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A Mass Valuation Model Proposal for Residential Property Taxation in Türkiye

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Abstract

Real estate valuation, which is an important part of land management functions, is encountered in many applications. One of these application areas is property taxation. In Türkiye, property tax for lands, minimum unit values on street basis are determined by municipalities, and minimum tax value is determined for residential properties. Since spatial, physical and socio-economic characteristics of the properties are not analyzed adequately in the practical studies for taxation purposes, a significant income loss occurs in tax amounts on behalf of the public. In order to ensure fair property taxation in Türkiye, it is clear that the value of each property should be appraised as stated in the property tax regulations, instead of making a generalized valuation on the basis of streets. However, considering the vast amount of properties, it is not practical to carry out the valuation using classical methods. In this study, a mass valuation model based on Nominal Valuation method, which takes into account the criteria expressed in the "Regulation on the Appreciation of Tax Values to be Subject to Property Tax" was developed. The performance of the developed model was tested with 1,000 residential properties whose tax values and current market values are known by the municipality in Gaziosmanpaşa district of Istanbul. According to the results, it has been observed that there is an approximate 6 to 7 times difference between the value of the taxable real estate applied by the Municipality and the market values. On the other hand, several performance metrics of the regression analysis showed that prediction accuracy was high enough. It is evaluated that the developed model will give more accurate results with the increase of data density and the use of real market values instead of property listing data.

1. Introduction

Real estate includes everything that is a natural part of the land, trees and mines, as well as additions made by people to the land like buildings and improvements (Açlar and Çağdaş, 2008). Thus, real estate represents all additions above or below the ground.

Valuation is an activity that aims to determine the monetary amount of an asset or liability. It can also be considered a valuation process. Real estate valuation, on the other hand, is the process of determining the value of a property by evaluating the affecting factors. At the same time, real estate valuation is the independent and impartial valuation of the probable value of a real estate, real estate project or rights and benefits attached to a real estate at a certain date (SPK, 2008).

Many factors such as zoning status, location, ground and construction structure, income earned from the property, accessibility (proximity to public transport, etc.), infrastructure status, parcel shape / size / width / slope should be taken into consideration on the valuation day. For the built environment, when determining the building tax value, the cost of unit m^2 according to the type, class, and usage style of the construction, the external surface area of the building (if there is a share, the area corresponding to the share), the value of the building calculated according to the normal construction cost in square meters, the heating difference, if any, Factors such as elevator difference, depreciation rate, tax-exempt amount are taken into consideration.

In Türkiye, property tax legislation is based on Property Tax Law no. 1319 (Official Gazette, 1970) and application details are expressed in " Regulation on the Appreciation of Tax Values to be Subject to Property Tax" (Official Gazette, 1972). In practice, municipalities calculate the tax value of a residential property as a summation of minimum unit land value on the street

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basis and roughly calculated minimum tax value of the improvement. Besides, spatial, physical and socio-economic characteristics of the properties are not analyzed adequately in the practical studies for taxation purposes. Thus, a significant income loss occurs in tax amounts on behalf of the public. In order to ensure fair property taxation in Türkiye, it is clear that the value of each property should be appraised as stated in the property tax regulations, instead of making a generalized valuation on the basis of streets. In this study, by using GIS-supported Nominal Valuation Method, the taxation process was applied to 1,000 residential properties located in Gaziosmanpaşa district in İstanbul, Türkiye according to the criteria included in the property tax regulation. Thus, it is aimed to prevent real estate tax losses and to make fair taxation by carrying out the valuation on a building basis instead of applying street-based taxation.

2. Method

Within the scope of the study, it was preferred to use the Nominal Valuation Method, which is one of the most widely used methods among mass real estate valuation methods. It is a stochastic method based on the weighted sum of the factors affecting the property value at different levels (Yomralioglu, 1993). By assigning scores on a certain scale (for example, in the range of 0-100) to each criterion affecting the value, the values of both land and buildings can be determined parametrically with this objective approach (Mete, 2022). Nominal criterion scores are multiplied by the weight of each property to obtain unit nominal values. As a result of multiplying the nominal unit value with the area, the total nominal values of the properties can be calculated (1). With this method, it is possible to calculate the tax values of the properties according to the property tax regulation.

$$V_i = S_i * \sum_{j=1}^{k} (f_{ji} * w_j) \qquad (1)$$

V: Total nominal value
S: Parcel or pixel area
f: Factor value (Score)
w: Factor weight
k: Total number of factors

2.1. Best-Worst Method (BWM)

The Best-Worst Method is a method which covers the application of a weighting process for each criterion. When carrying out pairwise comparisons, the best (most important) criteria are chosen, and the criteria scores are decreased according to the order of importance. Likewise, for the worst criterion, the highest score is given to the criterion with low importance, and the criterion score is decreased as the order of importance is increased. Criteria weights are calculated as a result of solving this process. In this method, the sum of the weights of the criteria is 1.

