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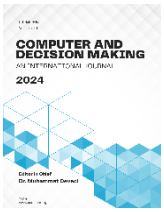

An Expert-based Perspective for Investigating Factors Affecting Residential Property Prices: A Case from Beylikduzu and Esenyurt, Istanbul

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ABSTRACT

Residential property prices have been the subject of interest in various domains, including economics, policy development, construction, and social welfare. Hence, it is of paramount and multifaceted importance to investigate factors affecting residential property prices. Despite the growing attention given by scholars to the topic, many of the past attempts collected real data in study areas to examine influential factors. However, consulting real estate experts to have their opinions about factors and their impact on the house prices can be very beneficial, particularly in data scarce regions. The major aim of this study is to examine factors affecting residential property prices based on the opinions of real estate agents, in contrast to traditional manner of the investigations based on sale or transaction prices. This approach is essential in the real estate sector since transaction process requires the involvement of both buyers and sellers, with whom real estate agents usually interact. To provide an altered perspective to the effects of transportation facilities on real estate prices, a data from 81 real estate agents collected through a questionnaire. Then, ANOVA tests were conducted to observe whether there was a perception difference on the importance of factors between experts who had different levels of experience. The findings of this study can be used as a guide for the decision makers to understand the expectations of stakeholders on their housing needs and develop more expectation-oriented future transportation project planning.

1. Introduction

The first sentence should start here [1]. Many residents in cities around the globe can hardly buy a house owing to the exorbitant house prices in addition to growing demand [1]. Real estate prices are affected by a variety of factors. According to Li *et al.* [2], factors influencing house prices can be grouped into four categories: economic, social, administrative, and environmental. A higher selling price for residential property is usually associated with a good surrounding environment, ease of access to transportation, and locating near the centre of the cities [3]. Due to the significance

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attributed by decision makers and policy makers to the house prices, recently, there has been a growing interest given by scholars on house prices, which is a critical indicator of economic welfare [2]. In Turkey, housing sector, along with the construction sector, is one of the locomotives of the economy and has a multi-tiered effects on the development of other sectors [4].

One of the critical factors affecting residential property prices in cities is the proximity to transportation systems. This effect can be either negative or positive depending upon the local characteristics of the area and type of the transportation systems involved. Due to its critical impact on house prices, there has been a plethora of research highlighting the importance of transportation systems in determining the house prices [5–11, e.g., 12–16]. However, along with proximity to transportation, there are many other factors that affect the prices of residential properties described in the literature. These can include house characteristics such as size, number of rooms, age, interior conditions, parking facilities, swimming pool, gym areas, floor level, view of the house etc. and environmental characteristics such as distance to transportation systems, city centers, central business districts, hospitals, shopping malls, social areas etc. [6–11, 14, 17–24]. Therefore, many researchers examined factors and their influences on house prices from different contexts such as macro-economic factors, regional factors, and demographic factors [25].

Still, the selection rationale of the parameters for estimating real estate prices was not well explained in these studies. Some of these parameters and their influences may change according to the identified location, while some of them may have no effect on the real estate prices. The parameters affecting the real estate prices mostly reflect the market conditions. Here, in real estate market, there is a professional group namely “real estate agents”. They interview with both buyers and sellers to form their professional opinions about the factors that affect the prices of residential properties. The opinions of real estate professionals are significantly different from the amateurs (Northcraft and Neale, 1987). However, there has not been any study analyzing the effects of factors on real estate prices based on professional opinions of real estate experts. Studies in the field chiefly based their approaches on statistical analyses according to the actual data points collected from study areas [4, e.g., 25–27]. In data scarce regions, a lack of data limitation can be overcome by utilizing professional opinions of real estate experts about the house prices.

This study aims to evaluate factors affecting real estate prices based on expert judgments and to explore perception differences among experts with different experience levels. In order to achieve this goal, the relationship between the selected parameters and house prices was investigated in this study. Esenyurt and Beylikdüzü districts of Istanbul were selected as a case study, such that experts working in these districts were contacted for the data collection. Collected data was analyzed using ANOVA and chi-squared tests, followed by corresponding post-hoc tests to observe perception differences about the importance of factors. Overall, the contributions of the study to the theory are twofold:

- This study brings expert judgments to the forefront in analyzing the effects of factors on property prices. Despite there being some studies on the effects of factors on residential property prices, majority of them based their approaches on the collected real data from case studies. This study can therefore serve as a roadmap for analyzing factors influencing real estate prices in case of a lack of empirical data.
- This study compares the perceptions of real estate experts based on experience levels. Hence, the opinions of inexperienced and experienced experts are compared, and the perception differences are explored. Up to authors knowledge, this approach has not been documented in the literature yet.

2. Methodology

According to selected parameters, data is collected from the case study area by contacting experts familiar to the areas. The case study zone consists of two regions of Istanbul: one of them is Esenyurt, the most crowded region of the city and the other one is Beylikduzu, one of the youngest counties of Istanbul. Istanbul is the most crowded city of Turkey. The current population of Istanbul is 15,907,951 (tuik.gov.tr). People migrate from rural areas to city centres due to its proximity to almost every facility such as, better schools, better hospitals, and more options for shopping malls. Therefore, nearly every year, similar to many other cities, the population of Istanbul population increases as presented in Figure 1. Istanbul covers a total of 5313 km2 and current population density is 2994 per/km2. It is a very high density compared to other metropolitan cities in the world and is close to the values of Tokyo (6158 per/km2) [28] and higher than many cities including Beijing (1334 per/km2) [29].

