

# Proposal For Rustic Cadastral Valuation

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## **SUMMARY:**

An overview is provided of the status of cadastral valuation in Latin America: general issues, legal frameworks, technical procedures, fiscal issues and consequences; justifying the presentation of a new normative technique – flexible, agile, rigorous, administratively impeccable and technically feasible.

We aim to automate data capture and computerize the mass processes, following the parameters of FIG without neglecting the participation of cadastral technicians, in order to obtain a cadastral value which will be comprehensible to the relevant citizens and administrations: the taxpayer, justice authorities, notary, property registry, etc.; and not a mere formula which is simply applied without knowing how and why it obtains a given result.

## **RESUMEN:**

Se ofrece una visión general sobre la situación de la valoración catastral, con especial énfasis en Iberoamérica: problemáticas, marcos legales, procedimientos técnicos, fiscalidad y consecuencias; lo que justifica la presentación de una propuesta de normativa técnica, flexible, ágil, rigurosa, administrativamente impecable y técnicamente posible.

Se ha intentado automatizar la captura de los datos e informatizar los procesos masivos, siguiendo los parámetros de FIG, sin dejar de lado la participación de los técnicos catastrales, con objeto de obtener un valor catastral que sea comprensible por los ciudadanos y administraciones implicadas: contribuyente, justicia, notaría, registro de la propiedad, etc.; y no una mera fórmula que se aplica y que pocos saben cómo y por qué ofrece un resultado.

## 1.- PRESENTATION

Regulatory and technological advances in urban cadastral valuation have not been paralleled in rural areas and in recent decades the product of this work, the value of rural land, has not offered the guarantees required of an administrative activity that reports directly to the State (Ministry of Finance, Justice Department, etc.). The reasons for this situation can be summarized under the following headings:

- a decrease in the territorial tax burden levied on rural areas,
- increasing complexity in the estimation of agricultural values,
- declining importance of agricultural income in determining land value.

The immediate consequence of this is that "rural land value" data become valid exclusively for fixing property taxes, but not for many other applications which could be claimed from the economic, technical and financial effort required for their estimation: in expropriations, in the formalization of property, in real estate credit valuation, urban activities and so on.

Unfortunately the consequences are not confined to a simple lack of further exploitation but spread to the cadastral project as a whole, and this lowers the potential quality of an entire comprehensive program, limiting the pretensions of many of the proposed multipurpose cadastre models.

In agrarian societies there is a clear coincidence between personal and familiar wealth and land ownership, as this has traditionally been their livelihood, the justification of a certain social status and the sign of identity of peasant communities. Following this line it is easy to locate land reform processes and the formalization of land ownership as attempts to facilitate settlement of the population in rural areas and to ensure self-sufficiency in food. However this reality gradually decreases as people obtain resources in other ways and mobility of people and money increases. Nevertheless, the land continues to enjoy an undeniable appeal in all societies because of:

1. greater security, embodied in an almost guaranteed capital gain in the short, medium and long term;
2. a steady income which over time can be considered, in many cases, permanent, constant and indefinite.

The traditional parameters which almost entirely explain the value of land based on its agricultural income, weighted according to the distance between the farm and residence and the focus market for the products obtained (population), have retreated in favor of others such as: the future expectations of urban exploitation, business, industry and tourism; and the ease of agricultural exploitation to absorb money of dubious fiscal transparency. These non-agricultural aspects have fostered an increased in land value, sometimes above its potential or actual production, so that the use of traditional income updating methodology ( $V = rta / i^1$ ) to estimate property values does not satisfy the current needs.

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<sup>1</sup> Value = income / capitalization rate ( $V = i/r$ ), in the case of permanent income which is continuous and indefinite in time.

Moreover, rural areas have seen an increase of some of the problems which also occur in urban areas, such as those directly related to:

- Identification and demarcation of property.
- Identification of owners, although it is increasingly more common for these to have documents substantiating their claims.
- dispersion and diversity of crops and produce.
- the unique and unrepeatable character of each and every one of these goods.

Consequently, to the already difficult task of evaluating rural land is added greater complexity in the development, management and conservation of land registration.

In this paper we outline the reality of some rural land valuation procedures already in place, evaluate the direct consequences of the products obtained, and propose a new methodology to improve results and obtain a value of rural land in accordance with the legislative framework. This methodology is simple and understandable, allows easy mass updating and does not require added financial resources.

## **2.- MODELS**

The most widely-used cadastral valuation models of rural properties can be grouped into three blocks which while they do not always present a clear partitioning in their application may be hybridized models seeking a better adaptation to local conditions within a clearly imperfect market:

1. Those in which a methodology is applied for updating the income, actual or potential, calculated by assigning a rating (cultivation) and classification (quality) to the property, within a technical and administrative framework which describes the territory in agronomic terms.
2. Those others in which documentation is collected and merged from multiple sources in order to obtain an approximate value of large patches of land. Maps are employed which delimit land use, quality and distance from commercial nuclei. These data are weighted and processed using procedures which are generally highly questionable and poorly transparent.
3. A final large group articulates its work in identifying farms representative of the local agrarian reality, which are assigned a value per unit area. This economic unit is multiplied by the surface area occupied by the premises to be valued, and the final values are adjusted using a limited, complex and uncertain set of weightings.

Models that do not fully meet the current cadastral needs, for the reasons set out briefly below:

- 1.- Income cannot explain, by itself, the value of an estate. It is true that it remains the most important component in land of solely agrarian use, but there are other explanatory variables that directly influence the formation of market value. Moreover, income estimation is already a problem in itself, one compounded

by the fact that the choice of a capitalization rate must take into account the characteristics of the culture and geographic location of the property.

For these reasons research currently being developed aims to identify, test and deploy a formula that relates value (endogenous variable) with other easily measurable variables (exogenous variables). That is to say, in addition to agricultural income to take into consideration variables such as the distance to urban nuclei, difficulty in tillage, financial assistance to farming, farm size, available labor, etc., in such a way that these can be determined mathematically by an expression of type [1]

$$V = f ( X_1, X_2, \dots, X_N ) \quad [1]$$

Where "V" represents the cadastral value and "Xi" the explanatory variables chosen.

