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The investigation of house value criteria in Atakum-Mimarsinan District Pre- and Post-Pandemic by multiple regression analysis

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Abstract

Real estate valuation is the impartial appraisal and determination of the value of a real estate property by evaluating its characteristics such as utility, quality and environment. In recent years, the whole world has faced the Covid19 pandemic. Although the pandemic has actually ended, its impact on human life still continues. It has been observed that living habits have changed in every field due to the pandemic. This study has been prepared by wondering the impact of this change on the importance of the criteria that affect the house valuation. Different methods can be used in real estate valuation. These approaches are categorized under 2 main headings: traditional methods, modern methods and statistical methods. The aim of this study is to analyse the data before and after the pandemic in Atakum-Mimarsinan district of Samsun province using a multiple regression model in the Minitab program and to compare the change in the coefficients of the criteria affecting the house value. As a result of the study, when the coefficients of the criteria affecting the house valuation pre-and post-pandemic are compared, it is concluded that the coefficient of the floor area has decreased, while the number of rooms has become more important.

1. Introduction

In simple terms, real estate is land, which is a physical asset, and structures built on it by people. In legal terms, the term "real estate" is generally defined as fixed assets that cannot be moved such as land, land, buildings and independent sections. There are 5 types of real estate according to their intended use: residential, commercial, industrial, agricultural and special purpose real estate. Residential real estate is that people use to live in safety, to meet one of their most basic needs for shelter or as a means of investment for the future.

Value is defined as, an abstract measure to determine the importance of something. Value is not a tangible data and is an estimate of the price to be paid for goods and services at any given time. In a purchase and sale contract, the price is the amount of money the seller agrees to receive and the buyer agrees to give under certain conditions (International Valuation Standards Council (IVSC)).

There are many methods for real estate valuation. These methods are divided into 2 headings as traditional, modern and statistical methods given in "Table 1." However, for professional real estate valuation,

subjective value based on the opinions of individuals it is essential to make use of a mathematical model rather than forecasts (Tabar, et al. 2021).

Table 1. Real Estate Valuation Methods

Traditional Methods	Modern and Statistical Methods	
*Cost Method	*Fuzzy Logic	*Nominal Method
*Income Method	*Structural Equation Modelling	*Multiple Regression Method
*Comparison Method	*Support Vector Machine	*Hedonic Pricing Method
	*Artificial Neural Network	*Spatial Analysis

House valuation is the determination of the value of a real estate by evaluating the benefit provided from a real estate, provided that it is impartial, the characteristics of the real estate such as its quality, environmental assessment and determination (Hışır, 2009). Valuation is the process of determining the value of an asset at a given point in time by collecting data on the asset and analysing them independently and objectively. House valuation requires a comprehensive examination as the other

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valuation. Because property is very important both in the world and in Türkiye, and throughout history, states have fought with each other to dominate and own land. The aim valuation process is to reach the fairest, most consistent and accurate conclusion possible. The house valuation influenced by many factors such as the community profile of the region, the location, the closeness to natural disaster zone, the structural and environmental features of the real estate. It is understated that the house valuation process is a very detailed and complex.

In recent years, the Covid19 pandemic has affected the whole world. Although the pandemic has actually ended, its impact on our living habits continues. Human life has changed due to the pandemic. This study was prepared by wondering the effect of this change on the importance of the criteria that affect the house valuation.

The aim of this study is to analyse the pre-and post-pandemic data of Atakum-Mimarsinan neighbourhood by multiple regression analysis (MRA) in the Minitab program and to interpret the changes in criteria coefficients by sorting comparing them.

2. Material and Method

2.1 Material

House valuation, many criteria that affect the value of real estate can be identified. In the literature, 17 different local studies were examined (Bulut et al.,2015; Calmasur & Aysin, 2019; Sisman & Sisman, 2013; Sisman & Sisman, 2016; Tabar, 2020; Tabar et al., 2021; Tabar et al., 2021; Uladi & Uladi,2017; Yayar & Gul, 2014; Yilmazel et al.,2018) and 8 different criteria that are most frequently used in these studies and affect the house price were identified. These criteria are area, number of rooms, age of the building, floor, number of floors in the building, heating method, number of bathrooms and balcony. The study was conducted in Atakum-Mimarsinan neighbourhood. The study area is shown in Figure 1. Atakum-Mimarsinan neighbourhood were preferred because they are the most developing district and neighbourhood of the region. A total of 82 data were collected, 32 pre-pandemic "Table 2" and 50 post pandemic "Table 3". The data were taken from a real estate sales website. While the data of post-pandemic covers the period June-August 2023, the data of pre-pandemic belongs to 2020.

