International Journal for Housing Science and Its Applications
Publish March 30, 2026. Volume 47, Issue 2 Pages 15-25

https://doi.org/10.70517/ijhsa47202

Where metro accessibility matters for housing value in emerging economies: Hedonic price model explains

Atefeh Sedaghati[1,*] and Mohammad Hamed Abdi[1,2]
[1]Department of Urban Planning and Design, Faculty of Art, University of Bojnord, Bojnord, Iran.
[2]Research Group for Urban Development, Faculty of Design Science, University of Antwerp, Mutsaardstraat 29, 2000, Antwerpen, Belgium.
Corresponding author: Atefeh Sedaghati (e-mail: a.sedaghati@ub.ac.ir).

Abstract Housing plays a vital role in urban settings facing shortages, particularly in emerging economies where challenges are more pronounced and efficient housing policies are essential to maintain a balance between housing values and consumer incomes. Among the factors influencing housing value, the impact of accessibility and proximity to transport infrastructure has long been established in the literature, considering various contributors such as physical and socio-economic characteristics. However, research focusing on emerging economies like Iran remains limited. This study employs a Hedonic Price Model to examine the effects of metro accessibility, alongside other factors, over time and across different socio-spatial areas within the Mashhad metropolis, Iran. Surprisingly, the results reveal that metro presence does not significantly influence housing prices, which are instead shaped by a combination of physical property attributes, buyer behavior, market conditions, property types, and broader socio-economic factors. These findings have important implications for real estate professionals, policymakers, and urban planners, offering insights to better allocate resources, adapt to evolving conditions, and promote long-term sustainable and equitable urban development.

Index Terms Metro accessibility; Housing value; Emerging economies; Hedonic Price Model.

I. Introduction

Besides providing somewhere to live safely and conveniently, housing is certainly one of the major sources of wealth and productive assets for households around the world. It is considerably of significance in urban settings with shortfalls of housing where population growth is faster and demand for housing is on the rise [1]. Under such circumstances, efficient housing policies play a critical role in the maintenance of housing prices investable in balance with consumers' income, more specifically in the context of emerging economies (ECs) which is characterized by greater challenges such as unfavorable financial and economic background, and in general, the small size of housing financial system and low growth rates, yet with faster growth pace, due to macroeconomic instability (e.g., higher inflation and interest rates than developed markets) [2]. They also contend with limited fiscal room for policymakers, greater systemic risks to address, poor legal systems to protect lenders' interests, underdeveloped housing and market infrastructures, less regulated capital markets, affordability issues, and relying immensely upon public credits sources to finance housing development policies [2]. Understanding and tracking housing value is thus of importance in ECs since it represents financial and macroeconomic stability of a country, helps to understand the ability of developers and investors' access to financial resources, and regulatory impediments for land acquisition [3].

Different factors lie behind residential property value. Of which, the effect of accessibility and proximity to transport infrastructure (e.g., road, rail transit, BRT system, conventional bus) on property/land value has long been well-documented in the literature empirically and theoretically (e.g., [4]–[10]). Mass transit and subway (metro) impacts have been investigated in the existing studies ([11]–[14]) showing varied correlations (i.e., positive, negative, and no significance). In addition, a number of authors have exclusively considered the effects of varying locations based on settlement type i.e., small, medium-sized and large cities [15], geographical positions such as inner-cities versus peripheries [16], and socio-economic characteristics e.g., high- versus low-income neighborhoods [17].

Data from several studies demonstrated that housing value in high income neighborhoods is less affected by metro accessibility, while housing price in poorer neighborhoods are highly sensitive to such investments ([9], [17]–[20]). However, the authors believe that this tend not to be the case always and everywhere, more specifically, where there are other powerful influencing factors related to the socio-economic features of communities.

Contrary to the prior studies declaring higher impacts on housing value in low-income areas, numerous studies express that values are increased for housings located near rail facilities in high-income neighborhoods [21]. Additionally, easy access is a significant factor considered by individuals when purchasing or renting homes in the vicinity of stations ([22]–[24]).

Erdoğanaras. et al. (2023) suggest that subways can help reduce polarization between income groups in cities while increasing accessibility [9]. Geng et al., (2015) found that the introduction of high-speed rail stations enhances accessibility between cities, attracts investment, and improves public service infrastructure, all of which positively contribute to housing prices [25]. Specifically, the research reveals that as the distance between residential properties and the high-speed rail station decreases within a range of 0.891 km to 11.704 km, housing prices tend to rise due to the station's influence. Tan et al. (2019) investigated the impact of metro station proximity on housing prices within the context of mega-cities in China, revealing that new metro lines significantly enhance the value of nearby properties, especially in suburban areas [26].