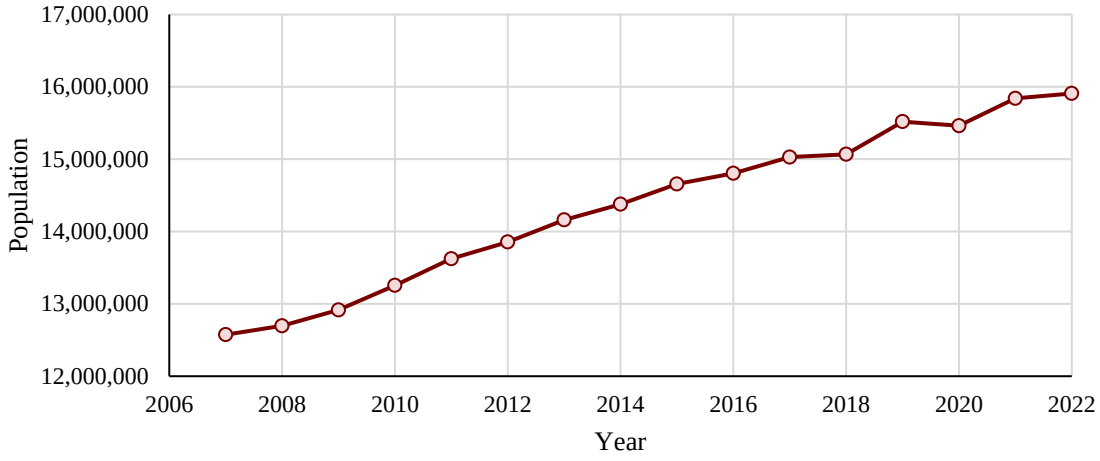

Figure 1. Population of Istanbul between 2007 and 2022

Esenyurt and Beylikduzu are relatively younger districts of Istanbul city. Both of them are established as a County in 2008. Public transportation is mainly provided by the bus rapid transit (BRT) line as that is on the D100 Highway which creates a border between the two counties (Figure 2). Beylikduzu district is placed on the south side of Esenyurt and is surrounded by Marmara Sea and the BRT line. Esenyurt district, on the other hand, is located between BRT line in the south and TEM Highway in the north. The public transportation is not very active in TEM highway, which increases the dependency of the population in Esenyurt on the BRT line.

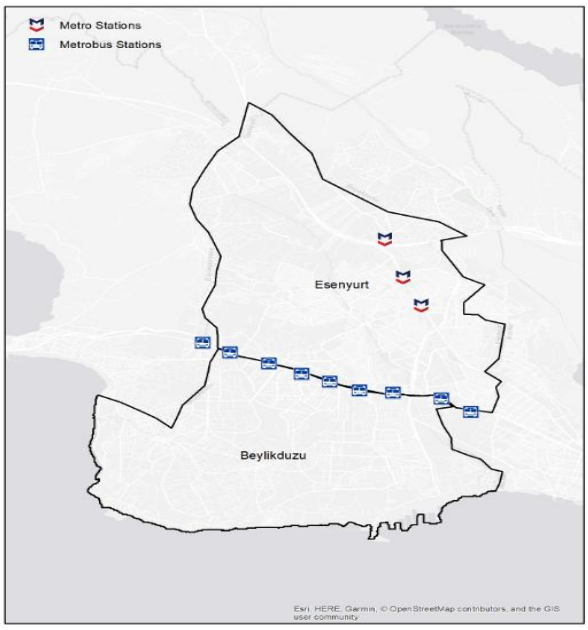

Figure 2. Borders and transportation stations in Esenyurt and Beylikduzu districts

3. Methodology

3.1 Data Collection and Model Development

Collecting the data from the site alone might not reflect the actual conditions. Therefore, the parameters affecting house prices were screened from the literature review in the first step of the research. In the next step, a questionnaire survey was prepared according to these parameters. For each of the predefined parameter, a specific question was designed and directed to real estate experts. The survey questions are presented in Table 1. The intervals provided in the questionnaire (such as 0, 1% - 5%, 6%-10%, 11%-15%, 16%-20%, and %21+ for "Q1: What is the effect of residential property's age on prices?") were defined by two head managers of the real estate agency. The aim of the questionnaire was to penetrate the experiences of real estate experts to observe the effects of the selected parameters. The real estate experts were surveyed in person and asked to concentrate on Esentyurt and Beylikduzu districts while answering the survey questions based on their job experiences about buyers' behaviors. There were two main parts of the questionnaire. In the first part of the survey (Questions D1 and D2), the aim was to measure the experience levels of the real estate experts. Two questions were directed to the experts in this part: (1) number of years in the real estate sector and (2) number of the clients that each expert interacted with. The aim of the second question was to determine the experience levels based on the number of clients with which the real estate experts interviewed.