Table 2. Data of Pre-Pandemic (Tabar, 2020)

Area	Room	Building Age (years)	Floor	Building Floor	Heating Method	Bathroom	Balcony	Value (TRY)
135	3+1	11-15	1	4	natural gas	1	yes	275000
120	3+1	11-15	2	5	natural gas	1	yes	260000
120	3+1	11-15	1	6	natural gas	1	yes	190000
150	3+1	5-10	3	5	natural gas	2	yes	375000
...
140	3+1	5-10	2	5	natural gas	1	yes	300000
120	2+1	5-10	3	3	natural gas	1	yes	240000

Table 3.Data of Post-Pandemic

Area	Room	Building Age (years)	Floor	Building Floor	Heating M.	Bathroom	Balcony	Value (TRY)
130	3+1	5-10	3	9	natural gas	2	yes	3.400.000
115	3+1	16-20	2	4	natural gas	1	yes	2.200.000
125	3+1	21-25	5	6	natural gas	1	yes	1.950.000
130	3+1	5-10	4	4	natural gas	1	yes	2.990.000
...
100	2+1	16-20	2	4	natural gas	1	yes	1.500.000
100	3+1	16-20	ground floor	5	natural gas	1	yes	990.000



Figure 1. Study Area

2.2 Method (Multiple Regression Analysis)

In general, regression analysis is the analysis of the relationship between two or more variables. it is used to explain whether there is a relation and, if there is a relation, how to demonstrate it. Regression is defined in modern statistics as finding the unknown with the help of the known (Akis, 2013). Regression analysis aims to make functional sense of the relationship between variables as well as to express the existing relationship as a model.

In MRA, there is one dependent variable and one or more independent variables (Tabar, Basara, Sisman, 2021). MRA is formulated as follows:

$$Y_i = \beta_0 + \beta_1X_{1i} + \beta_2X_{2i} + + \beta_nX_{ni} + \epsilon$$

Here; Y_i : is response variable, X_i : is independent criteria, $i = 1, 2, \dots, n$, β_0 and β_i are coefficients of criteria (Durmus,2016)

The data given in "Table 2" and "Table 3" must be normalized before analysis. There are many normalization methods, in this study data of pre- and post-pandemic were normalised according to the minimum-maximum method.

$$\text{Normalized data} = \frac{(x-\text{min})}{(\text{max}-\text{min})}$$

While evaluating the number of floors of the building and the floor where the subject real estate is located, the ratio of each other and quartiles were utilised. Since the region determined as the study area is a region where flood disasters are frequently experienced due to excessive rainfall and inadequate infrastructure, all of the floors below the 1st floor are taken into consideration when scoring as the place that will be most quickly affected by a possible disaster situation. Another issue taken into consideration while scoring is that the houses with (1+1) room number are more in demand due to the high student population in Atakum district. The scores used during normalisation are as in the table below "Table 4".

Table 4. The Rating of Normalized Criteria

Criteria	Values	
Area	47: (0)	0: (1)
	185: (1)	1-5: (0,8889)
Room	1+1: (0,5)	5-10: (0,6667)
	2+1: (0,25)	11-15: (0,4445)
	3+1: (0,75)	16-20: (0,3333)
	4+1: (1)	21-25: (0,2222)
	Centralized Heating S.: (1)	26-30: (0)
Heating Method	Natural Gas: (0,75)	1st floor below: (0)
	1: (0)	Q1: (0,25)
Bathroom	2: (1)	Q2: (0,50)
	Yes: (1)	Q3-Q4: (1)
Balcony	No: (0)	Top Floor: (0,75)

Normalised data pre and post-pandemic are shown in "Table 5" and "Table 6".

Table 5. Normalized Data of Pre-Pandemic (Tabar, 2020)

Area	Room	Age	Floor St.	Heating M.	Bathroom	Balcony
0.75	0.75	0.4445	0.25	0.75	0	1
0.60	0.75	0.4445	0.50	0.75	0	1
0.60	0.75	0.4445	0.25	0.75	0	1
...
0.80	0.75	0.6667	0.50	0.75	0	1
0.60	0.25	0.6667	0.75	0.75	0	1

3. Results

MRA was performed with Minitab program on normalized data. In the process the Analysis of Variance (ANOVA) and the significance test of criteria were realized. The results of applications were given in "Table

7" and "Table 8" respectively. Since the heating type and balcony criteria were the same in all data pre-pandemic, the analysis was carried out by excluding these criteria.