The use of geo-referenced econometric models is possible in areas where there is sufficient information to ensure the validity of the results for cadastral purposes. These are useful for estimating the weight of the explanatory variables, calculating the "statistical" cadastral value (Aragón, 2011), and the design of cadastral housing market observatories (CHMO)

- 2.- In line with the latter paragraphs, the "crossing" of different maps and geo-referenced data, such as: agrolological soil classification, the productive capacity of land, restrictions on certain crops, climate, slope, precipitation, topsoil texture, the effective depth of the topsoil, drainage, fertility levels, acidity, sun exposure, winds, frost, erosion, etc. may have valid results with enough information, and the level of detail (scale) required for the identification and assessment of each and every one of the parcels or units into which productive farms can be divided. Otherwise the result would be a generalization, to the smallest scale (e g 1/200,000) of the other information, and this probably would not match that required in the workplace to identify cadastral parcels (1/5,000 ), so that the result would be totally distorted.

The attached figure (Figure 1) shows this graphically: At 1/5,000 scale are marked plots or farms, with their information boundaries, crops and land use. This mapping is "crossed" with a map of soil classes (1:50,000), another of frost risk (1/200,000) and finally a drainage map (1/500,000). The practical result of this example would be the assignment, to the 49 different plots reflected in the mapping at 1/5,000 of four indices of frost (1/200,000) and a single level of drainage (1/500,000). The market probably does not respond to this degree of generalization and it would be necessary to "cross" maps at the same level of detail, the fact that this is not available making the initiative non-viable

Consequently, the valuation process discussed above is useful for providing guidance on the values of large areas of land, based on the smallest scale, but the results are not directly transferable to areas in which the degree of fragmentation is high or of medium level. The process may be feasible only on large estates with little subdivision and of homogeneous agronomic characteristics (Pampa, rainforest, etc.), but in this case it is not necessary to address such a complicated process when there exist simpler, perfectly valid and contrasted alternatives.

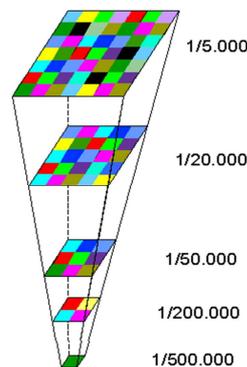


Figure 1.- Graphic information at different scales, used to assign values to cadastral plots.

- 3.- Except in areas where there is a clear monoculture, homogeneous fragmentation, similar infrastructure and comparable production this is not a viable alternative, given that the group of estates selected as representative of the agrarian situation could be so high that their number would be comparable with the number of cadastral units to be valued. Supported by the synthetic method known as Serpieri (Alcázar, 2012), the method is used in homogeneous areas in which processes of concentration or agrarian reform have been undertaken, and in which specific assessments have also been carried out by competent technicians with the approval of the current owners.

To these previous models can be added other initiatives aimed at assigning values, massively and automatically, to rural and urban properties. Among these processes should be emphasized kriging (Chica, 1996); others attempting to translate ideas, concepts and methodologies from the securities industry, and artificial neural networks (Ramos, 2009), useful in the creation and management of CHMOs.

Consequently, the overall administrative aim is to search for a formula capable of calculating in a reasonable manner an assessed value for rural properties, which have as reference the market value. The above statement presents a number of issues worthy of comment:

- Formula: in many cases this is what is sought, a formula, approved by the respective official bulletin and applied by law and which solves the evaluative

problem, with no option of interpretations or claims supported by methods other than the one imposed.

- Reasonably: that of a value being obtained for property which ensures tax collection without encouraging fiscal disobedience.
- Market value: what is considered as such, how it is identified and how or how much the reference is to be fixed in order to minimize the number of potential claims

Meanwhile, each cadastral valuation model articulates methodologies, pure or hybrid, supported by the aforementioned sections, which allow compliance with the requirements of the project but sometimes do not offer sufficient guarantees to citizens, nor allow the logical and rational reuse of the "assessed value" data. In fact one could speak of a cadastral value calculated "on the defensive", which enables the quantification of the tax base of property taxes and avoids the flow of resources against the estimated values, but will have few uses outside its specific scope.

The efforts employed to achieve rigorous mapping, an accurate division of estates and correct agro-economic data capture must be consistent with those aimed at obtaining a cadastral value commensurate with the demands of the modern, agile and multipurpose cadastre sought. Neither should the administrative and legal aspects be allowed to take precedence over evaluative technique.

Finally, there are cadastral models in countries which devote substantial resources to the development of cadastral mapping, in which self-appraisal is used to allocate cadastral value to property. Although supposedly verified, these do not offer any sort of confidence because even though the declaration of an owner may be real, how can this value be coordinated with that of the adjoining property? Does one neighbor lie or is the other ignorant of the value of what he possesses?, How are the values of properties updated when they are not transferred?, On which figure will the corresponding territorial tax be calculated?.

It thus remains clear, as indicated earlier in this section: if urban cadastral evaluation is complex it is even more so in the countryside. It is therefore not surprising that both university research centers and cadastral institutions are working along the lines of designing and implementing a methodology capable of making this (economic) cadastral feature comparable with the rest (physical, legal and fiscal).

### **3.- THE NEED FOR A REGULATORY ASSESSMENT TECHNIQUE**

Many examples can be identified where rustic cadastral values assigned to different homogeneous agronomic units do not correspond to the reality of the market, which is the general reference in most of the models consulted. In a similar vein, a common and widespread practice is the gathering of agronomic information (culture), and the assignation of a weighting according to its estimated quality. Among other reasons, this decision is justified not only for the purpose of estimating the value, but also for generating a map of the national crop and land use, allowing a large variety of statistical activities and appropriate management of production and the territory as a whole.

As an example we have chosen the Spanish cadastre model, a register of high quality but which provides a rustic valuation far removed from market realities. The cause of this situation is not the technical procedure followed, which is correct, but the downgrading of some of the explanatory variables used.

