The Appraisal System of Property Qualities

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Key words: appraisal, system, quality, element

SUMMARY

A surveyor working on the Italian real estate market will often find himself appraising the architectural, historical, and artistic qualities of properties. In these circumstances the surveyor would rely on the appraisal system, which is a market oriented method of valuation. The appraisal system applies the principles of the Market Comparison Approach, which is based on the collecting of comparable properties and the adjustments of their prices, based on the characteristics of all comparable properties and those of the property being valued. The appraisal system is formed by a system of equations which are capable of calculating the value of the property to be appraised and the monetary adjustments (hedonic prices) of the real estate characteristics employed in the valuation, especially the adjustments of the qualitative characteristics of the properties.

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1. INTRODUCTION

A big part of the Italian real estate patrimony is made up of antique buildings, and in many cases, of historical, architectural, and artistic gems which boast an array of qualitative characteristics. The Italian real estate market is set off by a weak transparency of prices and a general lack of information. Veracious market prices are not usually listed in public records, where you would find, on the other hand, assessed values based on a fiscal law which avoids true value if the value declared is equal or greater than the assessed value.

Available market information is based on real estate quotations which are indications of price levels determined by general market areas. These areas can be identified by zone (urban, semi-urban, suburban, etc.), by use (residential, commercial, etc.), and by type (new, used, refurbished, etc.). Quotations for the same market area can be many and divided among them, often resulting in contrasting one with another.

It's common knowledge that the appraisal process is developed alongside the economic system, the judicial system, and the social system in place in each country. In Italy there are an abundance of conventional appraisals which rely on criteria determined by laws and carried out by public officials. Professional appraisals take from the structure of conventional appraisals and oftentimes rely on real estate quotations; consequently they apply empirical or semi-empirical procedures which are based on a subjective valuation by the valuer who tends to make up for the lack of real market information with personal experience and competence (*animus aestimandi*).

Let's take for example the Market Comparison Approach (MCA) which is the most widespread real estate market appraisal procedure in the world, used in the international valuation and accounting standards. In Italy, the MCA holds hardly any ground in the professional field, although it is based on solid appraisal premises, on precise observations of the market, on a methodical and systematical procedure, and on a demonstration of the results.

2. *MCA* IN ITALY

Despite the unfavorable conditions of transparency within the market, the Italian appraisal methodology offers the MCA among its market oriented procedures, adapting it to the Italian real estate economy. In fact, the MCA imposes the collection of market price of comparable properties and carries out a systematic comparison between the properties based on their technical and financial characteristics (*figure 1*). The lack of market information not only reduces the number of the comparables, but also hinders the ability to identify needed price adjustments. Consequently, the adjustments of the price are made in terms of value and tend

to outweigh the adjustments in terms of percentages, which are the common approach. The appraisal of adjustments is therefore a complex but feasible process due to the quantitative real estate characteristics; in other words, those characteristics that present an independent market in which the price, the price of substitutes, or a corresponding cost can be observed. The characteristics are the elements of comparison of the MCA and the adjustments are the *marginal prices* of the characteristics. A fundamental component of the adjustment appraisals are the *commercial ratios*, which express the ratio between the prices of parts or characteristics of real estate properties. The commercial ratio is a pure number since it is a ratio between prices. The collection of commercial ratios is carried out on stipulated deeds and is inferred by real estate business transactions. The most common commercial ratios are those concerning the property area, especially the ratio between average prices of secondary area and those of the main area. Commercial ratios vary locally from market segment to market segment and according to market trends.

When looking at adjustments of qualitative real estate characteristics, for example the maintenance of a building, the presence of architectural and artistic elements, the age in which it was built, the environmental amenities, the pollution, it is impossible to rely on any market price references because it is a matter of quality and outside factors (spillover effects) which are not measurable and are oftentimes special and non-reproducible. These qualities are part of the historical real estate patrimony, but can also be seen in today's construction activity when making reference to the environmental real estate characteristics and to personal welfare, such as the overlook, the landscape, and generally functionality.