Table 1 Survey questions

Question ID	Question type	Question	Potential answers
P1	Personal	Age of the respondent	Open-ended
P2	Personal	Gender of the respondent	(1) Male, (2) Female
P3	Personal	Education Level of the respondent	(1) Elementary school, (2) Secondary school, (3) High school, (4), BSc (5) MSc or PhD
D1	Demographic	How long have you been in real estate sector? (year)	(1) 1-4 years, (2) 5-8 years, (3) 9-12 years, (4) 13-16 years, (5) 17-20 years, (6) 20+ years
D2	Demographic	How many people have you been interacting for selling or renting of a residential property?	(1) 0-200, (2) 201-400, (3) 401-600, (4) 601-800, (5) 801-1000, (6) 1001+
Q1	Questionnaire	What is the effect of residential property's age on prices?	(1: None) 0%, (2: Very low) 1% - 5%, (3: Low) 6%-10%, (4: Medium) 11%-15%, (5: High) 16%-20%, (6: Very high) %21+
Q2	Questionnaire	What is the effect of that whether the residential property has parking and other facilities or not, on prices?	(1: None) 0%, (2: Very low) 1% - 5%, (3: Low) 6%-10%, (4: Medium) 11%-15%, (5: High) 16%-20%, (6: Very high) %21+
Q3	Questionnaire	What is the effect of residential property' floor level on prices?	(1: None) 0%, (2: Very low) 1% - 5%, (3: Low) 6%-10%, (4: Medium) 11%-15%, (5: High) 16%-20%, (6: Very high) %21+
Q4	Questionnaire	What is the effect of residential property's credit viability on prices?	(1: None) 0%, (2: Very low) 1% - 8%, (3: Low) 9%-16%, (4: Medium) 17%-24%, (5: High) 25%-32%, (6: Very high) %33+
Q5	Questionnaire	What is the effect of residential property's proximity to hospitals on prices?	(1: None) 0%, (2: Very low) 1% - 3%, (3: Low) 4%-6%, (4: Medium) 7%-9%, (5: High) 10%-12%, (6: Very high) %13+
Q6	Questionnaire	What is the effect of residential property's proximity to shopping malls on prices?	(1: None) 0%, (2: Very low) 1% - 5%, (3: Low) 6%-10%, (4: Medium) 11%-15%, (5: High) 16%-20%, (6: Very high) %21+
Q7	Questionnaire	What is the effect of residential property's proximity to CBDs on prices?	(1: None) 0%, (2: Very low) 1% - 8%, (3: Low) 9%-16%, (4: Medium) 17%-24%, (5: High) 25%-32%, (6: Very high) %33+
Q8	Questionnaire	What is the effect of residential property's proximity to high schools on prices?	(1: None) 0%, (2: Very low) 1% - 3%, (3: Low) 4%-6%, (4: Medium) 7%-9%, (5: High) 10%-12%, (6: Very high) %13+
Q9	Questionnaire	What is the effect of residential property's proximity to seaside on prices?	(1: None) 0%, (2: Very low) 1% - 3%, (3: Low) 4%-6%, (4: Medium) 7%-9%, (5: High) 10%-12%, (6: Very high) %13+
Q10	Questionnaire	What is the effect of residential property's proximity to public transportation systems on prices?	(1: None) 0%, (2: Very low) 1% - 8%, (3: Low) 9%-16%, (4: Medium) 17%-24%, (5: High) 25%-32%, (6: Very high) %33+

The second part of the survey (Questions Q1 - Q10) aimed to reveal the opinions of experts about the impact of residential property characteristics on the house prices. The selected parameters were the age of the property, the floor level of the property, the existence of parking and other facilities, etc. The importance of a parking facility increases day by day and residents are expected to pay more money to have a private parking place in the future. Therefore Q2, (The effect of parking and other facilities on real estate prices?) was included in the questionnaire.

The influence of the surrounding area on real estate prices is measured based on experts' experiences about the Beylikduzu and Esenyurt counties. For example, since it is very difficult to

access to a hospital in case of emergency in rural areas, some people migrate to the cities only for this specific reason. Considering the recent migrations from rural areas to Istanbul, it is of paramount significance to consider hospital proximity. Besides, residents of Istanbul tend to spend much time in shopping malls as they include different facilities and social activities in the same location such as stores, theatres, cinemas, restaurants, and fitness clubs. Therefore, the proximity of a shopping mall can also be considered as an influential factor affecting the prices of residential properties. The population of Esenyurt and Beylikduzu consists of mostly young people, i.e., approximately 40 %, which constitutes a significant rate of commuters in Turkey. Therefore, the distance to central business districts (CBD) can also be considered as a critical parameter that affects the real estate prices.

According to the legislative regulation of the Ministry of Education, 90% of the students that are graduated from primary school have to be registered to high schools based on their residential addresses. Other 10% should pass the exam to enter popular high schools. In other words, only top high schools of Turkey still require taking an entrance exam, while rest of the high schools accept students living in the vicinity of the school. Therefore, proximity to a high-quality high school in the vicinity of a residential property also impacts the price of the property. Furthermore, Beylikduzu has a large seaside. At the south side of the county, there is Marmara Sea and in summertime, the habitants of the county join sea-related activities. Also in summertime, the population of the quarters next to seaside increases. Therefore, the residential properties that include sea view or the ones with easy access to the seaside can be regarded as more valuable.

3.2 ANOVA Analysis

The general form of the analysis of variance (ANOVA) model is:

$$\widehat{X(k)} = \widehat{\mu_k} + \widehat{a_k} + \widehat{\beta_k} + \epsilon(k) \quad (1)$$

where (X(k)) ̂ is the estimate of sample "k", (μ_k) ̂ is the general mean, and (a_k) ̂, (β_k) ̂ are the sample parameters. The term at the end of the equation ϵ(k) refers to the unknown effects. In the literature, many studies revealed that ANOVA is robust to assumption violations. Therefore, ANOVA is a powerful tool in order to reject the null hypothesis H0 that:

$$H_0 : \mu_0 = \mu_1 = \mu_1 = \cdots \ldots \ldots = \mu_n \ , \quad (2)$$

where μ_i,i=1,2,3…..n are the mean values of the n different data groups, which are experience levels of experts in this study.

