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An estimation of the transformation value by means of the estimation function. Market Comparison Approach with abridged data chart

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Abstract This essay suggests a re-elaboration of the Marketing Comparison Approach in order to set the value of properties subject to transformation. The essay focuses on identifying the property valuation following a certain transformation and is aimed at determining the land value by means of the extraction method. The outcome, based on trading data and a study case in the province of Bari may also be applied to under construction properties valuation and to the identification of the value of properties under construction, (investment property under construction) by means of the Future Value method.

INTRODUCTION

As far as professional valuation is concerned, you may often need to determine the land value of a land under transformation. To this purpose, the evaluator may use several valuation methods in order to establish the most probable land transformation value. International Standards (Ciuna, 2010) allow several Market Oriented procedures based on comparative market data search: the Allocation method, based on the percentage to apply to the asset value after its transformation (mercantile exchange relationship), the Extraction Method, based on the transformation value method, which calculates the value of the land from the difference between the asset value at the end of the transformation process and the required costs for the transformation, and the income methods, based on the capitalization of the price for land-use. In this essay we focus on the prediction of the value of the asset subject to transformation by means of the Extraction Method. We will not discuss the value judgement of a land as a whole, but only a part of it, made of the prediction of the asset value due to the land transformation. This issue is generally exemplified by the sic et simpliciter predictable impact of unitary prices. The essay is structured as follows: the first paragraph recalls the introductory concepts to the application of the extraction method in valuation procedures. The next paragraph introduces a method to identify the value of assets subject to transformation by means of the estimation function (Simonotti, 2003). The second to last paragraph highlights an example of such method. The last paragraph details the possible conclusions.

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ABOUT THE TRANSFORMATION VALUE

Among the techniques detailed in this essay, the attention is drawn on the determination of the land value based on the difference between the assets value under transformation and the required costs to carry out such transformation (extraction method). In other words, such difference may be calculated through different expressions according to the transformation conditions. For instance, land value within the extraction method may be expressed by Formula 1, as the difference between the asset value at the end of the transformation process and its related costs:

$$V = V_{BT} - K_T \quad (1)$$

V being the value of the land to be valued, $\mathbf{V_{BT}}$ the value of the asset subject to transformation and $\mathbf{K_T}$ the necessary construction costs of the transformation. The objective of this study is to determine a value judgement based on $\mathbf{V_{BT}}$**.** The above formula may be modified as per Formula 2, in case a building needs to be demolished before construction starts. In this case, you may have:

$$V = V_{BT} - K_T - K_D \quad (2)$$

V being the land to be valued, $\mathbf{V_{BT}}$ the value of the asset subject to transformation, $\mathbf{K_T}$ the costs required for the transformation, and $\mathbf{K_D}$ the demolition costs before starting the transformation. In case the demolition entails recycling, Formula 2 may be modified as per Formula 3:

$$V = [V_{BT} + (u + m)] - K_T - K_D \quad (3)$$

V being the land to be valued, $\mathbf{V_{BT}}$ the value of the asset subject to transformation, $\mathbf{K_T}$ the costs required for the transformation, $\mathbf{K_D}$ the demolition costs before the transformation starts, and **u** and **m** being earning values. Such values come from non-wasted residuals, as well as any earnings deriving from the sale of the spare parts coming from the demolition, respectively. Formula 3 follows the logical scheme of the site and cements valuation (Forte, 1968, p.275) Formulas are presented in a simplified and conceptual way. In practical terms, they must be adjusted according to necessary adjustments, to obtain uniform calculations from a financial point of view. One of the issues in the application of such formulas is the prediction of $\mathbf{V_{BT}}$, which is recurring in Formula 1, 2, e 3. The methodological proposal of this essay focuses on this term. $\mathbf{V_{BT}}$ can be seen from three different perspectives. Firstly, from the monetary point of view, being the value prediction coming from the placing of the properties built in the construction process. Secondly, from the time required to obtain the authorizations to commence the transformation process. Thirdly, from the time required to build the property subject to transformation. The required time for the transformation may be calculated via different methods. Among others, a recent essay (d'Amato, 2013) detailed the calculation of the instrumental relation $\boldsymbol{\tau}$, which suits especially situations with limited data. These three perspectives have a direct impact on the application of Formulas 1, 2 and 3, both during the land valuation process (appraising) and during the definition of the investment (counseling). Normally, the prediction of the value at listing of the asset subject to transformation is based on the determination of unitary prices coming from "interviews to operators", or, in the best scenario, you may undergo a regression analysis and try to define the estimation function that better reflects the market trend. The first option entails limited sources and the results may be uncertain and contradictory. On the other hand, applying multiple regressions requires the use of a conspicuous number of data, which could be hard to find. Indeed, there may or may not be a limited number of trading agreements available on the market, or, if many, they may not belong to market segments close to the one of the asset subject to transformation. It is useful to remember that the partial disclosure of property data through Law 266/2005 does not necessary mean that enough data is now available when needed. One of the predictable aspects of real estate valuation is the unrepeatability of real estate monitoring in terms of space and time. An evaluator, unlike a physicist or a chemist, is not entitled to replicate the monitoring method used to make predictions. The predictable nature of the value judgement forces the evaluator to act *hic et nunc*, with the available data at the time of the valuation. Or he/she could attempt to improve his/her method in order to be able to draw the best inferences out of the available data. For instance, by referring to the available estimation techniques for that specific case. The next paragraph will introduce one of these techniques.