In general, theoretical research and prior studies indicated that public transport infrastructure including metro or railway lines influence housing prices through improving accessibility. A look at emerging economies, however, research examining that across different income neighborhoods remains scarce and little is known about how new metro lines influence housing markets in emerging Middle Eastern cities, despite extensive hedonic studies in Europe, North America, and even China. This gap is particularly significant given the growing role of transit infrastructure in shaping urban housing dynamics. In response, this study determines the role of metro accessibility across income neighborhoods in Iranian study areas. Building upon testing the factors of time and location, this study set out to better understand the role of metro investments on housing value among other factors at play which generates two research questions: (1) how do housing characteristics including metro accessibility affect housing value over time? And (2) how do they react to the location of housing units based on socio-economic features?

The methodological approach taken in this study is quantitative based on the Hedonic regression in which the association between housing value and structural-physical and locational features such as metro accessibility are investigated. The case of Mashhad is selected as it is recognized as an Iranian metropolis and a newcomer to metro infrastructure. It also provides a perfect context to study different income neighborhoods (high- and low-income ones across inner-city and peripheral areas) and factors affecting housing value including metro accessibility. This investigation gives us new information on the role and degree of other factors affecting housing value compared to that of metro accessibility in such a developing-country city. Therefore, the research contributions can complement prior findings going beyond the case of Mashhad and can provide fresh insights for other cities in ECs where the nature of housing as a wealth and trade good overcomes merely being a living place.

The overall structure of the study takes the form of five sections: after the introduction, Section 3 elaborates on materials and methods used for this study. Section 4 presents the empirical results of the study over time and across different income neighborhoods, and finally, Section 5 discusses and concludes the paper and provide implications for policy and direction for future research.

II. Material and Methods

II. A. Study areas

Mashhad, the second-largest city in Iran and the capital of Razavi Khorasan Province, is a vibrant metropolis steeped in history and religious significance. Home to the Imam Reza Shrine, a key pilgrimage site for Shia Muslims, the city features stunning architecture and bustling bazaars that reflect its rich cultural heritage. As a major economic hub, Mashhad thrives on tourism, commerce, and agriculture, blending spirituality with modernity. This dynamic environment makes it an intriguing destination for visitors while highlighting the importance of mass transit investments such as the metro in promoting sustainable urban transportation in Mashhad.

To enhance connectivity and accommodate its growing population, Mashhad has developed an expanding metro system. Currently, the network consists of three operational lines: Line 1, the backbone of the system, spans 24 kilometers with 24 active stations, connecting key areas from southern neighborhoods to the city center. Line 2, running 14.5 kilometers with 12 active stations, links the university district to major commercial hubs, providing convenient access for students and shoppers. Additionally, some neighboring population centers, primarily inhabited by underprivileged communities, are within minimal distance of a Line 2 station, improving accessibility. Meanwhile, Line 3, still under construction, will eventually cover 25 kilometers with 24 stations, six of which are already operational (as of March 2024). Once completed, it will further expand the metro's coverage and efficiency. According to the city's comprehensive plan [27], Mashhad is divided into five residential areas based on socioeconomic factors, including average household income, land prices, housing rents, population density, subdivision regulations, and street width.

The present study aimed to capture the community's diverse demographics and income groups in the selection of station areas and housing units. These were chosen based on two key criteria: (1) predominant land use (i.e., residential neighborhoods) and (2) socioeconomic diversity, ensuring representation of both high- and low-income areas. Consequently, eight station areas (hereafter referred to as *study areas*) were selected to achieve balanced representation across both established metro lines and various residential types (Figure 1). *Tabarsi*, *Fajr*, *Parvin-e-Etesami*, and *Ghadir* were identified as low-income neighborhoods, while *Taleghani*, *Shariati*, *Koohsangi*, and *Kosar* were classified as high-income areas. Residential units were chosen within a 1,200-meter radius of each station - nearly double the transit-oriented catchment area proposed by Calthorpe (1993) [28] - representing the maximum potential influence zone of a metro station. A total of 53 residential properties were selected for analysis based on available housing sales data, including both apartment and single-detached housing types. This selection approach was designed not only to enhance the study's robustness but also to ensure inclusiveness and representation in urban research. Recognizing the inherent limitations of data collection, the research team acknowledged the need for field surveys and developed an efficient process to maintain accuracy once study areas were identified, as discussed in the following section.

