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EDITORIAL - Preface to Volume 6 Issue 2 of the Scientific Journal of Civil Engineering (SJCE)

Todorka Samardzioska EDITOR – IN - CHIEF

Dear Readers,

Scientific Journal of Civil Engineering (SJCE) was established in December 2012. It is published bi-annually and is available online at the web site of the Faculty of Civil Engineering in Skopje (www.gf.ukim.edu.mk).

This Journal welcomes original works within the field of civil engineering, which includes: all the types of engineering structures and materials, water engineering, geo-technics, highway and railroad engineering, survey and geo-spatial engineering, buildings and environmental protection, construction management and many others. The Journal focuses on analysis, experimental work, theory, practice and computational studies in the fields.

The international editorial board encourages all researchers, practitioners and members of the academic community to submit papers and contribute for the development and maintenance of the quality of the SJCE journal. The primary goal continues to be high quality of publications, enhancing objectivity and fairness of the review process.

As an editor of the Scientific Journal of Civil Engineering (SJCE), it is my pleasure to introduce the Second Issue of VOLUME 6.

This year marks the 40th anniversary of the high geodetic education in the Republic of Macedonia. Studies of geodesy lasting five semesters had been open for the first time in our country in 1977. The two departments of geodesy at the Faculty of Civil Engineering in Skopje worthily celebrate this significant jubilee for the geodesy in the Republic of Macedonia.

This issue of our Journal is entirely devoted to topics of geodesy and geomatics.

We are very pleased with the great response of our colleagues and friends from many countries in Europe and from Macedonia that responded to the call for papers. The result is this special Issue with a record number of 18 papers devoted to geodesy, mapping, photogrammetry, cadastre, real estate and related topics. I wish to thank to all authors for all the work and trust on us.

I also very much thank Prof. Zlatko Srbinoski and As. Prof. Zlatko Bogdanovski for the initiative and the great efforts invested in the final form of this edition of the Journal.

To all of our faithful readers, friends and colleagues

Happy New Year and Merry Christmas!

May your home be filled with happiness, your hearts with love, your days with joy for the upcoming holydays and always!

Sincerely Yours,
Prof. Dr. Sc. Todorka Samardzioska
December, 2017

Impressum

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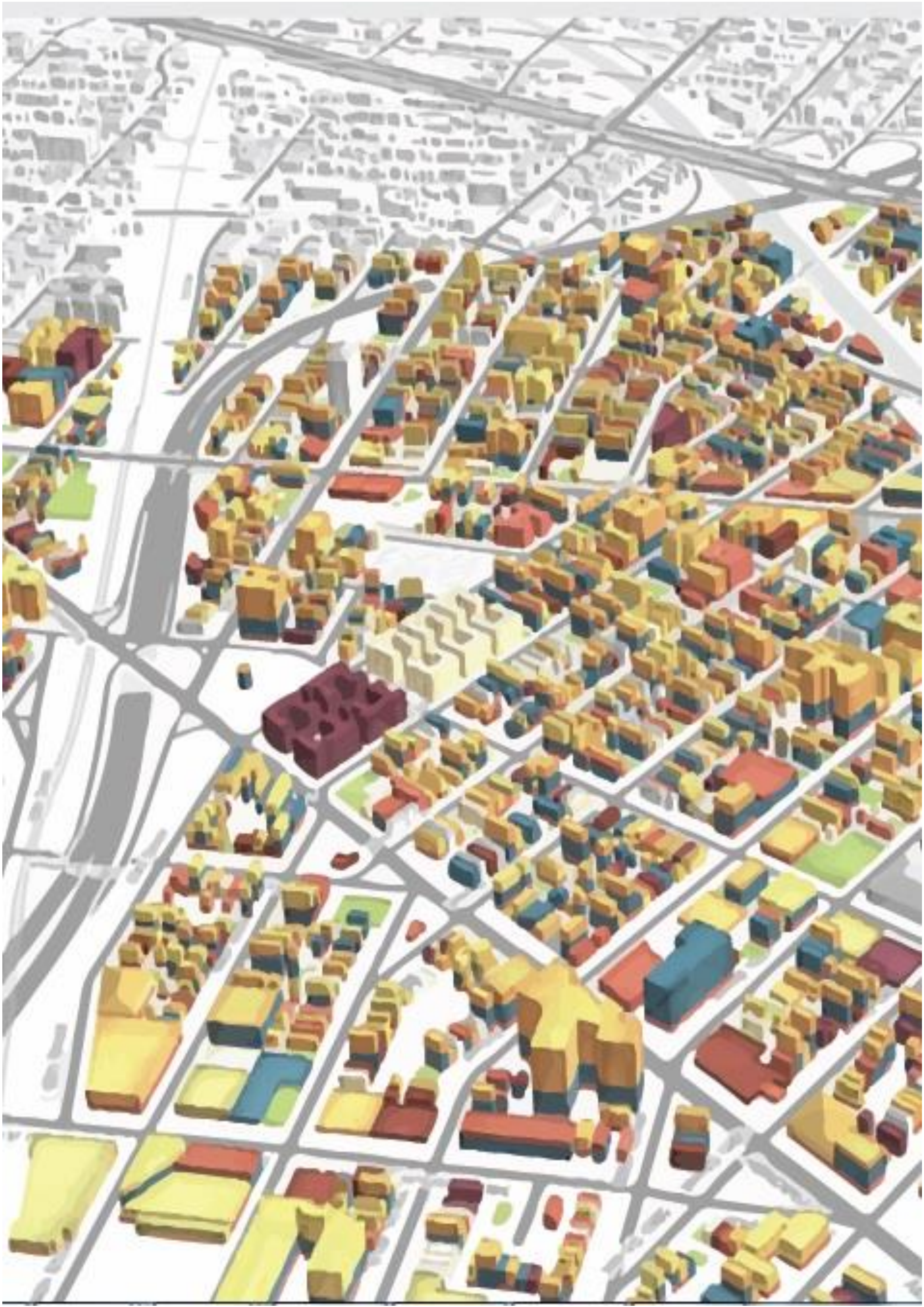