Under the revised Law of Real Estate Cadastre<sup>2</sup>, cadastral value is calculated by capitalizing current effective income. Specifically, in its second transitional provision it states that: "Until that moment, the cadastral value of those goods will be the result of capitalizing at three percent the amount of payable bases in effect for the levy of the Land Tax for Agriculture and Livestock of the year 1989, obtained through the application of the evaluatory rates of said contribution, extended by Royal Decree-Law 7/1988 (29 December), or those later having been approved to replace them, and without prejudice to its annual updating through the coefficients established and to be established by the Laws of the State Budget, once incorporated the cadastral changes experienced or to be experienced in each fiscal year. "

Following the procedure described above yields the data shown in Table n°. 1 (column n° 6), which also includes the average market values of these crops (column n°. 7) and the differences (in percentage, last row) between the two figures, all in an agricultural region representative of the agrarian reality.

Table n° 1. – Calculated cadastral values and those of the market

Crop	Key	PPI	LPI	ET (€)	Cadastral V./Ha (2012)	Market V./Ha (2012)	Increment (%)
Dryland	C-	1	1	17,43	734	15903	2166%
Dryland	C-	3	2	15,63	658	13252	2013%
Dryland	C-	7	3	11,72	494	8835	1789%
Irrigation	CR	6	1	88,95	3747	28272	754%
Irrigation	CR	14	2	52,29	2203	24738	1123%
Irrigation	CR	17	3	42,67	1798	20320	1130%
Irrigation	CR	21	4	24,34	1025	15903	1551%
Uncultivated – Pasture	E-	2	0	1,38	58	3092	5310%
Non-productive	I-	1	0	0,00	0	0	0%
Scrub	MT	1	0	1,02	43	2871	6671%
Dryland Olive	O-	6	1	37,86	1595	37106	2326%
Dryland Olive	O-	11	2	25,24	1063	33573	3157%
Dryland Olive	O-	17	3	12,62	532	28272	5317%
Dryland Olive	O-	23	4	7,21	304	22087	7269%

<sup>2</sup> Royal Decree 1/2004 (5 March), approving the revised text of the Law of Real Estate Cadastre (TRLR04)

Irrigated Olive	OR	7	1	37,26	1570	63611	4052%
Irrigated Olive	OR	9	2	28,85	1215	57427	4725%
Irrigated Olive	OR	11	3	22,84	962	39757	4132%
Tree bank	RI	1	0	33,66	1418	4417	312%
Dryland Vineyard	V-	3	0	18,03	760	24738	3257%

The result of this table is figure 2, which highlights the vast difference between calculated cadastral values and market values, but the problem lies not simply in this dispute but rather in the dispersity in relations: between 312 and 7,200 percent.

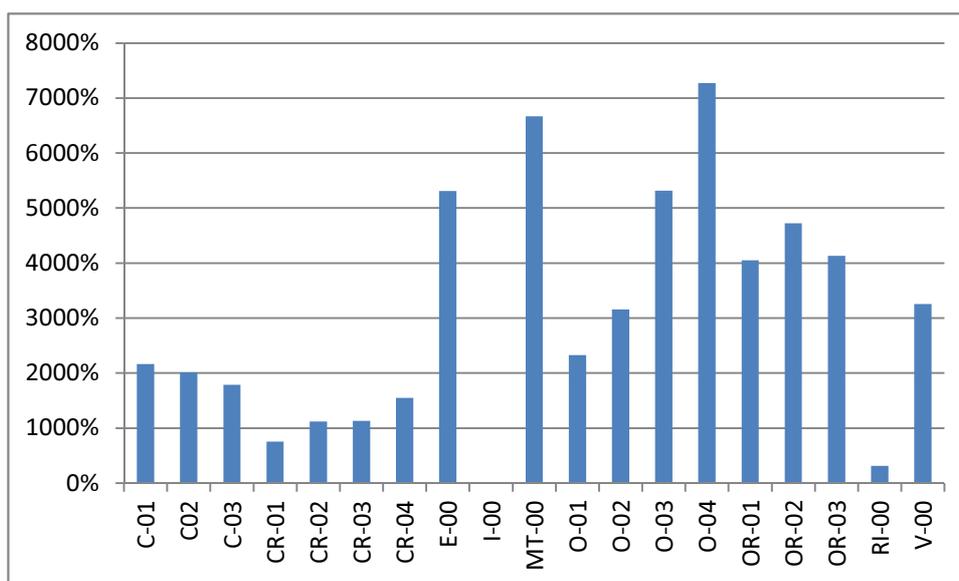


Figure nº 2.- Percentage differences between cadastral and market values.

The situation described above, which takes as its example the Spanish Cadastre (currently one of the best), can be found with different nuances in many other places. Thus what is required is to design a Technical Normative for Rural Real Estate Valuation (TNRREV) that allows:

- ↪ Cadastral management to have a database that reflects the reality of the real estate market;
- ↪ Local authorities to have cadastral values at their disposition in order to adjust property tax bases, and
- ↪ Different administrations and individuals reliable information to use within useful parameters for testing values in private capital transfers, expropriations, statistical studies, social and mortgage purposes, etc.

Many uses and applications can be derived from up to date cadastral information, particularly for use in property tax evaluation. For this reason the valuation

methodology used in determining the cadastral value of assets of a rural nature and its implementation and updating must have the confidence and security of the taxpayer. It would be difficult to justify the development of a cadastral valuation method which, clothed in theory, demonstrations and computer and mathematical processes, does not clearly show the citizen how and why a particular value is assigned to a building that he owns, especially if one considers that in the development of a rural cadastre most of the assessments are easily accepted by the affected parties:

- The surface area is assessed through topographic, cartographic, photogrammetric and remote sensing techniques, the exact method not being especially important, with a result which the owner trusts.
- The legal identification of the taxpayer and his obligation to declare any modification which might affect this.
- The clear and precise identification of existing crops and agricultural holdings, including the estimation of real and potential income from the property.

We support the Tax Office's continuance of its policy of clarity, that the taxpayer pay his debt (if applicable) on a tax base that he understands and about which he feels secure and confident<sup>3</sup>.

The design of the process of real estate valuation of a rural nature is at present in Spain conditioned by the legal structure which regulates it, and by the multitude of data collected in relation to the cadastral description of land and buildings used in agriculture. It is true that there is an advantage in using cadastres which have already been developed and maintained, but it is also true that the design of the valuation methodology has two conditions that follow the direction set by cadastral legislation. These limitations make it difficult to achieve this goal, already difficult in itself, if one takes into account the number of units to assess and their immediate tax purposes.

