Estimative Analysis of a Segment of the Bare Ownership Market of Residential Property

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Abstract. Estimative analysis of the property market aims to identify the parameters, economic variables and mechanisms at the basis of negotiations that take place in the market. The aims are explanatory and predictive. In this work, a multiple regression analysis is carried out to evaluate a segment of the bare ownership market of residential properties in a district of an Italian city. In particular, using regression, the explanatory variables in the price of the bare ownership are selected among those initially identified with the empirical observation of this phenomenon, the hedonic prices and weights of the explanatory variables are estimated, the estimation function of the bare ownership price is specified as well as the average depreciation rate determined by the usufruct. The discrepancy between the depreciation rates estimated with the regression and those set out by the law for tax purposes, but applied when estimating the bare ownership value, leads to distrusting the practical use of the latter in matters other than tax purposes.

Keywords: bare ownership, multiple regression analysis, housing market, hedonic prices, weights of characteristics of the properties.

1 Introduction

The current economic recession and related credit crunch to households and companies are shifting the focus of the operators towards how to buy and make medium-long term property investments.

Among the various options, the sale of the bare ownership subject to the lifetime usufruct to the seller is creating the most interest [8]. This solution entails the transfer of ownership of a property which, however, is not accompanied by the right to use the property. In fact, the seller retains the usufruct of the property, or the right to dispose of the property and continue to enjoy its benefits for the rest of his life. The buyer, in turn, obtains a reduction in the selling price as well as saves on transfer taxes and

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expenses that may occur within the usufruct. At the end of the usufruct, full ownership of the property returns to the owner.

The institutes of usufruct and bare ownership are considered, without any significant differences, in the Civil Codes of several countries ([10], [15], [14]). For example, this is the case of the French Civil Code (artt.601 et seq.), the German Civil Code (artt.1036 et seq.), the Civil Code of Louisiana (artt.567 et seq.), the Thai Civil and Commercial Code (artt.1417 et seq.), the Italian Civil Code (artt.978 et seq.), the Spanish Civil Code (artt.467 et seq.), the Dutch Civil Code (artt.201 et seq.), the Greek Civil Code (artt.1142 et seq.), the Swiss Civil Code (artt.745 et seq.) and the Civil Code of Québec (artt.1120 et seq.).

Both bare ownership as well as usufruct have a beneficial economic content and, as a consequence, a value, which can be obtained from the estimate. This happens when the bare property is sold or mortgaged, when the right to bare ownership consolidates the right to use or for tax reasons.

For tax purposes, the bare ownership value is determined by applying to the market value of the property the reduction coefficients established by the law, inversely proportional to the age of the usufructuary. For examples, in France (Act of 25/02/1901) the coefficient is equal to 10% if the usufructuary is under the age of 20, 20% aged between 21 and 30 and consecutively increases by 10% per ten-year age intervals, until reaching the value of 90% over the age of 91. In Spain (Act n.5 of 10/05/2006) the coefficient is equal to 30% if the usufructuary is less than 20, and increase by 1% for each additional year of seniority of the usufructuary. In Italy (DM of 22/12/2011) the coefficients reported in Table 1 are applied.

Due to its ease and speed, this way of working is also widely used in estimates carried out for the sale of property as well as in litigation cases, with significant consequences on the evaluation. In fact, the reduction coefficients set out by the law are specified in an aggregate manner for the entire nation. Thus, it is not taken into account that the life expectancy of the usufructuary, factor that strongly affects the bare ownership value, changes with the geographical context. Accordingly, the use of these coefficients can lead to results unrelated to the "true" market value of the bare ownership.

2 Aims of the Work

This work focuses on the sale of the bare ownership of residential properties. The main aim is to have a greater understanding of the bare ownership market. Thus, in relation to the Chiaia residential district of the city of Naples (Italy), the estimation function of the bare ownership will be specified on the basis of the essential factors that are taken into consideration in the sale, as well as the hedonic prices of these factors and the weight that they have on the bare ownership price.

Considering the widespread use of the procedure for estimating the bare ownership that applies the reduction coefficients established by the law, the depreciation rate for

the usufruct that exists on the market of Chiaia will be quantified and compared with the one obtained using the coefficients set by the law in order to highlight either the consistency or inconsistency.