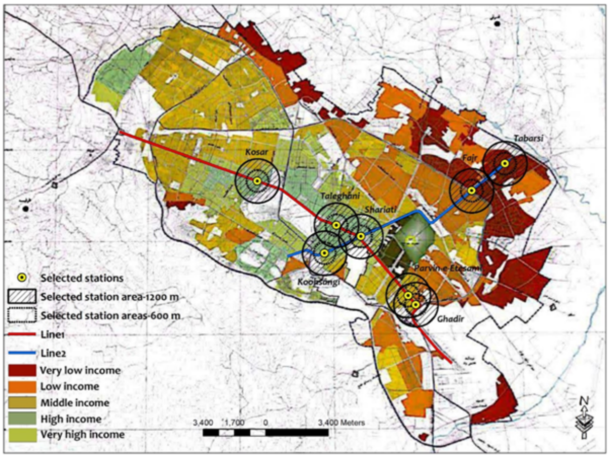

Figure 1: Selected station areas across various income neighborhoods in Mashhad city, adapted from [27], [29]

II. B. Data collection

The study data comprise various characteristics of residential units sampled within station precincts, including both apartments and single-detached houses sold between October 2023 and March 2024. Since registered housing price data were unavailable - a common limitation in Iranian cities and other emerging economies [3]- the selected properties were surveyed directly. Researchers visited 12 real estate agencies located within the study areas to collect data. Notably, some areas exhibited higher transaction volumes, while others had relatively few property sales. This disparity may be attributed to factors such as higher land prices in certain neighborhoods (e.g., *Koohsangi*) and tax-related disincentives for sales registration, which also contributed to limited sales statistics in some study areas.

Consistent with the study objectives, longitudinal price analysis is essential for understanding metro investments' impact on housing values in Mashhad. The study examined four key years - 2007, 2012, 2017, and 2024 - corresponding to periods before and after metro line construction (Line 1: 2010-2015; Line 2: initiated 2016). Data collection involved both primary surveys of real estate agencies and secondary data from the Iranian National Tax Administration (INTA), specifically the annual tax coefficients for residential properties based on expert-assessed values. This approach was necessary due to the lack of integrated, reliable real estate data. While INTA data formed the primary basis, findings were cross-validated through consultations with real estate professionals, followed by data adjustment and validation procedures. We tracked the same 53 residential units across four benchmark years (2007, 2012, 2017, and 2024), utilizing INTA's annual expert-price index for the first three time points and our 2023-24 field survey data for the most recent period. This approach yielded 53 price observations for each year.

While the flexibility of the hedonic approach is often viewed as both a strength and a limitation, Hill (2013) emphasizes that in contexts lacking systematic housing attribute records, this very flexibility becomes essential particularly when characteristics can be observed consistently over time [30]. In line with this perspective, our study focused on traceable housing features that could be monitored longitudinally, offering a practical solution to the absence of a structured property data system in Iran. Moreover, in order to examine the temporal impact of metro line development on housing value, the selected benchmark years; 2007, 2012, 2017, and 2024, were deliberately spaced to capture the dynamics before, during, and after the construction of metro Lines 1 and 2 in Mashhad. This approach enabled exploration of long-term price shifts across significant infrastructural transitions. Given housing price volatility, we further narrowed our observation window to six-month periods around each benchmark year to improve price comparability. Within these intervals, only 53 residential units had been sold with sufficient information, thus defining the sample. While limited in size, these samples provide empirically grounded observations that maintain analytical rigor within the study's data constraints.

Data were collected using a prepared form recorded both housing characteristics (independent variables) and sale prices (dependent variable). Drawing on previous studies ([9], [31]–[34]) and considering the specific context of the case study (i.e. Mashhad city) in terms of data availability and local trends, we included eight variables (listed in Table 1) as they demonstrated meaningful diversity in determining house prices. We also excluded other variables deliberately (e.g., availability of elevator, store room, parking, light, official documentation, and proximity to the main road) as they lacked distinct impacts or shared trends across the units. For the locational variable "distance to metro station", we calculated network distances using

ArcMap 10.8.2, accounting for residences falling within multiple station catchment areas. Table 1 presents descriptive statistics calculated for all variables included in the Hedonic price model.