Moreover, the full assumption of data from different administrations (unless used simply in a complementary way) is not recommended due to the different purposes which led to their capture or the different classification of crops and land use. Different courses of action may converge at one time or historical period, for various reasons, but then each must meet the needs of the project for which they were created and funded, and therefore it would not be advisable to leave cadastral processes to other administrations or agencies (although, of course, of unquestionable validity and seriousness) outside the cadastral institution

The day to day reality of real estate shows that all properties are different, no two are identical. This assertion is reinforced in the case of rural estates, because they contain a greater number of variables and are even more heterogeneous than properties of an urban nature. They can or should be considered as agricultural holdings in which the factor of human enterprise intervenes directly. They are divisible or appendable, with

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<sup>3</sup> There are, however, some restrictions to this desire on the part of the Treasury which require the use of coefficients and mathematical processes, however, their application can enjoy the same guarantees if they are sufficiently explained.

varying results in either case, the agronomic conditions are not reproducible and the product market is conditioned by many influences outside the agricultural sector. These, along with other agronomic conditions of an anthropological character, form a rural reality difficult to structure and, accordingly, to quantify and interpret.

It is therefore urgent to upgrade rural cadastral values through the development and approval of a Technical Standard which, in accordance with existing legislation on cadastre and taxation, will be able to incorporate the peculiarities of the great diversity of properties distributed throughout the rural area. At the same time the taxpayer must also be taken into consideration so that the evaluative process will provide the guarantees, reliability and security necessarily implicit in any administrative action.

Finally, although the Spanish rustic cadastre has been chosen as the theme of this text, the situation is very different from that which can be found in other cadastral models, many of which present even greater problems and deficiencies. Therefore, what is stated here can be generalized to many of the existing rustic and rural cadastral models, supported by the compilation of a small number of explanatory variables which as a rule are already known and accepted by the owners of the properties (crops and qualities).

#### **4.- STUDIES OF RURAL REAL ESTATE MARKET PRICES**

Regardless of the system chosen for fixing the land tax base, based on production (real or potential) or on the calculated cadastral value, it is considered essential to know the reality of the local property market and the territorial structures of a higher order (regional, provincial, departmental, etc.). The international cadastral tendency is to seek a rateable value, taking as reference and limit the market value, which can be employed in alternative uses and allow for automatic and massive checking and updating according to its own evolution.

There exist several different approaches to conducting a study of the rural housing market, but as this is not the purpose of this paper a description and analysis of these is presupposed. However, it is interesting to mention the current trend of performing these studies using ANNs, which enable us to analyze and draw conclusions quickly and efficiently on qualitative and quantitative variables (Gonzalez-Carpio, 2011).

#### **5.- PROPOSAL**

The need to upgrade rural values, or where applicable to assign a mass deployment process, requires the prior approval and design of a TNRREV. The framework within which this assessment procedure should be developed is the one described below:

1. A methodology that is easily applicable, upgradeable, rigorous and administratively impeccable and which allows for effective coordination between different territorial areas.
2. Support this with objective and quantifiable parameters which reduce the subjective burden all the valuations have and will have.

3. Minimize the volume of information to capture using traditional methods to promote the use of that available in the various existing databases, in an automatic manner.
4. The results should be able to be used in other administrative applications, private and corporate.
5. The whole process should be managed and automated through the Cadastral Geographic Information System (CGIS).
6. The assessment, once the necessary information is provided, should be realized through mass action, interrelating the different characteristics of the plots and the explanatory variables of their values.
7. A Procedure must be established for updating cadastral values, taking as reference those of the market, within the planned administrative and tax time limits.
8. The different alternatives for this rural terrain should be taken into consideration: prospects for administrative reclassification (urban development), environmental value, etc.

This would give a theoretical estimate of property value. An administrative value (in the proposed model) is set through the analysis of a number of representative samples of the market, taking into account the characteristics of the plot / subplot to assess. This is not its actual price, but an approximation to it through the tools that evaluative science gives technicians. Nevertheless, it would be considered "market value", which is what the cadastral law stipulates, and could be taken as both reference and limit for calculating the cadastre, and the respective tax and liquidity bases.

A large part of cadastral law (including spanish law) establishes that cadastral value is "the (value) determined objectively for each property from the data contained in the Real Estate Cadastre and composed of the assessed value of land and the assessed value of buildings<sup>4</sup>. "Taking into account, for its determination, the following criteria:

1. The location of the property, the urban circumstances affecting the soil and its suitability for production.
2. The material execution cost of construction, the contractual benefits, professional fees and taxes levied on the construction, the use, quality and edificatory age and the historical, artistic or other conditions of buildings.
3. Production costs and benefits of business development, or factors that apply in its absence.
4. The circumstances and values of the market.
5. Any other relevant factors determined by regulation.

From a practical point of view the foregoing considerations can be summarized, with respect to rural areas in [3]:

$$V_{CBI} = V_{C.SUELO} + V_{C.CONST} \quad [3]$$

Which becomes, according to the proposal that arises, in [4]:

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<sup>4</sup> TRLC04, article 23.

$$V_{CBI} = ( \sum V_{C.SUBP} + AUA ) + \sum V_{C.CONST} \quad [4]$$

In which:

- $V_{BI}$  : Value of the property (plot / farm / estate)
- $V_{C.SUELO}$ : Cadastral value of land
- $V_{C.SUBP}$  : Cadastral value of subplot
- $V_{CONST}$  : Value of construction
- AUA : Value of alternatives to non-agricultural use

These addends continue to present a problem, but they can be analyzed independently in the search for solutions, also independent, to be grouped later in order to set the cadastral value of the rural property.

### 5.1.- Cadastral value of the subplot ( $V_{C.SUBP}$ )

Within the so-called synthetic valuation methods the one known as the Marenghi method of correction or typical values provides a practical adjustment of the value of different crops in relation to one of them taken as a reference (Alcázar , 2012). Professors Iruretagoyena and Alonso (1995) define this, citing Medici and Michieli, as the " typical values method " and consider it to be "the embryo to the application of American methods based on regression theory with those which one can know which weighting coefficient is to be applied to each feature based on the behavior of the values used in the initial information."

