalization method from normalization methods. The min-max normalization formula is given in Equation 14.

$$x' = \frac{x_i - x_{min}}{x_{max} - x_{min}} \tag{14}$$

x' shows normalized data, x_i input value, the smallest number in x_{min} input set, the biggest number in x_{max} input set.

The nonlinear support vector regression method was used in the study. In the SVR method, tests were performed using Polynomial, Hyper Tangent and Radial basis function (RBF) techniques from core functions; Radial basis function (RBF) was preferred as the core function because it gave the successful result. 80% training of the data set in the study; 20% of it was used as test data. The overlapping penalty is a useful parameter used if input data is not detachable. It determines how much punishment will be given to each incorrectly predicted point, thus increasing the accuracy rate. In this study, overlapping penalty values were tested and the best value was found to give at 10.

In the decision trees regression method, the "Gini Index" was used as the quality measure in which the partition was calculated. Each node has at least 2 minimum records. If the number of records is less than or equal to this number, the tree is no more grown. The tree stores 10,000 records for appearance. The study used 8 threads and therefore the processor or core. This has improved the performance of the study.

Table 1. Test results.

Machine learning methods	R^2	MSE	RMSE	MAE	MAPE
Support vector regression	0,987	0,001	0,027	0,020	0,095
Decision trees regression	0,989	0,001	0,026	0,020	0,066
Artificial neural networks	0,981	0,001	0,033	0,020	0,163

It is modelled to have 100 iterations in the artificial neural network, 4 hidden layers and 4 neurons per hidden layer. In the model, it used a back propagation function in which weight values are updated according to the behaviour of the error function. The values that the parameters used to create models will receive have been tested by giving different values to show the highest performance for each dependent variable, and ideal values have been selected.

The coefficient of determination, R^2, which indicates how well the data fit into a linear curve, is 1, indicating that the test data provides a linear curve. R^2 value according to SVR method in study 0.987; 0.989 according to the decision tree method and 0.981 according to artificial neural networks method. According to this conclusion, 98.7% of the change in the output variable according to the SVR method, 98.9% according to the decision tree and 98.1% according to artificial neural networks can be explained by input changes. These three methods have been sorting decision trees, SVR and artificial neural networks compared to the success of the determination coefficient.

In the study, *MSE* values were found to be ideal values because they were very close to zero with 0.001. The *RMSE* value is requested to be close to zero; In this study, it was seen that it is in the range of 0.026-0.033

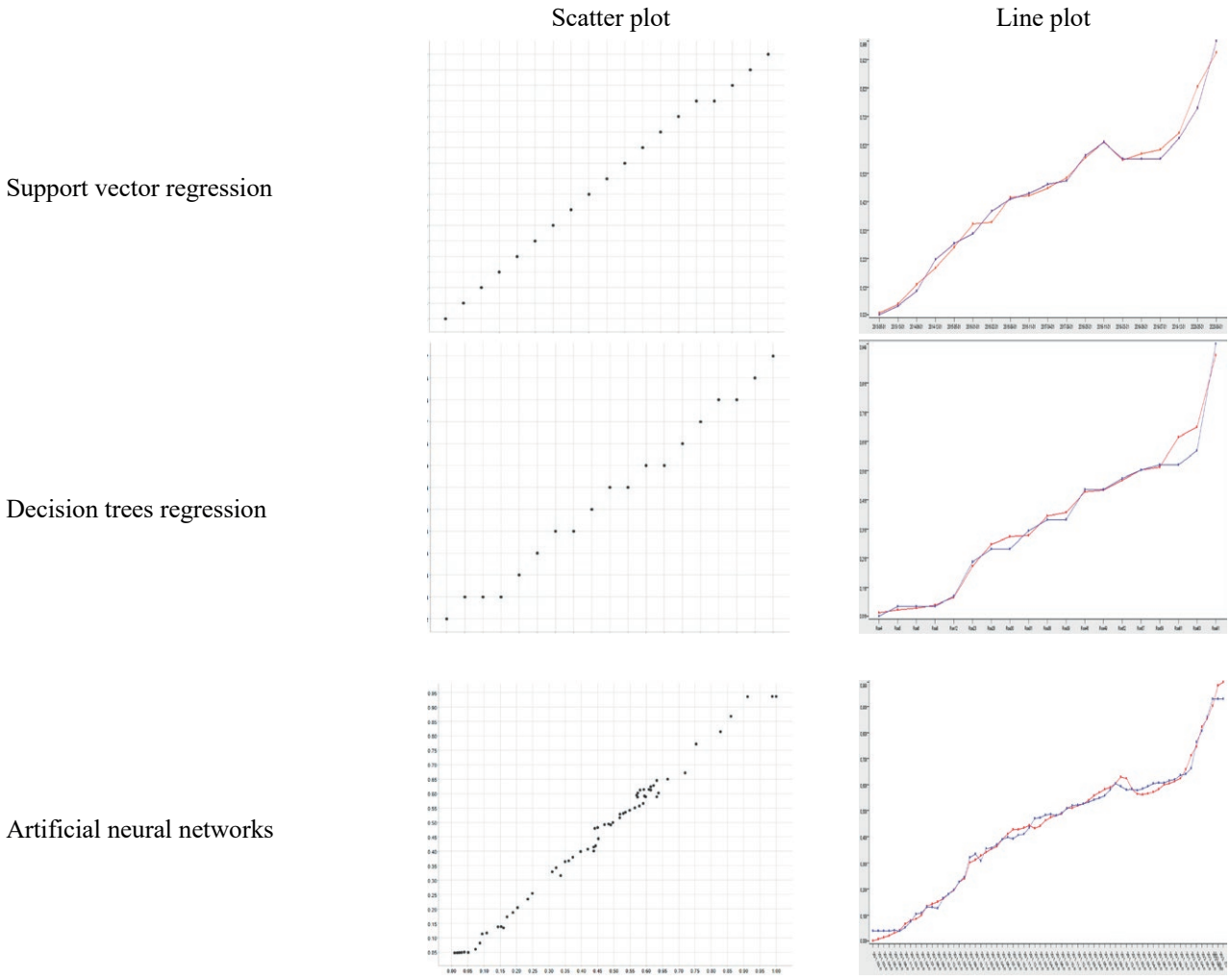

Figure 3. Graphical analysis of test data.

and is very close to the desired value. The three methods were optimal sorting decision trees, SVR and artificial neural networks compared to *RMSE* value.

In the study, *MAE* value was 0.020 with an ideal value of zero in three methods. The desired value for *MAPE* is the smallest value near zero. Accordingly, sorting decision trees have been in the form of regression, SVR and artificial neural networks.

The scatter plot and line plot curves were used to analyze test data in the study. It is seen as comparative in Figure 3.

The scatter plot curve is used to determine the relationship between two different variables. According to the scatter plot curve, which shows the relationship between the actual house m^2 price and the estimated house m^2 prices, there is a linear and strong relationship according to all three machine learning methods.

The line plot is a type of chart used to show and compare quantitative values over a period. It is used here to compare actual values with predicted values. When the values shown by the charts are examined, it is seen that all three machine learning methods are successful.

6. Conclusion

Creating solutions to problems in the housing market in developing countries, improving housing construction, diversifying the financing dimension of housing production are supported by the economic policies developed. Studies on housing sales price forecasting are important for creating incentives for the housing market and supporting economic policies. In developing countries, this is necessary for accelerating the growth momentum of countries. Successful forecasts for the housing market will allow banks to provide the funds they need in a shorter time, taking into account their ability to easily reach and pay for their customers who want to buy housing. Thus, the transfer of resources from the surplus of funds to the segment in need of funds will be fluting efficiently. An optimal housing financing system will emerge, and both household housing asses will be facilitated, and the growth performance of countries will improve.

The results obtained are also an indication that our study will make a significant contribution to the literature. It is thought that the studies to be carried out with machine learning for the housing market in Turkey, which is a developing country, can guide the construction of future plans and solutions to problems for the housing market and related sub-sectors, as well as the creation of various financing products suitable for the housing market in the banking system.

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Firenze University Press
www.fupress.com/ceset

Special Issue "Visions of the future in real estate appraisal"

Cyclical capitalization: basic models

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Abstract. The relevance of market cycles is known in the financial markets and in the context of real estate valuations it manifests itself in the estimate of the "exit value" of the Discounted Cash Flow Analysis. The hypothesis that the market cycle has a behaviour very similar to what happened in the past introduces some risks and uncertainty in the estimated value. To allow a more extensive use of cyclical capitalization in formulating value judgments, this paper proposes two methodological adaptations to the original model: the first, based on the presence of a regular market trend; the second based on the hypothesis of irregular market cycles and therefore more representative of the dynamics to which a specific real estate segment is exposed. In the perspective of a more extensive availability of information, data and extra-data, other application areas are also identified on which further investigations need to be developed.

Keywords: Cyclical capitalization, Dividend Discount Model, g-factor, Real estate valuation, DCFA.
JEL codes: C19, E32, E43, R39.

OPEN ACCESS

Citation: d'Amato, M., & Cucuzza, G. (2022) Cyclical capitalization: basic models. *Aestimum* 80: 45-54. doi: 10.36253/aestim-12625

Received: January 18, 2022

Accepted: June 20, 2022

Published: October 17, 2022

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

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1. INTRODUCTION[1]

Gordon e Shapiro (1956) developed the well-known model *Dividend Discount* (DD) to estimate the present value of a firm distributing growing dividends at a percentage *g*, defined growth factor. The term growth factor or g-factor can be considered imprecise because it may be either positive or negative (Smith et al., 1998). In general term the model is the following:

$$V = \frac{D}{Y - g} \tag{1}$$

where
V_{DD} = firm value

[1] This paper is based on the presentation provided by one of the authors during an event in honor of prof. Marco Simonotti in Catania his hometown organized by Geo.Val. It is the first article on an Italian review dedicated to this brand new income approach models. The work was carried out in close cooperation between the two authors. The merit of the publication must be equally divided among them.

D = Dividend distributed
Y = Discount rate
g = growth or degrowth factor

The model was developed for the valuation of firm able to distribute dividend, subsequently the model was applied to property valuations. Since the 50s of the last century, the growth of the inflation rate and the growth of the price and rent in real terms determined the application of these models to the property market (French, 2019). Traditionally in real estate market is used the ratio between rent and overall capitalization rate or yield rate based on market comparables as in the Equation 2 below (where *NOI* is Net Operating Income):

$$V = \frac{NOI}{R_0} = \frac{R}{y} \tag{2}$$

Such method is normally applied in the valuation of market value whilst the Dividend Discount Model (DDM) is applied for the valuation of investment value and the determination of scrap value in the Discounted Cash Flow Analysis (DCFA).

In the application of the DDM to income producing properties the term D in the Equation 1 is replaced by Net Rent or *Net Operate Income*, whilst the *g-factor* is calculated, according to US standards, as the product between the sinking fund factor per the future variation in term of capital and rent for the remaining life of the property. According to Commonwealth Standards the g-factor is calculated subtracting from the expected rate of rental growth the expected depreciation calculated in different ways (Baum and Crosby, 1998).

A first method is the extrapolation of the g-factor using time series of rental values reflecting both long term trends and cyclical variations, a further approach is using economic variables that may affect property yields like interest rates and finally a combination of approaches may be a combination of both approaches. The depreciation rate can be calculated in several different ways. The former is the so-called empirical approach through a comparison between the current rental value of a new building with the one to be estimated. An annualized difference become a measure of depreciation. Another method is the so-called theoretical approach (Baum,1991) deducting the land value and calculating the depreciation of building cost over the building life. In this model the cyclicality of the property market is not included in the model but in the g-factor determination. In Italian Standard for appraiser of Italian Association of Bankers (ABI, 2022) a general indication is provided in the "yield and change formulas" method deriving the overall capitalization rate as a difference between the discount rate or yield rate and a D which can be considered a way to include the g-factor as a part of Italian Standards. In general term it can be considered as the variation in term of property price and rent of the property along the time. In US Standards there are several methodologies to estimate the g-factor. One of the most important is the so-called Inwood Premise. In this case the g-factor is estimated as a product between the growth rate calculated in the market segment multiplied by a sinking fund factor (Italian "quota di reintegrazione") at the risk-free rate referred to the economic life of the property. Early applications of this model (d'Amato, 2013; d'Amato,2015; d'Amato 2017a; d'Amato, 2017b; d'Amato, 2018; d'Amato et al., 2019) referred to the US standards in order to test the valuation accuracy compared to the traditional direct capitalization techniques. In the early applications the meaning of the Inwood Premise was changed. The g-factor become a product between the variation in term of rent a price in a specific market phase instead of being the variation along the building life. Therefore, different property market phases depict different g-factors and, as a consequence the overall cap rate became a dynamic concept instead of a static one.