Table 1. – Coefficients for the evaluation, for tax purposes, of the value of the bare ownership in function of the age of the usufructuary (Source: DM del 22/12/2011)

Age of the usufructuary	% Bare ownership
from 0 to 20	5
from 21 to 30	10
from 31 to 40	15
from 41 to 45	20
from 46 to 50	25
from 51 to 53	30
from 54 to 56	35
from 57 to 60	40
from 61 to 63	45
from 64 to 66	50
from 67 to 69	55
from 70 to 72	60
from 73 to 75	65
from 76 to 78	70
from 79 to 82	75
from 83 to 86	80
from 87 to 92	85
from 93 to 99	90

This research is structured as follows. In section 3, multiple regression analysis is discussed, which in this work identifies the instrument used to achieve the objectives outlined. In section 4, the calculations are carried out on a sample of residential properties of the Chiaia district of the city of Naples, whose the bare ownership has recently been sold subject to the lifetime usufruct to the seller and the results are described. In section 5, the conclusions of the work are discussed.

3 The Adopted Procedure

Multiple regression analysis was used to achieve the objectives outlined in the present study.

The regression model takes the form of a function that relates the sales price with a set of variables related to the intrinsic and extrinsic characteristics of the building.

In the presence of the required database, regression analysis allows to select the variables that contribute to the explanation of the phenomena investigated, assess the impact of quantitative and qualitative factors, check the reliability of the results through the use of statistical indices and control tests.

On property, the regression was applied to several topics. Among these, it is worth mentioning: the forecast prices for the sale and lease of property, ([6], [13]), the determination of capitalization rate ([4]), the quantification of the effect on property values of social, environmental or urban factors ([7], [2], [12], [9], [3], [1]).

The main limitation of the regression is of an operational nature and relates to the limited availability of database upon which to implement the procedure. For bare ownership, however, this obstacle is overcome due to the large number of transactions that are being recorded almost everywhere.

The regression model that is used is linear in the coefficients and passes through the origin. This model is easy to analyse, allowing for an immediate and acceptable understanding of the phenomenon being investigated and approximating many nonlinear phenomena.

In the linear model, the coefficients of the regression also identify the hedonic prices of the explanatory variables.

With the linear model, it is also possible to directly estimate the weight that each characteristic has on the bare ownership value. In fact, once calibrated the estimate function, the average weight w_{imed} of the i-th property characteristic, expressed in percentage terms, can be obtained with the relation ([5]):

$$w_{imed} = [\alpha_i . x_{imed} / y_{med}] \cdot 100 \quad (1)$$

where x_{imed} is the average of the i-th characteristic of the property, determined as the average for the units sampled, α_i is the corresponding coefficient of the regression equation, y_{med} is the average price of the bare ownership deduced from the sample estimate.

4 The Case Study

The evaluation sample consists of fifty residential apartments in the district of Chiaia of the city of Naples, where in 2011-2012, the bare ownership was sold subject to the lifetime usufruct to the seller.

The Chiaia district is central, homogeneous from the point of view of the qualification of the buildings, the distribution of the services and urban infrastructures.

The sample properties are consistent for the structural and constructive characteristics.

For each housing unit, the sum of the characteristics that, on the market, are usually taken into account in the negotiations concerning the bare ownership were detected:

- the *selling price* of the bare ownership (PRZ), in euro per square meter of floor area of the property;
- the *floor* (LP) the apartment is on;
- the *number of bathrooms* (SER) of the property;
- the *panoramic views* (PAN), differentiated by the scale 1=low, 3=average, 5=high;
- *life expectancy* (LE) of the usufructuary, inferred from the mortality tables produced for the province of Naples by the National Institute of Statistics and expressed in number of years of remaining life;

- the *state of preservation and maintenance* (SC) of the housing unit, differentiated by the scale 1=poor, 3=good, 5=excellent;
- the presence of a *porter* (PORT), expressed dichotomously according to the sum of 1 per housing unit with a porter, and 0 for those without.

The inherent characteristics that fall into a condition of substantial equality between the units sampled and do not contribute to the explanation of the price were excluded from the analysis.

Location factors were also excluded, due to the substantial uniformity of the housing units found in the district ([11]).

4.1 Main Sample Statistics

The average unit price of the bare ownership of the sample properties was 3,301 euro per square meter of floor area, with a standard deviation of 712.82 euro/m^2.

The average floor area is 97.60 m^2.

Of the units surveyed, 6 are located on the ground floor, 12 on the first floor, 7 on the second floor, 10 on the third floor, 9 on the fourth floor, 4 on the fifth floor, 2 on the sixth floor.

Of the apartments, 24 are with a single bathroom, 18 with two and 8 with three.

In total, 16 of the units have not very scenic views, 19 semi-scenic views and 15-panoramic views.