DETERMINATION OF V_{BT} THROUGH THE ESTIMATION FUNCTION. MARKET COMPARISON APPROACH AT MARGINAL PRICES

The estimation function is a mathematical relation to associate a dependent variable, the price, to its features within a specific real estate segment, (Fregonara *et al.*, 2013), by means of the relation detailed in Formula 4 below:

$$P = L_0 + p_1x_1 + \dots p_nx_n \tag{4}$$

In Formula 4 **P** is the price, $\mathbf{L_0}$ the location variable, $\mathbf{p'_j}$ marginal prices and $\mathbf{x_i}$ the quantified measurement of its features. If we apply the above estimation function to this specific valuation case, the goal is to define the asset value after the $\mathbf{V_{BT}}$ transformation process in order to be able to apply Formula 1 (extraction method). Hence, the calculation of the function will be detailed in Formula 5 as follows:

$$V_{BT} = L_0 + p_1x_1 + \dots p_nx_n \tag{5}$$

In Formula 5 $\mathbf{V_{BT}}$ is the value of the asset subject to transformation, $\mathbf{L_0}$ is the location variable, $\boldsymbol{p'_j}$ are marginal prices and $\boldsymbol{x_i}$ is the quantified measurement of the asset characteristics. In this case, the value of the asset subject to $\mathbf{V_{BT}}$ transformation is found through the application of a market comparison approach based on the limited available data at the time of the value judgement. From a conceptual point of view, the market comparison approach corresponds to the subtraction member to member of another estimation function having a dependent price, known characteristics and falling into the same market segment, as opposed to Function 4, which features an unknown dependent variable.
Hence, from Formula 4 we obtain Formula 6:

$$V_S - P_A = \cancel{L_0} - \cancel{L_0} + p'_1(x_{S,1} - x_{A,1}) + \dots + p'_n(x_{S,n} - x_{A,n}) \tag{6}$$

The first part of this formula is made of the difference between the value to be determined Vs or subject, and the comparable of a known price $\mathbf{P_A}$ (comparable). In the second member you have the location variable, which comes to zero, as the asset subject to estimation and the comparable fall into the same market segment. Adjustments will be determined by the product of the marginal prices, which are identical within the same market segment, and the difference between the physical features (elements of comparison).

The subject value is determined by Formula 7:

$$V_S = P_A + \not{L_0} - \not{L_0} + p_1^{'}(x_{S,1} - x_{A,1}) + \ldots + p_n^{'}(x_{S,n} - x_{A,n}) \qquad (7)$$