Table 1: List of structural and locational housing characteristics and their descriptive statistics (N=53)

Variable		Unit	Description	Variable type	Mean	Standard deviation	Min	Max
House price	2023-24	Iranian Rial	House price in 2023-24	Scale	133,229,811,320.7	236,592,479,117.4	7,000,000,000	1,470,000,000,000
	2007	Iranian Rial	House price in 2007	Scale	3,213,528,301.8	3,672,856,824.5	200,000,000	14,800,000,000
	2012	Iranian Rial	House price in 2012	Scale	4,579,273,584.9	5,390,118,503.9	320,000,000	27,000,000,000
	2017	Iranian Rial	House price in 2017	Scale	5,873,424,528.3	6,777,236,737.9	360,000,000	35,000,000,000
Structural-physical features	House type	Binary	Type of building (1=Villa, 2=Apartment)	Nominal	1.47	0.504	1	2
	House area	Square meters	Total residential area	Scale	191.02	164.477	40	1000
	Room Number	Integer	Number of rooms, living room	Ordinal	2.57	1.101	0	6
	House age	Years	Total times since Construction	Scale	15.26	13.462	1	50
	Floor number	Integer	Total number of floors	ordinal	3.23	1.783	1	7
	House floor	Integer	Number of floors	ordinal	2.40	1.378	1	5
	House quality	Integer	1=Dilapidated, 2=Maintainable, 3=Newly built-up	ordinal	2.26	0.858	1	3
	Internal equipment	Integer	1=Poor Status, 2=Good Status, 3=Very Good Status	ordinal	2.06	0.818	1	3
Locational features	Distance to metro station	Integer	Network distance (meter)	Scale	523.54	214.74	111.11	1017.20

II. C. Data analysis: Hedonic Price Model

The factors influencing housing prices were analyzed using the Hedonic Price Model (HPM), a well-established method in economics, real estate research, and related fields for examining how product or service characteristics affect pricing [35]. The model estimates value by decomposing observed price differences among comparable goods into the implicit value of their individual attributes [36]. Typically implemented through hedonic regression analysis, this approach statistically examines relationships between product attributes and prices. Formally, the model treats a good's price as a function of its characteristics, derived by regressing observed prices against measurable attributes. The resulting hedonic prices represent the shadow prices (or implicit marginal values) of each characteristic.

The analysis of housing prices is the most widely used application for estimating the value of environmental features that are not directly priced [32]. Within real estate domain, HPM helps in estimating the implicit value of individual features of a property, such as location, size, equipment, and more, by analyzing actual market data. One of the key aspects that makes HPM appealing is its simplicity in interpretation and its consistency with real-world observations as highlighted by Kuethe et al. (2008) [31]. The enduring appeal of the model can be also attributed to its intuitive premise that aligns with economic reasoning and empirical feasibility. This model posits that buyers make decisions based on a property's intrinsic characteristics such as size, number of rooms, and bathrooms, as well as location-specific amenities like air quality, proximity to parks, education facilities, and flood risk, as discussed by Bishop et al. (2020) [37]. Rosen (1974) points out that the hedonic price model is actually a reflection of the shared preferences of consumers and producers, and it indicates the maximum price that buyers are willing to pay to acquire a unit of a good with specific characteristics [36].

Previous studies employed HPM to explore the determinants of housing value ([31], [32], [38]–[48]). It is noteworthy that these studies encompassed various urban levels, often focusing on a single city's characteristics. The simple linear and quasi-logarithmic regression forms were predominantly utilized in their hedonic analyses, although complete logarithmic forms were preferred in some studies. Most of these investigations aimed to partition cities into homogeneous zones, categorizing attributes primarily into three groups: (1) *locational characteristics* (e.g., access to various services, location security, the distance to urban centers (2) *structural-physical characteristics* (e.g., land and built space area, the number of rooms, having a landline telephone, parking, the right to gas connection, and the type of construction materials, as well as building age and form [32], and (3) *environmental and socioeconomic characteristics* such as neighborhood demographics or the presence of environmental disamenities ([31], [33]). On this, the hedonic regression function is introduced as follows:

$$P = F(S, E, L) \tag{1}$$

In this formulation, P represents observed housing prices, while S, E, and L denote structural characteristics, environmental and socioeconomic factors, and locational attributes, respectively [31]. The function captures consumers' "willingness to pay" for properties with specific features. The variable coefficients in the hedonic price function reveal the relative contribution of each characteristic to housing prices. These coefficients, calculated as partial derivatives of the function with respect to each characteristic, represent the hedonic (implicit) prices of the respective attributes.