The P value of ANOVA table shows the possible amount of error that can be made when it is desired to decide that there is a statistically significant difference in comparisons.

Table 6. Normalized Data of Post-Pandemic

Area	Room	Age	Floor St.	Heating M.	Bathroom	Balcony
0.601	0.75	0.67	0.50	0.75	1	1
0.493	0.75	0.33	0.50	0.75	0	1
0.565	0.75	0.22	1	0.75	0	1
...
0.384	0.25	0.33	0.50	0.75	0	1
0.38	0.75	0.33	0	0.75	0	1

Table 7. ANOVA for Pre-Pandemic Data

Criteria	Adj SS	Adj MS	F	P
area	0.21149	0.21149	6.22	0.019
room	0.00069	0.000686	0.02	0.888
buildingage	0.12578	0.125776	3.7	0.066
floorstatus	0.07359	0.073588	2.16	0.153
bathroom	0.12721	0.127212	3.74	0.064

If the P value of criteria is bigger than the significance level (0.05), it is decided that this criterion is affect the house value. In this case, it is concluded that the area criterion affects the value for the pre-pandemic period, while the others do not affect the value as they have values above the significance level. Also, the regression equation can be created from significance test results. The regression equation of pre-pandemic data is as follows;

$$\text{House Value} = -0,273 + 0,547 \text{ area} + 0,035 \text{ room} + 0,393 \text{ buildingage} + 0,204 \text{ floorstatus} + 0,1841 \text{ bathroom}$$

When the weights in the equation are ranked from largest to smallest, the ranking of area, age, floor status, bathroom and number of rooms is obtained.

Table 8. ANOVA for Post Pandemic Data

Criteria	Adj SS	Adj MS	F	P
area	0.16588	0.165878	15.87	0.000
room	0.00436	0.004359	0.42	0.522
buildingage	0.17446	0.174456	16.69	0.000
floorstatus	0.00218	0.002182	0.21	0.650
heatingmethod	0.1107	0.110698	10.59	0.002
bathroom	0.07936	0.07936	7.59	0.009
balcony	0.0267	0.026695	2.55	0.117

When P values for the post-pandemic period "Table 8" were examined, it was determined that the area, age, heating system and bathroom criteria, which were below the significance level, were effective in the house value. The equation for the after the pandemic MRA is as follows:

$$\text{House Value} = 0.912 + 0.407 \text{ area} + 0.0554 \text{ room} + 0.2697 \text{ buildingage} + 0.0224 \text{ floorstatus} + 0.847 \text{ heatingmethod} + 0.1217 \text{ bathroom} + 0.0924 \text{ balcony}$$

When the weights in the equation are sorted from largest to smallest, the order of heating method, area, age, bathroom, number of rooms and floor status is obtained.

4. Discussion

The MRA results for pre-and-post pandemic data can be summaries in the “Table 9”. The R-sq value indicates the variability of the model that can be explained by the independent variables. R-sq adjusted for degrees of freedom is R sq (adj).

Table 9. Model Summaries

	S	R-sq	R-sq(adj)	R-sq(pred)
Before	0.18443	66.02	59.49	46.59
After	0.102225	78.56	74.99	63.36

According to “Table 9”, it is seen that the post-pandemic data can be more explained than pre-pandemic. Also, although the accuracy level can be increased with more data after the pandemic, since there was no difference in the pre-pandemic data, the heating method and balcony and post-pandemic data could not be compared. In addition, more accurate results can be obtained by increasing the factors that will affect the value.

5. Conclusion

The conclusions of this study can be taken follows;

- If the ranking is made according to pre-pandemic data it is obtained that area (0,547) > age (0,393) > floor status (0,204) > bathroom (0,1841) > number of rooms (0,035),
- If the ranking is made according to post-pandemic data it is obtained that the heating method (0,847) > area (0,407) > age (0,2697) > bathroom (0,1217) > number of rooms (0,0554) > floor status (0,0224).
- When the coefficient in the equations are compared;
 - ❖ While the area criterion was more effective pre-pandemic (0.547), it was less effective post-pandemic (0.407),
 - ❖ Number of rooms became a more sought-criteria post pandemic (0.035 to 0.0554)
 - ❖ While floor status was a more effective criterion pre-pandemic (0.204), it decreased after the pandemic (0.0224),

There is no significant difference in other criteria. In line with these changes, it can be concluded that people's sensitivity to private space has increased after the pandemic, and the floor status is less effective in housing purchase decisions compared to before the pandemic.

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