Therefore, discount rate is the target rate of return, whilst the difference between the target rate of return and the growth rate will be the capitalization rate or all-risk yield, which will be calculated also to determine the exit value in the DCFA.

Several papers highlighted limits of the application of DDM showing a meaningless valuation accuracy with an important difference between the value and price (Jacobs and Levy, 1988). In some cases, this difference is approximated to 88% and it is 4,21 times compared to the results obtained applying the Price Earnings ratio (Hickman and Petry, 1990).

Although the problems have been raised in the financial applications, critical remarks may be also referred to the applications in real estate valuations. Imprecise determination of g-factor may have an impact on the final result (Gehr, 1992).

This paper proposes a variation of the original Dividend Discount Model applied to property valuation. In particular, a g-factor determination is realized, based on the evolution of property market cycle in the specific real estate market segment (Roulac, 1996).

After the Global Financial Crisis, the relevance of the role of property market cycle in the valuation process has been increasing. The role of property market cycle has been stressed and an extensive literature review

is provided in a seminal work (Born and Pyhrr, 1994). In particular, Roulac stressed in a visionary contribution that "*…the concept of market cycles dominates the concerns of, and is employed as a rationalization by, real estate investment professionals. Perceptions of real estate cycles influence market participants' strategies and transactions decisions…*" (Roulac, 1996, p.2). Subsequently, the analysis of the trend of the real estate market cycles, led to the identification of some valuation models called "Cyclical Dividend Discount Models" (d'Amato, 2001), which allow evaluate a property whose Net Operate Income increases or decreases cyclically.

Recently, has been proposed an initial classification of cyclical capitalization models in four different groups (d'Amato, 2018). In these groups have been included not only the direct capitalization based on the Dividend Discount Model but also a model based on the traditional form of direct capitalization. One of the groups is dedicated to the application of cyclical capitalization to limited in time rent.

The paper is organized as follows: in the first part is provided a brief introduction on property market cycle and the first version of cyclical capitalization (d'Amato, 2001). In the following paragraph after presenting a second version of the model (d'Amato, 2003) will be exposed the results of several applications of the model. Final remarks and future directions of research will be offered at the end.

2. PROPERTY VALUATION AND MARKET CYCLE: THE FIRST MODEL (2001)

The relevance of property market cycle has been stressed even in the Holy Bible (Chapter 41 of Genesis). In this chapter is described a Pharaoh's dream with seven fat cows and seven lean cows. Prophet Joseph was able to interpret this dream with a cyclical alternate of expansive and recessive property market cycles. Kuznets pioneer work highlighted property market cycle with an amplitude of 15-25 years strongly correlated with immigration, growth of building activity (Kuznets, 1930) among the others. Hoyt (1933), analyzing the value of the land in Chicago between 1830 and 1933 described different cycles relate to population growth, rent level, management cost of building and land prices. Bjorklund and Pritchett (1984) proposed the vacancy rate between price and rent as an appropriate indicator for property market cycle.

Peiser (1983), studying the relationship between inflation and discount rate, proposed a causal relationship between the decreasing of overall capitalization growing expectation on inflation rate. Hekman (1985) demonstrated the cyclicality of building sector in an analysis of the property market trend in the office market of 14 cities in the period between 1979 and 1983. Witten (1987) explored the relationship between economic cycle and property acquisition, whilst Voith e Crone (1988) discovered a strong relationship between vacancy in the office market and property market cycle in 17 great metropolitan areas in the United States in the years 1980-1987

In a seminal article, Pyhrr, Webb and Born (1990) proposed a Discounted Cash Flow model to measure the relationship between the economic variables and the performance of property. In this paper a relationship between a cyclical variable like inflation rate and real estate return has been highlighted. In another successive contribution Born and Pyhrr (1994) introduced in the valuation model the cycles of demand and supply of property in a specific market segment, the life cycle of the building and the economic cycle of urban area. In this paper they included in the model an analysis on their impact on the valuation procedure, debt structure and real estate investment diversification. Clapp (1993) showed the correlation among economic variables like labor, demand and supply and absorption and vacancy rate in real estate market segment of office, using a case study. Afterwards, Mueller e Laposa (1996) explored the rent distribution in different property market cycle. Hendershott (1996) observed that the value of real estate properties, in the expansive phases of the market cycle, tends to be overestimated by investors, whilst during the recessive phases, it is underestimated. Other analyses (Clayton, 1996) concerned the property market cycle of residential properties during the period 1982-1994 in Vancouver, through a historical series conducted on eight different market segments. DeLisle and Grissom highlighted the procyclical nature of the traditional direct capitalization (DeLisle and Grissom,2011). An application of HP Hodrick-Prescott filter to build Real Estate Cycle Indicator (RECI) (Witckiewicz, 2002). A taxonomy of property market cycle is proposed by Phyrr et al. (2003). In their seminal work (Malpezzi and Wachter, 2005) presented a model of lagged supply response to the price change and speculation may be able to generate real estate market cycles. The relevance of housing price and transactions as indicators for real estate market cycles has been proposed (Festa et al., 2012). The importance of bubble the economy is indicated in literature (Grover and Grover, 2014) together with the delicate role of the bubble in the market segment of commercial property because of the inelasticity of supply. The use of Markov Chain to provide forecast

for portfolio's future risk across cycle was developed by Evans and Mueller (2016). A rigorous analysis on real estate research is provided by (Kampf Dern et al., 2018).

As for the formulation of the cyclical capitalization model, it should be remembered that in the valuation of an investment, the capitalization rate used is determined by combining the Fisher Approximation Equation with the Gordon formula (Baum and Crosby, 1998). Therefore, the capitalization rate can be defined as the sum of the following components:

$$r = RFR + RP - g \tag{3}$$

where:
r = overall cap rate/yield rate
RFR = risk free rate
RP = risk premium rate
g = g-factor

However, real estate tends to lose value over time because of physical deterioration and functional obsolescences. The determination of the previous capitalization rate, therefore, should be reformulated taking into account an incremental term that allows to include obsolescence and deterioration in the determination of all risk yield (Baum, 1988). Therefore:

$$r = RFR + RP - g + d \tag{4}$$

where, d is the expected depreciation caused by both physical deterioration and functional obsolescence. The relationship between the real estate value and the microeconomic variables can therefore be defined strong. Cyclical capitalization fundamental models presented focus the attention on the relationship between the g-factor and the real estate market cycle, assuming the other terms of the relationship are constant. Market cycles, in turn, have numerous classifications and among the most commonly used is the one that divides the cycle into two main phases: "expansion-contraction" and "recovery-recession" (Mueller and Laposa, 1994). Assuming that the discount rate is constant and that the cyclical phases of the real estate market have the same duration, in the first version of the proposed cyclical capitalization, the distinction with the Gordon-Shapiro model (1956) can be represented as schematized in Figure 1.

In fact, whilst in the first case more than one g-factor is determined, distinguishing a property market phase of growth from a phase of contraction both in terms of income and capital gain, in the second case, it is possible to observe an ever-growing value over the time.

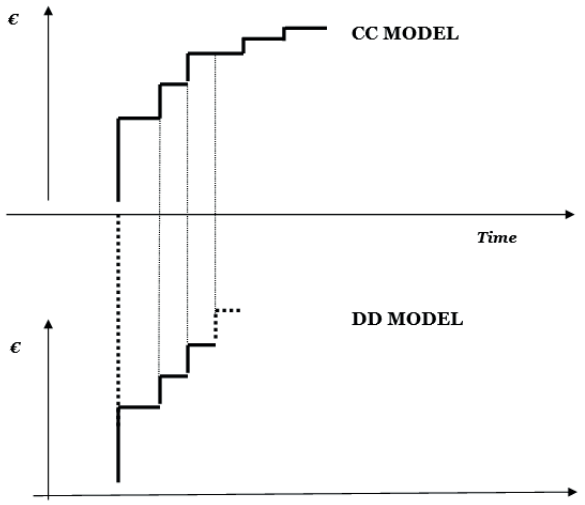

Figure 1. The relationship between value and time in the DD model and in the CC model assuming the constant discount rate.

A cycle may have two phases, the former of expansion-contraction, with negative g-factors, the latter of recovery-recession with positive g-factors, therefore it is necessary to distinguish two different g-factors or different capitalitazion rate/yield rate. Opinion of value will be equivalent to the sum of the different "intervals" elaborated using different g-factors. The sum of different slices of value.

Consequently, valuation of the property is characterized by a defined market cycle based on the hypothesis that future cycle has a behaviour similar to what happened in the past. Valuer, according to the time of the valuation may start predictably with a Recovery-Recession phase or with an Expansion-Contraction phase having a duration equal to t. It depends on the data available and the characteristics of time series observed by the valuer. The time series may refer to a specific interval of time that has been defined "backward holding period" of 10-15 years in which it is possible to observe the temporal lag of each property market phase and the rate of variation in term of property price and property rent. The value of the property in each property market phase will be calculated through the difference between the value of the property at the beginning of the Recovery-Recession phase (moment 0), and the value of the property at the end of the Recovery-Recession phase, discounted at time 0. Therefore, each interval will be summed up reaching the opinion of value as in the Equation 5 below:

$$V = \frac{NOI}{R} - \frac{NOI}{R(1+Y)^t} \tag{5}$$

Using Dividend Discount Model the expression is:

$$V_{RR} = \frac{NOI}{Y + g_{RR}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{trr}} \tag{6}$$

The value in the first cycle (composed by one phase of recovery recession) will be summed up to the second property market phase (expansion-contraction) as in the Equation 7 below:

$$V_{1stPhaseRR+2ndphaseEC} = \frac{NOI}{Y + g_{RR}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{trr}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{tec+trr}} + - \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{tec+2trr}} \tag{7}$$

Considering a number *n* of phases and assuming $t_{rr} = t_{ec} = n$, then, we have:

$$V_{CC} = \frac{NOI}{Y + g_{RR}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{n}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} - \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{2n}} + + \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{2n}} - \frac{NOI}{Y + g_{RR}} \frac{1}{(1+Y)^{3n}} \cdots \tag{8}$$

The model assumes that the cycle is substantially repeated in an identical and continuous manner. The valuer's forecast shifts from a single capitalization rate representative of all future fluctuations, to two or a plurality of which represent the cyclicality of the market. The assumption that the phases of the cycle have the same duration may be considered strong. Normally, market cycles may have irregular phases, with an expansion phase that can be shorter than the recession phase, or vice versa. Anyway, starting from Equation 8 it is possible to write:

$$V_{CC} = \frac{NOI}{Y + g_{RR}} \left[1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} + \ldots \right] + + \frac{NOI}{Y - g_{EC}} \left[\frac{1}{(1+Y)^{n}} - \frac{1}{(1+Y)^{2n}} + \frac{1}{(1+Y)^{3n}} - \frac{1}{(1+Y)^{4n}} + \ldots \right] \tag{9}$$

Therefore:

$$V_{CC} = \frac{NOI}{Y + g_{RR}} \left(1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} + \ldots \right) + + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \left(1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} \ldots \right) \tag{10}$$

Finally:

$$V_{CDD'} = \left[\frac{NOI}{Y + g_{RR}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \right] \left(1 - \frac{1}{(1+Y)^{n}} + \frac{1}{(1+Y)^{2n}} - \frac{1}{(1+Y)^{3n}} \cdots \right) \tag{11}$$

The second part of the Equation 11 represents an infinite geometric progression. When the common ratio for an infinite geometric progression is included in the following interval -1 <r <1, the progression will tend to the following Equation 12:

$$\sum_{i=1}^{\infty} r_i = \frac{1}{1 - r} \tag{12}$$

where $r = -\frac{1}{(1+Y)^{n}}$

Consequently, it follows that the value of perpetuity can be calculated as in the following Equation 13:

$$V_{CDD'} = \frac{1}{1 + \frac{1}{(1+Y)^{n}}} \left[\frac{NOI}{Y + g_{RR}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \right] \tag{13}$$

And finally:

$$V_{CDD'} = \frac{(1+Y)^{n}}{(1+Y)^{n} + 1} \left[\frac{NOI}{Y + g_{RR}} + \frac{NOI}{Y - g_{EC}} \frac{1}{(1+Y)^{n}} \right] \tag{14}$$

In this formulation, the cyclical capitalization model is based on two different g-factors, but it can also be applied with reference to two different capitalization rates. From Equation 12 it is easily possible to go back to the original model of Gordon-Shapiro (1956) as a particular case of the cyclical capitalization model. In fact, in the presence of the same cap rate or yield rate, it is possible to write:

$$V_{CC} = \frac{(1+Y)^{n}}{(1+Y)^{n} + 1} \left[\frac{NOI}{Y - g} + \frac{NOI}{Y - g} \frac{1}{(1+Y)^{n}} \right] \tag{15}$$

And therefore:

$$V_{CC} = \frac{NOI}{Y - g} \frac{\cancel{(1+Y)^{n}}}{\cancel{(1+Y)^{n}} + 1} \left[\frac{\cancel{(1+Y)^{n}} + 1}{\cancel{(1+Y)^{n}}} \right] = \frac{NOI}{Y - g} \tag{16}$$

The application of the model can be carried out by determining the g-factors through an econometric analysis of time series (d'Amato, 2015) or it can be developed using the variation ratio on the observed time series (d'Amato, 2022). Capitalization rates can be calculated, respectively, one on the basis of the comparables available at the time of the valuation (commonly known as "support") and the other one on the basis of forecasts

formulated by of the valuer or a company specialized on market analysis. It is clear therefore the role of the valuer and the property market cycle in the process of property valuation. The first version of the proposed model is conditioned by the hypothesis that the cyclical phases of the market have the same temporal length.