The first member of the Formula is the **Vs** value or subject. This is determined by the value of the comparable of the known price $\mathbf{P_A}$ (comparable) after the adjustments, which equal the product of the marginal prices and the related differences in the features between the subject and the comparable subject to valuation. First of all, since you know the technical specifications of the asset to be valuated as well as the features of those assets located in modern construction sites falling into the same market segment, you may want to apply a market comparison approach between the known comparable prices and the characteristics of the final asset. However, in this case, the comparative process may be extremely difficult. This would mean a comparison between a property being on the market at a later stage and the most recent ones. Another issue on the matter could be that, whilst the comparable features (elements of comparison) are defined by an ongoing or a recently completed transaction, in the case of an asset to be built, the data may only be determined by the nature of the destination planning, in other words, by the details of a preliminary or executive project detailing the transformation to be carried out. Hence the need to overcome the direct comparison between an existing and located asset, and a contingent one, that is, an asset to be built only if an investment allows it. The comparison could be made through the comparables in order to define an estimation function based on the limited available data. The estimation function derived from an "MCA with abridged data chart" will help predicting the value of the asset subject to $\mathbf{V_{BT}}$ transformation. Within a residential market segment, by value of the asset subject to transformation you mean those residential real estate units to be built on a certain land. This method is made of three stages. First of all, an MCA is performed in order to define an estimation function (not a real estate valuation). Once the marginal prices have been determined through the comparable data analysis, a linear function may be determined. The function type shall be determined by the evaluator, who may opt for non-linear or linearized functions in an empirical application. In this specific case, a linear function will be adopted, as this is normally the case in MCA. After defining the marginal prices, they will be applied to test units in order to define a derived value of the estimation function $\mathbf{V_{FUNZ\ STIMj}}$ for each comparable. This value is detailed in Formula 8

$$V_{FUNZ\ STIMj} = L_0 + p_1x_1 + \ldots + p_nx_n \qquad (8)$$

The first part of the formula is value $\mathbf{V_{FUNZ\ STIMj}}$ or estimation function value, and is determined by the product of the asset characteristics and the marginal prices coming from the unit analysis. The impact of the location variable will be determined in a residual way through the difference between the price of comparable **Pj** and the derived value of the product of the marginal prices of the detected characteristics and the characteristics of each comparable $\mathbf{V_{FUNZ\ STIMj}}$. Thus, the role played by the regression constant in hedonic models will be simulated. The location variable will be quantified as per Formula 9:

$$P_i - V_{FUNZ\ STIMj} = L_0 \qquad (9)$$

In Formula 9, **Pj** is the price of the j-nth comparable from the market, $\mathbf{V_{FUNZ\ STIMj}}$ comes from applying the estimation function as a product of the characteristics and the marginal prices of the comparable. In practical terms, such difference $\mathbf{L_0}$ often varies in the test unit. At this stage the estimation function has been determined. The second stage involves making sure that the values coming from the estimation functions $V_{FUNZ\ STIM_i}$ do not differ too much. At this verification stage, we have a divergent percentage value (not over 10%) between the max and the min values coming from the estimation functions $V_{FUNZ\ STIMj}$, which is also the case when verifying the percentage error in MCA. Once the verification stage is completed, the estimation function is applied to the common technical specifications of the area, that is, the specifications of the project on that land. At the third stage, an estimation function is determined as well as the value of the assets subject to transformation. The goal of such analysis may be just to define an estimation function that clarifies the impact of a certain variable or the influence of one variable on the others. Such method may be used with caution to determine an estimation function in case there is limited data. The case study detailed in the following paragraph may help to better comprehend this method.

A CASE STUDY IN THE BARI PROVINCE

In a small town of the Bari province the suggested procedure was applied to the real estate market segment of terraced houses. In this context, three real estate transactions have been detected in the immediate proximity of a land to be estimated for construction. Such three comparables were recently built and sited properties. The MCA in Formula 6 could not be applied due to the fact the comparables had already been built, whereas the asset to be evaluated was contingent, that is, its existence was depending on a certain investment (state of uncertainty). Not having enough data to perform multiple regression and having rejected the idea of using “opinions” based on unitary prices , as they often do not match, the MCA with abridged data chart method has been applied to establish the estimation function that implies the analysis of the area comparables in that specific market segment. The land was classified as susceptible to immediate building. From the volume calculation, it was clear 8 real estate units could be built, with similar features to the detected comparables. In addition, the main target in that area was to build terraced houses. Three comparables of recent construction and placing have been detected, whose features are detailed in Table 1 (A, B, and C):