INFLUENCE OF PARKS AND URBAN FORESTS ON THE PRICES OF RESIDENTIAL REAL ESTATES IN SKOPJE

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The focus of this research was to evaluate the influence of the Vodno urban forest and the City Park on the prices of apartments in Skopje, Republic of Macedonia. Detailed investigation and examination of the spatial relations between the residential real estates and the open green spaces (parks and urban forests) was performed utilizing the hedonic pricing method and multiple linear regressions. Quantitative research method was applied for data analyses and processing.

Presented results indicate moderate negative correlation between Vodno and the apartment price in the sample, as well as weak negative correlation between the City Park and the apartment price in the sample. The Vodno urban forest and the City Park are regarded as predictors of the apartment price in the sample.

Keywords: parks, urban forests,Vodno, City Park, hedonic pricing method, multiple linear regression.

1. BACKGROUND AND PROBLEM STATEMENT

In the modern lifestyle and the rapid rhythm of living in recent years, there is an evident increase in the environmental awareness and need for greater contact with nature. Parks, urban forests and green spaces directly and indirectly affect human life. They are a source of various benefits such as recreation and aesthetic experience.The city as a system represents different layers of built environment, in which urban forests, parks and green public spaces exist as a common good for all.

International scientific research findings indicate that the park is consideredan advantage and a desirable amenity in purchasing a property, (Ståhle, 2006; Sander &Polasky, 2009; More et al., 1988; Kestens et al., 2004; Luttik, 2000; Morancho, 2003). Central Park is the first example of a designed park with a professional landscape architecture in the

United States, which contributes to increasing the value of the surrounding properties as well as increasing city tax revenues from property taxes (Crompton, 2007; Luttik, 2000). According to McCormack et al. (2010), the park or public green spaces positively influence the perception of people for that area. However, this does not always happen. If the crime rate in the park has increased, local residents perceive it as unsafe, in which case there may be a negative effect on the prices of surrounding residential buildings, (Troy & Grove, 2008; Sampson &Raudenbush, 1999; Knutson, 1997).

Research findingsindicate that the proximity of parks and urban forests has an influence on the value of the surrounding properties (Crompton, 2004). Therefore, this paper is focused on examining the influence of the City Park and the Vodno urban forest on the price of the apartments in Skopje.Based on the literature findings the following hypotheses can be formulated:

- H_0 hypothesis: The urban forest Vodno and the City Park do not influence the price of apartments in Skopje.
- H_1 hypothesis: The urban forest Vodno and the city park influence the price of the apartments in Skopje.