Depending upon the Levene statistics and ANOVA results if the mean values are significantly different from each other, post hoc tests should be implemented. The selection of the post hoc statistic tests is conducted based on their assumptions and requirements [30]. The selection of proper post hoc test is important because the main purpose of these tests is to avoid the type I and type II errors. In general, the post hoc tests are divided into two main groups based on the equality of variances [31]. There are several tests in case of having equal variances such as least significant test (LSD), Tukey, Scheffe, etc. In this study, the Scheffe test was used because compared to LSD test, Scheffe tends to show less type I error in case of the analysis on more than 3 groups [32]. The post hoc tests are different if unequal variances are observed as a result of Levene statistics. In this context, the tests such as Games-Howell, Tamhane's T2 and T3, Dunnet's C and T3 can also be used

to analyze the mean differences between groups. These tests consider "student t" or "expanded t modulus" to define the differences. While Tamhane's T2 and T3 tests use only "student t" concept [33] and Dunnet's C and T3 tests use only "expanded t modulus" concept [34], Games-Howell test uses both of these concepts for comparison and due to that it is called liberal multiple comparison test [35]. Hence, this study adopted Scheffe and Games-Howel tests as post hoc analysis.

4. Results and Discussion

The ANOVA tests were performed to determine whether there is a significant difference between the means of the experience levels of real estate experts. D2 *(How many people have you been interacting for selling or renting of a residential property?)* denotes for the second question of the survey, and it was used to measure the experience levels of real estate agents. Real estate experts answered this question by providing the number of clients they interviewed with. The experience levels were then divided into 6 categories. The highest experience level was labelled by 6, while the lowest level was 1. It is important to note that the success (or performance) of interviews with clients is irrelevant, since the interview process, itself, is enough to obtain an intuition about the effects of the parameters.

Table 2 provides the frequencies of the real estate experts with respect to their experience levels. It can be observed from the table that most of the experts in the survey interacted with 0-200 (27.2%) or 201-400 (22.2%) people, while only 12.3% of the experts interacted with more than 1000 people for selling or renting a residential property.

Table 2
Frequencies of the real estate experts by experience

Experience level	Number of contacted people	Frequency	Percent
1	0-200	22	27.2
2	201-400	18	22.2
3	401-600	14	17.3
4	601-800	8	9.9
5	801-1000	9	11.1
6	1001<	10	12.3

Table 3 shows the mean experience levels of experts for answer categories in each question. That is, for example, experts who considered "low effect on property prices" as the answer for Q1 (i.e., age of building) had a mean experience level of 3.12 out of 6. A general trend can be observed in the way that more experienced experts thought that the effects of the included factors on property prices would be higher in most questions (e.g., age, parking, floor level etc.). However, there is no clear distinction for distance to hospital (Q5), distance to shopping mall (Q6), and distance to school (Q8). In other words, more traditional and technical criteria such as age of the building, parking area, and floor level seemed to be more important for experienced experts, while distance-based factors were important for all the expert groups, regardless of their experience levels.

Table 3
Mean experience levels of experts for each answer category in all questions

Answer	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1 (None)	1.00	1.00	2.00	1.00	3.07	3.10	2.67	2.29	2.83	-
2 (Very Low)	2.18	2.55	1.97	1.94	3.00	2.89	2.52	2.68	2.39	1.63
3 (Low)	3.12	2.22	2.89	1.78	2.18	2.23	2.96	3.61	3.18	1.64
4 (Medium)	3.67	3.12	3.68	2.84	-	4.00	2.91	3.25	3.07	3.39
5 (High)	3.57	3.10	4.33	4.00	3.00	3.20	3.43	3.00	3.00	3.47
6 (Very High)	5.00	3.77	5.50	5.30	-	-	4.00	1.00	4.75	4.85

Table 4 is the cross tabulation of frequencies of experts with answer categories for all questions. The general trend is that most of the experts considered that the effects of factors would be either very low (2) or low (3). However, for Q2 (presence of parking and other facilities) and Q10 (proximity to public transit), approximately 40% of the experts considered that those two factors would have high (5) or very high (6) impacts on the residential property prices.

Table 4
Response frequencies of experts for survey questions

Question ID	1 (None)	2 (Very Low)	3 (Low)	4 (Medium)	5 (High)	6 (Very High)	Average
Q1	2	28	25	18	7	1	3.0370
Q2	2	20	9	17	20	13	3.8889
Q3	2	31	18	19	9	2	3.0988
Q4	1	17	18	19	16	10	3.7654
Q5	41	27	11	0	2	0	1.7037
Q6	21	37	13	5	5	0	2.2099
Q7	12	21	23	11	7	7	3.0123
Q8	17	22	18	16	7	1	2.7160
Q9	12	23	11	15	16	4	3.1481
Q10	0	19	14	18	17	13	3.8889

Chi-squared and ANOVA analyses were carried out for experience levels and answer categories. In the chi-squared tests, the two categories were considered as experience levels. On the other hand, in the ANOVA tests, answer categories for each question were regarded as the factors and mean experience levels were considered as dependent variables. These analyses were conducted to understand whether the experience levels of real estate experts affected their answers or not. The results of chi-squared and ANOVA analyses are shown in Table 5.

For chi-squared tests, it can be seen in Table 5 that the null hypothesis “experience levels of real estate experts do not affect the answers” can be rejected for Q1, Q3, Q4, and Q10, since p-values were found lower than the level of significance, i.e., 0.05. In other words, it can be concluded that there is a relationship between experience levels of experts and their judgements over age (Q1), floor level (Q3), credit viability (Q4) and proximity to public transport (Q10) of the properties on the prices of them.

In order to understand whether factors with similar means are statistically different from each other based on experience levels, ANOVA tests were also conducted. ANOVA tests were performed with post-hoc analyses, which cannot be conducted via chi-squared tests alone. Before the ANOVA test, however, Levene’s test was carried out to observe if the variances of dependent variable are distributed homogeneously or not. In this test, the null hypothesis is as follows: “variances are distributed homogeneously”. In Table 5, except for Q10 (proximity to public transit), variances were

observed to be distributed homogeneously over the answer categories for all questions at 0.05 significance level since p-values for Levene's test were greater than 0.05 for those questions.