2.2. Study Area

Turkey has an important position in the world since it is located on the intersection of the continents of Asia and Europe. Connecting these two continents, Istanbul, Turkey's most populous city, is located in the northwest of the Marmara region. Gaziosmanpaşa is an important district with a population of 493,096 and an area of 11.67 km^2, located in the city center of Istanbul. The region has a vibrant real estate market due to urban transformation projects. For these reasons, Gaziosmanpaşa district of Istanbul was chosen as the study area (Figure 1).

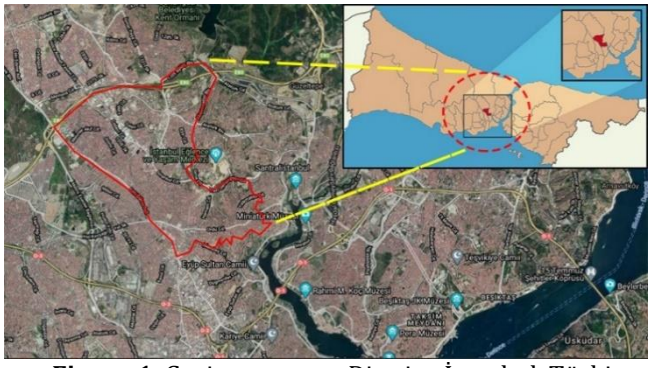

Figure 1. Gaziosmanpasa District, İstanbul, Türkiye

Within the scope of the study, property tax values are calculated for Gaziosmanpaşa district by using the necessary factors (Table 1) according to the issues specified in the "Regulation on the Appreciation of Tax Values to be Subject to Property Tax". The issues specified in the regulation and considered appropriate to be used as a factor are selected from 1,000 residential property; type of use, type of construction, building class, number of rooms, number of halls, water-electricity-gas, front-rear facade situation, presence of elevator, heating, air conditioner, extension, proximity to fire stations, proximity to universities, other education centers (primary school-secondary school-high school), proximity to hospitals, other health centers (health care centers, medical centers, etc.), proximity to metro stations, proximity to police stations, proximity to shopping malls and proximity to hazardous areas. Considering those criteria, nominal factor scores are calculated. For proximity criteria, GIS-based Network Analysis is carried out and the proximity of residential properties to these centers are evaluated by considering road network instead of Euclidean distance.

Table 1. Factors affecting property value

#	Criteria	#	Criteria
1	Type of Use	11	Proximity to Fire Stations
2	Type of Construction	12	Proximity to Education Centers
3	Building Class	13	Proximity to Health Centers
4	Number of Rooms	14	Proximity to Universities
5	Number of Halls	15	Proximity to Hospitals
6	View Quality	16	Proximity to Subway Stations
7	Water, Electricity, Gas	17	Proximity to Police Stations
8	Front - Rear Facade	18	Proximity to Shopping Malls
9	Elevator, Heating, Air Conditioning	19	Proximity To Hazardous Areas
10	Extension		

2.3. Network-Based Proximity Analysis

Network Analysis is used for decision-making with geographic data showing line characteristics and performed with vector-based geographic data (Yomralıoğlu, 2000). There are several GIS-based network analysis applications like service area, location-allocation, and shortest path. In this study, Network-Based Proximity Analysis is carried out by using building and road data obtained for the study area, and proximity criteria of the selected properties are analyzed in 7 distance thresholds (Figure 2).

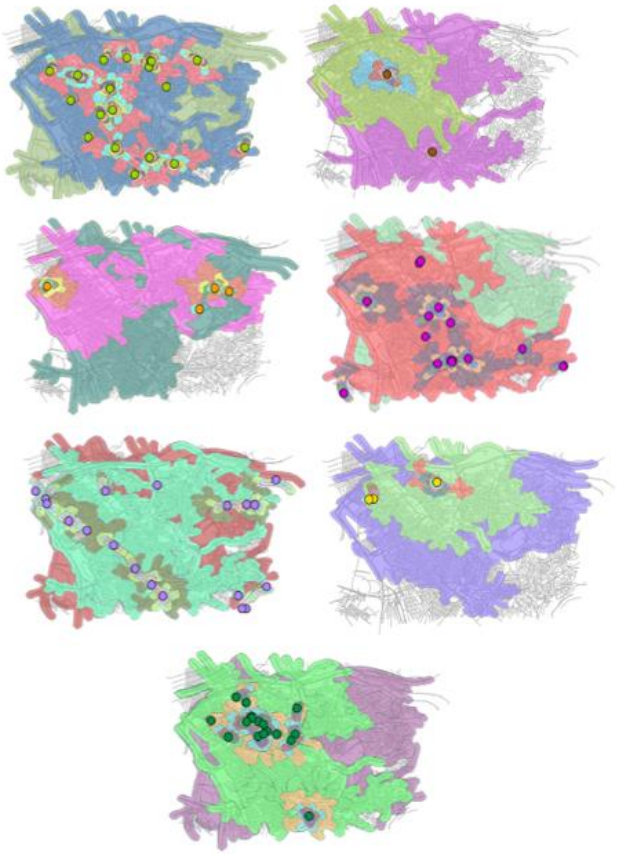

Figure 2. Network Analysis

In the literature, it has been observed that the ranges of distances vary according to the purpose and field of study. For this reason, it was deemed appropriate to select classes as 0-100, 101-200, 201-300, 301-500, 501-1000, 1001-3000, and 3001-5000 in order to have good distinguishability and to easily identify class differences by processing more than one class. Nominal Valuation Method was used to normalize the criteria and calculate the total values after the analysis, and each factor was scored between 0-100 (Table 2). After scoring the criteria, pairwise comparisons were made using the Best-Worst Method to calculate the factor weights, and the weight value of each criterion was calculated with a high consistency ratio (Figure 3).

