Proceedings of the XXXVIII IAHS World Congress

Visions for the Future of Housing

Mega Cities

April 16-19, 2012 Istanbul Technical University

edited by

Oktay Ural
Muhammed Şahin
Derin Ural

International Association for Housing Science

ISTANBUL TECHNICAL UNIVERSITY
Pioneer through the ages

IAHS HOUSING ISTANBUL 2012

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Congress Secretary

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Preface

This proceedings include the manuscripts submitted to the 38th IAHS World Congress-Istanbul,2012. All these documents are reviewed by competent persons before they are included in this document.

The Congress has a topic which covers the global interests of all, as we are interested in the improvement of human life. This desire and venture starts with better habitat and environment. The manuscripts, which are from every corner of the world, will present a complete spectrum of the subject of housing.

As the world population exceeds seven billion and urbanization continues, mostly in Asia, the issue of Mega-cities becomes a topic to confront before the problems become unmanageable. This congress will dwell on this topic, study it with every detail, and try to introduce reasonable solutions. To have new solutions we need people, visionaries, to trace new routes for us. The elite and well-informed participants are the greatest resource to solve the problem.

IAHS presents a great tradition in these World Congresses. In 2012, IAHS will celebrate the 40th year of its founding at the University of Missouri-Rolla. IAHS Congresses have been in many countries, for the last forty years, and it will continue its journey. The next stop will be in 2013, at the Milano Politecnico University, Italy.

IAHS, ITU and all who are involved in the organization of this congress are waiting to meet you in Istanbul. Be sure this will be a congress to remember for all of us!

Professor Oktay Ural, IAHS Founding President
Professor Muhammed Şahin, ITU President
Professor Derin Ural, Congress Chairperson

April 16, 2012, Istanbul

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Price Formation and Real Estate Characteristics Residential Real Estate, Lisbon - Portugal

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Keywords: Real Estate Valuation; Hedonic Models; Lineal Regression; Factorial Analysis; Residential Real Estate Characteristics.

Abstract

The discretionality and the appraisers' subjectivity that characterize traditional real estate valuation are still allowed to take part in the formation of the asset price even when respecting international standards (EVS, IVS) or Appraisal Institution´s regulations (TEGOVA, RICS, etc.).

The application of Econometric Methods to Real Estate valuation by the use of statistic procedures aims at the elimination of subjectivity on the appraisal process.

On this study, Hedonic Models (Econometric Methods applied to Real Estate Appraisal) are used to determine the most important characteristics that define the multifamily residential Real Estate selling price and therefore to make estimations on real estate selling price (knowing the asset characteristics). Two different Statistical Techniques were used in order to compare the results: Multiple Lineal Regression; and Factorial Analysis. These techniques were applied to a sample of 82 flats for sale located in Lisbon, Portugal.

From the 15 studied characteristics, we conclude that the ones that determine/influence the most the asset price are: Area (m2); Nr. of Bathrooms; Privileged View; Nr. of Parking places. Using these 4 variables the asset's price estimation model obtained explains 80, 9% of the Real Estate selling Price.

1 Introduction

The estimation of the Real Estate market value applying the hedonic prices method is based on determining the factors (independent variables) that create the value and its interrelations. In theory, the global value of a building is determined by the linear combination of the inherent prices of each of one of the variables explaining value.

In this study we show the application of the hedonic models into the real estate market aiming at determining the most important variables when explaining the residential real estate value located in Lisbon, capital of Portugal, more specifically in Santa Maria dos Olivais. The samples, residential real estate multifamily buildings (flats) new and used, have been collected during June 2011.

Currently, Real Estate appraisal, considered of extreme importance regarding the maintenance of stability in the financial markets, takes a leading role. We're living at a time where financial entities make the access to mortgage credit very difficult, due to the increase of credit risk; supervision forces the banks to capitalize and increase capital ratio; and the decision on the Real Estate market value through objective and universal methods achieves major relevance.

The current financial crisis overstresses the need of feasible real estate valuations whose values represent reasonable market value. Portuguese and Spanish real estate markets are now in a standstill situation (there are few real estate transactions) which changes valuation and real estate market paradigms. Therefore, players (buyers, sellers and appraisers) have to adjust to this new scenario, developing methods, techniques and new concepts and assumptions adapted to the market change as well as applying new valuation techniques.

In the same manner, the international crisis increased the debate about financial supervision and, consequently, about real estate valuation regulation. In London, in April 2011, G20 meeting clarity and consistency on the application of real estate valuation standards has been considered an important objective to achieve.

Therefore, to exclude discricionarity from the market value equation should be the right path for real estate appraisal's discipline.

Primary questions of this study are:

- Which are the most important determining factors (independent variables: flat's characteristics) of multifamily residential real estate on price formation? We intend to determine which characteristics of a flat concur more decisively for the calculation of the dependent variable, the Real Estate value.
- Which characteristics are more relevant (and should he analyzed under a broader spectrum) to the real estate appraiser when visiting the real estate under valuation?
- The model presented is fitted to predict feasible selling values and if it does, which is the trust interval that it presents?