The null hypothesis for ANOVA is "mean experience levels are equal between all answer categories". In the ANOVA test, H0 is rejected if the corresponding p-value is smaller than 0.05. It can be observed in Table 5 that for Q1, Q3, Q4, and Q10, the null hypothesis for ANOVA can be rejected as the p-values were smaller than 0.05. Hence, it can be concluded that at least two groups (based on experience level of experts) differ from each other regarding the importance of age (Q1), floor level (Q3), credit viability (Q4), and proximity to the public transit (Q10) in the context of house prices. In order to explore experts' experiences with statistically different means, post-hoc tests were carried out. Since the variances were distributed homogeneously for questions on age, floor level and credit viability of the property, Scheffe test was employed for these questions. On the other hand, for the last question (i.e., Q10), which is about the proximity of the property to public transit, Games-Howell test was carried out since variances were distributed heterogeneously in this question.

Table 5
ANOVA and chi-square results of the survey questions

	Chi Square Test		Levene's Statistics		ANOVA	
Questions	χ^2	P-value	F-statistic	P-value	F-statistic	P-value
Q1 (Age)	39.330	0.034*	1.498	0.211	3.106	0.013*
Q2 (Facilities)	30.769	0.197	2.458	0.035	1.762	0.131
Q3 (Floor level)	46.076	0.006*	2.062	0.08	6.472	0.000*
Q4 (Credit viability)	57.230	0.000*	2.435	0.055	14.776	0.000*
Q5 (Proximity to hospital)	12.504	0.641	0.534	0.66	0.788	0.504
Q6 (Proximity to shopping mall)	26.149	0.161	1.36	0.256	1.097	0.364
Q7 (Proximity to CBD)	20.758	0.706	1.239	0.299	0.936	0.463
Q8 (Proximity to school)	28.280	0.295	1.651	0.170	1.515	0.195
Q9 (Proximity to seaside)	28.820	0.271	1.445	0.218	1.448	0.217
Q10 (Proximity to public transport)	56.001	0.000*	4.385	0.003*	16.603	0.000*

* Statistically significant at 5% level of significance.

Table 6 shows the Scheffe test results for the importance of age of properties (Q1) based on experts' experience levels. According to the results, the impact of age of real estate on property prices is statistically different based on experience "none" and "high". Age of properties were more influential in property prices for experienced experts compared to non-experienced experts (first row negative and first column positive mean differences). Here, the mean difference was -1.591 between non-experienced experts and high experienced experts and this was statistically significant at 0.05 level. In other words, the age of the properties was more influential on property prices for highly experienced experts than the inexperienced experts by an average of 1.591.

Table 6
Results of Scheffe test for Q1

Experience level	1 (None)	2 (Very Low)	3 (Low)	4 (Medium)	5 (High)	6 (Very High)
1 (None)		-0.424	-1.019	-0.716	-1.591*	-0.891
2 (Very Low)	0.424		-0.595	-0.292	-1.167	-0.467
3 (Low)	1.019	0.595		0.304	-0.571	0.129
4 (Medium)	0.716	0.292	-0.304		-0.875	-0.175
5 (High)	1.591*	1.167	0.571	0.875		0.700
6 (Very High)	0.891	0.467	-0.129	0.175	-0.700	

* The mean difference is significant at the 0.05 level.

Scheffe test results for Q3 are presented in Table 7. As it can be observed in Table 7 that there were significant differences observed between the expert groups. Findings show that inexperienced experts (i.e., 1: none) and experts with very low experience underestimated the role of floor level on real estate prices compared to experts who had medium, high, and very high experiences. The most significant difference between the mean values were observed between inexperienced experts and very highly experienced experts (-1.609), and between inexperienced experts and highly experienced experts (-1.756). Overall, experts with higher experience levels tend to evaluate the effect of floor level on prices at higher levels, which are statistically significant.

Table 7
Results of Scheffe test for Q3

Experience level	1 (None)	2 (Very Low)	3 (Low)	4 (Medium)	5 (High)	6 (Very High)
1 (None)		0.146	-0.338	-1.409*	-1.298	-1.609*
2 (Very Low)	-0.146		-0.484	-1.556*	-1.444*	-1.756*
3 (Low)	0.338	0.484		-1.071	-0.960	-1.271
4 (Medium)	1.409*	1.556*	1.071		0.111	-0.200
5 (High)	1.298	1.444*	0.960	0.111		-0.311
6 (Very High)	1.609*	1.756*	1.271	0.200	0.311	

* The mean difference is significant at the 0.05 level.

Results of Scheffe test for Q4 is given in Table 8. Similar to the findings related to floor level (i.e., Q3), credit viability (Q4) was more important for experienced experts compared to experts who had lower levels of experience. It can be observed that there were significant differences in the evaluations of experts based on experience levels such as 1 (none) - 5 (high), 1 - 6 (very high), 2 (very low) - 5 (high), 2 (very low) - 6 (very high), 3 (medium) - 5 (high), and 3 (medium) - 6 (very high). Based on the results, it can be concluded that the effect of credit viability on real estate prices was considered more important for the experts with higher experience levels compared to those who had less experience.

Table 8
Results of Scheffe test for Q4

Experience level	1 (None)	2 (Very Low)	3 (Low)	4 (Medium)	5 (High)	6 (Very High)
1 (None)		-0.101	-0.688	-1.295	-2.268*	-2.345*
2 (Very Low)	0.101		-0.587	-1.194	-2.167*	-2.244*
3 (Low)	0.688	0.587		-0.607	-1.579*	-1.657*
4 (Medium)	1.295	1.194	0.607		-0.972	-1.050
5 (High)	2.268*	2.167*	1.579*	0.972		-0.078
6 (Very High)	2.345*	2.244*	1.657*	1.050	0.078	

* The mean difference is significant at the 0.05 level.