Measuring the qualitative characteristics of a real estate property is based on the functions and assignments (pros and cons) of a classification or evaluation. Where it is possible to differentiate between levels of qualitative characteristics, these can be measured using an interval scale (ordinal scale). However, in an appraisal analysis all characteristics must be presented in a numerical scale (cardinal), therefore each qualitative characteristic is assigned a score according to its level. Each score then receives a numerical value. It is necessary to first assign to each level a name by which it can be easily identified and classified. The *nominators* (*nomenclatori*) are responsible for systematically describing and cataloguing the levels of the real estate qualitative characteristics, assigning a name to each level and describing them individually. Finally, each concept belonging to a single level is then connected to a definition whose goal it is to describe the level on a conceptual plane (Simonotti, 2005). Measuring qualitative characteristics occurs in two stages: first the number of levels, the names of the levels, and their hierarchical order (ascending or descending) are determined; then transitory scores are assigned to each level, with the purpose of then being substituted by the marginal prices of the qualitative characteristics. The task of the nominators is to describe the specific qualities of the level with reference to the adjustments, therefore the score assigned to each level is only temporary in the scheme of the appraisal.

A few qualitative characteristics can be measured with the nominal scale when describing a situation of presence or absence of the characteristic; this is usually done by assigning a one or zero value according to the presence or absence of the characteristic, or assigning a one or zero value to either one of the qualitative conditions.

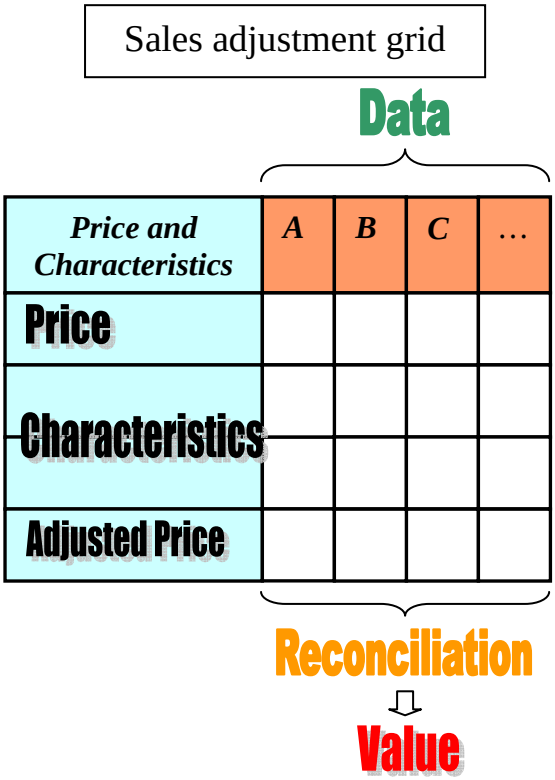

Figure 1 – Market comparison approach

3. APPRAISAL SYSTEM

In 1985 the Italian appraisal methodology established a general appraisal system which addresses the problem of the appraisal of qualitative real estate characteristic adjustments (Simonotti, 1985).

The *appraisal system* was created by transforming the comparison between the subject property and a set of similar comparable properties of the MCA into a mathematical equation. This equation of comparison states that the difference between the price of the comparable properties and the property to be appraised is the function of the differences derived from their characteristics. The comparative equation can be applied to each comparison between the single property collected and the property to be appraised. This set of functions makes up the appraisal system.

The appraisal system is a linear system which is based on the collection of a sample of comparable properties. The collection of data concerns: the characteristics of x_{ji} with index $j=1,2,...,m$ and $i=1,2,...,n$ relating respectively to the comparables and the characteristics taken into consideration; the market prices described as P_j; the characteristics of the subject property x_{0i}. Therefore, the appraisal system is represented as follows:

$$\begin{cases} V + \sum_{i=1}^{n} (x_{1i} - x_{0i}) \cdot p_i = P_1 \\ V + \sum_{i=1}^{n} (x_{2i} - x_{0i}) \cdot p_i = P_2 \\ \ldots = \ldots \\ V + \sum_{i=1}^{n} (x_{mi} - x_{0i}) \cdot p_i = P_m \end{cases};$$

where V represents the value of the property to be appraised and p_i represents the adjustments of the characteristics. The adjustment of a characteristic represents the change of the price according to the variation of the characteristic itself; the appraisal system describes this price as a *marginal price* of the characteristic, expressed as a monetary value (euro) for the unit of of the characteristic.