In this study, we examined eight structural characteristics and one locational characteristic[1] (distance to metro station),

[1]Based on the findings in Review Article by Sedaghati et al., (2021), the share of structural-physical variables and building characteristics has the most significant contribution, accounting for 53.5 percent of the application in the Hedonic housing valuation model: "Structural-physical features with a greater share in explaining the value of urban housing have been predominantly considered in all reviewed studies. [34]"

excluding environmental factors due to data reliability constraints. Among the selected independent variables, 'distance to metro station' values were analyzed using inverse measurement. After data cleaning[2], statistical analyses were conducted using *IBM SPSS* (Version 27). We employed *Pearson* correlation and hedonic regression models to identify significant relationships between specific characteristics and housing prices. The analysis included calculation of correlation coefficients, standardized beta coefficients, and (adjusted) R-squared values. Complementing the standard linear regression approach, we also employed semi-logarithmic regression models with natural logarithm transformation of the dependent variable (house price). These semi-log results were systematically analyzed and compared with the linear model outputs to strengthen the robustness of our interpretations.

To evaluate construct validity and inter-item correlation adequacy, we conducted both the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. The KMO value of 0.834 demonstrated meritorious sampling adequacy, while Bartlett's test yielded statistically significant results ($\chi^2(78) = 802.832$, $p < 0.001$), confirming sufficiently strong variable correlations. These results indicate the variables' conceptual coherence and suitability for subsequent analysis. We intentionally omitted Cronbach's alpha calculation for physical housing indicators (e.g., room count, material types, ventilation access) as these represent formative measures rather than reflective indicators of a latent construct, making internal consistency assessment conceptually inappropriate.

For regression model validation, multiple diagnostic tests were additionally performed: (1) ANOVA confirmed the model's statistical significance (Sig < 0.05); (2) The Durbin-Watson statistic (1.576) indicated no residual autocorrelation; (3) All Variance Inflation Factor (VIF) values remained below 5, with Tolerance values exceeding 0.2, demonstrating no multicollinearity concerns; And, (4) the model achieved strong explanatory power ($R^2 > 0.7$) for the 2024 housing price dependent variable. These results collectively affirm the model's statistical robustness despite sample size limitations.

III. Results

III. A. Longitudinal analysis: weak metro contribution over time

To test the relationships between variables and determine their strength and direction, a Pearson correlation was utilized. The results showed that "distance to metro station" witnessed no strong and significant correlation with the other research variables including "house price" (Table 2). Meanwhile, "house price" has a direct relationship with "house area" (0.832), "room number" (0.449), "house age" (0.385) and "house type" (0.292). The strongest correlation of "house price" is with "house area". Also, the variable of "house quality" and "housing price" displayed a correlation of 0.369, although this is negative. The reasoning behind this is that deteriorated houses are usually now found in high income areas in Iranian cities and unlike recently built houses, they occupy a larger area of land. Therefore, despite being dilapidated or low quality, they value a higher price thanks to the larger area plus their privileged locations.

Table 2: Correlational (Pearson) relationships between variables and house price (2024)

	House price 2024 (IRR)	House type	House area (m²)	Room number	House age	Floor number	House floor	House quality	Internal equip-ment	Distance to metro
House price 2024 (IRR)	1	.292*	.832**	.449**	.385**	-.169	-.062	-.369**	-.171	-.104
House type	.292*	1	.392**	.168	.772**	-.785**	-.441**	-.738**	-.765**	-.252
House area (m²)	.832**	.392**	1	.614**	.455**	-.216	-.064	-.436**	-.235	.007
Room number	.449**	.168	.614**	1	.308*	.110	.154	-.161	.070	.182
House age	.385**	.772**	.455**	.308*	1	-.621**	-.352**	-.790**	-.647**	-.195
Floor number	-.169	-.785**	-.216	.110	-.621**	1	.511**	.601**	.769**	.247
House floor	-.062	-.441**	-.064	.154	-.352**	.511**	1	.365**	.406**	.188
House quality	-.369**	-.738**	-.436**	-.161	-.790**	.601**	.365**	1	.690**	.238
Internal equipment	-.171	-.765**	-.235	.070	-.647**	.769**	.406**	.690**	1	.077
Distance to metro	-.104	-.252	.007	.182	-.195	.247	.188	.238	.077	1

Notes: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

Compared to previous years studied, the result of "house area" variable showed that there is a strong positive correlation with house prices across all years, particularly evident in 2017 (0.949) and 2012 (0.928) (Table 3). This implies that larger house areas are associated with higher prices. Similar to "house area", there is a strong positive correlation about "room number" with "house price", particularly in 2017 (0.641), showing that more rooms generally lead to higher prices. The correlations for "house area" and "room number" have remained consistently strong over the years, indicating that these factors have consistently influenced "house price".