The state of preservation was poor in 11 cases, good in 20 and excellent in 19.

Of the apartments 27 have a porter, while 23 do not.

The average life expectancy value was 11.52 years, with a standard deviation of 6.82 years.

To systematically examine the phenomenon under study, the sales recorded are distributed on the basis of the life expectancy of the usufructuary in Fig.1.

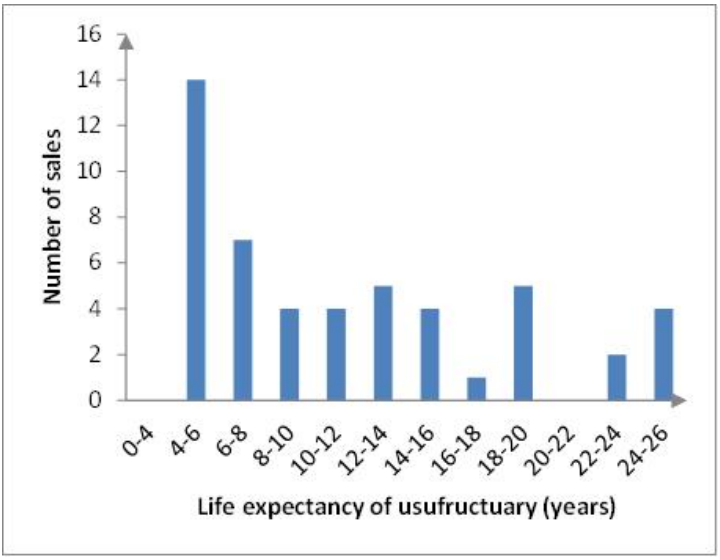

Fig. 1. – Distribution of sales recorded due to life expectancy of the usufructuary

Examination of the figure shows that, in 2011-2012, the sale of the bare ownership affected a wide range of life expectancies, between 4 and 26 years. Thus, according to the mortality tables for the province of Naples, this corresponds to usufructuaries of 94 and 55 years old. This confirms that bare ownership is becoming more widespread.

Most of the sales were properties with relatively old usufructuaries, with a reduced life expectancy. In fact, in the first four classes of life expectancy, those between 4 and 12, which correspond to usufructuaries aged between 94 and 75 years, there were 29 exchanges out of 50, i.e. 58% of the transactions recorded. This implies that in the Chiaia district, whoever purchases a bare ownership wants a moderate saving on the price, but to take possession of the property within a "short" period.

It is also worth pointing out that 6 out of 50 transactions, or 12% of the sales, had relatively young usufructuaries, with a life expectancy of between 22 and 26 years, i.e. aged between 65 and 55 years. These sales can be interpreted in light of the economic difficulties that the current crisis is generating, and therefore the need for many people to ensure the immediate availability of money, without giving up possession of the property. For these cases, the high life expectancy of the usufructuary leads to recognizing the right of purchase in the investment: the buyer hopes for a substantial saving on the purchase price as well as the revaluation of the property over time *(capital gain).*

4.2 Multiple Regression Analysis

Implemented on the sample collected, the regression model passing through the origin has pointed out that the variable PORT is not very significant to explain the unit price of the bare ownership (Table 2). For this variable, the absolute value of the ratio $t = tb_i/Sb_i$ does not exceed the value of the *Student's t* test (1.6802), read on the statistics tables to a confidence level $\alpha = 95\%$ and for 44 degrees of freedom. For this reason the variable PORT is eliminated from the model.

Table 2. – ARM of the case study

Number of the explanatory variables	6
Degrees of freedom of the model (g)	44
Determination Index (R^2)	0.929
Average PRZ (euro/m^2)	3,301
Stanfromrd Error SE (euro/m^2)	855.49
Percentage Error (SE/Average PRZ)	0.2592
Fisher F test	96.588

Variables	Coefficients		t
	B	Std. Error	
LP	293.579	75.573	3.885
SER	689.025	164.120	4.198
PAN	325.463	90.083	3.613
LE	-44.499	20.291	-2.193
SC	243.136	80.658	3.014
PORT	266.680	281.614	0.947

Carried out on the initial sample without the variable PORT, the regression analysis has produced the results summarized in Table 3.

The reading of the data indicates that the model obtained offers excellent performances. The *determination index* (R^2) is equal to 0.963, for this value the linear regression model passing through the origin interpolates well the cloud of data samples, managing to explain more than 96% of the variability of dependent variable.

The Standard Error of the model (SE) is 454.391 euro per square meter of floor area, whereas the percentage error, equal to 13.77%, indicates a good forecast capability.