In terms of matrix, the appraisal system sets the matrix coefficient $\boldsymbol{D}$, the price vector $\boldsymbol{p}$ of the element P_j and the vector of unknown value and marginal prices $\boldsymbol{s}$ of elements V and p_i in the following way:

$$\boldsymbol{D} = \begin{bmatrix} 1 & x_{11} - x_{01} & x_{12} - x_{02} & \ldots & x_{1n} - x_{0n} \\ 1 & x_{21} - x_{01} & x_{22} - x_{02} & \ldots & x_{2n} - x_{0n} \\ \ldots & \ldots & \ldots & \ldots & \ldots \\ 1 & x_{m1} - x_{01} & x_{m2} - x_{02} & \ldots & x_{mn} - x_{0n} \end{bmatrix};$$

$$\boldsymbol{s} = \begin{bmatrix} V \\ p_1 \\ p_2 \\ \ldots \\ p_n \end{bmatrix}; \boldsymbol{p} = \begin{bmatrix} P_1 \\ P_2 \\ \ldots \\ P_m \end{bmatrix}.$$

Therefore, the appraisal system looks like this:

$$\begin{bmatrix} 1 & x_{11} - x_{01} & x_{12} - x_{02} & \ldots & x_{1n} - x_{0n} \\ 1 & x_{21} - x_{01} & x_{22} - x_{02} & \ldots & x_{2n} - x_{0n} \\ \ldots & \ldots & \ldots & \ldots & \ldots \\ 1 & x_{m1} - x_{01} & x_{m2} - x_{02} & \ldots & x_{mn} - x_{0n} \end{bmatrix} \cdot \begin{bmatrix} V \\ p_1 \\ p_2 \\ \ldots \\ p_n \end{bmatrix} = \begin{bmatrix} P_1 \\ P_2 \\ \ldots \\ P_m \end{bmatrix}.$$

Consequently, the appraisal system can be described as follows:

$$\boldsymbol{D} \cdot \boldsymbol{s} = \boldsymbol{p};$$

and its solution is as follows (*figure 2*):

$$\boldsymbol{s = D^{-1} \cdot p.}$$

The result of the appraisal system is the set of the value of the property to be appraised and the marginal prices of the real estate characteristics taken into consideration. The matrix permits only one result when the matrix coefficients are non-singular, which means that it will have its own inverse matrix. In order to be a single solution, the system requires that the number of data (equations) be equal to the number of characteristics augmented by one ($m=n+1$).

In the better case in which the number of data is greater than the number of characteristics ($m>n+1$), the result of the appraisal system can be calculated by applying the technique known as the Moore-Penrose generalized inverse, in the following way:

$$\boldsymbol{s = \left(D' \cdot D\right)^{-1} \cdot D' \cdot p.}$$

The appraisal system as an appraisal procedure is usually applied under conditions where the number of unknown quantities is equal or less than the number of equations. However, in many circumstances on the Italian real estate market, the number of comparables can be quite low, while the number of characteristics to be considered can be quite high. Consequently, on one hand it can be difficult to retrieve market prices and on the other the qualitative characteristics are numerous.

In these cases it's necessary to bring the appraisal system back to a situation of parity or prevalence of data collected. This can be done by collecting new comparables if available, aggregating the characteristics where possible, and using an outside appraisal of the marginal prices of the characteristics. In this last case, the appraisal of the marginal prices of the quantitative characteristics can be carried out according to the MCA, because the appraisal system applies the comparative function derived from the MCA.

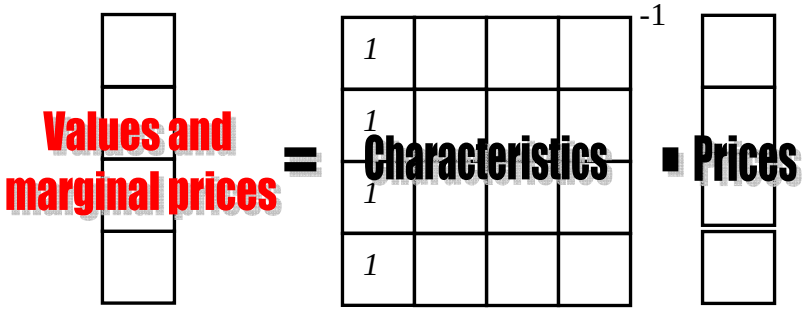

Figure 2 – Appraisal System

4. *MCA* AND THE APPRAISAL SYSTEM

The comparative equation is the common denominator between the appraisal system and the MCA, therefore the two procedures can be integrated into a single market oriented procedure.