3. SECOND VERSION OF THE MODEL (2003)

The second version of the cyclical capitalization model therefore aims to seek a methodology that interprets market cycles that have variable duration, in relation to the context of real estate valuations as outlined in Figure 2.

This model is also applicable in this condition by dividing the market cycle into a series of intervals of time having a temporal length equivalent to the shorter one between the two phases of "Recovery-Recession" and "Expansion-Contraction". The entire cycle is therefore divided on the basis of the duration of the smaller phase, as illustrated below:

$$V_{CDD^*}=\left[\begin{array}{l}\left(\frac{NOI}{Y+g_{RR1}}-\frac{NOI}{Y+g_{RR1}}\frac{1}{(1+Y)^t}\right)+\left(\frac{NOI}{Y+g_{RR2}}\frac{1}{(1+Y)^t}-\frac{NOI}{Y+g_{RR2}}\frac{1}{(1+Y)^{2t}}\right)+\\ +\left(\frac{NOI}{Y-g_{EC1}}\frac{1}{(1+Y)^{2t}}-\frac{NOI}{Y-g_{EC1}}\frac{1}{(1+Y)^{3t}}\right)+\left(\frac{NOI}{Y-g_{EC2}}\frac{1}{(1+Y)^{3t}}-\frac{NOI}{Y-g_{EC2}}\frac{1}{(1+Y)^{4t}}\right)\end{array}\right] \quad (17)$$

The entire cycle can then be plotted by a number of g-factors - with n> 2 (otherwise we have the first model 2001) - whose temporal length is the duration of the shortest cycle phase. Assuming a cycle that can be described by four g-factors, we have:

$$V_{CC}=\left(1-\frac{1}{(1+Y)^t}\right)\left[\frac{NOI}{Y+g_{RR1}}+\frac{NOI}{Y+g_{RR2}}\frac{1}{(1+Y)^t}+\frac{NOI}{Y-g_{EC1}}\frac{1}{(1+Y)^{2t}}+\frac{NOI}{Y-g_{EC2}}\frac{1}{(1+Y)^{3t}}\right] \quad (18)$$

Assuming that the cycle occurs with the same regularity over time:

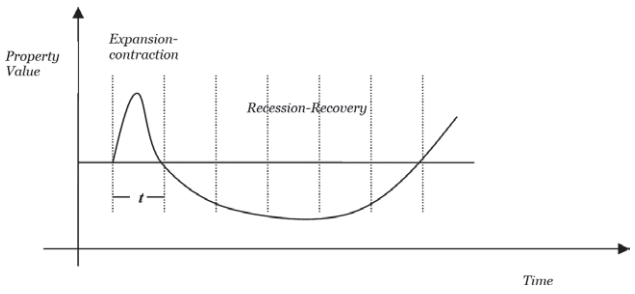

Figure 2. Second Version Cyclical Capitalization Models.

$$V_{CC}=\left(1-\frac{1}{(1+Y)^t}\right)\left[\begin{array}{l}\frac{NOI}{Y+g_{RR1}}+\frac{NOI}{Y+g_{RR2}}\frac{1}{(1+Y)^t}+\\ +\frac{NOI}{Y-g_{EC1}}\frac{1}{(1+Y)^{2t}}+\frac{NOI}{Y-g_{EC2}}\frac{1}{(1+Y)^{3t}}\end{array}\right]\left(1+\frac{1}{(1+Y)^{4t}}+\frac{1}{(1+Y)^{8t}}\cdots\right) \quad (19)$$

where 4*t* represents the duration of the cycle consisting of 4 time intervals of equal length. Similarly, to what was previously highlighted, also in the new formulation of the model it is possible to observe that the third part of the formula represents a geometric progression with the following ratio included in the interval -1< r <1.

$$r=\frac{1}{(1+Y)^{4t}} \quad (20)$$

Therefore

$$V_{CDD^*}=\left(1-\frac{1}{(1+Y)^t}\right)\left(\frac{(1+Y)^{4t}}{(1+Y)^{4t}-1}\right)\left(\begin{array}{l}\frac{NOI}{Y+g_{RR_1}}+\frac{NOI}{Y+g_{RR_2}}\frac{1}{(1+Y)^t}+\frac{NOI}{Y-g_{EC_1}}\frac{1}{(1+Y)^{2t}}+\\ +\frac{NOI}{Y-g_{EC_2}}\frac{1}{(1+Y)^{3t}}\end{array}\right) \quad (21)$$

Then,

$$V_{CC}=\left(\frac{(1+Y)^{3t}}{((1+Y)^{2t}+1)((1+Y)^t+1)}\right)\left(\begin{array}{l}\frac{NOI}{Y+g_{RR_1}}+\frac{NOI}{Y+g_{RR_2}}\frac{1}{(1+Y)^t}+\frac{NOI}{Y-g_{EC_1}}\frac{1}{(1+Y)^{2t}}+\\ +\frac{NOI}{Y-g_{EC_2}}\frac{1}{(1+Y)^{3t}}\end{array}\right) \quad (22)$$

Finally,

$$V_{CC}=\frac{NOI}{(1+Y)^{3t}+(1+Y)^{2t}+(1+Y)^t+1}\left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}}+\frac{(1+Y)^{2t}}{Y+g_{RR_2}}+\frac{(1+Y)^t}{Y-g_{EC_1}}+\frac{1}{Y-g_{EC_2}}\right) \quad (23)$$

There may also be two g-factors for the Expansion-Contraction phase and a single g-factor for the Recovery-Recession phase, in the event that the latter is the shortest phase of the cycle. This kind of forecast allows for the definition of a more flexible cyclical capitalization model in methodological terms and represents a further method of "reading" the market cycle relating to the market segment of the property to be appraised. In general terms, the two models can be summarized in the following Table 1.

Both cyclical capitalization models present some differences compared to the traditional direct capitalization model with explicit growth, as described in Tab. 2 in terms of assumptions and inputs

Consequently, it is possible to calculate two different capitalization rates which also take into account the cyclical trend of the market segment to which the US refers and the relative real estate value thus determined. Using Dividend Discount Model, the capitalization rate can be obtained as follows:

Table 1. Two early version of Cyclical Capitalization.

Cyclical Capitalization First Model (2001)	
$V = \frac{(1+Y)^n}{(1+Y)^n+1}\left[\frac{NOI}{Y+g_{RR}} + \frac{NOI}{Y-g_{EC}}\frac{1}{(1+Y)^n}\right]$	Regular Cycle no more than two different all risk yield rate – cap rate per each phase
Cyclical Capitalization Second Model (2003)	
$V_{CDD''} = \frac{NOI}{(1+Y)^{3t}+(1+Y)^{2t}+(1+Y)^t+1}\left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}} + \frac{(1+Y)^{2t}}{Y+g_{RR_2}} + \frac{(1+Y)^t}{Y-g_{EC_1}} + \frac{1}{Y-g_{EC_2}}\right)$	Cycle not regular more than one all risk yield rate – overall capitalization rate

Table 2. Comparison between Explicit Growth Model and Cyclical Capitalization.

Dividend Discount Model Traditional Growth Explicit Model	Cyclical Capitalization Model First Version (2001)	Cyclical Capitalization Model Second Version (2003)
	Premise	
There is one *g-factor* representing the combination between the capital and the rent growth	The valuer may estimate a g-factor both in the recession and in the expansion market phase	Property market cycle can be represented by more than two overall capitalization rates, all risk yields
One only growth factor	The valuer knows the temporal length both of the single phase and of the cycle.	The valuer knows the temporal length both of the single phase and of the cycle.
	Inputs	
Discount Rate – Target Rate of return - Equated Yield	Discount Rate – Target Rate of return - Equated Yield	Discount Rate – Target Rate of return - Equated Yield
Rent – Net Operate Income	Rent – Net Operate Income	Rent – Net Operate Income
One g-factor	Two g-factors	More than two g-factors
t =oo	$t_{RR} = t_{EC}$	t
Y > g	$Y > g_{EC}$	$Y > g_{EC}$

$$r = \frac{NOI}{V} = Y - g \tag{24}$$

Using Cyclical Capitalization it is possible to calculate a "dynamic cap rate"

$$V = \frac{(1+Y)^n}{(1+Y)^n+1}\left[\frac{NOI}{Y+g_{RR}} + \frac{NOI}{Y-g_{EC}}\frac{1}{(1+Y)^n}\right] \tag{25}$$

Therefore:

$$V = NOI\frac{(1+Y)^n+1}{(1+Y)^n}(1+Y)^n\left[\frac{(1+Y)^n}{Y+g_{RR}} + \frac{1}{Y-g_{EC}}\right] \tag{26}$$

Finally,

$$R_{CC} = \frac{NOI}{V} = \frac{(1+Y)^n+1}{\left[\frac{1}{Y+g_{RR}} + \frac{1}{Y-g_{EC}}\right]} = \frac{[(1+Y)^n+1][(Y+g_{RR})(Y-g_{EC})]}{(Y-g_{EC})+(Y+g_{RR})} \tag{27}$$

It is clear that the "dynamic" capitalization rate cannot simply be defined as a "… constant annual rate". It takes into account the trend and intensity of the market cycle. Starting from the second version it is possible to write:

$$V = \frac{NOI}{(1+Y)^{3t}+(1+Y)^{2t}+(1+Y)^t+1}\left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}} + \frac{(1+Y)^{2t}}{Y+g_{RR_2}} + \frac{(1+Y)^t}{Y-g_{EC_1}} + \frac{1}{Y-g_{EC_2}}\right) \tag{28}$$

Finally,

$$R_{CDD''} = \frac{NOI}{V} = \frac{\left[(1+Y)^{3t}+(1+Y)^{2t}+(1+Y)^t+1\right]}{\left(\frac{(1+Y)^{3t}}{Y+g_{RR_1}} + \frac{(1+Y)^{2t}}{Y+g_{RR_2}} + \frac{(1+Y)^t}{Y-g_{EC_1}} + \frac{1}{Y-g_{EC_2}}\right)} \tag{29}$$

A first application of Cyclical Capitalization (first version) was carried out in the British real estate market comparing the valuation variation between the values obtained with the first version and those obtained either with the direct capitalization of the Gordon-Shapiro model (1956) or the direct capitalization without explicit growth (d'Amato, 2013).

Subsequently, it was highlighted that the values deriving from cyclical capitalization can be characterized by a tendential prudence (d'Amato, 2015). This peculiarity would suggest the possibility of using cyclical capitalization models in for the valuation of mortgage lending value of commercial properties (d'Amato et al., 2019). The model can include in the valuation also vacancy lag (d'Amato, 2017b).

Furthermore, from 2017, the cyclical capitalization seems to be indicated by the International Valuation Standards as a way to calculate the "exit value" in the discounted cash flow analysis. In fact, for the first time since 2017, the concept of "cyclical asset" was introduced in the international valuation standards. This concept demonstrates the growing important role of the property market cycle in the valuation process. It is specified: *"…for cyclical assets the terminal value should consider the cyclical nature of the asset and should not be performed in a way that assumes "peak" or "trough" levels of cash flow in perpetuity…"* (International Valuation Standards, 2020, paragraph 50.21 letter e). Considering that cyclical capitalization appears to be the only methodology close to this description, the proposed methodological tool is officially recommended from International Valuation Standards. The interest in this methodology may also be justified by the information more and more available in the age of information.