2. RESEARCH METHODOLOGY

2.1 RESEARCH DESIGN AND RESEARCH METHOD

Presented research can be classified as descriptive. Quantitative research method was appliedfor data analyses and processing.The research uses a hedonic pricing method and multiple linear regression that was suitable for analysis and explicit explanation of real estate variations such as number of bedrooms, area or proximity to open green space.

2.2 TARGET POPULATION AND SAMPLE

Target group of interest for this research are residential real estate i.e. apartments in Skopje. The sample consists of 501 apartments in several Skopje neighborhoods, randomly selected according to the principle of intentional (non-probability) sampling, based on researchers' personal conviction.

2.3 MEASURING INSTRUMENT

Data collection included distance measuring using the ArcGIS tool, available on the official portal of the City of Skopje (http://gis.skopje.gov.mk/skopjegis).Microsoft Excel and IBM SPSS software packagewere used for data coding, grouping and statistical processing.

3. DATA ANALYSIS AND RESEARCH FINDINGS

The analysis of collected data wascompleted using descriptive and inferential statistical methods.

3.1 DESCRIPTIVE ANALYSIS

The research compiled data of 501 apartments distributed in various neighborhoods across the city of Skopje.

Table 1. Total price of apartments per neighborhoods

Neighbourhood	N	Min. price (EUR)	Max. price (EUR)	Mean price (EUR)	Std. deviation
Avtokomanda	17	31000	72000	50705,88	11686,07
Aerodrom	57	36900	123050	68418,25	15457,64
Butel	2	46000	52000	49000,00	4242,64
Vlae	1	138900	138900	138900,00	.
Vodno	64	46200	350000	113034,66	55128,73
Gazi Baba	2	38000	42000	40000,00	2828,43
GjorchePetrov	29	26500	85000	50121,45	13496,01
Debar Maalo	17	59000	183000	95217,06	32062,16
Zhelezhara	9	30000	79000	48442,67	15109,98
Kapishtec	11	46000	130000	84219,82	24169,11
Karposh 1	6	35000	66700	53175,00	12318,03
Karposh 2	3	57600	94800	71133,33	20566,32
Karposh3	15	55000	159850	81435,33	29144,04

Table 1. Total price of apartments per neighborhoods (continue)

Neighbourhood	N	Min. price (EUR)	Max. price (EUR)	Mean price (EUR)	Std. deviation
Karposh 4	6	59000	89000	71333,33	13775,58
KiselaVoda	53	29000	98000	59873,75	16822,33
Kozle	22	49500	180000	78320,45	26806,73
Madjari	3	44000	66400	56800,00	11537,76
Novo Lisiche	24	39000	94000	63706,88	11680,93
Przhino	2	51660	82770	67215,00	21998,09
Radishani	4	38000	55000	46750,00	6994,05
Skopje Sever	1	51000	51000	51000,00	.
Taftalidze	20	46000	110000	72760,00	19299,02
Topan. Pole	5	40000	60590	49140,00	8843,42
Hipodrom	2	40000	42000	41000,00	1414,21
Centar	85	25000	154000	79633,06	27756,36
Crniche	9	50600	118800	86077,78	21723,02
Chair	30	27000	86250	46511,63	14912,74
Chento	2	35000	35000	35000,00	0,00
TOTAL	501	25000	350000	73232,47	33782,55

For greater relevance of the research, most of the apartments or 58.5% are concentrated in and around the central city area, i.e.the neighborhoods: Centar, Vodno, Debar Maalo, Kapishtec, Crnice, Kozle, Przino, Karpos 1, 2, 3, 4 and KiselaVoda. Those locations are near the City Park or the urban forest Vodno and the city center. The research also includes the variable Distance to the center of Skopje due to its close connection with the two points of interest, especially to the City Park. This has been utilized in order to avoid the potential influence of the city center on the apartments located close to the City Park, Vodno and the city center.

The price of the apartments, as representation of their value, is of special interest to this research, and in the inferential statistical analysis, it is a dependent variable. Table 1 presents the values of the total price of apartments per neighborhoods.