By using the criteria points and weights, the total nominal values of the buildings have been calculated considering the Property Tax Regulation.

Table 2. Classification of criteria and nominal scores

Proximity Status	Score
0 - 100	100
101 - 200	90
201 - 300	80
301 - 500	70
501 - 1000	60
1001 - 3000	40
3001 - 5000	20
5000 - ↑	0
View Quality	**Score**
15 - 20	100
10 - 15	75
5 - 10	50
0 - 5	25
0 ↓	0
Building Class	**Score**
Luxury	100
1.Class	75
2.Class	50
3.Class	25
Simple	0
Number of Rooms	**Score**
10 - ↑	100
9	90
8	80
7	70
6	60
5	50
4	40
3	30
2	20
1	10
Number of Halls	**Score**
5 - ↑	100
4	80
3	60
2	40
1	20
0	0

In order to express the nominal values in Turkish Lira so that they can be used for taxation purposes, the sales value of the 1,000 residential property selected in the study area using a real estate listing web page. In this context, 80% of the sales values were selected randomly as training data and 20% as test data set, and a mass valuation model is developed by performing regression analysis (Figure 4). Thus, property tax values calculated according to 19 criteria in the study area.

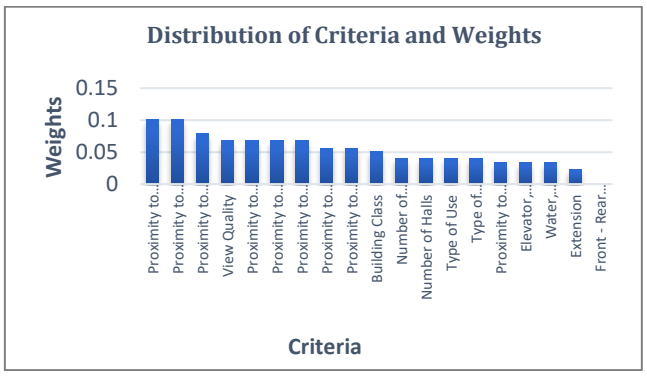

Figure 3. Distribution of Criteria and Weights

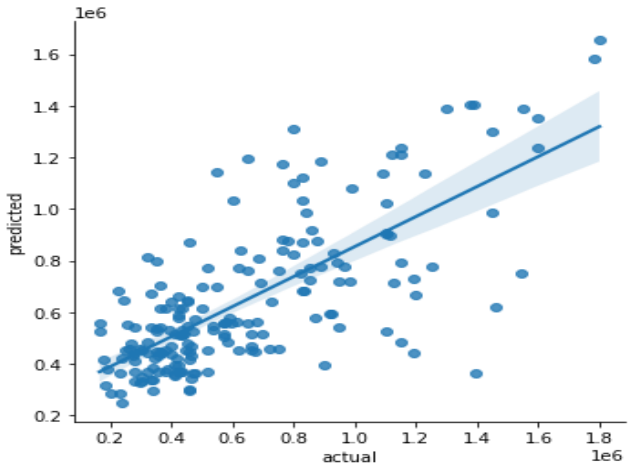

Figure 4. Actual and predicted property values

3. Results & Conclusion

As a result of the study, the tax values for residential properties (‰2) calculated with GIS-based Nominal Valuation Method based on "Regulation on the Appreciation of Tax Values to be Subject to Property Tax" with 0.5244 R^2, 0.3428 Mean Absolute Percentage Error (MAPE), and 248,039 Root Mean Square Error (RMSE). The results of the proposed method were compared with the tax values levied by the municipality and it was observed that there was a difference of approximately 6-7 times. Suggestions to overcome this problem can be listed as follows:

- A GIS-based property valuation system can be created by using real estate listing pages and property attributes can be automatically entered and updated in the created database.
- Up-to-date data about features such as "Building Class, Number of Floors, Location" can be gathered from Google Street View imagery.
- With the HGM Atlas Application, information such as "Building Class, Number of Floors, Location in the Street" can be accessed.
- With the 3D Cadastre and 3D City Modeling project carried out by the General Directory of Land Registry and Cadastre (GDLRC), some information can be accessed from the computer environment and related features can be valued more easily.
- By establishing a dynamic, GIS-based, Property Information System, it will be possible to prevent tax loss as a result of the more equitable determination of the property tax.
- Tax values of lands are updated every four years and the revaluation rates do not reflect the real value increase/decrease rates of the properties. In order to avoid such problems, it will be useful to determine the current value of properties every year or every two years. (Organ and Çiftçi,2015).

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