The MCA is responsible for appraising the marginal prices of the quantitative characteristics which can be evaluated with the market information available; the appraisal system takes care of calculating the value of the property to be appraised and of the marginal prices of the qualitative characteristics.

For these characteristics the estimate of marginal prices is not possible because there are no market references and the estimate would be complex and imprecise. In valuation terms, the characteristics for which it is possible to determine the marginal price are called *aestimabilis* characteristics; the others are called *inaestimabilis.*

In the integration between the MCA and the appraisal system, in practice the external estimate of marginal prices *aestimabilis* is carried out, the market prices are then adjusted, and the adjusted prices of the sales adjustment grid of MCA are then inserted into the appraisal system, once it has been set to consider the qualitative characteristics. This way the simplified system for marginal prices of *inaestimabilis* characteristics and the value of the subject property is also solved (*figure 3*).

The adjusted prices of the MCA represent an intermediate stage in the process of the integrated appraisal, when the price of the property to be appraised has been adjusted according to the estimated characteristics, but has yet to be adjusted according to the inestimable ones. To fulfill this requirement, the appraisal system steps in. The divergence between adjusted prices is a fact, and it is this divergence which expresses the effects of the remaining *inaestimabilis* characteristics.

In formal terms estimable characteristics can be represented by the subscript i equal to $1,2..,v$ and the inestimable characteristics with $i=v+1,\ v+2,..,n$. Subsequently, the appraisal system splits in order to import into the left-hand of known values the differences and marginal prices of estimable characteristics, in the following way:

$$\begin{cases} V + \sum_{i=v+1}^{n}(x_{1i} - x_{0i}) \cdot s_i = P_1 - \sum_{i=1}^{v}(x_{1i} - x_{0i}) \cdot p_i \\ V + \sum_{i=v+1}^{n}(x_{2i} - x_{0i}) \cdot s_i = P_2 - \sum_{i=1}^{v}(x_{2i} - x_{0i}) \cdot p_i ; \\ \ldots = \ldots \\ V + \sum_{i=v+1}^{n}(x_{mi} - x_{0i}) \cdot s_i = P_m - \sum_{i=1}^{v}(x_{mi} - x_{0i}) \cdot p_i \end{cases}$$

where p_i is the known marginal price of the generic *aestimabilis* characteristic (estimated by the MCA) and s_i is the unknown marginal price of the generic *inaestimabilis* characteristic. The known value represents the vector of the partially adjusted prices by the estimable characteristics, obtained from the last line of the sales adjustment grid of the MCA.

In summary, the integrated procedure, composed of the MCA and the appraisal system, is represented as follows:

$$\boldsymbol{D}_v = \begin{bmatrix} 1 & x_{1,v+1} - x_{0,v+1} & x_{1,v+2} - x_{0,v+2} & \dots & x_{1n} - x_{0n} \\ 1 & x_{2,v+1} - x_{0,v+1} & x_{2,v+2} - x_{0,v+2} & \dots & x_{2n} - x_{0n} \\ 1 & \dots & \dots & \dots & \dots \\ 1 & x_{m,v+1} - x_{0,v+1} & x_{m,v+2} - x_{0,v+2} & \dots & x_{mn} - x_{0n} \end{bmatrix};$$

$$\boldsymbol{s}_v = \begin{bmatrix} S \\ s_{v+1} \\ s_{v+2} \\ \dots \\ s_n \end{bmatrix}; \boldsymbol{p}_v = \begin{bmatrix} P_1 - \sum_{i=1}^{v} (x_{1i} - x_{0i}) \cdot p_i \\ P_2 - \sum_{i=1}^{v} (x_{2i} - x_{0i}) \cdot p_i \\ \dots \\ P_m - \sum_{i=1}^{v} (x_{mi} - x_{0i}) \cdot p_i \end{bmatrix}.$$

Consequently, the appraisal system which integrates the MCA is described as follows:

$$\boldsymbol{D}_v \cdot \boldsymbol{s}_v = \boldsymbol{p}_v;$$

which is solved according to the appraisal method described previously.

In this case, under the same conditions of an equal number of comparables, the solution of the appraisal system is preferable over the appraisal system which takes into consideration all the property characteristics.

The appraisal system can be applied in the independent valuation of the marginal prices of the real estate characteristics, putting aside from the valuation of the property to appraise, to example in the case of partial damages, of temporary fruition, of choices of investment. In these circumstances the comparative equation is applied to the difference of price among the two properties; this difference is explained by the differences in their characteristics.