It is obvious that the apartments in Vodno have the highest mean value of 113034.66 EUR. The apartments in Debar Maalo have amean value of 95217,06 EUR, in Crniche 86077,78 EUR, Center 79633,06 EUR and Kapishtec 84219,82 EUR, which corresponds with the research of Davidovska Stojanova et al. (2008).

Table 2. Mean prices of apartments grouped by proximity zones from Vodno, City Park and Center

	zone 0 – 400m	zone 400m – 800m	zone 800m – 1200m	zone over 1200m
Distance to Vodno	*N=61 Mean price: 110257,32 €*	*N=70 Mean price: 77456,54 €*	*N=74 Mean price: 71800,39 €*	*N=296 Mean price: 64961,42 €*
Distance to the City park	*N=25 Mean price: 91324,00 €*	*N=43 Mean price: 71900,93 €*	*N=43 Mean price: 77889,07 €*	*N=390 Mean price: 71706,14 €*
Distance to Center	*N=9 Mean price: 97221,11 €*	*N=19 Mean price: 75889,47 €*	*N=53 Mean price: 81023,02 €*	*N=420 Mean price: 71615,35 €*

As represented in *Table 2*, there are overlapping zones of potential influencethat may be most pronounced in the 800m - 1200m zone. Because of the potential overlapping influences of Vodno, Center and the City Park, further analyses will be conducted with simultaneous examination of all three potential centers of influence.

Correction of the sample has been performed in order to get a normal sample distribution histogram. All apartments with a price higher than EUR 170.000 have been excluded from further analysis. The sample has been reduced to 491 apartment and ln(Price) has been accepted as a dependent variable.

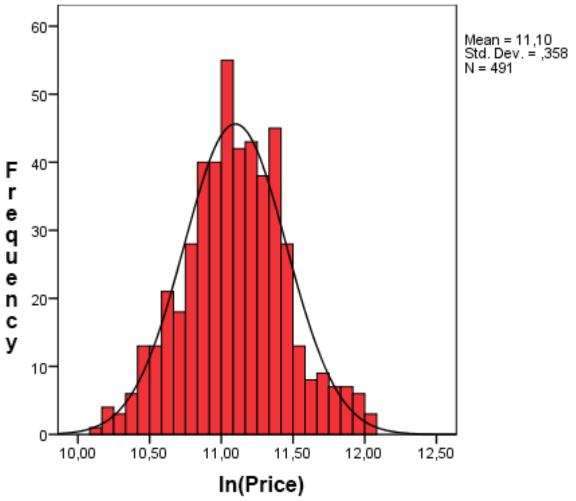

Figure 1. Reduced sample distribution histogram

3.2 INFERENTIAL ANALYSIS AND HEDONIC PRICING MODEL

Several inferential statistical techniques have been applied to investigate the influence of the urbanforestVodno and the City Park on the price of the apartments in Skopje. A correlation test between the variables was made, by examining the Pearson Correlation Coefficient.Furthermore,utilizing multiple linear regression method, a hedonic pricing model of the sample was created, which determines which independent variables can be considered as price predictors of the apartments.

Due to the large number of variables and further simplification of output, only an extract from the Pearson correlation matrix for the locational attributesis presented in *Table 3*.

Table 3. Pearson correlation matrix for locational attributes of the sample

		ln(Price)	Center(m)	Vodno (m)	City Park (m)
ln(Price)	Pearson Correlation	1	-,362)**	-,474)**	-,293)
	Sig. (2-tailed)		,000	,000	,000
	N	491	491	491	491
Center (m)	Pearson Correlation	-,362)**	1	,651**	,779
	Sig. (2-tailed)	,000		,000	,000
	N	491	491	491	491
Vodno (m)	Pearson Correlation	-,474)**	,651**	1	,492
	Sig. (2-tailed)	,000	,000		,000
	N	491	491	491	491
City Park (m)	Pearson Correlation	-,293)**	,779**	,492**	1
	Sig. (2-tailed)	,000	,000	,000	
	N	491	491	491	491

*. Correlation is significant at the 0.01 level (2-tailed).