For the last question, Q10, since the variances were distributed heterogeneously, Games-Howell test was performed. Analysis results are given in Table 9. Findings show that expert categories based on experience such as 4 (medium), 5 (high), and 6 (very high) had different views on the impact of proximity to public transit on real estate prices compared to experts with lower levels of experiences (i.e., categories 2: very low and 3: low). Interestingly, the mean differences between experts with very low (2) or low (3) experience and experts with very high (6) experience were very high, even higher than 3 (-3.215 and -3.203, respectively).

Table 9
Results of Games-Howell test for Q10

Experience level	2 (Very Low)	3 (Low)	4 (Medium)	5 (High)	6 (Very High)
2 (Very Low)		-0.011	-1.757*	-1.839*	-3.215*
3 (Low)	0.011		-1.746*	-1.828*	-3.203*
4 (Medium)	1.757*	1.746*		-0.082	-1.457
5 (High)	1.839*	1.828*	0.082		-1.376
6 (Very High)	3.215*	3.203*	1.457	1.376	

* The mean difference is significant at the 0.05 level.

At the final step of the analysis, the percentage of the effects of each factor on property prices were calculated by normalizing the average values provided by all experts. Figure 3 shows that proximity to transportation (Q10: 12.8%), presence of parking or other facilities (Q2: 12.8%), and credit viability (Q4: 12.4%) were the most critical factors for determining property prices. Interestingly, the most influential factors were among the factors that showed significant difference between expert groups according to categories. Therefore, it can be concluded that all expert groups considered factors other than the most important factors to be of similar importance. However, due to the perceptions of more experienced experts, transportation, parking/other facilities, and credit viability were found more influential in real estate prices.

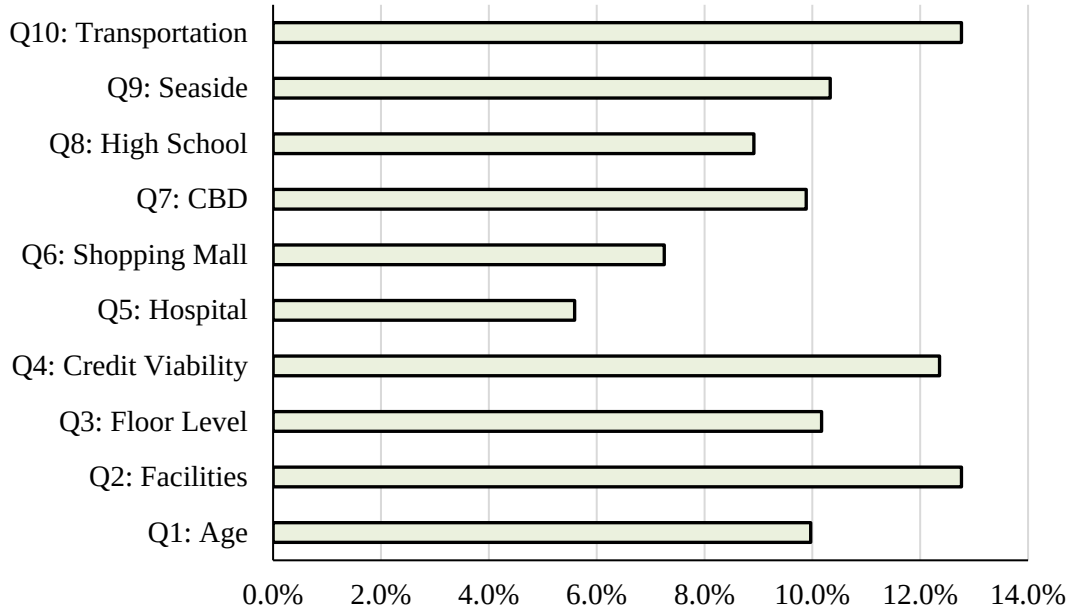

Fig. 3. Comparison of factor weights

The findings of this study show similarities in the existing literature. First, proximity to transportation has always been considered as an important factor affecting house prices [2]. Given that many people in Esenyurt and Beylikdüzü are commuters, proximity to transportation is more important for buyers in these districts than the buyers in other districts that are close to CBD. Considering the unprecedented urbanization on these districts causing heavy traffic [36], more people may tend to use public transportation to save money and time.

The current number of vehicles in Istanbul is 4,669,113 (tuik.gov.tr). These vehicles cover more area than 6 districts of Istanbul (i.e., Gungoren, Beyoglu, Bayrampasa, Zeytinburnu, Gaziosmanpasa

and Fatih), with approximately 64.5 million square meters (tuik.gov.tr). Hence, existence of parking area can be regarded as a significant factor affecting property prices. Parking facility was also addressed as a significant predictor of house prices in previous research [37].

Credit viability is another factor affecting residential property prices and common to nearly every country [27]. Although some residential properties have a lower price, since there are no suitable bank credits, buyers may have to consider more expensive houses for which they can use loans. Hacıevliyagil *et al.* [38] also stated that credit trends are important for residential property prices. Given the increase in the housing market in Istanbul, which is the seventh most attractive city in Europe (after London, Paris, Moscow, Milan, and Rome) in terms of residential housing market, buyers tend to buy houses with bank credits.