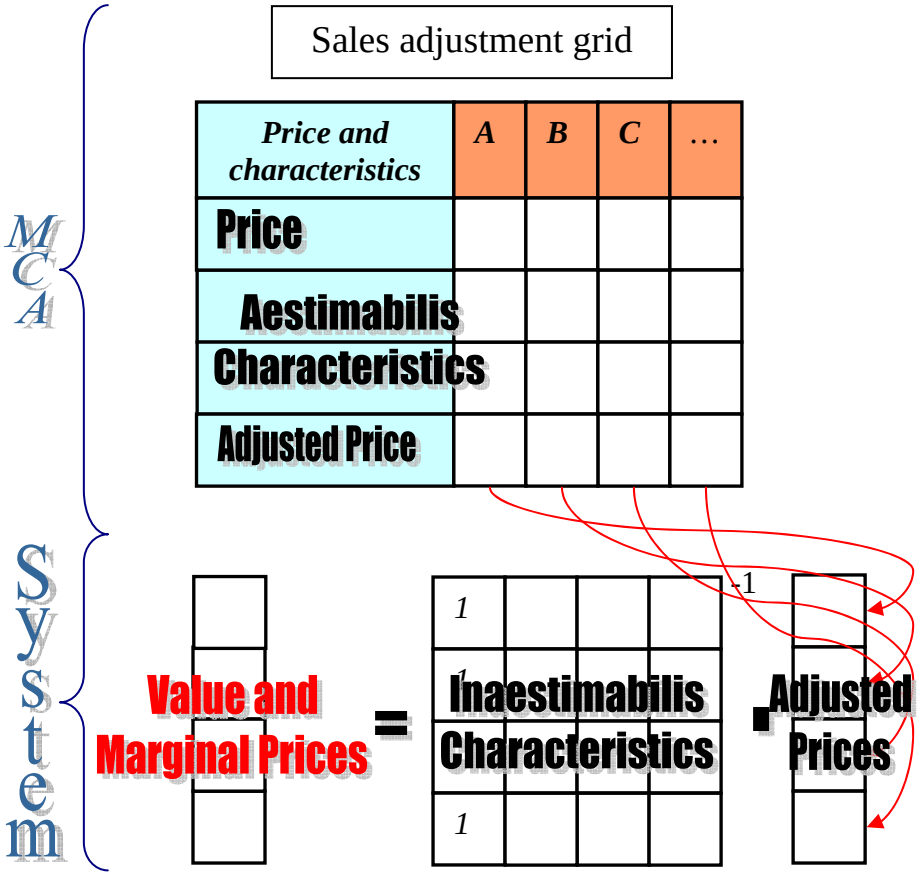

Figure 3 – MCA and appraisal system

5. CONCLUSION

Real estate valuations are often carried out based on little market data because of the uniqueness and complexity of real estate, because of the real estate market segmentation, and because of the difficulty in Italy of retrieving relevant and transparent market prices. Under these circumstances the peculiarity of the appraisal problem lies in determining value with little data through logical and mathematical models set up specifically for appraising. Among these models, the appraisal system is able to provide the property value and the marginal prices of its characteristics, faithfully reflecting the logic of the MCA and more widely that of the Adjustment Grid Methods.

In the last few years the publication of international valuation standards, the application of international accounting standards, and the progressive integration of the real estate market with the finance market, have promoted the application of market oriented procedures based on data collection. Within the context of Italian real estate, the application of these procedures faces the interesting problem of estimating the effects that qualitative real estate characteristics have on market value. These characteristics do not represent an independent

market price because they are used as indivisible goods which are external to the context and belong to the abstract sphere of subjective judgments. In spite of all previously said, these characteristics are still capable of producing real estate market price variations. These variations represent the hedonic prices, or in appraisal terms the marginal prices or the adjustments of the qualitative characteristics.

The appraisal system proposed by the Italian appraisal methodology is capable of estimating the marginal prices of real estate qualitative characteristics, as well as the market value of the property to be appraised. It is an appraisal procedure which integrates the MCA, becoming its mathematical manifestation. Following this procedure, the appraisal of the adjustments is subtracted from the subjective criteria used by the individual valuer. The system allows calculations to be made even when little comparable data is available, as is usually the case in Italian real estate.

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