The *Fisher F* test is significant to a confidence level of 95%, with a value of 115.992.

The coefficients of the model have signs consistent with the evaluative interpretation of the phenomenon as well as the measurement methods assumed for the variables: the unit price of the bare ownership grows with an increase of the *floor*, the *number of bathrooms*, the *panoramic views* and the *state of preservation and maintenance*, as the respective positive signs indicate, whereas the same price decreases with an increase of the *life expectancy* of the usufructuary, which has a negative sign.

Table 3. – Results of ARM without the variable PORT

Number of the explanatory variables	5
Degrees of freedom of the model (g)	45
Determination Index (R^2)	0.963
Average PRZ (euro/m^2)	3,301
Standard Error SE (euro/m^2)	454.391
Percentage Error (SE/Average PRZ)	0.1377
Fisher F test	115.992

Variables	Coefficients		t	Collinearity statistics
	B	Std. Error		VIF
LP	305.948	74.350	4.115	2.591
SER	714.420	161.728	4.417	4.049
PAN	312.774	88.979	3.515	3.607
LE	-39.697	19.625	-2.023	3.623
SC	260.179	78.535	3.313	4.293

All the variables of Table 3 exceed *Student's t* test, so they can be maintained in the model. Definitively, among the independent variables initially considered, the *Student's t* test has led to selecting the variables LP, SER, PAN, LE and SC as significant to explain the unit price of the bare ownership.

In Table 3, the *collinearity test* among the variables of the model is considered. In order to the values in the table, for the variables LP, PAN and LE the variance inflation factors (VIF) are less than 4, revealing the absence of collinearity, whereas for the variables SER and SC the VIF are slightly higher than 4, indicating an "acceptable" collinearity. These data exclude the use of procedures that involve adding more information (*ridge regression*).

Implemented with the parameters obtained by the analysis, the multiple linear regression model becomes:

$$PRZ = 305.948 \cdot LP + 714.420 \cdot SER + 312.774 \cdot PAN - 39.697 \cdot LE + 260.179 \cdot SC \quad (2)$$

This function can be used to estimate directly the market value of the bare ownership of residential properties belonging to the same market segment, entering the values recognized for the respective independent variables and obtaining the corresponding unit price.

In the linear regression model, the coefficients of the variables also identify the hedonic prices of the residential characteristics. In this case, the hedonic price of the generic characteristic represents the variation of the unit price of the bare ownership that is generated when the measurement of the characteristic is varied by one unit. In fact, the implicit price of the variable LP is equal to 305.948 euro/m^2 per additional floor; the implicit price of the variable SER is 714.420 euro/m^2 per additional bathroom; the implicit price of the variable PAN is 312.774 euro/m^2 per step for the scale adopted; the implicit price of the variable LE is equal to – 39.697 euro/m^2 per additional year of life expectancy of the usufructuary; the implicit price of the variable SC is 260.179 euro/m^2 per step of the scale adopted for the measurement.

Substituting in (2), the arithmetic average of the sum of the characters recorded for the sample units and applying (1), the percentage weight that on the average, segment of the market in question, the property characteristics have on the evaluation of the price of the bare ownership (Table 4).

Table 4. – Evaluation of the average percentage weights of the characteristics selected by ARM

Variables	Coefficients of the regression (a)	Average value of the variable (b)	Average value of the bare ownership (c)	Average weight of the variable [(a·b/c)·100]
LP	305.948	2.48	3,301.68	22.88%
SER	714.420	1.68	3,301.68	36.35%
PAN	312.774	2.96	3,301.68	28.04%
LE	-39.697	11.52	3,301.68	-13.85%
SC	260.179	3.36	3,301.68	26.48%

An analysis of the table shows that, in the segment of the market in question, the average weight of the variable LP is equal to 22.88%, the average weight of the variable SER is equal to 36.35%, the average weight of the PAN variable is equal to 28.04%; the average weight of the variable LE is negative and amounts to -13.85%, the average weight of the variable SC is equal to 26.48%.

From the values in the table, there are some considerations on the variable life expectancy (LE). It should be noted that the weight of this variable, equal to 13.85%, identifies the average incidence that, in the Chiaia district, is exerted on the bare ownership price by the differential between an apartment with usufruct and an apartment free from this constraint. It is, in other words, the average depreciation rate

that the housing unit undergoes in that segment of the market due to the presence of the usufructuary.

