Determining the Factors Affecting Housing Prices

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SUMMARY

There are several critical problems regarding cities of Turkey, in which urban sprawl, squatters (gecekondu) and illegally built houses, rapid population growth, disaster-vulnerable buildings, infrastructure and transportation are the most important ones. Urban regeneration projects must enable the renewal of urban environment, identification and demolishment of risky buildings, construction of safe housing, preservation and renewal of social and historical identities in cities that are growing unplanned for many years.

Urban regeneration projects are very important implementation that results in confiscating or changing the property so they have to be transparent, reasonable and acceptable for all actors in the projects. As a special urban development method, in urban regeneration projects, use of a unit land value based method works properly rather than an area based method. To apply a value based method; a dynamic valuation model, built upon the geographical information technologies is needed in order to determine the value of a property before and after the project.

One of the most important things about valuation process is the determination of the factors that affect the value of real estate. Various factors can be found in different sources. Numbers and significances of those factors can be change according to experiences and desires of the people. Some valuation factors will not make a significant change on the value of the real estates, but some of them will affect the value dramatically. Therefore it is important to define the indispensable valuation factors and their significances. The aim of this paper is to determine the valuation factors, which affect the unit value of a property most. Besides the Regression Analyses were performed and the results were examined with respect to selected land valuation factors.

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1. INTRODUCTION

Land is the key components of investments conducted by private sector, national and local governments, far reaching projects related to land, collecting taxes, land readjustment, expropriation and other similar applications which have social and economic importance (Candas and Yomralioglu, 2014). Every investment is in some way or another dependent on land and property (Dale and McLaughlin, 2003). Although land value is one of the most important data needed for all these investments and applications, it is usually hard to predict the "real value".

To assess the value of land by evaluating several factors, related to a real estate, e.g. location, environment, topography, utilization conditions etc. is called real estate valuation, which is a key factor for land management. In Turkey as well as worldwide, private or public sectors use land valuation in quite a few applications, directly or indirectly. Several problems are faced because an administrative infrastructure for real estate valuation in Turkey has not been established yet. It has been shown in some studies that Turkey needs for a sufficient and an effective land valuation system. Some arrangements have been done but they could not be enough to solve the problem yet. There has to be a holistic solution, which covers not only legislative and administrative bases, but also technical bases such as well-defined criteria and standards related to land units (Candas, 2012).

Urban regeneration can be defined as the integrated local redevelopment of deprived areas (neighbourhood, city, metropolitan area). It covers many aspects of city life: physical, social and environmental (URL-1). Law on Redevelopment of Areas Under Disaster Risk numbered 6306 (dated 2012) describes the rules and bases of regeneration. It is expected that about 6 million houses will be redeveloped under this law. Most important and needed data for urban regeneration projects is "land unit value". Governments, investors and holders of property rights aim to get optimal benefits from the projects that create plus value.

Urban regeneration projects are very important implementations, so they have to be transparent, reasonable and acceptable for all actors in the projects. Use of a value based method in urban regeneration projects works properly rather than an area based method. To apply a value based method; a dynamic valuation model, built upon the geographical information technologies is needed in order to determine the value of a property before and after the project.

In this study, 19 independent variables were tested in order to explain changes in dependent variable (Value). After consecutive tests, the model with highest significance of a regression coefficient is decided.

1.1 Study Area

Istanbul is a transcontinental city in Eurasia, with its commercial and historical centre lying on the European side and about a third of its population living on the Asian side of Eurasia (URL-2). Aside from its unique geographic position, Istanbul currently houses one fifth of Turkey's population, making it especially significant in Turkey (URL-3).

With a population of approximately 12.5 million people, Istanbul is one of the biggest metropolitan cities in the world (Istanbul Municipality, 2010). In addition to these, the increasing migration also changes the structure of the city.

Figure 1. Location of the Study Area-Istanbul

Istanbul is not a stable city that has some transformations in the past periods, and it is a dynamic city which the development of the city not finished yet according to the social, economic, cultural and technological improvements (Yazgi and Dokmeci, 2007). As a result of rapid population growth, Istanbul faces several critical problems, in which urban sprawl, squatters (gecekondu) and illegally built houses, disaster-vulnerable buildings, infrastructure and transportation are the most important ones.