The greater availability of qualitative and quantitative data and information, in aggregate and disaggregated form, with respect to a "local" scale and the easier accessibility, much greater than in the past, allow the valuer to acquire more extensive elements of knowledge and analysis. Traditional technical and economic knowledge of the "comparable" is accompanied, with increasing frequency, by a quantity of complimentary information. They are useful for carrying out the comparison and can contribute to improve the property appraiser's knowledge of the property to be estimated and its market segment. Even in the most recent manuals, the role of these complimentary information is growing. An example may be the calculation of data variable in the Market Comparison Approach or the Segment Comparison Method (MCS), both assuming extra-data, in the valuation process (Simonotti, 2019). Moreover, the analysis of time series can be of help to the estimation of the property market cycle. These analysis are useful for the determination of a plurality of capitalization rates based on recognised procedure such as ARIMA models, now easily executable with the aid of free software available on the net.

4. CONCLUDING REMARKS AND FUTURE DIRECTIONS OF RESEARCH

In this contribution two different variants of cyclical capitalization have been illustrated which may be of interest in the context of real estate valuations extending the scope beyond the determination of the exit value in the context of the estimate for discounting cash flow. Cyclical capitalization models offer the opportunity to determine the value starting either from the historical series of real estate values relating to the segment being valued or on the basis of factual evidence and the ability to formulate forecasts by the valuer. In the former model the market cycle considered is regular, while in the second, irregular market cycles are taken into consideration.

Assessment of the real estate market cycle may assume a strategic role in capitalization models although *"... over the past twenty-five years of research on the subject, authors have recounted numerous reasons for and arguments on the irrelevancy of cycles.... Support for these assertions is based on fundamental concepts embodied in the efficient market hypothesis ..."* (Roulac et al., 1999).

A hypothesis that, beyond the integration processes between the financial and real estate market, is incompatible with the characteristics of real estate market.

The proposed analysis also points out the need to develop further insights into the nature of the process of extracting capitalization rates, which allows to lead to an assessment based not on a single and static forecast but on a dynamic approach. A further need that has emerged is to establish the empirical relationships between the selection of capitalization rates and the time series of incomes and prices currently available. If the capitalization rates can be determined subjectively by the valuer, the question arises as to which procedures to use and whether it is possible to entrust the determination of the two (or more) assays to sensitivity analyzes.

In this sense, it may be useful to deepen the study of cyclical capitalization models, not only to broaden the knowledge on a still innovative methodological tool in the context of real estate valuations, but also because these models are consistent with the need to estimate cyclical assets, introduced by the International Valuation Standards in 2017 and confirmed in the IVS 2020. Future research directions may be found in integrating this methodology with the use of trigonometric functions for forecasting the market cycle.

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Firenze University Press
www.fupress.com/ceset

Citation: Lucifero N. (2022) Rassegna giurisprudenziale II semestre 2021. *Aestimum* 80: 55-66. doi: 10.36253/aestim-13381

Published: October 17, 2022

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Rassegna giurisprudenziale II semestre 2021

a cura di Nicola Lucifero

AGRICOLTURA

CGUE, 5/5/2022, C-189/21, R. en R. c. Minister van Landbouw, Natuur en Voedselkwaliteit

Rinvio pregiudiziale – Politica agricola comune (PAC) – Regolamento (UE) n. 1306/2013 – Allegato II – Criterio di gestione obbligatorio 10 – Regolamento (UE) n.1107/2009 – Articolo 55, primo comma e secondo comma, prima frase – Regimi di sostegno diretto – Norme comuni – Riduzione o esclusione di tutto o parte dell'aiuto ricevuto a titolo della PAC – Inosservanza delle regole di condizionalità – Uso di un prodotto fitosanitario che non è o non è più autorizzato nello Stato membro interessato e, in quest'ultima ipotesi, il cui termine ultimo di utilizzo sia scaduto

Il criterio di gestione obbligatorio 10, quale previsto all'allegato II del regolamento (UE) n. 1306/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, sul finanziamento, sulla gestione e sul monitoraggio della politica agricola comune e che abroga i regolamenti del Consiglio (CEE) n. 352/78, (CE) n. 165/94, (CE) n. 2799/98, (CE) n. 814/2000, (CE) n. 1290/2005 e (CE) n. 485/2008, che fa riferimento all'articolo 55, primo comma e secondo comma, prima frase, del regolamento (CE) n. 1107/2009 del Parlamento europeo e del Consiglio, del 21 ottobre 2009, relativo all'immissione sul mercato dei prodotti fitosanitari e che abroga le direttive del Consiglio 79/117/CEE e 91/414/CEE, deve essere interpretato nel senso che esso riguarda anche l'uso di un prodotto fitosanitario che non sia o non sia più autorizzato nello Stato membro interessato e, in quest'ultima ipotesi, il cui termine ultimo di utilizzo sia scaduto.

CGUE, 28/4/2022, C-160/2021 e 217/2021, «Nikopolis AD Istrum 2010» EOOD (C-160/21), «Agro – eko 2013» EOOD (C-217/21) c. Izpalnitelen direktor na Darzhaven fond «Zemedelie»

Rinvio pregiudiziale – Politica agricola comune – Regimi di sostegno diretto – Regolamento (UE) n. 1306/2013 – Pagamenti ai beneficiari – Articolo 75 – Termine di pagamento – Rispetto – Assenza – Rifiuto implicito della domanda di aiuto

L'articolo 75, paragrafo 1, del regolamento (UE) n. 1306/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, sul finanziamento, sulla gestione e sul monitoraggio della politica agricola comune e che abro-

ga i regolamenti del Consiglio (CEE) n. 352/78, (CE) n. 165/94, (CE) n. 2799/98, (CE) n. 814/2000, (CE) n. 1290/2005 e (CE) n. 485/2008, come modificato dal regolamento (UE) 2017/2393 del Parlamento europeo e del Consiglio, del 13 dicembre 2017, deve essere interpretato nel senso che il mancato pagamento, da parte dell'organismo pagatore di uno Stato membro, di un aiuto richiesto da un agricoltore prima della scadenza del termine fissato in tale disposizione non deve essere considerato una decisione implicita di rigetto della domanda di aiuto di cui trattasi, e ciò a prescindere dalla circostanza che l'agricoltore interessato sia stato o meno informato dell'esecuzione di eventuali verifiche supplementari che giustificherebbero un tale superamento di detto termine.

CGUE, 28/4/2022, C-251/21, «Piltenes meži» *SIA c.* Lauku atbalsta dienests

Rinvio pregiudiziale – Fondo europeo agricolo per lo sviluppo rurale (FEASR) – Regolamento (UE) n. 1305/2013 – Sostegno allo sviluppo rurale da parte del FEASR – Articolo 30 – Indennità Natura 2000 – Ambito di applicazione – Domanda di sostegno per una microriserva creata in una foresta non facente parte della rete Natura 2000, al fine di contribuire alla protezione di una specie di uccello selvatico – Regolamento (UE) n. 702/2014 – Esenzione per categoria di alcuni aiuti ai settori agricolo e forestale – Applicazione ad aiuti cofinanziati mediante risorse dell'Unione europea – Non applicazione alle imprese in difficoltà

1) L'articolo 30 del regolamento (UE) n. 1305/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, sul sostegno allo sviluppo rurale da parte del Fondo europeo agricolo per lo sviluppo rurale (FEASR) e che abroga il regolamento (CE) n. 1698/2005 del Consiglio, deve essere interpretato, tenuto conto in particolare del suo paragrafo 6, nel senso che un sostegno richiesto per una microriserva creata in una foresta al fine di realizzare gli obiettivi della direttiva 2009/147/CE del Parlamento europeo e del Consiglio, del 30 novembre 2009, concernente la conservazione degli uccelli selvatici, rientra nell'ambito di applicazione di tale articolo 30.

2) Il regolamento (UE) n. 702/2014 della Commissione, del 25 giugno 2014, che dichiara compatibili con il mercato interno, in applicazione degli articoli 107 e 108 [TFUE], alcune categorie di aiuti nei settori agricolo e forestale e nelle zone rurali, deve essere interpretato nel senso che deve escludersi la possibilità di dichiarare compatibile con il mercato interno, ai sensi di tale regolamento, un sostegno richiesto sulla base del regolamento n. 1305/2013, per una microriserva creata in una foresta al fine di realizzare gli obiettivi della direttiva 2009/147, da un'impresa in difficoltà, ai sensi dell'articolo 2, punto 14, del regolamento n. 702/2014.

CGUE, 7/4/2022, C-176/20, SC Avio Lucos SRL c. Agenţia de Plăţi *şi* Intervenţie pentru Agricultură – Centrul judeţean Dolj e Agenţia de Plăţi *şi* Intervenţie pentru Agricultură (APIA) – Aparat Central

Rinvio pregiudiziale – Agricoltura – Politica agricola comune – Regimi di sostegno diretto – Norme comuni – Regime di pagamento unico per superficie – Regolamento (UE) n. 1307/2013 – Articolo 4, paragrafo 1, lettere a) e c), e paragrafo 2, lettera b) – Normativa nazionale che subordina il sostegno diretto alla detenzione da parte dell'agricoltore di animali propri – Articolo 9, paragrafo 1 – Nozione di "agricoltore in attività" – Regolamento (UE) n. 1306/2013 – Articolo 60 – Clausola di elusione – Nozione di «condizioni create artificialmente.

1) L'articolo 4, paragrafo 1, lettera c), punto iii), e paragrafo 2, lettera b), del regolamento (UE) n. 1307/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, recante norme sui pagamenti diretti agli agricoltori nell'ambito dei regimi di sostegno previsti dalla politica agricola comune e che abroga il regolamento (CE) n. 637/2008 del Consiglio e il regolamento (CE) n. 73/2009 del Consiglio, deve essere interpretato nel senso che esso non osta a una normativa nazionale che prevede che l'attività minima sulle superfici agricole mantenute naturalmente in uno stato che le rende idonee al pascolo o alla coltivazione, di cui a tali disposizioni, debba essere esercitata dall'agricoltore con animali da lui stesso detenuti.

2) L'articolo 4, paragrafo 1, lettere a) e c), nonché l'articolo 9, paragrafo 1, del regolamento n. 1307/2013 devono essere interpretati nel senso che rientra nella nozione di «agricoltore in attività», ai sensi di tale seconda disposizione, una persona giuridica che ha stipulato un contratto di concessione avente ad oggetto una superfice da pascolo appartenente a un comune e che vi fa pascolare animali che gli sono stati prestati, a titolo gratuito, da persone fisiche che ne sono proprietarie, purché tale persona svolga, su tale superficie da pascolo, una «attività minima», ai sensi dell'articolo 4, paragrafo 1, lettera c), punto iii), di tale regolamento.

3) L'articolo 60 del regolamento (UE) n. 1306/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, sul finanziamento, sulla gestione e sul monitoraggio della politica agricola comune e che abroga i regolamenti del Consiglio (CEE) n. 352/78, (CE) n. 165/94, (CE) n. 2799/98, (CE) n. 814/2000, (CE) n. 1290/2005 e (CE) n. 485/2008, deve essere interpretato nel senso che una situazione in cui il richiedente un sostegno finanzia-

rio in base al regime di pagamento unico per superficie produce, per corroborare la sua domanda, un contratto di concessione avente ad oggetto superfici di pascolo e contratti di comodato d'uso, a titolo gratuito, riguardanti animali destinati a pascolare su tali superfici, può rientrare nella nozione di «condizioni create artificialmente», ai sensi di tale disposizione, a condizione che, da un lato, risulti da un insieme di circostanze oggettive che, nonostante il rispetto formale delle condizioni previste dalla normativa pertinente, l'obiettivo perseguito da tale normativa non è stato raggiunto e, dall'altro, sia accertata l'intenzione di ottenere un vantaggio risultante dalla normativa dell'Unione creando artificialmente le condizioni richieste per il suo ottenimento.