This study has the aim of contesting these questions by the application of several statistical tests to a set of information collected observing on sale residential multifamily real property at a specific location. We have selected properties with similar locational characteristics in order to exclude this variable from this study. From all the 82 flats that compose our sample where extracted 15 characteristics, which are the 15 independent variables used on the statistical tests.

2 State of the Art

The creation of regulation concerning the real estate appraisal activity has been on Portugal´s political agenda since the year of 2007. On the 2007, 2008 and 2009 "Big Choices plan" for the Construction and Real Estate Sector this issue is discussed and it also refers to the creation of a supervisor and standards for real estate appraisal. However, it hasn´t been approved yet and there is only a draft of the normative to be applied to this subject.

We have had access to this first version of the legal document. It indicates that supervision and coordination of real estate valuation practice will be an attribution of Portugal's National Institute of Construction and Real Estate – INCI.

Till this day, Portuguese real estate valuers have no legal document that supports their activity, except for valuations under certain purposes like Investment Property Funds which are supervised by Real Estate and Market Commission – CMVM. Therefore, appraisers apply valuation methods on a subjective basis and without guidelines.

The present financial crisis brought considerable changes to the Portuguese real estate market. Mortgage credit is now very hard to obtain because of the high spreads asked by the financial institutions. However, it is noted that Portuguese people continue to have great appreciation by real property despite the crisis situation.

Portuguese real estate market is characterized by its opacity and lack of public (accessible to all) information respecting trading prices, construction costs and real estate indexes. Renting market has been a traditionally poor market in result of a conservative market regulation that offered more advantages to the tenant then to the property owner. It is expected that the recently published Renting Market legal document as well as the memorandum signed by FMI, UE and BCE both contribute to the increase of this market dynamics.

Comparing the Portuguese with the Spanish situation it's easy to understand the weaknesses of Portuguese valuation. Spanish valuation has set the ground rules to access the appraisal activity, the valuation companies are homologated

and have a special registry by the Bank of Spain, there are supervising activity organisms and legislation that regulates valuation criteria, parameters, methods and information sources. In addition, the Bank of Spain can request all the information concerning the valuations performed by the valuation companies in order to accomplish its supervising role and to publish public information.

Considering what was formerly exposed , the question asked by Roca Cladera (1996) [4] concerning the Spanish valuation situation can be transposed to the present Portugal situation: "Real Estate Appraisal: Science, Art or Activity?" Which leads us to another question: Real Estate Appraisal: a subjective or a professional opinion?

Despite the lack of legislation concerning all types of real estate valuation, some of the Portuguese appraisers apply the rules and valuation criteria internationally considered the best practices as the ones from the Red Book of the Royal Institute of Chartered Surveyors – RICS, or from the International Valuation Standards (IVS).

Some schools, like the Architectural Faculty of Lisbon's Technical University, the Superior Institute of Economics and Management – ISEG, Lisbon or the Institute of Civil Engineering have real estate valuation courses in order to form students and give them the knowledge they need to produce accurate and feasible valuations providing them with the methods and valuation standards internationally acknowledged.

There are three types of valuers working in Portugal: the ones who work for financial institutions working in mortgage credit valuations; valuers working for big real estate consulting companies (that normally apply international standards like IVS, RICS or Tegova); and independent valuers that present a large spectrum of level of formation on the area.

3 Methodology

With the goal of determining which are the most important independent variables on real estate multifamily residential (flats) price formation and, consequently, which should be the observations made by the real estate valuers when visiting the real properties, we applied the statistical methods of linear regression and factorial analysis to the information extracted from the 82 flats that compose the sample. The statistical software used was SPSS 19 by IBM. We used two different methods with the purpose of comparing the results obtained and finding the best fitted Probable Selling Value equation (the equation that best explains the dependent variable and allows the best selling value estimation).

We determine the best fitted factors that explain the model by using Exploratory Factorial Analysis. Referred factors create constructs that combine real property characteristics. From this analysis we find the Principal Components, grouping variables according to their importance on explaining the dependent variable.

Several tests have been done applying Linear Regression - entering and withdrawing variables and using ENTER, STEPWISE and STEPFORWARD methods – in order to achieve the best fitted model, which means, the model that (best) explains the dependent variable, the Probable Selling Value.

3.1 Sample

The sample used on this study was obtained by searching real properties located in Lisbon, – Santa Maria dos Olivais, on real estate websites. This neighborhood suffered a profound urban transformation that started with Lisbon's EXPO 98. After the end of the exposition this area became a new Lisbon's residential zone.

We have selected real properties located within the polygon formed by Segunda Circular highway, Vasco da Gama Bridge and Marechal Gomes da Costa Avenue because of the locational characteristics of the real properties.