1.2 Land Valuation Methods &GIS

Real estate valuation is being used in a wide range of applications including taxation, mortgage, urban regeneration, land readjustment and land consolidation. There are three major land valuation approaches such as sales comparison approach, income approach and cost approach. Similar to the many other countries, three major methods (cost, income and sales comparison methods) are also used in Turkey. Also with the help of advancing computer technology new methods have improved.

To make the right estimation of land value, there are many qualitative and quantitative factors that should be taken into consideration. As a matter of fact, such an approach requires the management of an intensive and classified spatial data resource that is obtained from different disciplines. Geographical Information Systems (GIS) is a very effective technology used in such spatial data management and decision making procedures (Nisanci, 2005).
Methods can be grouped as follows (Nisanci and Colak, 2006):

Traditional valuation methods:

- Comparable method;
- Investment/income method;
- Profit method;
- Development/residual method;
- Contractor's method/cost method;
- Multiple regression method; and
- Stepwise regression method.

Advanced valuation methods:

- Artificial neural networks (ANNs);
- Hedonic pricing method;
- Spatial analysis methods;
- Fuzzy logic; and
- Autoregressive integrated moving average(ARIMA).

Using GIS functionality, spatial analysis is performed in order to determine land parcel values by the combination of mathematical analysis and subjective judgment. The statistic science is used for determining of land value factors and their weights. Especially statistical analysis is performed for testing results, regression analysis, reliability and factor analysis (Simons and Saginor, 2006; Nisanci, 2005). Combining GIS and statistics, enables researchers to analyse numeric, verbal and geographical data all together. GIS can be incorporated in the valuation process to give appraisers a spatial perspective of data (Poletti, 2012).

2. ANALYSIS

The method used in the study is the multiple regression analysis just to be able to compare different kinds of data that comes from different kinds of variables (Yazgi and Dokmeci, 2007). In this study, 19 independent variables such as continent, district, type, earthquake region, etc. were tested in order to investigate the factors affecting housing prices in Istanbul. Consecutive tests were performed to decide the model with the highest significance of a regression coefficient with the help of SPSS Software.

2.1 Multiple Regression Analysis

The Multiple Regression Analysis (MRA) is based on the correlation analysis. Generally correlation and regression can be used to conduct multivariate analysis on fairly small samples (Yusof and Ismail, 2012). "Multiple regression" is a technique that allows additional factors to enter the analysis separately so that the effect of each can be estimated. It is valuable for quantifying the impact of various simultaneous influences upon a single dependent variable (Sykes, 2010).

MRA is a flexible method of data analysis that may be appropriate whenever a quantitative variable (the dependent or criterion variable) is to be examined in relationship to any other factors (expressed as independent or predictor variables). Relationships may be nonlinear, independent variables may be quantitative or qualitative, and one can examine the effects of a single variable or multiple variables with or without the effects of other variables taken into account (Cohen, Cohen, West and Aiken, 2003). A multiple regression equation for predicting "y" can be expressed a follows:

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_n x_n + \varepsilon$$

2.2 Dataset

In this study, the dataset is generated using two different data sets. The first dataset is gathered from 116 valuation reports that were prepared by licensed land valuation experts (Figure 2). The second dataset is derived from GIS.