This broadly consists of:

1. Conducting a market study of crops and produce that can be differentiated (similar to cadastral subplots) and obtaining their average value.
2. Percentuating the value of each one of them in relation to the most representative, to which a100% coefficient is assigned.
3. Dividing the property being valued into as many units (subplots) as can be assessed with reference to their agronomic, topographic, productive and other characteristics. The surface value for each of these is estimated and assigned its corresponding percentage according to the provisions outlined in the previous point.
4. Assessing the property as a result of the sum of all the percentuated surfaces of the subplots, multiplying the result by the value which corresponds to that taken as a reference.

The use of this method in estimating cadastral value, taking as reference the market value and considering its viability for production allows the automation, at an early stage, of the process . This is because it relies on only a few variables and determines, from time to time and through proper management of the CHMO, the respective weight of each of the selected crops in carrying out its regular updating. In order to facilitate understanding of this process the following example is included.

Example: In a provincial, district or local (preferably local) market study, the different qualities and products of the plots are identified, as well as the corresponding value per unit area. These classes can be likened perfectly to the different cadastral productive intensities, and thus each is assigned a market value. Thereupon all of them are interrelated in terms of olive trees (O-2), chosen as the reference in this example (Table n°. 2).

Table n°. 2. - Table of market values, divided by crops and class, using the value of class 2 dryland olive (O-2) as reference (100%)

Crop	Grade	Surface in Has.	% of total surface	Value / Ha. (c.u.)	% of value/ over O-2
Almond trees	1	225	1,889	1000	66,667
Almond trees	2	275	2,309	850	56,667
Almond trees	3	200	1,679	750	50,000
Dryland cereal	1	500	4,198	1200	80,000
Dryland cereal	2	650	5,458	1100	73,333
Dryland cereal	3	350	2,939	900	60,000
Irrigated cereal	1	400	3,359	2500	166,667
Irrigated cereal	2	500	4,198	2200	146,667
Irrigated cereal	3	300	2,519	1800	120,000
Erial-grazing	1	150	1,259	300	20,000
Erial-grazing	2	100	0,840	250	16,667
Irrigated fruit trees	0	75	0,630	3500	233,333
Scrub	0	25	0,210	400	26,667
Coppice	0	35	0,294	450	30,000
Dryland olive	1	1000	8,396	1800	120,000
<b>Dryland olive</b>	<b>2</b>	<b>1800</b>	<b>15,113</b>	<b>1500</b>	<b>100,000</b>
Dryland olive	3	1300	10,915	1200	80,000
Dryland olive	4	750	6,297	1000	66,667
Irrigated olive	1	850	7,137	4000	266,667
Irrigated olive	2	1100	9,236	3500	233,333
Irrigated olive	3	900	7,557	3000	200,000
Vineyard	1	225	1,889	1800	120,000
Vineyard	2	200	1,679	1500	100,000
<b>TOTAL:</b>		<b>11910</b>	<b>100,000</b>		

With this information it is relatively easy to determine the value of an estate of 12.8700 has., Which has the following distribution of crops and qualities (cadastral subplots):

- ↪ Class 1 dryland olive: 3.2500 Has.
- ↪ Class 2 Irrigated olive: 1.4500 Has.
- ↪ Class 1 Vineyard: 0.2500 Has.
- ↪ Single class scrub: 0.1200 Has.
- ↪ Class 2 dryland olive: 2.2500 Has.

→ Class 3 dryland cereal: 5.5500 Has.

Table n° 3 shows the result of this conversion:

Table No 3. - Value percentages of the reference crop on the estate being valued

Crop	Class	Surface (Ha)	% value
Dryland olive	1	3,25	120,000
Irrigated olive	2	1,45	233,333
Vineyard	1	0,25	120,000
Scrub	0	0,12	26,667
Dryland olive	2	2,25	100,00
Dryland cereal	3	5,55	60,000
TOTAL		12,87 Has	

In accordance with the market research the dryland olive module of the 2nd class (the reference module in this case) is 1,500 currency units (cu / Ha), so that the total value of the property is obtained by performing the following operation:

$$F_v = 1500 * [(3.25*120\%)+(1.45*233.33\%)+(0.25*120\%)+(0.12*26,667\%)+(2.25*100\%)+(5.55*60.00\%)]$$

With which the calculated value, taking into consideration the viability for production of the property described, is: nineteen thousand seven hundred ninety-three (19,793) cu.

The application of a single reference for crops, quality and market value, as in the example (O-2), is not recommended in a massive process (department or state). One must be more versatile and choose a module consisting of the values per hectare of a crop group and qualities representative of the agrarian reality. Similarly, including several references allows us to assume with greater flexibility possible percentage changes in market values within the time periods considered.

To overcome this situation the module "JAL" is defined, which will serve as a reference for collecting the variations in the market value of rural property, comprising the average crop values and their most representative qualities, in such a way as to compensate for the different pressures put on some of them on a seasonal or periodic basis: mainly capital gains and PAC. A logical choice would be to establish a percentage average between the two qualities most representative of the most common crops: olives, irrigated cereal and dryland cereal (Table No. 4). The high number of plots allocated to these crops, as well as their real estate dynamic, favor the capture of samples through the various existing alternatives (property agencies, price surveys, local practices, notary offices, ministries of finance, appraisal companies, etc.), information that can be checked by the local cadastral technicians in order to obtain an average value which allows for all crops, including these, to be related with the approved national module (JAL). Obviously, if the market study is articulated on an IMCO, this will be one more parameter to quantify.

Table No. 4. - Crops and qualities most representative of market values(MV) and percentages of the estimated module (% s / JAL), obtained as arithmetic averages of market values.

Crop	National Grade	Market Value (cu/Ha)	% s/ JAL
C-	i	1000	37,97%
C-	j	800	30,38%
CR-	i	2000	75,95%
CR-	j	1600	60,76%
O-	i	6000	227,85%
O-	j	4400	167,09%
JAL		2633,3	100,00%

Once approved, following the relevant administrative procedure, this will serve to establish the national table of coordination of values (example in Table No. 5), and may be used as a reference in calculating the basic values (BV) of each agricultural region , which should coincide if the market research (MS) has been successful.