CGUE, 7/4/2020, C-116/20, SC Avio Lucos SRL c. Agenţia de Plăţi *şi* Intervenţie pentru Agricultură – Centrul judeţean Dolj e Agenţia de Plăţi *şi* Intervenţie pentru Agricultură (APIA) – Aparat Central

Rinvio pregiudiziale – Agricoltura – Politica agricola comune – Regimi di sostegno diretto – Norme comuni – Regime di pagamento unico per superficie – Regolamento (CE) n. 73/2009 – Articolo 2, lettera c) – Nozione di "attività agricola" – Articolo 35 – Regolamento (CE) n. 1122/2009 – Normativa nazionale che impone la produzione di un titolo giuridico che dimostri il diritto di utilizzare la parcella agricola messa a disposizione dell'agricoltore nell'ambito di un contratto di concessione e che subordina la validità di un siffatto contratto alla qualità di allevatore o di proprietario di animali del futuro concessionario – Concessionario di un pascolo che ha stipulato un contratto di collaborazione con allevatori di animali – Autorità di cosa giudicata.

1) Il regolamento (CE) n. 73/2009 del Consiglio, del 19 gennaio 2009, che stabilisce norme comuni relative ai regimi di sostegno diretto agli agricoltori nell'ambito della politica agricola comune e istituisce taluni regimi di sostegno a favore degli agricoltori, e che modifica i regolamenti (CE) n. 1290/2005, (CE) n. 247/2006, (CE) n. 378/2007 e abroga il regolamento (CE) n. 1782/2003, come modificato dal regolamento (UE) n. 1310/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, e il regolamento (CE) n. 1122/2009 della Commissione, del 30 novembre 2009, recante modalità di applicazione del regolamento n. 73/2009 per quanto riguarda la condizionalità, la modulazione e il sistema integrato di gestione e di controllo nell'ambito dei regimi di sostegno diretto agli agricoltori di cui al medesimo regolamento e modalità di applicazione del regolamento (CE) n. 1234/2007 del Consiglio per quanto riguarda la condizionalità nell'ambito del regime di sostegno per il settore vitivinicolo, devono essere interpretati nel senso che non ostano a una normativa nazionale che subordina l'ottenimento di un sostegno in base al regime di pagamento unico per superficie all'obbligo per il richiedente di dimostrare che esso detiene un «diritto di uso» della superficie agricola oggetto di tale domanda, purché siano rispettati gli obiettivi perseguiti dalla normativa dell'Unione di cui trattasi e i principi generali del diritto dell'Unione, in particolare il principio di proporzionalità.

2) Il regolamento n. 73/2009, come modificato dal regolamento n. 1310/2013, e il regolamento n. 1122/2009 devono essere interpretati nel senso che essi non ostano, nel caso particolare in cui il beneficiario di un sostegno concesso in base al regime di pagamento unico per superficie abbia giustificato il diritto di sfruttare una superficie agricola mediante la presentazione di un contratto di concessione di un pascolo appartenente al demanio pubblico di un ente amministrativo territoriale, a una normativa nazionale che subordini la validità di un siffatto contratto alla qualità di allevatore o di proprietario di animali del futuro concessionario.

3) L'articolo 2, lettera c), del regolamento n. 73/2009, come modificato dal regolamento n. 1310/2013, deve essere interpretato nel senso che la nozione di «attività agricola» comprende un'attività con la quale un soggetto prende in concessione un terreno adibito a pascolo e stipula successivamente un contratto di collaborazione con allevatori di animali, in forza del quale tali allevatori fanno pascolare gli animali sul terreno dato in concessione, laddove il concessionario conserva il diritto di uso del terreno, ma si impegna a non limitare l'attività di pascolo e si assume la responsabilità delle attività di manutenzione del pascolo, purché tali attività soddisfino le condizioni previste dalla norma facoltativa di cui all'allegato III a tale regolamento.

4) Il diritto dell'Unione deve essere interpretato nel senso che esso osta all'applicazione, nell'ordinamento giuridico di uno Stato membro, del principio dell'autorità di cosa giudicata che, nell'ambito di una controversia tra le stesse parti vertente sulla legittimità di un atto di recupero di somme versate al richiedente di un sostegno concesso in base a un regime di pagamento unico per superficie, ostacola un esame, da parte del giudice adito, della conformità al diritto dell'Unione di requisiti nazionali relativi alla legittimità del titolo di sfruttamento della superficie agricola che è stata oggetto della domanda di sostegno, per il motivo che tale atto di recupero è basato sugli stessi fatti che oppongono le stesse parti e sulla stessa normativa nazionale che sono stati analizzati in una precedente decisione giurisdizionale divenuta definitiva.

CGUE, 24/3/2022, C-726/20, CT, Ferme de la Sarte SPRL c. Région Wallonne

Rinvio pregiudiziale – Politica agricola comune (PAC) – Finanziamento da parte del Fondo europeo agricolo per lo sviluppo rurale (FEASR) – Regolamento (UE) n. 1305/2013 – Articolo 17, paragrafo 1, lettera b) – Sostegno agli investimenti riguardanti la trasformazione, la commercializzazione e/o lo sviluppo di prodotti agricoli di cui all'allegato I del Trattato FUE – Nozione di "prodotti agricoli" – Nozioni di "piante vive" e di "prodotti della floricoltura" – Manto erboso in rotoli per l'allestimento di tetti verdi

L'articolo 17, paragrafo 1, lettera b), del regolamento (UE) n. 1305/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, sul sostegno allo sviluppo rurale da parte del Fondo europeo agricolo per lo sviluppo rurale (FEASR) e che abroga il regolamento (CE) n. 1698/2005 del Consiglio, deve essere interpretato nel senso che la nozione di «prodotti agricoli di cui all'allegato I del Trattato [FUE]», ivi contenuta, comprende le piante utilizzate per l'allestimento di tetti verdi, come il manto erboso in rotoli, cosicché gli investimenti materiali che le riguardano possono beneficiare di un sostegno a titolo della misura di sostegno allo sviluppo rurale prevista da tale disposizione.

CGUE, 27/1/2022, C-234/20, SIA „Sātiņi-S" c. Lauku atbalsta dienests

Rinvio pregiudiziale – Fondo europeo agricolo per lo sviluppo rurale (FEASR) – Regolamento (UE) n. 1305/2013 – Sostegno allo sviluppo rurale – Articolo 30, paragrafo 6, lettera a) – Indennità Natura 2000 – Compensazione per il mancato guadagno nelle zone agricole e forestali – Torbiere – Divieto d'impiantare coltivazioni di mirtilli rossi – Assenza d'indennizzo compensativo – Carta dei diritti fondamentali dell'Unione europea – Articolo 17 – Diritto di proprietà

1) L'articolo 30, paragrafo 6, lettera a), del regolamento (UE) n. 1305/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, sul sostegno allo sviluppo rurale da parte del Fondo europeo agricolo per lo sviluppo rurale (FEASR) e che abroga il regolamento (CE) n. 1698/2005 del Consiglio, deve essere interpretato nel senso che esso non esclude, in linea di principio, le torbiere dalle indennità Natura 2000, a condizione che esse siano situate in zone Natura 2000 designate ai sensi della direttiva 92/43/CEE del Consiglio, del 21 maggio 1992, relativa alla conservazione degli habitat naturali e seminaturali e della flora e della fauna selvatiche, e della direttiva 2009/147/CE del Parlamento europeo e del Consiglio, del 30 novembre 2009, concernente la conservazione degli uccelli selvatici, e che rientrino nelle nozioni di «superficie agricola» o di «foresta» di cui, rispettivamente, alle lettere f) e r) dell'articolo 2, paragrafo 1, o all'articolo 2, paragrafo 2, del regolamento n. 1305/2013, potendo così beneficiare delle indennità di cui all'articolo 30, paragrafo 1, del medesimo regolamento in quanto «zone agricole e forestali Natura 2000» ai sensi del suddetto articolo 30, paragrafo 6, lettera a).

2) L'articolo 30, paragrafo 6, lettera a), del regolamento n. 1305/2013 deve essere interpretato nel senso che esso consente a uno Stato membro di escludere dalle indennità Natura 2000, da un lato, le «zone agricole Natura 2000» ai sensi di detta disposizione, comprese le torbiere che eventualmente rientrino in tali zone, e, dall'altro lato, e conformemente all'articolo 2, paragrafo 2, del regolamento n. 1305/2013, torbiere situate in zone Natura 2000 che rientrino in linea di principio nella nozione di «foresta» di cui all'articolo 2, paragrafo 1, lettera r), di tale regolamento e, pertanto, in quella di «zone forestali Natura 2000» di cui all'articolo 30, paragrafo 6, lettera a), di detto regolamento. Quest'ultima disposizione deve essere interpretata altresì nel senso che essa consente a uno Stato membro di limitare i pagamenti di siffatte indennità per zone forestali Natura 2000 comprendenti, eventualmente, torbiere alle situazioni in cui la designazione di tali zone quali «zone Natura 2000» ha l'effetto di ostacolare l'esercizio nelle stesse di un tipo specifico di attività economica, segnatamente la silvicoltura.

3) L'articolo 30 del regolamento n. 1305/2013, in combinato disposto con l'articolo 17 della Carta dei diritti fondamentali dell'Unione europea, deve essere interpretato nel senso che non occorre concedere un'indennità Natura 2000 al proprietario di una torbiera rientrante in detta rete per il motivo che è stata posta una restrizione a un'attività economica che poteva essere esercitata in tale torbiera, segnatamente è stato vietato di piantarvi mirtilli rossi, allorché, nel momento in cui ha acquisito l'immobile in questione, il proprietario era a conoscenza di una siffatta restrizione.

Cass. civ., Sez. II, Ordinanza, 21/03/2022, n. 9071

Riforma fondiaria - Assegnazione - Riforma agraria - Assegnazione delle terre - Acquisto della proprietà del cespite da parte dell'assegnatario - Condizioni - Conseguenze in caso di suo decesso prima di tale momento - Successione "iure hereditatis" dei discendenti in linea retta o, in subordine, del coniuge - Esclusione - Subentro degli stessi nel rapporto con l'ente e aspettativa condizionata ai requisiti di legge - Sussistenza - Collocazione temporale dell'acquisto - Entrata in vigore della l. n. 386 del 1976

In tema di assegnazione di terre di riforma agraria, per

effetto dell'art. 10 l. 30 aprile 1976 n. 386, secondo cui l'effetto traslativo del cespite coincide con il pagamento della quindicesima annualità del prezzo di assegnazione, il decesso dell'assegnatario in data antecedente al riscatto fa sì che i discendenti in linea retta ovvero, in mancanza, il coniuge non legalmente separato per sua colpa, non subentrino "iure hereditatis", ma, sulla base della designazione fatta dal testatore, o dai coeredi o, in caso di loro disaccordo, dall'Autorità giudiziaria, succedano ad esso nel rapporto con l'ente e dunque nell'aspettativa, condizionata al possesso, da parte loro, dei medesimi requisiti oggettivi e soggettivi richiesti per l'originario assegnatario, come sancito dall'art. 7, l. n. 379 del 1967. Peraltro, non avendo il citato art. 10 l. n. 386 del 1976 portata retroattiva, l'acquisto del fondo da parte di un assegnatario che abbia in epoca anteriore pagato le quindici annualità previste, va temporalmente collocato all'epoca di entrata in vigore della suddetta legge.

Cons. Stato, Sez. IV, 09/02/2022, n. 935
Bosco – Definizione.
La nozione di "bosco" richiamata ai fini della tutela paesaggistica è un "elemento normativo", perché fa espresso riferimento alla definizione dettata dall'art. 2, D.Lgs. n. 227/2001, postulante la presenza di un terreno di una certa estensione, coperto con una certa densità da vegetazione forestale arborea, arbusti, sottobosco ed erbe. Il vincolo paesaggistico per le aree boscate presuppone la sussistenza in natura del bosco; la finalità di tutela del paesaggio, sottesa alla nozione di bosco, implica il rispetto della ragionevolezza e della proporzionalità in relazione a tale finalità, con la conseguenza che foreste e boschi sono presunti di notevole interesse e meritevoli di salvaguardia perché elementi originariamente caratteristici del paesaggio, cioè del "territorio espressivo di identità" ex art. 131, D.Lgs. n. 42/2004; c) elemento qualificante di tale fattispecie è la presenza di un sistema vivente complesso ovvero di "un ecosistema in grado di autorigenerarsi".

T.A.R. Friuli-V. Giulia Trieste, Sez. I, 31/01/2022, n. 71
Agevolazioni – Invalidità – Prelievo supplementare – contrasto diritto UE
Costituisce una nullità rilevabile anche d'ufficio quella dei provvedimenti con i quali l'Agenzia delle Entrate- ente riscossione ha intimato al produttore di latte il pagamento relativo al prelievo supplementare sulle consegne di latte, cd. "quote latte" relativo alle campagne lattiere, che si fondino sulla base di norme interne attributive del potere che i giudici europei hanno dichiarato contrarie a diritto UE.