The results presented in *Table 3* indicate a moderate negative correlation between the variables Vodno (m) and ln(Price) with r = -0.474 at significance level p <0.01 indicating that the price of the apartments is reduced by increasing the distance from Vodno. The coefficient r = -0.362 with significance level p <0.01 implies a weak negative correlation between the variables Center (m) and ln(Price). Weak negative correlation also occurs between the variables City Park (m) and ln(Price) with r = -0.293 and significance level p <0.01, which again would mean that the price of the apartments is reduced by increasing the distance to the Center and the City Park. The presented results imply interesting correlations between the variables Center and Vodno and Center and the City Park. They indicate a moderate positive correlation with r = 0.651 and significance level p <0.01 between Center (m) and Vodno (m), and a strong positive correlation with r = 0.779

and significance level p <0.01 between Center (m) and City Park (m). There is moderate positive correlation between the variables Vodno (m) and City Park (m) with r = 0.492 and significance level p <0.01. These correlations are probably due to the relatively small distance between these three parts of Skopje. These results provide supporting evidence that H1 hypothesis is supported by this research.

For determining or estimating the hedonic pricingmodel for the sample of 491 apartments, the multiple linear regression method was selected, which was performed using the IBM SPSS software package. Due to the large number of independent variables, a multiple linear regression was first performed using the Stepwise method in order to find the most appropriate linear model. The ln (Price) was taken as the dependent variable, and other variables were taken as independent. This method provided 10 models with a sufficiently high R2 coefficient, which are presented in *Table 4*.

Table 4. Model summary of multiple linear regression with Stepwise method

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,834[a]	,696	,695	,19748
2	,903[b]	,816	,815	,15379
3	,908[c]	,825	,824	,15016
4	,914[d]	,836	,835	,14543
5	,918[e]	,844	,842	,14219
6	,922[f]	,850	,848	,13938
7	,924[g]	,853	,851	,13798
8	,925[h]	,855	,853	,13733
9	,925[i]	,857	,854	,13675
10	,926[j]	,858	,855	,13626

The variables that are predictors of the dependent variable ln (Price) for each of the proposed models in *Table 4* are as follows:

1. Predictors: (Constant), Size
2. Predictors: (Constant), Size, Vodno(m)
3. Predictors: (Constant), Size, Vodno(m), Age
4. Predictors: (Constant), Size, Vodno(m), Age, Heating
5. Predictors: (Constant), Size, Vodno(m), Age, Heating, City Park(m)
6. Predictors: (Constant), Size, Vodno(m), Age, Heating, City Park(m), Floor
7. Predictors: (Constant), Size, Vodno(m), Age, Heating, City Park(m), Floor, Rooms
8. Predictors: (Constant), Size, Vodno(m), Age, Heating, City Park(m), Floor, Rooms, Garage
9. Predictors: (Constant), Size, Vodno(m), Age, Heating, City Park(m), Floor, Rooms, Garage, Orientation South-west
10. Predictors: (Constant), Size, Vodno(m), Age, Heating, City Park(m), Floor, Rooms, Garage, Orientation South-west, Basement

The ANOVA test for each of the proposed 10 models, as shown in *Table 5* has a high significance p = 0,000; indicating that the sample fits well into each of the 10 regression models.

Table 5. ANOVA test for the 10 models

ANOVA[k]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43,626	1	43,626	1118,616	,000[a]
	Residual	19,071	489	,039		
	Total	62,696	490			
2	Regression	51,154	2	25,577	1081,398	,000[b]
	Residual	11,542	488	,024		
	Total	62,696	490			
3	Regression	51,715	3	17,238	764,496	,000[c]
	Residual	10,981	487	,023		
	Total	62,696	490			
4	Regression	52,417	4	13,104	619,563	,000[d]
	Residual	10,279	486	,021		
	Total	62,696	490			
5	Regression	52,891	5	10,578	523,241	,000[e]
	Residual	9,805	485	,020		
	Total	62,696	490			
6	Regression	53,294	6	8,882	457,226	,000[f]
	Residual	9,402	484	,019		
	Total	62,696	490			
7	Regression	53,500	7	7,643	401,416	,000[g]
	Residual	9,196	483	,019		
	Total	62,696	490			
8	Regression	53,606	8	6,701	355,308	,000[h]
	Residual	9,090	482	,019		
	Total	62,696	490			
9	Regression	53,701	9	5,967	319,059	,000[i]
	Residual	8,995	481	,019		
	Total	62,696	490			
10	Regression	53,784	10	5,378	289,677	,000[j]
	Residual	8,912	480	,019		
	Total	62,696	490			

Model 10 has the highest R2 value and at the same time has the largest number of included independent variables as well as p = 0,000, and is therefore selected for further analysis. The following variables are included in further analysis:

- Dependent variable: ln (Price);
- Independent variables: Size, Vodno_M, Age, Heating, City Park_M, Floor, Rooms, Garage, Orientation South-west, Basement.