3.2 Linear Regresion Analisis (LR)

The determination of the most important independent variables on price formation (dependent variable) was reached applying the following methods, according to Marôco, 2010 [18]:

ENTER selecting all 15 independent variables of each real property that compose the sample;

STEPFORWARD (progressive variables introduction on the model): the first step consists on entering the constant, followed by the variable that represents the higher increase of the model's Coefficient of determination, R2a (variable

with higher p-value). This routine ends when the higher available variable p-value is lower than the reference coefficient (normally 0,05 or 0,1), or when all variables are within the model;

STEPBACKWARD (progressive variables elimination): this routine starts with all variables and eliminates at each step the variable that explains the minor part of the dependent variable, testing the model's significance as if the variable was the last one introduced on the model. It ends when the F statistics of the withdraw variable is higher than FRemoval or when there are no variables left.

STEPWISE (step by step regression): hybrid model – STEPFORWARD+ STEPBACKWARD. The analysis starts with 1 only variable but new variable significance is tested as in the backward method. At each step the regression variable is entered with higher significance, testing if all variables entered should remain in the model. The routine ends when all variables not entered in the model are out of FEntry range and none of the entered needs to be excluded because of the FRemoval value.

ENTER selecting the most important variables on the value formation extracted from the previous methods.

ENTER selecting the Factorial Analysis 1st Component variables;

3.3 Factorial Analysis (FA)

The application of the Factorial Analysis statistics aims the validation of the results obtained using the multiple Lineal Regression method.

We have introduced all of the 15 independent variables – only the dependent variable, real property value, was kept out.

Table 1 presents the resulting components of the factorial analysis using Rotated Component Matrix VARIMAX, as well as the Eigenvalues (own values) and factors explained variance percentage:

Variables	Rotated Component Matrix				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Number Bathrooms	0,855				
Number Sleep. Rooms	0,846				
Area (m2)	0,814				
Number Parking	0,747				
Finishing Quality		0,779			
Building_Category		0,77			
Sights Quality		0,668			
Building_Equipment		0,65			
Equipment		0,546			
Depreciation			0,816		
Balconies/Terraces			0,686		
2nd hand/New			0,458		
Swimming Pool/ Community Gardens				0,872	
Storage room					0,776
Building _Depreciation					0,713
Eigenvalue	4,64	2,201	1,476	1,362	1,029
% Total Variance Explained	30,936	14,672	9,839	9,078	6,862

Table 1: Exploratory Factorial Analysis: Rotated Component Matrix

By the observation of table 1 we conclude that Factor 1 includes the variables (Number of Bathrooms, Number of Bedrooms; Area; Number of Parking) that explain the higher percentage of variance, which means that this factor stands out as the most significant on real property value. We should also refer the homogeneity on the clustering of the variables that compose each factor or construct.

4 Conclusions

By applying LR and FA statistics, we have determined the most important variables – real property characteristics with the highest influence - on the formation of real estate value. Several tests have been done using predictors selection methods STEPFORWARD, STEPBACKWARD and STEPWISE, applying reasoning weighing to the variables included in the final model.

Table 2 presents the extracted variables applying the different methods exposed:

ANALISYS METHOD	VARIABLES				
	Area (m2)	Number of Bathrooms	Number of Parkings	Sights Quality	2nd Hand/New
Linear Regresion ENTER all variab.					
Linear Regresion STEPWISE	■	■	■		
Linear Regresion STEPBACWARD					
Linear Regresion STEPFORWARD	■	■	■		
Factorial Analisis: Princip. Comp. Anal.					
	FINAL MODEL VARIABLES				
Linear Regresion ENTER var. final model	■	■	■	■	

Table 2: Final Model Variables

Analyzing the results obtained by the appliance of the different methods we should highlight the convergence on the variables extracted. For the final model we have selected only the variables that present significance and p-value lower than 10%.

The most important variables on explaining real property probable selling value extracted are: Area (m2); Number of Parking; Sights Quality; and Number of Bathrooms.

The FA results validate the conclusions withdrawn from the several LR analysis performed. Variables extracted form LR and FA (1st component) methods allow us to be confident on the results achieved on this study, as they are almost coincident. FA's 1st component – the one with the higher dependent variable explanation percentage – withholds the variables Area, Number of Bathrooms, Number of Parking. These 3 variables present the highest dependent variable explanation coefficients (coefficient) and are 3 of the 4 variables used on the final model.

Final LR model presents itself as a highly significant statistic model (sig. = 0,000 < 0,01), with no multicolineality problems (all the VIF are under 10) and as a well-fitted model – with a Coefficient of determination, R2a, of 0,809. This means that 80,9% of the asset value variance is explained by the independent variables used on this study. According to the results obtained, the final model has a great capacity of explaining the dependent variable and it has high significance. The Probable Selling Value equation can be used to anchor real property value and enlighten the appraiser to determine and approximated value of property considering only 4 variables.

Final model equation:

Probable Selling Value (PSV) = -54.966,874 + 1.455,788 * Area(m^2) + 65.294,572 * Number Bathrooms + 37.854,572 * Number Parking + 46.557,918 * Sights Quality (0/1) (1)

The obtained value is valid for a 95% confidence interval, according to the 5% statistical significance applied.

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