T.A.R. Umbria Perugia, Sez. I, 03/01/2022, n. 1
Agevolazioni - Benefici comunitari e nazionali – Falsa dichiarazione sui terreni – rapporti tra procedimenti.
In tema di l'indebito percepimento di premi di cui ai regolamenti CE n. 73/2009 e n. 1122/2009 mediante l'esposizione nella succitata domanda di dati e notizie falsi in riferimento a terreni, nell'ambito dei provvedimenti amministrativi non è illegittimo per difetto di istruttoria il provvedimento emesso sulla base di fonti di prova estrapolate dagli atti di un procedimento penale che ancora non sono stati vagliati definitivamente dal giudice penale. Ciò in quanto i due procedimenti, penale ed amministrativo, ben possono trovare la loro comune origine nei medesimi atti di contestazione redatti dagli organi di polizia giudiziaria, ma poi corrono parallelamente, avendo contenuto e finalità nettamente autonome.

ALIMENTI

CGUE, 28/4/2022, C-86/20, Vinařství U Kapličky s.r.o. c. Státní zemědělská a potravinářská inspekce
Rinvio pregiudiziale – Organizzazione comune dei mercati dei prodotti agricoli – Vino – Regolamento (UE) n. 1308/2013 – Norme applicabili alla commercializzazione – Articolo 80 – Pratiche enologiche – Divieto di commercializzazione – Articolo 90 – Importazioni di vino – Regolamento (CE) n. 555/2008 – Articolo 43 – Documento V I 1 – Attestato che certifichi che le partite di vino sono state ottenute con l'impiego di pratiche enologiche raccomandate o autorizzate – Valore probatorio – Regolamento (UE) n. 1306/2013 – Articolo 89, paragrafo 4 – Sanzioni – Commercializzazione di vino proveniente da un paese terzo – Vino sottoposto a pratiche enologiche non autorizzate – Esenzione dalla responsabilità – Onere della prova
1) L'articolo 80, paragrafo 2, lettere a) e c), e l'articolo 90, paragrafo 3, lettera a), del regolamento (UE) n. 1308/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, recante organizzazione comune dei mercati dei prodotti agricoli e che abroga i regolamenti (CEE) n. 922/72, (CEE) n. 234/79, (CE) n. 1037/2001 e (CE) n. 1234/2007 del Consiglio, devono essere interpretati nel senso che l'attestato contenuto in un documento V I 1, redatto per una partita di vino importata nell'Unione europea sulla base dell'articolo 43 del regolamento (CE) n. 555/2008 della Commissione, del 27 giugno 2008, recante modalità di applicazione del regolamento (CE) n. 479/2008 del Consiglio relativo all'organizzazione comune del mercato vitivinicolo, in ordine ai

programmi di sostegno, agli scambi con i paesi terzi, al potenziale produttivo e ai controlli nel settore vitivinicolo, secondo il quale tale partita è stata ottenuta con l'impiego di pratiche enologiche raccomandate e pubblicate dall'Organizzazione internazionale della vigna e del vino o autorizzate dall'Unione, è rilevante ai fini della valutazione della conformità di tale partita alle pratiche enologiche di cui all'articolo 80, paragrafo 2, lettere a) e c), del regolamento n. 1308/2013, senza essere tuttavia sufficiente per dimostrare, di per sé, tale conformità.
2) L'articolo 89, paragrafo 4, del regolamento (UE) n. 1306/2013 del Parlamento europeo e del Consiglio, del 17 dicembre 2013, sul finanziamento, sulla gestione e sul monitoraggio della politica agricola comune e che abroga i regolamenti del Consiglio (CEE) n. 352/78, (CE) n. 165/94, (CE) n. 2799/98, (CE) n. 814/2000, (CE) n. 1290/2005 e (CE) n. 485/2008, in combinato disposto con l'articolo 64, paragrafo 2, lettera d), di tale regolamento e con l'articolo 80, paragrafo 2, del regolamento n. 1308/2013, deve essere interpretato nel senso che esso osta a una normativa di uno Stato membro ai sensi della quale, qualora una persona che commercializza, in tale Stato membro, una partita di vino importata da un paese terzo non conforme alle pratiche enologiche di cui all'articolo 80, paragrafo 2, lettera a) o c), del regolamento n. 1308/2013, produca un documento V I 1 redatto per tale partita e attestante che quest'ultima è stata ottenuta nel rispetto delle pratiche enologiche raccomandate e pubblicate dall'Organizzazione internazionale della vigna e del vino o autorizzate dall'Unione, l'onere della prova circa la sussistenza di responsabilità in capo a tale commerciante per la violazione del divieto di commercializzazione di cui all'articolo 80, paragrafo 2, del regolamento n. 1308/2013 grava sulle autorità competenti di detto Stato membro.

CGUE 24/3/2022, C-533/20, Somogy Megyei Kormányhivatal c. Upfield Hungary Kft
Rinvio pregiudiziale – Tutela dei consumatori – Regolamento (UE) n. 1169/2011 – Fornitura di informazioni sugli alimenti ai consumatori – Etichettatura – Indicazioni obbligatorie – Elenco degli ingredienti – Denominazione specifica di tali ingredienti – Aggiunta di una vitamina a un alimento – Obbligo di indicare la denominazione specifica di tale vitamina – Insussistenza di un obbligo di indicare la formula vitaminica utilizzata
Il regolamento (UE) n. 1169/2011 del Parlamento europeo e del Consiglio, del 25 ottobre 2011, relativo alla fornitura di informazioni sugli alimenti ai consumatori, che modifica i regolamenti (CE) n. 1924/2006 e (CE) n. 1925/2006 del Parlamento europeo e del Consiglio e abroga la direttiva 87/250/CEE della Commissione, la direttiva 90/496/CEE del Consiglio, la direttiva 1999/10/CE della Commissione, la direttiva 2000/13/CE del Parlamento europeo e del Consiglio, le direttive 2002/67/CE e 2008/5/CE della Commissione e il regolamento (CE) n. 608/2004 della Commissione, deve essere interpretato, tenuto conto in particolare del suo articolo 18, paragrafo 2, nel senso che, nell'ipotesi in cui una vitamina sia stata aggiunta a un alimento, l'elenco degli ingredienti di tale alimento non deve comprendere, oltre alla denominazione di tale vitamina, l'indicazione della formula vitaminica che è stata utilizzata.

CGUE, 28/4/2022, C-89/21, «Romega» ***UAB c.*** Valstybinė maisto ir veterinarijos tarnyba
Rinvio pregiudiziale – Legislazione alimentare – Regolamento (CE) n. 2073/2005 – Criteri microbiologici applicabili ai prodotti alimentari – Articolo 1 – Allegato I – Carne fresca di pollame – Controllo da parte delle autorità nazionali competenti della presenza delle salmonelle elencate alla riga 1.28 del capitolo I di tale allegato – Controllo della presenza di altri microrganismi patogeni – Regolamento (CE) n. 178/2002 – Articolo 14, paragrafo 8 – Potere discrezionale delle autorità nazionali – Portata
L'articolo 1 del regolamento (CE) n. 2073/2005 della Commissione, del 15 novembre 2005, sui criteri microbiologici applicabili ai prodotti alimentari, quale modificato dal regolamento (UE) n. 1086/2011 della Commissione, del 27 ottobre 2011, letto in combinato disposto con l'articolo 14, paragrafo 8, del regolamento (CE) n. 178/2002 del Parlamento europeo e del Consiglio, del 28 gennaio 2002, che stabilisce i principi e i requisiti generali della legislazione alimentare, istituisce l'Autorità europea per la sicurezza alimentare e fissa procedure nel campo della sicurezza alimentare, deve essere interpretato nel senso che l'autorità competente di uno Stato membro può trattare come categoria a rischio, ai sensi dell'articolo 14, paragrafi 1 e 2, del regolamento n. 178/2002, la categoria di alimenti costituita da carne fresca di pollame in cui siano stati rilevati microorganismi patogeni diversi dai sierotipi di salmonella previsti all'allegato I, capitolo 1, riga 1.28, del regolamento n. 2073/2005, come modificato dal regolamento n. 1086/2011.

CGUE, 7/4/2022, C-668/20, Y GmbH c. Hauptzollamt
Rinvio pregiudiziale – Tariffa doganale comune – Nomenclatura combinata – Classificazione delle merci – Voci 1302, 3301 e 3302 – Oleoresina di vaniglia d'estrazione – Accise – Direttiva 92/83/CEE – Esenzioni – Articolo 27, paragrafo 1, lettera e) – Nozione di

"aroma" – Direttiva 92/12/CEE – Comitato delle accise della Commissione europea – Competenze

1) La nomenclatura combinata contenuta nell'allegato I del regolamento (CEE) n. 2658/87 del Consiglio, del 23 luglio 1987, relativo alla nomenclatura tariffaria e statistica ed alla tariffa doganale comune, come modificata dal regolamento di esecuzione (UE) 2015/1754, della Commissione, del 6 ottobre 2015, deve essere interpretata nel senso che una merce, composta circa dall'85% di etanolo, dal 10% di acqua, dal 4,8% di residuo secco, il cui tenore medio di vanillina è dello 0,5% e che è ottenuta diluendo, a fini di standardizzazione, nell'acqua e nell'etanolo un prodotto intermedio, a sua volta estratto da baccelli di vaniglia mediante etanolo, rientra nella sottovoce 1302 1905 di tale nomenclatura.

2) L'articolo 27, paragrafo 1, lettera e), della direttiva 92/83/CEE del Consiglio, del 19 ottobre 1992, relativa all'armonizzazione delle strutture delle accise sull'alcole e sulle bevande alcoliche, deve essere interpretato nel senso che un'oleoresina di vaniglia rientrante nella sottovoce 1302 1905 della nomenclatura combinata contenuta nell'allegato I del regolamento n. 2658/87, come modificata dal regolamento di esecuzione 2015/1754, deve essere considerata un «aroma», ai sensi di tale disposizione, a condizione che essa costituisca un ingrediente che apporta un gusto o un odore specifici a un determinato prodotto.

CGUE, 9/2/2022, C-35/21, «Konservinvest» ***OOD c.*** «Bulkons Parvomay» ***OOD***

Rinvio pregiudiziale – Articolo 99 del regolamento di procedura della Corte – Regimi di qualità dei prodotti agricoli e alimentari – Regolamento (UE) n. 1151/2012 – Denominazioni di origine e indicazioni geografiche – Articolo 9 – Protezione nazionale transitoria – Indicazione geografica che designa un prodotto agricolo, registrata in base alla legislazione di uno Stato membro e beneficiante di una protezione a livello nazionale

Il regolamento (UE) n. 1151/2012 del Parlamento europeo e del Consiglio, del 21 novembre 2012, sui regimi di qualità dei prodotti agricoli e alimentari, deve essere interpretato nel senso che esso osta ad una normativa di uno Stato membro che prevede un sistema nazionale di registrazione e protezione di designazioni geografiche qualificate, relative a prodotti agricoli e alimentari rientranti nell'ambito di applicazione di tale regolamento, destinato ad applicarsi soltanto alle controversie aventi ad oggetto violazioni dei diritti derivanti da tali designazioni tra operatori di tale Stato membro che producono, nel territorio di quest'ultimo, i prodotti per i quali tali designazioni sono state registrate ai sensi di detta normativa.

CGUE, 13/1/2022, C-881/19, Tesco Stores ČR a.s. contro Ministerstvo zemědělství

Rinvio pregiudiziale – Tutela dei consumatori – Ravvicinamento delle legislazioni – Regolamento (UE) n. 1169/2011 – Allegato VII, parte E, punto 2, lettera a) – Informazione dei consumatori sugli alimenti – Etichettatura e presentazione dei prodotti alimentari – Direttiva 2000/36/CE – Allegato I, parte A, punto 2, lettera c) – Prodotti di cacao e di cioccolato – Elenco degli ingredienti di un alimento destinato ai consumatori in uno Stato membro

L'allegato VII, parte E, punto 2, lettera a), del regolamento (UE) n. 1169/2011 del Parlamento europeo e del Consiglio, del 25 ottobre 2011, relativo alla fornitura di informazioni sugli alimenti ai consumatori, che modifica i regolamenti (CE) n. 1924/2006 e (CE) n. 1925/2006 del Parlamento europeo e del Consiglio e abroga la direttiva 87/250/CEE della Commissione, la direttiva 90/496/CEE del Consiglio, la direttiva 1999/10/CE della Commissione, la direttiva 2000/13/CE del Parlamento europeo e del Consiglio, le direttive 2002/67/CE e 2008/5/CE della Commissione e il regolamento (CE) n. 608/2004 della Commissione, dev'essere interpretato nel senso che un operatore economico, nell'ambito dell'etichettatura di prodotti commercializzati nel territorio di uno Stato membro, è esonerato dall'obbligo di elencare tutti gli ingredienti che costituiscono un ingrediente composto, ai sensi dell'articolo 2, paragrafo 2, lettera h), di tale regolamento, solo se tale ingrediente composto che è oggetto di una denominazione di vendita ai sensi dell'allegato I, parte A, della direttiva 2000/36/CE del Parlamento europeo e del Consiglio, del 23 giugno 2000, relativa ai prodotti di cacao e di cioccolato destinati all'alimentazione umana, è designato, nell'elenco degli ingredienti, utilizzando tale denominazione di vendita, nella versione linguistica dello Stato membro interessato.