4. Conclusion

In this work, factors affecting the residential property prices were investigated by surveying real estate experts through a questionnaire. These factors include age, existence of parking areas and other facilities, floor level, credit viability as well as its proximity to a hospital, shopping mall, CBD, high school, seaside, and public transport. First, 81 real estate experts were surveyed through the questionnaire and the perception differences based on the experience levels of the real estate experts were analyzed by ANOVA and corresponding post-hoc tests: Scheffe and Games-Howell. It was found that except age, floor level, credit viability and proximity to public transportation factors, experience levels of experts did not change their judgements about the influence of the factors on the property prices. It is also important to point out the proximity to public transport, presence of parking area/other facilities, and credit viability as they were the most determinant factors with the highest effects on the real estate prices. Proximity to public transport is particularly important and should be considered by urban planners for transportation planning purposes.

This study has several limitations that should be considered in future attempts. Firstly, a study area with a lack of information about the real estate prices was analyzed using the professional opinions of real estate experts. Since further statistical analyses (e.g., regression analysis) depends on the actual data, such an analysis can represent more accurate results compared to the subjective evaluations of real estate experts. Secondly, in the literature, the parameters affecting the house prices were chiefly selected without any pre-investigation. This study suggests that the real estate experts can be surveyed in order to determine the parameters that affect the real estate prices for a study area. In future studies for a statistical analysis, data can be collected for the most important factors identified in the current research, depending on the outputs of the survey with the real estate experts. Overall, this study is expected to bring the opinions of real estate professionals to the forefront in the analysis of real estate prices.

Author Contributions

Conceptualization, Onur Sahin and Ilgin Gokasar; methodology, Onur Sahin and Ilgin Gokasar.; software, Onur Sahin; validation, Onur Sahin and Ilgin Gokasar; formal analysis, Onur Sahin and Ilgin Gokasar; investigation, Onur Sahin and Ilgin Gokasar; resources, Onur Sahin; data curation, Onur Sahin; writing—original draft preparation, Onur Sahin and Ilgin Gokasar; writing—review and editing, Onur Sahin and Ilgin Gokasar; visualization, Onur Sahin.; supervision, Ilgin Gokasar.; project administration, Onur Sahin and Ilgin Gokasar. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References
[1] Amit, N., Sapiri, H., & Yusof, Z. (2022). Factors Affecting Housing Price in Malaysia Using Structural Equation Modeling Approach. Sains Malaysiana, 51(12), 4161–4173. https://doi.org/10.17576/jsm-2022-5112-23
[2] Li, N., Li, R. Y. M., & Nuttapong, J. (2022). Factors affect the housing prices in China: a systematic review of papers indexed in Chinese Science Citation Database. Property Management, 40(5), 780–796. https://doi.org/10.1108/PM-11-2020-0078
[3] Chasco, C., & Gallo, J. Le. (2013). The Impact of Objective and Subjective Measures of Air Quality and Noise on House Prices: A Multilevel Approach for Downtown Madrid. Economic Geography, 89(2), 127–148. https://doi.org/10.1111/J.1944-8287.2012.01172.X
[4] Özsoy, O., & Şahin, H. (2022). Factors affecting housing prices in Izmir, Turkey: a quantile regression approach. International Journal of Housing Markets and Analysis, 15(1), 145–164. https://doi.org/10.1108/IJHMA-11-2020-0133
[5] Rodríguez, D. A., & Targa, F. (2004). Value of accessibility to Bogotá's bus rapid transit system. Transport Reviews, 24(5), 587–610. https://doi.org/10.1080/0144164042000195081
[6] McMillen, D. P., & McDonald, J. (2004). Reaction of House Prices to a New Rapid Transit Line: Chicago's Midway Line, 1983–1999. Real Estate Economics, 32(3), 463–486. https://doi.org/10.1111/J.1080-8620.2004.00099.X
[7] Pilgram, C. A., & West, S. E. (2018). Fading premiums: The effect of light rail on residential property values in Minneapolis, Minnesota. Regional Science and Urban Economics, 69, 1–10. https://doi.org/10.1016/j.regsciurbeco.2017.12.008
[8] Dziauddin, M. F. (2019). Estimating land value uplift around light rail transit stations in Greater Kuala Lumpur: An empirical study based on geographically weighted regression (GWR). Research in Transportation Economics, 74, 10–20. https://doi.org/10.1016/J.RETREC.2019.01.003
[9] Hess, D. B., & Almeida, T. M. (2007). Impact of Proximity to Light Rail Rapid Transit on Station-area Property Values in Buffalo, New York. Http://Dx.Doi.Org/10.1080/00420980701256005, 44(5–6), 1041–1068. https://doi.org/10.1080/00420980701256005
[10] Pan, H., & Zhang, M. (2008). Rail Transit Impacts on Land Use. https://doi.org/10.3141/2048-03
[11] Martínez, L. M., & Viegas, J. M. (2009). Effects of Transportation Accessibility on Residential Property Values. Https://Doi.Org/10.3141/2115-16, 2115, 127–137. https://doi.org/10.3141/2115-16
[12] An, Y., Qiu, G., & Liu, L. (2010). A Study of Real Estate Prices in Jilin Province. Chinese Economy, 43(2), 53–63. https://doi.org/10.2753/CES1097-1475430204
[13] Pagliara, F., & Papa, E. (2011). Urban rail systems investments: an analysis of the impacts on property values and residents' location. Journal of Transport Geography, 19(2), 200–211. https://doi.org/10.1016/J.JTRANGEO.2010.02.006
[14] Efthymiou, D., & Antoniou, C. (2013). How do transport infrastructure and policies affect house prices and rents? Evidence from Athens, Greece. Transportation Research Part A: Policy and Practice, 52, 1–22. https://doi.org/10.1016/J.TRA.2013.04.002
[15] Bohman, H., & Nilsson, D. (2016). The impact of regional commuter trains on property values: Price segments and income. Journal of Transport Geography, 56, 102–109. https://doi.org/10.1016/J.JTRANGEO.2016.09.003
[16] Beimer, W., & Maennig, W. (2017). Noise effects and real estate prices: A simultaneous analysis of different noise sources. Transportation Research Part D: Transport and Environment, 54, 282–286. https://doi.org/10.1016/J.TRD.2017.05.010