Table No 5. - Extract from the national table of crops, grades and percentages, including the estimated basic value (BV) (Example)

Crop	Grade	% s/ JAL	BV (cu/Ha)
AM	1	85,00%	2238
AM	2	81,50%	2146
... / ...	... / ...	... / ...	... / ...
AM	45	15,40%	406
... / ...	... / ...	... / ...	... / ...
C-	1	42,50%	1119
... / ...	... / ...	... / ...	... / ...
C-	5	37,90%	998
... / ...	... / ...	... / ...	... / ...
C-	26	18,50%	487
... / ...	... / ...	... / ...	... / ...
CR	8	76,00%	2001
CR	9	74,30%	1957
... / ...	... / ...	... / ...	... / ...

Crop	Grade	% s/ JAL	BV (cu/Ha)
CR	21	61,50%	1620
... / ...	... / ...	... / ...	... / ...
CR	50	38,40%	1011
... / ...	... / ...	... / ...	... / ...
O-	13	220,00%	5793
O-	14	218,40%	5751
... / ...	... / ...	... / ...	... / ...
O-	38	115,30%	3036
... / ...	... / ...	... / ...	... / ...
... / ...	... / ...	... / ...	... / ...
V-	1	135,00%	3555
V-	2	130,00%	3423
... / ...	... / ...	... / ...	... / ...
V-	50	54,30%	1430

Within this last area, once the corresponding studies for each district have been performed, the following table is established (Table No. 6) of values and percentages of the JAL, interlinked with the theoretical national table.

Table No. 6. - Extract from district table of crops, grades and percentages, including the estimated cadastral base value (BV) and total surface value (Example)

Crop	District Grade	National Grade	% s/ JAL	Calculated BV (cu/Ha)	Surface by grades	BV land in district (cu)
AM	1	2	81,50%	2146	25	53912
AM	2	5	76,30%	2009	31	62789
AM	3	18	53,20%	1401	85	119247
AM	4	31	38,70%	1019	66	66955
AM	5	45	15,40%	406	13	5069
... / ...	... / ...	... / ...	... / ...	... / ...	... / ...	... / ...
C-	1	5	37,90%	998	852	850324
C-	2	9	35,30%	930	987	917482
C-	3	15	30,10%	793	1236	979695
C-	4	21	22,60%	595	1456	866514
C-	5	26	18,50%	487	951	463296
C-	6	31	15,30%	403	751	302578
C-	7	39	10,20%	269	251	67419
... / ...	... / ...	... / ...	... / ...	... / ...	... / ...	... / ...
CR	1	8	76,00%	2001	13	26017
CR	2	9	74,30%	1957	34	66523
CR	3	21	61,50%	1620	58	93931
CR	4	35	48,30%	1272	41	52148
... / ...	... / ...	... / ...	... / ...	... / ...	... / ...	... / ...
O-	1	3	259,14%	6824	651	4442437
O-	2	8	231,80%	6104	851	5194561
O-	3	13	220,00%	5793	990	5735400
O-	4	14	218,40%	5751	1235	7102732
O-	5	20	187,20%	4930	1582	7798627
O-	6	23	151,80%	3997	1002	4005395
O-	7	29	121,80%	3207	985	3159289
O-	8	38	115,30%	3036	852	2586871
... / ...	... / ...	... / ...	... / ...	... / ...	... / ...	... / ...
V-	1	2	130,00%	3423	22	75313
				Totales	15020	45094524

Thus each and every one of the plots / subplots may be assigned a basic value, with reference to the market and taking into consideration its productive capacity, with information currently found in the cadastral database This is fully coordinated with neighboring districts and the rest of the country. Another additional advantage is that it relies on a methodology which does not break with the existing number of cadastral models, thus facilitating its understanding and increasing the confidence of those involved: cadastral technicians and the taxpayer. Without forgetting that this is a methodology which is easily understandable by ordinary citizens, in this respect the taxpayer.

Studying the market annually or permanently, we can detect variations and update the JAL in each of the periods considered, thus easing the updating process of the cadastral values (Table No. 7).

Table No. 7. - The most representative crops and grades, market values (MV) and percentages of the estimated module (% s / JAL) in three successive years (1st, 2nd and 3rd)

Crop	Grade	Market Value year 1	% s/ JAL	Market Value year 2	% s/ JAL	Market Value year 3	% s/ JAL
C-	i	1000	37,97%	1150	38,98%	1200	40,36%
C-	j	800	30,38%	900	30,51%	915	30,77%
CR-	i	2000	75,95%	2050	69,49%	2110	70,96%
CR-	j	1600	60,76%	1800	61,02%	1815	61,04%
O-	i	6000	227,85%	6800	230,51%	6700	225,34%
O-	j	4400	167,09%	5000	169,49%	5100	171,52%
<hr/>							
JAL		2633,3	100,00%	2950	100,00%	2973,3	100,00%

So for the example provided in the above table (No. 3), the JAL would be 2,633.3 cu / Ha. In the 1st year, 2,950 cu / Ha. in the 2nd, and 2,973.3 cu / Ha. in the 3rd.

In updating values samples are obtained of the other crops in order to also update the relationship between them and those forming the JAL. These variations are not significant unless there has been a profound transformation in this sector, in which case it would suffice to collect a larger number of samples, but without forgetting that the rural market registers similar behavior and that massive transformations would affect the sector as a whole.

In any case, the table of coefficients that interrelates JAL with the other crops in a given district should remain invariable during the useful life of the exposition of cadastral values, if deemed appropriate, adapting to the expectations of the legislative and tax framework respective to property tax.

In a complementary manner, there exist other factors affecting the value of agricultural property which are often taken into account when establishing cadastral classification. Considering that the inclusion of each and every one of them, in the event that they could be identified, would be inapplicable because of the magnitude of work which converting the cadastral evaluation into a real estate valuation would involve, it is considered advisable to take into consideration only three<sup>5</sup> which can easily be quantified by relying on existing documentation, perfectly integrable in an automated manner; namely: accessibility, ease of mechanization and plantation age.

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<sup>5</sup> This proposal does not exclude the possibility of including some others, or even eliminating some of those listed. Their choice should be based on statistical analysis of the information captured in market research, identifying those variables which most influence the shaping of the market value of rural properties and their possible capture and automatic processing. We must be aware that obtaining just one additional field datum would imply visiting tens of millions of subplots, as well as subsequent recording and processing, so its capture would need to be of vital importance in order to justify the human and financial resources and time required.