AMBIENTE

CGUE, 24/2/2022, C-463/20, Namur-Est Environnement ASBL c. Région wallonne

Rinvio pregiudiziale – Ambiente – Direttiva 2011/92/UE – Valutazione dell'impatto ambientale di determinati progetti – Direttiva 92/43/CEE – Conservazione degli habitat naturali – Articolazione tra la procedura di valutazione e di autorizzazione di cui all'articolo 2 della direttiva 2011/92/UE e una procedura nazionale di deroga alle misure di protezione delle specie previste dalla direttiva 92/43/CEE – Nozione di "autorizzazione" – Processo decisionale complesso – Obbligo di valutazione – Ambito di applicazione ratione mate-

riae – Fase procedurale in cui deve essere garantita la partecipazione del pubblico al processo decisionale
1) La direttiva 2011/92/UE del Parlamento europeo e del Consiglio, del 13 dicembre 2011, concernente la valutazione dell'impatto ambientale di determinati progetti pubblici e privati, deve essere interpretata nel senso che una decisione adottata in forza dell'articolo 16, paragrafo 1, della direttiva 92/43/CEE del Consiglio, del 21 maggio 1992, relativa alla conservazione degli habitat naturali e seminaturali e della flora e della fauna selvatiche, che autorizza un committente a derogare alle misure applicabili in materia di protezione delle specie, per realizzare un progetto, ai sensi dell'articolo 1, paragrafo 2, lettera a), della direttiva 2011/92, rientra nel processo di autorizzazione di tale progetto, ai sensi dell'articolo 1, paragrafo 2, lettera c), di tale direttiva, nel caso in cui, da un lato, la realizzazione di detto progetto non possa intervenire senza che il committente abbia ottenuto tale decisione e, dall'altro, l'autorità competente ad autorizzare un tale progetto mantenga la possibilità di valutarne l'impatto ambientale in maniera più rigorosa di quanto sia stato fatto nella decisione.
2) La direttiva 2011/92 deve essere interpretata, tenuto conto in particolare dei suoi articoli 6 e 8, nel senso che l'adozione di una decisione preliminare che autorizza un committente a derogare alle misure applicabili in materia di protezione delle specie, per realizzare un progetto, ai sensi dell'articolo 1, paragrafo 2, lettera a), di tale direttiva, non deve essere necessariamente preceduta da una partecipazione del pubblico, purché tale partecipazione sia garantita in maniera effettiva prima dell'adozione della decisione che l'autorità competente deve prendere per l'eventuale autorizzazione di tale progetto.

CGUE, 22/2/2022, C-300/20, Bund Naturschutz in Bayern eV contro Landkreis Rosenheim
Rinvio pregiudiziale – Ambiente – Direttiva 2001/42/CE – Valutazione degli effetti di determinati piani e programmi sull'ambiente – Articolo 2, lettera a) – Nozione di "piani e programmi" – Articolo 3, paragrafo 2, lettera a) – Atti elaborati per determinati settori e che definiscono il quadro di riferimento per l'autorizzazione dei progetti elencati negli allegati I e II della direttiva 2011/92/UE – Articolo 3, paragrafo 4 – Atti che definiscono il quadro di riferimento per l'autorizzazione dei progetti – Regolamento sulla tutela paesaggistica adottato da un'autorità locale
L'articolo 3, paragrafo 2, lettera a), della direttiva 2001/42/CE del Parlamento europeo e del Consiglio, del 27 giugno 2001, concernente la valutazione degli effetti di determinati piani e programmi sull'ambiente, dev'essere interpretato nel senso che una misura nazionale volta a tutelare la natura e il paesaggio, che enuncia a tal fine divieti generali e obblighi di autorizzazione senza prevedere norme sufficientemente dettagliate per quanto riguarda il contenuto, l'elaborazione e l'attuazione di progetti menzionati negli allegati I e II della direttiva 2011/92/UE del Parlamento europeo e del Consiglio, del 13 dicembre 2011, concernente la valutazione dell'impatto ambientale di determinati progetti pubblici e privati, non rientra nell'ambito di applicazione di tale disposizione.
L'articolo 3, paragrafo 4, della direttiva 2001/42 dev'essere interpretato nel senso che una misura nazionale volta a tutelare la natura e il paesaggio, che enuncia a tal fine divieti generali e obblighi di autorizzazione senza prevedere norme sufficientemente dettagliate per quanto riguarda il contenuto, l'elaborazione e l'attuazione di progetti non rientra nell'ambito di applicazione di tale disposizione.

ANIMALI

CGUE, 27/1/2022, C-238/20, SIA „Sātiņi-S" c. Dabas aizsardzības pārvalde
Rinvio pregiudiziale – Carta dei diritti fondamentali dell'Unione europea – Articolo 17 – Diritto di proprietà – Direttiva 2009/147/CE – Versamento di un indennizzo per i danni causati all'acquacoltura dagli uccelli selvatici protetti in una zona Natura 2000 – Indennizzo inferiore ai danni realmente subìti – Articolo 107, paragrafo 1, TFUE – Aiuti di Stato – Nozione di "vantaggio" – Presupposti – Regolamento (UE) n. 717/2014 – Principio de minimis
1) L'articolo 17 della Carta dei diritti fondamentali dell'Unione europea deve essere interpretato nel senso che esso non osta a che l'indennizzo concesso da uno Stato membro per le perdite subìte da un operatore economico in ragione delle misure di protezione applicabili in una zona della rete Natura 2000 in forza della direttiva 2009/147/CE del Parlamento europeo e del Consiglio, del 30 novembre 2009, concernente la conservazione degli uccelli selvatici, sia sensibilmente inferiore ai danni effettivamente subìti da tale operatore.
2) L'articolo 107, paragrafo 1, TFUE deve essere interpretato nel senso che un indennizzo concesso da uno Stato membro per le perdite subìte da un operatore economico in ragione delle misure di protezione applicabili in una zona della rete Natura 2000 in forza della direttiva 2009/147 conferisce un vantaggio atto a costituire un «aiuto di Stato», ai sensi di detta disposizione, qualora siano soddisfatte le altre condizioni relative a una tale qualificazione.

3) L'articolo 3, paragrafo 2, del regolamento (UE) n. 717/2014 della Commissione, del 27 giugno 2014, relativo all'applicazione degli articoli 107 e 108 [TFUE] agli aiuti «de minimis» nel settore della pesca e dell'acquacoltura, deve essere interpretato nel senso che, nell'ipotesi in cui un indennizzo come quello descritto al punto 2 del presente dispositivo soddisfi le condizioni di cui all'articolo 107, paragrafo 1, TFUE, a tale indennizzo si applica il tetto degli aiuti «de minimis» di EUR 30 000 previsto da detto articolo 3, paragrafo 2.

CACCIA E PESCA

Corte cost., 15/03/2022, n. 69
Ambiente - Caccia - Norme della Regione Liguria - Modifiche alla legge regionale n. 29 del 1994, recante norme per la protezione della fauna selvatica omeoterma e per il prelievo venatorio - Previsione che per arco temporale massimo, di cui all'art. 18, c. 1 e 2, della legge n. 157 del 1992, si intende il numero complessivo di giornate di caccia fruibili nel corso dell'intera stagione venatoria, riferite a una determinata specie - Previsto divieto temporaneo di caccia a una specie, che sospende la decorrenza dei termini contenuti nel suddetto arco temporale massimo, non necessariamente collocabile all'inizio o al termine della stagione venatoria.
Va dichiarata l'illegittimità costituzionale dell'art. 29, comma 3, della L.R. Liguria n. 32 del 2020 laddove, introducendo la sospensione, durante i giorni di divieto temporaneo di caccia ad una specie, del decorso dell'arco temporale massimo di cacciabilità di cui all'art. 18 della L. n. 157 del 1992, estende la durata del periodo di caccia oltre i limiti normativamente stabiliti. Ciò in quanto la disciplina dei termini per l'attività venatoria è rimessa alla competenza esclusiva dello Stato in materia ambientale, con conseguente vincolo al suo rispetto per il legislatore regionale che non può derogare in peius i livelli di tutela dell'ambiente e dell'ecosistema fissati dalla legislazione statale.

Cass. civ., Sez. III, 09/05/2022, n. 14549
Fauna selvatica – danni da esercizio di attività venatoria – assicurazione – esclusione.
In caso di danni conseguenti all'esercizio dell'attività venatoria, la copertura assicurativa per la responsabilità civile, obbligatoria per legge, non opera per quei danni che sono l'esito della violazione di norme di sicurezza che l'assicurato dovrebbe osservare, non avendo rilievo la violazione di norme che mirano semmai ad organizzare l'attività venatoria secondo altri scopi, e la cui violazione non comporta quindi concretizzazione del rischio di danno.

CONTRATTI

Cass. civ., Sez. III, Ordinanza, 15/04/2022, n. 12383
Affitto – inadempimento al canone – risoluzione
In tema di affitto di fondo pascolativo, ove l'affittuario non corrisponda il canone pattuito, il contratto di affitto deve essere dichiarato risolto per suo inadempimento, ma non è dovuta alcuna maggiorazione del canone o risarcimento del danno in favore del concedente ove non sia da questi allegato e dimostrato che l'uso pascolativo ha interessato un'area di estensione maggiore rispetto a quella oggetto del negozio.

Cass. Civ., Sez. II, 14/04/2022, n. 12206
Enfiteusi – indennità per miglioramenti – limitazioni.
La disposizione dell'art. 975, primo comma, cod. civ., secondo cui l'enfiteuta, quando cessa l'enfiteusi, ha diritto al rimborso dei miglioramenti apportati, nella misura dell'aumento di valore conseguito dal fondo per effetto dei miglioramenti stessi, quali risultino accertati al momento della riconsegna, trova applicazione solo ai miglioramenti che si collocano nell'ambito del rapporto di enfiteusi e che, essendo ancora esistenti alla data della riconsegna, si traducono in un valore economico direttamente o indirettamente riconducibile alla legittima attività dell'enfiteuta o dei suoi danti causa, e non anche ai miglioramenti realizzati dopo la cessazione del rapporto nel tempo in cui l'enfiteuta abbia conservato di fatto il possesso materiale del bene, per i quali, invece, risultano applicabili i criteri generali previsti dall'art. 1150 cod. civ.

Cass. civ., Sez. III, Sentenza, 08/04/2022, n. 11491
Diritto di prelazione e di riscatto - In genere - Riscatto agrario - Pagamento del prezzo di acquisto del fondo - Tempestività - Rifiuto del creditore di accettazione del pagamento - Offerta non formale - Irrilevanza - Offerta reale - Necessità - Obsolescenza, macchinosità ed eccesso di formalismo della "mora credendi" - Esclusione - Fattispecie
Ai fini dell'esercizio del riscatto agrario, il soggetto retrattante, in assenza di collaborazione dei venditori, deve necessariamente effettuare il versamento del prezzo - alla cui tempestiva esecuzione è subordinata l'efficacia del riscatto - mediante l'offerta reale ex art. 1208 *c.c., non potendo valersi di un'offerta non formale - la quale non estingue l'obbligazione, ma produce il solo effetto di non incorrere nella mora del debitore - ed essendo irrile-*

vante la pretesa obsolescenza e macchinosità della "mora credendi", la cui disciplina è fondata su esigenze di certezza giuridica.