	A	B	C
PRZ	€ 210.000	€ 220.000	€ 215.000
DAT	2	1	3
SUP	90	95	100
SUB	4	4	8
SUE	20	15	25
IMP	1	1	0

Table 1 MCA data with marginal costs

Table 1 shows the features to be considered, that is, the PRZ or cardinal price in Euros. The date has been calculated retrospectively and cardinally in months starting from the time of the price definition up to the estimation. The third feature is the SUP, that is, the useful floor space cardinally measured in square metres on two levels. The fourth feature is the SUB, that is, the area cardinally measured in square metres of a small balcony located on the upper floor, whereas the fifth variable is the SUE, or the external appurtenant area of the house. The last variable or IMP indicates the air-conditioning, it is measured in a dichotomous way and estimated to the most probable depreciated replacement cost. The goal of this procedure is not to estimate an existing property but to define, through a reduced number of considerations, the estimation function introduced with Formula 6. An abridged chart means a smaller data chart due to the elimination of the subject column. It will be used to approximate the final asset value after the transformation. Then, the marginal prices shall be defined. As far as the date is concerned, its marginal price is calculated retrospectively in months. Table 2 details the relative marginal price:

p(DAT)	s. riv mens	P(DAT)
	-0.01	-0.00083

Table 2 DATE marginal price

The variable will also be negative when applying the MCA to abridged data chart, since the future price trend has been predicted as negative. Obviously, if the future price trend had been positive, the variable sign would have been positive too, meaning an increase of the values at the end of the placing period (Salvo *et al.*, 2014). The SUP (main area) marginal price is calculated by considering the lowest of the average prices or unitary prices established (Simonotti, 1997), as the three values belong to the same market segment. In order to calculate it, the fourth mercantile theorem shall be considered (Simonotti, 2006) as detailed in Table 3:

$p(SUP_A)$	€ 2,306.17	p(SUP)
$p(SUP_B)$	€ 2,291.75	€ 2.108.76
$p(SUP_C)$	€ 2,108.76	

Table 3 Useful Floor Space (SUP) Marginal Price)

The SUB Marginal Price (balcony area) is calculated by considering the product between the marginal price of the main area and the correspondent mercantile relation **π**, determined in the market segment and equaling 0.2, as indicated in Table 4 below:

π	P(SUP)	p(SUB)
0,2	€ 2,108.76	€ 421.75

Table 4 Definition of the marginal price of the Balcony Area (SUB))

The external area is also quantified independently through a marginal price, which is defined by the operators as shown in Table 5:

p(SUE)	30 €	P(SUE)
		€ 30.00

Table 5 Marginal Price of the External Area (SUE)

When calculating such areas, the position relation was approximated to the unit. The marginal price of the IMP plants is calculated through the depreciated cost of the replication of the plant itself. Below, in Table 6 t^a is the economic lifecycle of the plant from its settlement, t^u is the total economic duration of the asset, K_N is the cost to replicate a brand new plant.

The depreciation has been calculated in a linear way.

P(IMP)	t^A 2	K_N	€ 10,000.00	P(IMP)
	t^P 20			9,000 €

Table 6 Definition of the marginal price of the plants (IMP)

In order to establish the marginal price, the cost of the replication will be considered but not its depreciation. This will lead to a further differentiation between the MCA and the MCA to abridged table. Now you may detail the valuation chart of the *MCA to abridged table.* The values have been calculated by applying the marginal prices to the comparable characteristics without considering the localization variable:

	A		B		C	
PRZ	**€ 210,000.00**		**€ 220,000.00**		**€ 215,000.00**	
DAT	**2**	€ 350.00	**1**	€ -183.33	**3**	€ -537.50
SUP	**90**	€ 189,788.39	**95**	€ 200,332.19	**100**	€ 210,875.98
SUB	**4**	€ 1,687.01	**4**	€ 1,687.01	**8**	€ 3,374.02
SUE	**20**	€ 600.00	**15**	€ 450.00	**25**	€ 750.00
IMP	**1**	€ 10,000.00	**1**	€ 10,000.00	**0**	
		€ 201,725.39		**€ 212,285.86**		**€ 21,4462.50**

Table 7 MCA valuation to abridged data table

In Table 7 the first column details the selected features, in the second column the features of comparable property A are reported, the third column highlights the product of the marginal prices identified in tables from 2 to 6 and the relative features of property A per each line. The last line of the third column details the estimated value of A considering the sum of all the adjustments. At this stage, the location variable has not been calculated yet. The same procedure applies to comparable B in column 4 and 5 and to property C in column 6 and 7. Verifying all estimated values through percentage divergence will determine whether the test itself is acceptable or not. As shows Formula 10:

$$d = \frac{V_{MAX} - V_{MIN}}{V_{MIN}} = \frac{214.462,250€ - 201.725,39€}{201.725,39€} = 0,0631 \leq 10\% \tag{10}$$

The 10% threshold suggested for the MCA abridged data table is higher than the 5% established for the MCA, as its price adjustments do not consider the location variable.