A.- The factor of accessibility (Fa). All rural properties have access, the problem is the difficulty with which this access is achieved. From perfectly paved roads to paths of a horse's width the casuistry is extensive. We must be aware that in exercising an agricultural activity, like any other, one must have the mechanical and technical resources necessary, which in this case includes an appropriate vehicle. Therefore, the lack of access to the property in a vehicle other than "off-road" does not necessarily represent a traumatic depreciation in the agricultural sector. Simultaneously, agricultural roads and lanes have experienced a considerable improvement in recent years, as well as agricultural vehicles, so it is not surprising that this variable has lost the weight it had in previous years and has become a factor which must be taken into account, but is by no means decisive. Based on the foregoing, and except in extreme cases, specific weights can be assigned automatically to each and every existing access route, using the existing maps. Thus the coefficient 1.00 can be assigned to all plots and another, smaller than the above, to those others where poor quality road access is identified, meaning that this ratio would be applied in an exclusive manner. Although initially difficult to quantify, its application is not if:

- Access routes are assigned and weighted in a cartography in which they are identified, for example in the cadastral cartography itself.
- References are obtained through the analysis of results of EMR and CHMO.
- Consideration is given to the idea that the total volume of properties with these characteristics may represent a minimal amount (perhaps less than 3% of the total), a figure that would not justify the constraint of a TNRRREV.

On certain occasions and in response to specific situations regarding the poor quality of roads presented and motivated by interested parties (and expounded in PVs) global value depreciation rates may be developed or applied in an automatic manner.

B.- The Factor of ease of mechanization (Fem) is very important in today's agriculture. An estate with good access but technical impossibility for the mechanization of its labors: tilling, planting, harvesting, etc, is definitely impaired in value. Ease of mechanization is closely related to the average slope of the plot and / or subplot and this information can be included automatically, using existing maps and digital terrain models or from the same graphical documentation that the relevant cadastral institution can access directly from its databases. In a brief study, in consultation with agricultural experts or through the results of MS, corrective intervals and weightings can be defined, even for crops, for inclusion in the technical regulations and the PV. These factors in particular could be taken into consideration:

- less than 25% slope, mechanizable;
- between 25 and 50%, with difficulties;
- greater than 50%, non-mechanizable,

and coefficients be assigned to them, automatically.

C.- Factor plantation age (Fpa). Is a variable of interest for tree crops: olives, irrigated citrus , fruit, almonds, etc., which can be captured in the process of cadastral implementation. As cadastral legislation is rigorous in this regard, reference regarding the age of the new plantation can be taken from the date stated in the document soliciting the corresponding cadastral alteration Thereupon, and with the corresponding yields table as a function of age, one per crop (published in many specialized texts), it is possible to quantify the production and weight the market value based on this information, also reflected in market research.

D.- The factor of diversification (Fd). The day to day exercise of valuation shows that there are at times factors that determine the market value of a property in such a way that this does not correspond to that which would normally be the case in terms of location, production, accessibility, etc. . As long as it is not an isolated case this reality must be taken into account so that in the process of individualized allocation of the cadastral value of such a property results remain within the established relationship between cadastral value and market value .

The casuistry into which rural estates are embedded is as large as the number of these, so it is not possible to identify or (obviously) quantify all the explanatory variables of value. Consequently the technical (in this case cadastral) valuator must have additional tools at his disposal enabling him, following the exhaustion of traditional methods, to adjust the cadastral value to market realities, and to this end we define the so-called diversification factor (Fd) .

The use of this coefficient must be perfectly regulated in the respective PV, which includes intervals and properties or areas over which it is applied attempting, at all times, that it be equal to the unit (1.00).

Accordingly, the cadastral value (per surface unit) of a plot of rural land, of only agricultural use, would consist of the sum of the cadastral value of the subplots, and this is obtained by multiplying the module JAL by the respective crop and grade coefficient (Cg) and the remaining four (Fa, Fem, Fpa and Fd), whose values will have been generated automatically based on information obtained from the cadastral database itself, other authorities or the MS / CHMO performed [5].

$$V_{\text{SUBP}} = ( \text{JAL} \times \text{Cc} ) \times ( \text{Fa} \times \text{Fm} \times \text{Fe} \times \text{Fd} ) \quad [5]$$

Undoubtedly these corrections are controversial, like any others made on valuation, but we must be aware that in addressing the tax assessment of millions of rural subplots generality and flexibility in the process should be pursued, obviously facilitating its automation. Trying to achieve a high level of accuracy, close to that of a tax appraisal,

with this volume of subplots and the small number of variables to choose from (due to limitations of time, financial and human resources and operability) would be an illusion. We must be flexible and adopt solutions that do not obstruct the general process and which do not take rural land valuation to complex processes which would hinder its implementation or subsequent maintenance.

### **5.2.- Value of construction ( $V_{CONST}$ )**

Cadastral institutions are currently choosing to apply the same procedure followed in urban areas to buildings located in rural land, this usually being the replacement cost method.

As for the soil component, this will be the same as the property would have without trees, bordering that which is intended for construction. This can be automated by identifying the shortest distance between the centroids of two subplots of the plot, whereby the closest will automatically be chosen, with its respective crop.

### **5.3.- Alternative to agricultural use (AUA)**

The cadastral valuation of rural properties located in proximity to urban centers (primary or secondary), and which on occasion do not fully comply with the local planning law, is a complex problem.

As a general rule, and this is reflected in the cadastral valuation regulations of many countries, the lowest value of urban land should be greater than the highest of rural land. Simultaneously, the value of rural land shows a positive gradient as the distance to urban centers is reduced.

This is not always the case, as evidenced by the market. There is land used for intensive farming (greenhouses, for example) whose value can be fully comparable with land suitable for building. Also, the increases in land value are not the same in all directions from the urban core, and there are even cases where the values of properties nearer urban soil are lower than others of a more remote rural nature. This is not just for their productive capacity, but because of the limitations that may exist on them. In particular environmental constraints that exist on certain properties tend to influence their value in a "traumatic" nature.