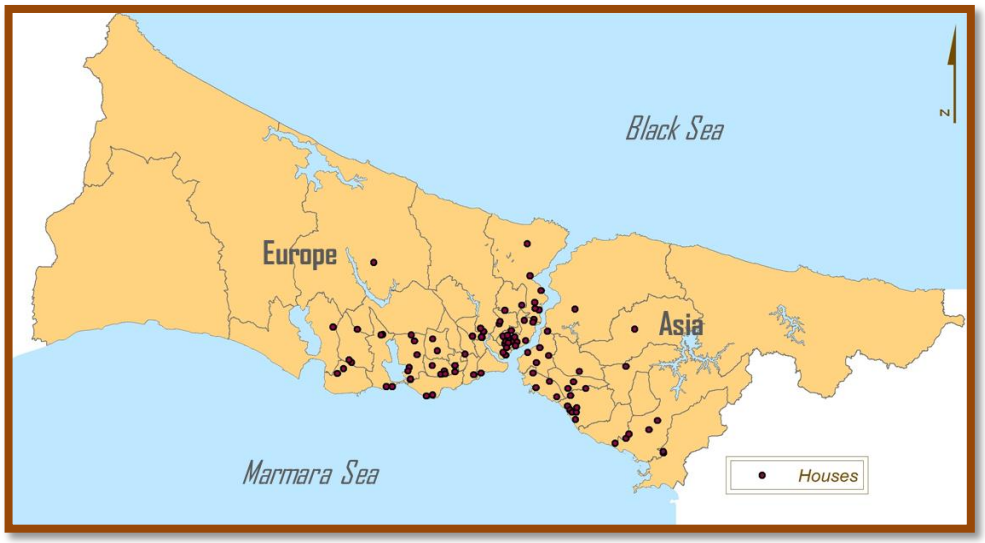

Figure 2. General Distribution of the Houses in Istanbul

In order to determine the valuation factors which affect the value of a property most, 19 variables (Table 1) are analysed; 15 of them (continent, district, type, earthquake region, etc.) are chosen from the reports and 4 of the variables (distance to shopping mall, distance to hospital, distance to sea, and distance to main road) are extracted from GIS.

Location	Site/Building Type	Elevator	*Distance to Mall*
Land Title Type	Heating System	Earthquake Zone	*Distance to Hospital*
Parcel Area	Sewage	Rental Value	*Distance to Sea*
In Zoning	Hydrophore	Land Value	*Distance to Road*
Floor	Fire Escape	Gross Used Area	

Table 1. Independent Variables from Reports and GIS

Dependent variable in regression analyse is <value> which refers to the housing prices in this study. The housing prices from the valuation reports ranging from 44,000 TL to 3,750,000 TL (Table 2). %62 of the houses have apartment-sharing titles, when %37 of them has condominium titles. Almost all of the houses (%97) are in a development plan zone. %26 of the houses situated in the third degree earthquake zone, %68 of them in the second degree earthquake zone and the rest are in the first degree earthquake zone.

Descriptive Statistics

	N	Minimum	Maximum
Value	116	44000	3750000
Valid N (listwise)	116		

Table 2. Range of Housing Prices

2.3 Determining the Factors

The aim of this paper is to determine the factors affecting housing prices. To that end, MRA were performed and the results were examined. When all of the independent variables were tested, the regression model showed that there are lots of independent variables not in relation with the dependent variable.

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-239559,464	197359,397		-1,214	,229
	Location	24496,690	60935,202	,020	,402	,689
	LandTitleType	-1785,710	38298,783	-,002	-,047	,963
	ParcelArea	1,926	1,152	,059	1,672	,099
	InZoning	-107366,558	75586,353	-,041	-1,420	,160
	Floor	-12170,708	5291,547	-,088	-2,300	,025
	SiteBuildingType	3477,724	16148,199	,008	,215	,830
	HeatingSystem	155755,833	89018,724	,052	1,750	,085
	Hydrophore	26846,554	55623,606	,023	,483	,631
	FireEscape	34855,996	53952,912	,030	,646	,521
	Elevator	-65692,482	47135,936	-,057	-1,394	,168
	EartquakeZone	27296,373	37024,562	,026	,737	,464
	RentalValue	267,262	23,010	,693	11,615	,000
	LandValue	,728	,109	,340	6,661	,000
	GrossUsedArea	-511,099	545,790	-,035	-,936	,353
	DistanceToMall	9,443	10,931	,055	,864	,391
	DistanceToHospital	11,171	8,874	,062	1,259	,213
	DistanceToSea	-3,558	6,506	-,027	-,547	,586
	DistanceToRoad	-18,048	14,064	-,074	-1,283	,204

a. Dependent Variable: Value

R-Square=0,960

Then second model with fewer variables is tested.