Knowing the three $V_{FUNZ\ STIMj}$, you will be able to calculate the location variable by applying Formula 9 of the previous paragraph. Hence, there is:

Prices	$V_{funz.\ stima}$	Price – $V_{funz.\ stima} = L_0$	d
€ 210,000.00	€ 201,725.39	€ 8,274.61	0.0410
€ 220,000.00	€ 212,285.86	€ 7,714.14	0.0363
€ 215,000.00	€ 214,462.50	€ 537.50	0.0025
		€ 5,508.75	

Table 8 MCA Valuation. Determination of location variable

Here are some remarks. First of all, the location variable has a positive sign for all three observations and the first and the second one are substantially similar. The third one features a lower location variable. The mathematical average approximates the location marginal price, which is equal to € 5,508.75. The last column stresses out the percentage divergence between every single price and the estimation function with no location variable. All absolute divergences are below the 5% threshold. If we consider the results in Table 8 and in Table from 2 to 6, it is possible to calculate an estimation function within this specific market segment shown in Table 9:

ACR	FEATURE	MARGINAL PRICE
LOC	LOCALIZZAZIONE	€ 5,508.75
DAT	DATA	-0.00083
SUP	SUP. PRINCIALE	€ 2,108.76
SUB	SUP. BALCONI	€ 421.75
SUE	SUP. ESTERNA	€ 30.00
IMP	IMP	€ 10,000.00

Table 9 Marginal prices of the estimation function calculated by applying MCA to abridged data table

The second DAT variable is a *percentage adjustment*, that is, a percentage applied to the calculated price. Formally, Formula 11 details the full function and shows its application:

$$V_{BT} = 5.508{,}75€ - 0{,}00083 * V_{BT} * DAT + 2108{,}76€ * SUB + 30€ * SUE + 10.000€ * IMP \quad (11)$$

The negative price trend requires the variable to have a negative sign, which refers to a future projection of the estimation function. In order to calculate the dependent variable it is necessary to take a final step and isolate the V_{BT} variable to the first member.

Considering for this unit a location of 24 months from the estimation date deriving from the relation **τ** (omitted for brevity reasons), the result is

$$V_{BT} = \frac{50508{,}75€ + 20108{,}76€ * SUP + 421{,}75€ * SUP + 30€ * SUE + 10.000€ * IMP}{(1 + 0{,}00083 * \frac{24}{12})} \quad (12)$$

Other than the estimation function in Chart 9 and in Formula 12, it is possible to use the gathered data as an approximation to estimate the predictable placing value of the units being built. In this specific case, the units that may be built in the area had the following quantity features:

FEATURE	
SUP	90
SUB	4
SUE	20
IMP	1

Whose value, applying Formula 12, equals to:

$$V_{BT} = \frac{5.508{,}75€ + 2.108{,}76€ * 90 + 421{,}75€ * 4 + 30 * 20 + 10.000€ * 1}{(1 + 0{,}00083 * \frac{24}{12})} \quad (13)$$

In this case not only the estimation function has been calculated, but also a subject that may be in the process of being built. The subject determination process may also contribute to determine the risk premium (d'Amato *et al.*, 2012). The other stages of the land value estimation are omitted as they do not concern this essay.

CONCLUSIONS AND FUTURE RESEARCH GUIDELINES

The MCA to abridged data table method, defined to meet the needs of this study, details how to calculate an estimation function to approximate the value of those assets deriving from a real estate transformation. This is particularly useful to determine the land value subject to such transformation or the current value of investment properties under construction. Such procedure has been tested several times, and recently, on a three real estate units study case in the Bari province. The most relevant achievement is the possibility to define an estimation function by means of a limited number of data and through marginal price determination, which are widely accepted from a theoretical point of view as well as in the practice of the professional valuation in Italy. In addition, the estimation function may be used to determine the importance of certain variables. In case the variables are inestimable, the MCA to marginal prices may be integrated with the estimation methods. Future research guidelines may include comparing the results of the MCA to marginal prices with the results coming from multiple regression. Also, another interesting aspect is the evaluation of the use of easy-to-implement linearized functions and the comparison of the possible results.

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