As shown in *Table 6*, R2 of this model is 0.858, while the adjusted R2 coefficient is 0.855. This means that this model describes more than 85% of the apartments in the sample.

Table 6. Model summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
10	,926[a]	,858	,855	,13626	1,436

a. Predictors: (Constant), Size, Vodno_M, Age, Heating, City Park_M, Floor, Rooms, Garage, Orientation South-west, Basement

b. Dependent variable: ln (Price)

Additionally, the Durbin-Watson test value is 1,436, and is at the acceptable lower limit. Although this indicates the existence of a small, but acceptable positive auto-correlation between the independent variables of the model, it can still be concluded that the independent variables in the model are well selected.In addition, the significance level is 0,000. This indicates that the sample of apartments in this analysis has statistical significance and that the regression equation is effective.

Table 7 shows that the level of significance of the T-test for most variables is less than 1%, while only for the variables Garage, Orientation Southwest and Basement is less than 5% indicating that the corresponding coefficients B have statistically significant influence in the model. The variance inflation factor (VIF) is used to monitor multicollinearitybetween independent variables. Since the smallest value of the VIF is 1.027 and the greatest 2.747, which are much lower than the limit value 10, it can be concluded that the degree of multicollinearity of the independent variables is insignificant.

Table 7. Regression coefficients of the model

Coefficients[a]

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
10	(Constant)	10,304	,031		335,926	,000		
	Size	,011	,000	,721	25,283	,000	,364	2,747
	Vodno_M	-5,077E-5	,000	-,216)	-9,491)	,000	,574	1,741
	Age	-,001)	,000	-,108)	-5,171)	,000	,675	1,482
	Heating	,047	,008	,112	6,094	,000	,880	1,137
	City Park_M	-2,693E-5	,000	-,101)	-5,027)	,000	,737	1,356
	Floor	-,005)	,001	-,088)	-4,905)	,000	,920	1,087
	Rooms	,047	,014	,098	3,440	,001	,367	2,722
	Garage	,054	,022	,043	2,440	,015	,965	1,036
	Orientation.Southwest	-,033)	,015	-,039)	-2,229)	,026	,974	1,027
	Basement	-,034)	,016	-,041)	-2,116)	,035	,779	1,284

a. Dependent variable: ln (Price)

According to the regression coefficients presented in *Table 7*, the regression equation that describes the hedonic pricing model of the apartments in the sample is as follows:

ln(Price) = 10,304 + 0,011 · Size-0,00005077 · Vodno_M-0,001 · Age + 0,047 · Heating - 0,00002693 · City Park_M-0,005 · Floor + 0,047 · Rooms + 0,054 · Garage-0,033 · Orientation_South-west-0,034 · Basement

The regression equation indicates that in addition to the fact that the location attributes distance from Vodno (m) and City Park (m) have a moderate or weak negative correlation with ln (Price) as shown by Pearson's correlation analysis; they can additionally be considered predictors of ln (Price). This is in favor of the complete support of the research hypothesis H1, which meansthat the urban forest Vodno and the City Park influence the price of the apartments in the sample. Therefore, by increasing the distance from Vodno for one unit i.e. for 1m, the value of the apartment decreases by 0.00005077, while increasing the distance from the City Park for one unit i.e. for 1m, decreases the value of the apartment by 0.00002693.

5. CONCLUSIONS

The Pearson correlation test indicates a moderate negative correlation between the distance from Vodno and the apartmentprice in the sample, as well as a weak negative correlation between the distance from the City Park and the apartment price. Additionally, an assessment of the influence of the urban forest Vodno and the City Park on the apartmentprices was performed utilizing multiple linear regression. The results confirmed that the distances from Vodno and the City Park can be considered as predictors of the price of the apartments in the sample. This is in favor of confirmation of the research hypothesis in the focus of this paper. Based on this it can be concluded that the proximity to the urban forest Vodno and the City Park influences the price of the apartments in Skopje.

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