Perhaps it is in this section where the information provided by a CHMO will have the most importance, which as such is not intended to provide valuation procedures or evaluation of market behavior, but only to report on market values and, where appropriate, be able to generate layers or zones of value obtained by interpolating these values (cu/Ha or cu/m<sup>2</sup>). Compared to other rural land in these zones there is a higher level of information, a higher number of recent transactions and a better degree of approximation to local real estate reality. Also, the percentage of land of the municipality's total does not exceed double digits.

Using the cartography of market values generated in a geo-referenced CHMO, the increment or decrement of the value per unit area of the plot can be calculated. Therefore, in order to estimate the possible "overshoot" due to non-agricultural use (AAU) it is sufficient to identify it in the relationship [ 4 ] and reduce from the market value the calculated value of land for agricultural use, following the process outlined, and that of any existing buildings.

$$V_{\text{MARKET}} = ( \Sigma V_{\text{SUBP}} + \text{AAU} ) + \Sigma V_{\text{C. CONST}} \quad [4]$$

$$\text{AAU} = V_{\text{MARKET}} - \Sigma V_{\text{SUBP}} - \Sigma V_{\text{C. CONST}} \quad [6]$$

In this way we can estimate the "overshoot" or over-valuation of the areas affected by influences not strictly agricultural, based on these amounts "added" to the agricultural value, perfectly geo-referenced in the existing cadastral mapping.

From a cadastral-administrative standpoint, the cadastral value should include an area, peripheral to urban soil, in which the corresponding coefficients applicable to the plots, or parts of them, affected by this "overshoot" are assigned through tessellations (area units) or isoAAU curves.

Consequently the market value, from which the cadastral value is to be extracted in the percentage determined, is calculated by adding the estimated value [5] to the corresponding increase reflected in the IMCO. Thus, for the example shown in this text, and considering that the estate as a whole was located in an area in which the AAU per hectare was 2,000 cu, the total market value would be obtained by adding the amount of 25,740 cu (2,000 cu/Ha x 12.87 Ha), to the initial 19,786 cu, which would give a total of 45,526 cu, the market value of the property.

The choice of traditional alternatives, supported by "the aptitude for production", would entail the allocation of fictitious qualities to crops, mostly in an attempt to increase their value, which would in turn undermine the cadastral database.

## 6.- PRESENTATION OF VALUES

The presentation of values (PV) is a document that structures and normalizes the process of the cadastral valuation of assets of a similar nature within a pre-determined territory. We should try to make this an administrative reference document which is agile, easy to develop, useful for other applications, administratively impeccable, and which does not hamper the implementation of the proposed national rural cadastral evaluation. Without losing the rigor required of any administrative action we must keep in mind the current situation of rural values and assume that it would not be easily comprehensible to assess a municipality and not assign it values updated to another (new) boundary within a decade, when this could be done by the corresponding PV. Mechanisms must be put in place to encourage the approval and development of this process.

Briefly, and based on the discussion in this text, it would be desirable to include in a rural district PV the following:

- Delineation of rural land.
- Calculation and approval of JAL and coefficients table adjustment factors (Table No. 8).
- Selection and approval of the correction coefficients: Fa, Fem, Fpa and Fd.
- A normative for valuation of buildings on rural land.
- CHMO and isoAAU value zones.

Table No. 8.- Example of a municipal coefficients table included in a PV, on the JAL

CROPS	TYPES								
	1	2	3	4	5	6	7	8	9
AM	0,82	0,76	0,53	0,39	0,15				
... /...									
C-	0,38	0,35	0,30	0,23	0,19	0,15	0,10		
... /...									
CR	0,76	0,74	0,62	0,48					
... /...									
O-	2,59	2,32	2,20	2,18	1,87	1,52	1,22	1,15	
... /...									
V-	1,30								

## 7.- CONCLUSIONS

Knowing the reality of rural land valuation, its applications and its immediate fiscal impact, we can understand the effort that some cadastral institutions are allocating to it.

It is considered that the process should be structured according to the following operational sequence:

1. Justification of the need to conduct a comprehensive study of rural real estate prices.
2. Development of a market research framework (CHMO).
3. Proposals for rural cadastral valuation methodologies.
4. Cadastral valuation of control properties and verification of results.
5. Drafting and approval of the Technical Normative for Rating.
6. Choice of reference between estimated cadastral value and market value.
7. Development of a market study to determine the local or regional reality.
8. Drafting of a Presentation of Values coordinated within the jurisdiction concerned: national, provincial, district and local levels.
9. Assignment to each property of its cadastral value, tax base and the payable tax corresponding to the respective tax year.
10. Notification of the interested party.

The first sections of this presentation correspond to research in the field of real estate, and technical and administrative developments which will serve to lay the foundation for subsequent work. The latter are directed towards the individual allocation of cadastral value to all properties. From an eminently administrative point of view the proposed sequence may present some points for discussion, but from a practical standpoint it is likely that no tax decisions are taken without knowing the full reality of the housing market and their immediate fiscal impact (Alcázar, 2003 and 2012).

In summary, with this proposal, and in the opinion of its author:

1. We have presented a methodology adapted to the legislation current in many of the existing cadastral models.
2. We have presented a methodology which is simple, effective, easily upgradeable, applicable automatically, which shares processes with the current methodology (thus encouraging its implementation), and whose results may be used by other administrations, individuals and businesses.
3. The volume of information captured not found in the cadastral database is very small, and this fact has a direct impact on the execution time of the valuation process and the economic cost involved.
4. The methodology offers the taxpayer guarantees and confidence in the process of calculating the cadastral value of property which he owns, thus making clear the principle of tax equity that should govern all actions of the Ministry of Finance.
5. It offers the necessary flexibility, always monitored by the Presentation of Values, to adjust the cadastral value to the market value which will be its reference and limit.
6. It Enjoys the sovereignty that all the actions of the Public Administration should have, not depending on other administrations, ministries, institutes, etc.
7. It will end a situation in which cadastral values present relationships that are very disparate from those of the market.
8. It is a process which can easily be computerized and is technically manageable by the geographic information systems used by the cadastral institutions. This means savings in human and material resources and optimization of time.
9. It allows the Cadastre to complete the descriptive characteristics of the real estate of the nation and thus provide a detailed inventory that may have a multitude of fiscal and administrative applications.
10. It is in line with quality strategies already implemented in the Public Administration.

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