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-183461,551	151273,887		-1,213	,229
	ParcelArea	1,722	1,042	,053	1,652	,103
	InZoning	-102213,448	70261,225	-,039	-1,455	,150
	Floor	-11871,464	4427,295	-,086	-2,681	,009
	HeatingSystem	135810,130	77972,517	,045	1,742	,086
	FireEscape	57630,906	42470,045	,050	1,357	,179
	Elevator	-62585,370	41586,805	-,054	-1,505	,137
	EartquakeZone	35015,306	32489,470	,034	1,078	,285
	RentalValue	265,690	21,210	,689	12,526	,000
	LandValue	,731	,104	,341	7,003	,000
	GrossUsedArea	-522,810	526,888	-,036	-,992	,325
	DistanceToMall	3,067	7,291	,018	,421	,675
	DistanceToHospital	11,079	8,124	,061	1,364	,177
	DistanceToRoad	-15,841	11,865	-,065	-1,335	,186

a. Dependent Variable: Value

R-Square=0.959

Third model with fewer variables is tested.

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-250992,713	116294,672		-2,158	,034
	Floor	-10570,864	4041,547	-,077	-2,616	,011
	HeatingSystem	155199,035	75440,460	,052	2,057	,043
	EartquakeZone	47758,908	25668,233	,046	1,861	,067
	RentalValue	254,533	18,466	,660	13,784	,000
	LandValue	,737	,102	,344	7,235	,000
	ParcelArea	1,604	,987	,049	1,625	,108
	InZoning	-94873,794	67898,075	-,036	-1,397	,166

a. Dependent Variable: Value

R-Square=0.956

The most proper result according to dataset used in this study, is explained below.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	,977[a]	,954	,951	125403,368571	,954	317,644	5	77	,000	2,266

a. Predictors: (Constant), LandValue, HeatingSystem, Floor, EarthquakeZone, RentalValue

b. Dependent Variable: Value

The R-Square value is essentially a measure of the predictability of the model (i.e. Independent variables in relation to the dependent variable). The R-Square value can range from 0 to 1 where 1 would represent a perfect correlation between the independent and dependent variable(s) (Corsini, 2009). Here it can be said that the %95 of the changes on dependent variable <value> are explained by Floor, Heating System, Earthquake Zone, Rental Value and Land Value.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24976325902485,030	5	4995265180497,006	317,644	,000[b]
	Residual	1210902373363,662	77	15726004848,879		
	Total	26187228275848,690	82			

a. Dependent Variable: Value

b. Predictors: (Constant), LandValue, HeatingSystem, Floor, EarthquakeZone, RentalValue

Coefficients[a]

Model		t	Sig.
1	(Constant)	-3,708	,000
	Floor	-2,155	,034
	HeatingSystem	2,012	,048
	EartquakeZone	1,969	,053
	RentalValue	13,593	,000
	LandValue	7,174	,000

a. Dependent Variable: Value

According to the analysis, the following results can be driven:

1. If the existing floor of the house decreases, the price of the house will increase,
2. If the house has a heating system, the price of the house increases,
3. If the earthquake region degree decreases, the price of the house will increase,
4. If the rental value of the house increases, the price of the house will increase,
5. If the land value of the house increases, the price of the house will increase.

3. CONCLUSION

If significance level is accepted as 0.05, all of the 5 variables in the last regression model (Floor, Heating System, Earthquake Zone, Rental Value and Land Value) have a significant impact on the dependent variable <Value>. Land value and rental value have the highest impact on the housing price. Existing floor, heating system and earthquake zone are following them. Although it is found that the other variables are not significant in this study, it can change according to the sample size. If sample size increases, regression model will change correspondingly. To increase the sample size in order to test the model once again is recommended for further studies.

The application of multiple regression analysis in a house data set explains or models variation in house price which demonstrated good examples of the strategic application of mathematical tool to aid analysis hence decision making in property investment (Yusof and Ismail, 2012).

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BIOGRAPHICAL NOTES

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