Cass. civ., Sez. VI - 3, Ordinanza, 25/03/2022, n. 9781
Controversie - Procedimento - Competenza e giurisdizione - Sezioni specializzate - Competenza - Controversia relativa all'indennità per miglioramenti apportati al fondo rustico - Inclusione - Domanda formulata ai sensi dell'art. 2041 c.c. - Irrilevanza - Ragioni
La controversia relativa all'indennità per i miglioramenti apportati ad un fondo agricolo, oggetto di contratto di affitto di azienda agricola, rientra nella competenza esclusiva delle sezioni specializzate agrarie, essendo attribuite a detto giudice tutte le controversie in materia di contratti agrari, sia sotto il profilo della genesi del rapporto che del suo funzionamento o della sua cessazione, anche ove la decisione venga assunta sulla base delle norme generali del codice civile; è irrilevante, pertanto, che la domanda sia proposta ai sensi dell'art. 2041 *c.c. piuttosto che dell'*art. 17 *della* l. n. 203 del 1982, stante la natura indennitaria, e non risarcitoria, della pretesa azionata, che configura una ipotesi di responsabilità da atto lecito connessa con attività realizzate nell'esecuzione del contratto

Cass. civ., Sez. VI - 3, Ordinanza, 03/02/2022, n. 3438
Controversie - Procedimento - Competenza e giurisdizione - Sezioni specializzate - Competenza - Locazione di un fabbricato con annesso fondo rustico per lo svolgimento di un'impresa agricola - Competenza della sezione specializzata agraria - Esclusione - Fondamento
La controversia in materia di locazione di un fabbricato con annesso fondo rustico per lo svolgimento di un'impresa agricola non è di competenza delle sezioni specializzate agrarie non essendo sufficiente a configurare un contratto agrario né la destinazione agricola del fondo, né la qualità di imprenditore agricolo del conduttore.

CONSORZI

Cass. civ., Sez. V, Sentenza, 08/04/2022, n. 11431
Contributi consortili - Obbligo contributivo - Presupposti - Beneficio fondiario - Esistenza del perimetro di contribuenza o del piano di classifica - Rilevanza ai fini del riparto dell'onere probatorio
In tema di opposizione a cartella di pagamento avente per oggetto contributi di bonifica, il presupposto impositivo che consiste, ai sensi degli artt. 860 *c.c. e 10 del* r.d. n. 215 del 1933, nel vantaggio diretto ed immediato per l'immobile, deve ritenersi presunto in ragione dell'avvenuta approvazione del piano di classifica e dell'inclusione dell'immobile nel perimetro di intervento consortile, sicché spetta al contribuente l'onere di provare l'inadempimento del consorzio agli obblighi derivanti dalle indicazioni contenute nel piano di classifica; in assenza di tali requisiti, grava, invece, sul consorzio l'onere di provare che il contribuente sia proprietario di un immobile sito nel comprensorio, nonché il conseguimento, da parte del suo fondo, di concreti benefici derivanti dalle opere eseguite.

IMPRESA AGRICOLA

Cass. civ., Sez. VI - 1, Ordinanza, 22/03/2022, n. 9357
Consorzi – fallimenti – accertamento presupposti.
Ai fini del fallimento di un consorzio di cooperative agricole, è necessario che il giudice verifichi sia le clausole statutarie ed il loro tenore, sia l'attività d'impresa svolta in concreto. Ciò in quanto il riscontro del perseguimento dello scopo mutualistico non è assorbente della verifica degli altri presupposti di legge.

Cass. civ., Sez. VI - 1, Ordinanza, 22/03/2022, n. 9353
Imprenditore agricolo – fallimento – esenzione – onere della prova.
L'esenzione dell'imprenditore agricolo dal fallimento postula la dimostrazione, da parte di chi la invoca, in ossequio all'art. 2697, comma 2, cod. civ. e del principio di vicinanza della prova, della sussistenza delle condizioni per ricondurre l'attività di commercializzazione dei prodotti agricoli esercitata nell'ambito di cui all'art. 2135, comma 3, cod. civ., dovendosi segnatamente dimostrare che essa ha come oggetto prodotti ottenuti prevalentemente dalla coltivazione del fondo.

Corte d'Appello Bari, Sez. lavoro, Sentenza, 11/02/2022, n. 215
Impresa agricola – lavoratori agricoli – iscrizione all'elenco – onere della prova
L'iscrizione di un lavoratore nell'elenco dei lavoratori agricoli svolge una funzione di agevolazione probatoria ai fini dell'attribuzione di prestazioni previdenziali che viene meno qualora l'INPS, a seguito di un controllo, disconosca l'esistenza del rapporto di lavoro, esercitando la facoltà di cui all'art. 9 *del* D.Lgs. n. 375 del 1993; ne consegue che, in tal caso, il lavoratore ha l'onere di provare l'esistenza, la durata e la natura onerosa del rapporto dedotto a fondamento del diritto all'iscrizione e di ogni altro diritto consequenziale, fermo restando che, nella controversia avente ad oggetto la prestazione

previdenziale, lo status di lavoratore agricolo può essere accertato solo incidentalmente.

IMPOSTE, TASSE E CONTRIBUTI

Cass. civ., Sez. V, Ordinanza, 14/03/2022, n. 8278
Piccola proprietà contadina - Agevolazioni tributarie - Agevolazioni fiscali in favore della piccola proprietà contadina ex art. 2 d.l. n. 194 del 2009 - Iscrizione alla gestione previdenziale ed assistenziale del coltivatore diretto o dell'imprenditore agricolo professionale presso l'inps - Necessità - Condizioni - Conseguenze
L'iscrizione alla gestione previdenziale INPS, richiesta al fine di ottenere l'agevolazione per favorire la piccola proprietà contadina di cui all'art. 2, comma 4-bis, del d.l. n. 194 del 2009 in sede di stipula dell'atto, non può che conseguire da una domanda presentata dal soggetto interessato e l'eventuale retrodatazione dell'obbligazione contributiva (che, di quella iscrizione, costituisce l'effetto giuridico principale) implica che la richiesta di iscrizione (ancorché accolta con riserva) sia stata effettivamente presentata

T.A.R. Friuli-V. Giulia Trieste, Sez. I, 18/01/2022, n. 27
Prodotti agricoli – prelievo supplementare – iscrizione a ruolo – atti presupposti
In materia di agricoltura, relativamente al tema di iscrizione a ruolo di somme dovute a titolo di prelievo supplementare sulle consegne per la campagna lattiera (c.d. prelievo latte), gli atti di accertamento/imputazione del prelievo supplementare costituiscono un presupposto necessario rispetto all'emissione della cartella di pagamento in caso di mancato versamento della somma dovuta e come in tali atti accertata, essendo provvedimenti amministrativi lesivi della posizione giuridica soggettiva dei destinatari, restando, in mancanza privi di efficacia.

PARCHI E AREE PROTETTE

Corte cost., 09/05/2022, n. 115
Ambiente - Parchi e riserve naturali - Norme della Regione Lazio - Modifica della perimetrazione del Parco naturale regionale dell'Appennino "Monti Simbruini", istituito con la legge regionale n. 8 del 1983.
Sono infondate le questioni di legittimità costituzionale dell'art. 1 della legge della Regione Lazio 1° luglio 2021, n. 8, nella parte in cui l'ampliamento del parco naturale regionale "Monti Simbruini" è avvenuto con atto legislativo anziché con il piano per il parco, così eludendo la necessaria partecipazione delle province, dei comuni e delle comunità montane al relativo procedimento, prescritta da detta legge quadro, poiché, nel silenzio del legislatore statale, deve ritenersi che riacquisti il suo spazio l'autonomia regionale, alla condizione che siano ovviamente rispettati i princìpi stabiliti dalla legge quadro del 1991, con la conseguenza che – per quel che riguarda la perimetrazione definitiva, la quale segue quella provvisoria fatta al momento dell'istituzione dell'area protetta – è implicito nel sistema legislativo statale che essa possa essere affidata dalla legge regionale ad una fase procedimentale successiva, ed in particolare al piano del parco; mentre per quel che riguarda la riperimetrazione – la quale presuppone un'area protetta già esistente a tutti gli effetti (e, dunque, non solo provvisoriamente ma anche definitivamente delimitata) – essa può essere affidata tanto a modifiche del piano per il parco, quanto alla legge regionale.

USI CIVICI

Corte cost., 02/12/2021, n. 228
In genere - Caratteri e tutela - Disciplina - Necessità di regolamentazione uniforme dell'istituto su tutto il territorio nazionale - Disciplina regionale (nella specie: della Regione Abruzzo) dei criteri di priorità ai fini della assegnazione delle terre civiche di pascolo da parte dei Comuni e degli enti gestori - Violazione della competenza esclusiva statale nella materia dell'ordinamento civile - Illegittimità costituzionale
La sovrapposizione tra tutela dell'ambiente e tutela del paesaggio, introdotta dalla legge n. 431 del 1985, si riflette in uno specifico interesse unitario della comunità nazionale alla conservazione degli usi civici, in quanto essi concorrono a determinare la forma del territorio su cui si esercitano, intesa quale prodotto di una integrazione tra uomo e ambiente naturale. Il riconoscimento normativo della loro valenza ambientale - in attuazione, tra l'altro, dell'art. 9 Cost. - ha determinato, da un lato, l'introduzione di vincoli diversi e più penetranti e, dall'altro, la sopravvivenza del principio tradizionale, secondo cui eventuali mutamenti di destinazione - salvo i casi eccezionali di legittimazione delle occupazioni e di alienazione dei beni silvo-pastorali - devono essere compatibili con l'interesse generale della comunità che ne è titolare. La nozione di «dominio collettivo» - quale diritto reale, riservato a una comunità, di usare e godere congiuntamente in via individuale o collettiva di un bene fondiario o di un corpo idrico sulla base di una norma preesistente all'ordinamento dello Stato italiano - è un diritto soggettivo dominicale, che, quale proprietà

collettiva, si colloca tra quelle, privata e pubblica, previste dall'art. 42, primo comma, Cost., avente ad oggetto un bene economico riferibile all'ente esponenziale della collettività degli aventi diritto. La natura della situazione giuridica soggettiva attribuita dall'ordinamento per tutelare l'interesse dei singoli membri della collettività all'uso promiscuo dei beni collettivi, è quella di diritto soggettivo dominicale, presentando le caratteristiche tipiche del diritto di proprietà, quali, in particolare, la "realità", l'"assolutezza" e l'"inerenza" Gli usi civici e ora i domini collettivi presentano i caratteri della proprietà comune, sia pure senza quote, su un bene indiviso; essi sono tutelabili con azione petitoria. L'attribuzione alla potestà legislativa esclusiva dello Stato della materia «ordinamento civile» trova fondamento nell'esigenza, sottesa al principio di uguaglianza, di garantire nel territorio nazionale l'uniformità della disciplina dettata per i rapporti tra privati. Sia prima che dopo la riforma del Titolo V della Parte II della Costituzione, del 2001, il regime civilistico dei beni civici non è mai passato nella sfera di competenza delle Regioni e i decreti del Presidente della Repubblica con cui sono state trasferite, a queste ultime, le funzioni amministrative, non consentivano nel vigore del vecchio Titolo V (né consentono oggi, nel mutato assetto costituzionale) alle Regioni di invadere, con norma legislativa, la disciplina di tali assetti fondiari collettivi, estinguendoli, modificandoli o alienandoli. (Nel caso di specie, è dichiarato costituzionalmente illegittimo, per violazione dell'art. 117, secondo comma, lett. l, Cost., l'art. 9, comma 1, lett. c, della legge reg. Abruzzo n. 9 del 2020, nella parte in cui inserisce il comma 3-bis, lett. a, b, c e d, all'art. 16 della legge reg. Abruzzo n. 25 del 1988, introducendo criteri di priorità ai fini della assegnazione delle terre civiche di pascolo da parte dei Comuni e degli enti gestori, prevedendo che esse siano conferite anzitutto agli abitanti del Comune o della frazione che possono vantare i seguenti requisiti dalla medesima disposizione indicati. La norma impugnata dal Governo non si limita alla disciplina dell'esercizio delle funzioni amministrative in materia di usi civici, ma incide - peraltro in modo difforme da quanto previsto dalle norme statali in materia, così pregiudicando la necessaria uniformità della regolamentazione dell'istituto su tutto il territorio nazionale - sul regime della titolarità e dell'esercizio dei diritti dominicali sulle terre collettive, escludendo indebitamente dal godimento promiscuo alcuni membri della collettività territoriale).

Finito di stampare da
Logo s.r.l. – Borgoricco (PD) – Italia

A E S T I M U M

Vol. 80 – 2022

CENTRO STUDI DI ESTIMO E DI ECONOMIA TERRITORIALE - Ce.S.E.T.

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