[17] Vichiensan, V., Malaitham, S., & Miyamoto, K. (2011). Hedonic Analysis of Residential Property Values in Bangkok: Spatial Dependence and Nonstationarity Effects. Journal of the Eastern Asia Society for Transportation Studies, 9, 886–899. https://doi.org/10.11175/EASTS.9.886
[18] Xu, T., & Zhang, M. (2016). Tailoring empirical research on transit access premiums for planning applications. Transport Policy, 51, 49–60. https://doi.org/10.1016/J.TRANPOL.2016.03.003
[19] Mulley, C., Ma, L., Clifton, G., Yen, B., & Burke, M. (2016). Residential property value impacts of proximity to transport infrastructure: An investigation of bus rapid transit and heavy rail networks in Brisbane, Australia. Journal of Transport Geography, 54, 41–52. https://doi.org/10.1016/J.JTRANGEO.2016.05.010
[20] Wagner, G. A., Komarek, T., & Martin, J. (2017). Is the light rail "Tide" lifting property values? Evidence from Hampton Roads, VA. Regional Science and Urban Economics, 65, 25–37. https://doi.org/10.1016/J.REGSCIURBECO.2017.03.008
[21] Cohen, J. P., & Brown, M. (2017). Does a new rail rapid transit line announcement affect various commercial property prices differently? Regional Science and Urban Economics, 66, 74–90. https://doi.org/10.1016/J.REGSCIURBECO.2017.05.006
[22] Cervero, R., & Duncan, M. (2002). Transit's Value-Added Effects: Light and Commuter Rail Services and Commercial Land Values. Https://Doi.Org/10.3141/1805-02, 1805, 8–15. https://doi.org/10.3141/1805-02
[23] Cervero, R. (2004). Effects of Light and Commuter Rail Transit on Land Prices: Experiences in San Diego County. Journal of the Transportation Research Forum, 43(1). https://doi.org/10.5399/OSU/JTRF.43.1.741
[24] Munoz-Raskin, R. (2010). Walking accessibility to bus rapid transit: Does it affect property values? The case of Bogotá, Colombia. Transport Policy, 17(2), 72–84. https://doi.org/10.1016/J.TRANPOL.2009.11.002
[25] Jiang, L., & Gao, Y. (2021). Influencing factors of real estate price based on grey relational analysis. AACE Clinical Case Reports, 7(1), 1. https://doi.org/10.2174/1874110X01509011270
[26] Kobylińska, K. (2021). The Application of Spatial Autoregressive Models for Analyzing the Influence of Spatial Factors on Real Estate Prices and Values. Real Estate Management and Valuation, 29(4), 23–35. https://doi.org/10.2478/REMAV-2021-0027nutta
[27] Mallick, H., & Mahalik, M. K. (2015). Factors determining regional housing prices: evidence from major cities in India. Journal of Property Research, 32(2), 123–146. https://doi.org/10.1080/09599916.2014.963642
[28] Tokyo Metropolitan Government. (2015). Tokyo's History, Geography, and Population. https://www.metro.tokyo.lg.jp/ENGLISH/ABOUT/HISTORY/history03.htm
[29] Statista. (2023, November). Population density in Beijing, China from 1980 to 2022. https://www.statista.com/statistics/1083596/china-population-density-in-beijing/
[30] Ramig, P. F. (1983). Applications of the Analysis of Means. Journal of Quality Technology, 15(1), 19–25. https://doi.org/10.1080/00224065.1983.11978837
[31] Nelson, P. R. (1983). A Comparison of Sample Sizes for the Analysis of Means and the Analysis of Variance. Journal of Quality Technology, 15(1), 33–39. https://doi.org/10.1080/00224065.1983.11978839
[32] McClave, J. T., & Sincich, T. (2003). Statistics (9th ed). Prentice Hall.
[33] Hochberg, Y., & Tamhane, A. C. (1987). Multiple Comparison Procedures. https://doi.org/10.1002/9780470316672
[34] Bechhofer, R., & Dunnett, C. (1986). Percentage Points of Multivariate Student t Distributions. https://hdl.handle.net/1813/8588
[35] Games, P. A. (1971). Multiple Comparisons of Means, 8(3), 531–565. https://doi.org/10.3102/00028312008003531
[36] Polat, Z. A., Memduhoğlu, A., Hacar, M., & Duman, H. (2017). Kentsel Büyüme ile Motorlu Araç Trafiği Yoğunluğu Arasındaki İlişkinin Belirlenmesi: İstanbul Örneği. Niğde Ömer Halisdemir Üniversitesi Mühendislik Bilimleri Dergisi, 6(2), 442–451. https://doi.org/10.28948/NGUMUH.341275 [37] Ebru, Ç., & Eban, A. (2011). Determinants of house prices in Istanbul: A quantile regression approach. Quality and Quantity, 45(2), 305–317. https://doi.org/10.1007/S11135-009-9296-X/METRICS
[38] Hacıevliyagil, N., Drachal, K., & Eksi, I. H. (2022). Predicting House Prices Using DMA Method: Evidence from Turkey. Economies 2022, Vol. 10, Page 64, 10(3), 64. https://doi.org/10.3390/ECONOMIES10030064