The "modest" weight of this variable compared to the others can be attributed to several reasons. Firstly, it can be attributed to the sample, which is composed mainly of sales made by elderly usufructuaries, which are responsible for a reduced average life expectancy (11.52 years). This results in a modest reduction of the full market value of the property.

It should also be noted that currently, the demand for bare ownership is not offset by an offer of equal size, which leads to a depreciation of the limited value of the property.

It is also worth adding that Chiaia is a more "upmarket" district, so that in parity of the other conditions, the presence of usufructuaries determines a smaller reduction than in less prestigious districts.

Other considerations are determined by comparing the weight of the life expectancy produced by the model, a weight that identifies the average depreciation that the unit suffers on that market segment due to the presence of the usufructuary, and the corresponding coefficient depreciation set by the Ministerial Decree of 22/12/2011 (Table 1). For the same life expectancy of 11.52 years, and therefore corresponding to an age of 77 years of the usufructuary, the reduction coefficient in Table 1 is 30%. The discrepancy between the two depreciation rates, therefore, is strong. What is obtained with the rate adopted by the Ministerial Decree of 22/12/2011 is more than double the 13.85% estimated with the regression model.

Table 5. – Depreciation percentages of the usufruct determined according to DM 22/12/2011 and obtained by the regression model

Age of the usufructuary	% depreciation (DM 22/12/2011)	% depreciation (regression model)
92	15	4.41
89	15	5.57
86	20	6.76
84	20	7.98
83	20	9.23
80	25	10.50
79	25	11.81
77	30	13.85
76	30	14.51
74	35	15.91
73	35	17.35
72	40	18.82
71	40	20.33
69	45	21.88
68	45	23.47
67	45	25.10
66	50	26.78
65	50	28.50

The outcome does not change if the depreciation is determined with the relation (2) in correspondence to the different life expectancy values of the usufructuary detected with the sample. This calculation can be performed by inserting in the relation (2) the average amount of the variables sampled, and obtaining the weight in corrispondence of the different life expectancy values of the usufructuary detected in the sample. The results are reported in Table 5, in which the depreciation percentages set by DM 22/12/2011 (second column) are next to the percentages defined with the adopted procedure (third column). There is always a clear difference.

This discrepancy can be ascribed to two factors. Without doubt, it depends on the fact that the coefficients of Table 1 identify the aggregated mean values for the entire nation. In contrast, the property evaluations cannot be separated from the specific mechanisms of the market in which the property is, which not only vary from city to city, but also between different areas of the same city.

However, it is also worth recalling the function of the coefficients set out by the law, who are not created to generate the market value of the bare ownership of the residential property, but to produce a reference value for the payment of taxes. Moreover, the periodical updating of the coefficient tables for the determination of the "tax" values of the usufruct and bare ownership is not related to any characteristic that rationally is relate to the market price. It is exclusively associated to financial parameters, in particular, to the legal interest rate (article 48 of Presidential Decree 131 of 04/23/1986).

These elements lead to the conclusion that the coefficients in Table 1 cannot be used outside of the tax environment, even for the rough estimate of bare ownership, due to the result leading to a completely different value from that of the market value of the bare ownership.

5 Conclusions

In this work, the estimative analysis of a segment of the bare ownership market of residential properties recently sold with life usufruct in a district of an Italian city was carried out.

Analysis of the sample highlighted how the exchange of bare ownership is a widespread phenomenon, which also affects young usufructuaries, driven by the needs arising from the current economic crisis.

By using multiple regression analysis, it was possible to identify the factors that, in this market segment, are involved in the formation of the bare ownership price. These include the *floor level*, the *number of bathrooms*, the *view*, *life expectancy of the usufructuary* and the *state of preservation*. The analysis, however, has ruled out the variable *presence of the porter*, initially considered, due to it not having passed the statistical test of the regression model.

The resulting linear additive model without known terms, not only allows the immediate interpretation of the phenomenon being investigated but also direct estimation of the bare ownership value of the residential property in the market segment from very little information. It also provides the hedonic prices of the

variables considered in the selling and, with some simple algebra, allows for the estimation of the weights of the same variables in price formation.

This has led to quantifying the average depreciation due to the presence of usufruct as 13.85% in the Chiaia district. The comparison between this data and the depreciation of the product with coefficients set by the law, which is commonly used in the estimation, showed a clear discrepancy. This leads to the conclusion that the use, for purposes other than tax ratios established by law is improper, and leads to bare ownership values that are disconnected from reality.

There is no doubt that further study is required for this last aspect, by repeating the calculations based on larger samples and investigating the same phenomenon in different urban contexts.

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