[2]Given the limited sample size and the importance of preserving the maximum quantitative information in the model, numeric variables were not converted into dummy variables. Dichotomizing variables can reduce data variability and granularity, potentially diminishing the model's ability to detect nuanced relationships. Therefore, to ensure a more precise analysis and prevent loss of valuable information, variables were retained in their continuous and original form.

Table 3: Correlational (Pearson) relationships between variables and house price over time (2007, 2012, 2017, 2024)

	House price 2024 (IRR)	House type	House area (m²)	Room number	House age	Floor number	House floor	House quality	Internal equip-ment	Distance to metro
House price 2024 (IRR)	1	.292*	.832**	.449**	.385**	-.169	-.062	-.369**	-.171	-.104
House price 2017 (IRR)	1	.369**	.949**	.641**	.495**	-.160	-.008	-.430	-.227	.045
House price 2012 (IRR)	1	.352**	.928**	.615**	.489**	-.156	.006	-.407**	-.231	.065
House price 2007 (IRR)	1	.357**	.783	.614**	.561**	-.130	.36	-.429**	-.224	.041

Notes: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

The overall trend between "distance to metro" and "house price" does not indicate a strong price dependency on distance to metro station. So, we can say, except for 2024, there is a positive correlation between "distance to metro" and "house price" and it appears to be weak and has not shown significant growth over the years considered (Figure 2).

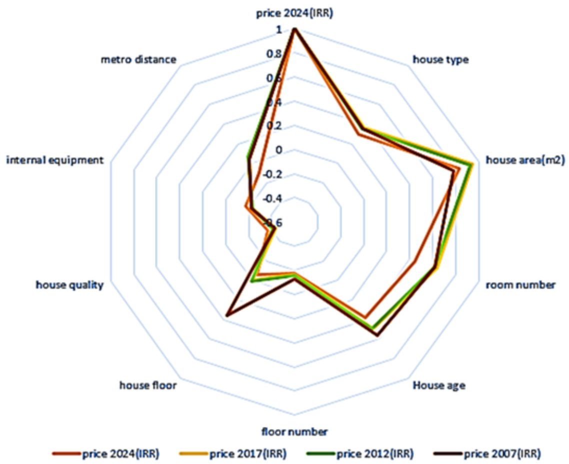

Figure 2: Correlations between house characteristics and house price during four studied years (2007, 2012, 2017, 2024)

According to Table 4, the Hedonic regression analysis revealed that approximately 72 per cent of the variance in the latest prices (2024) can be explained by "house area" alone, with a very strong positive relationship indicated by the beta coefficient (0.906). For 2017 and 2012, about 92 and 90 per cent of the variance, respectively, can be explained by both "house area" and "house age", yet "house area" has a stronger influence significantly. A look at 2007, a declining trend in explanatory power over time compared to the previous years mentioned is evident since variance in house prices went down to about 73 per cent explained similarly by "house area" and "house age". One can conclude that, unlike other independent variables specifically "distance to metro", the relationship between "house area" and "house price" is consistently strong across all the years researched, with beta coefficient mostly above 0.6. The inclusion of "house age" adds explanatory power, particularly in the years 2017 and 2012, but its influence diminishes in comparison to "house area", especially in 2024.

The semi-log regression results further reinforce the dominant role of "house area" in shaping price levels, though with slightly reduced beta coefficients compared to the linear models. For instance, in 2024, "house area" remains the strongest predictor ($\beta = 0.577$), followed by "house age" ($\beta = 0.32$), "room number" ($\beta = 0.257$), and "internal equipment" ($\beta = 0.239$), altogether explaining about 78 per cent of the variance in log-transformed housing prices. Similarly, in 2017 and 2012, "house area" and "house age" continue to have substantial explanatory power, with beta values of 0.486 and 0.482 for "house area" respectively, and R-squared values staying above 0.75, indicating the model's strong fit. Even in 2007, the oldest benchmark year, the pattern holds: "house area" ($\beta = 0.399$) and "house age" ($\beta = 0.566$) remain consistent influencers of housing price. Interestingly, variables such as "room number" and "internal equipment" occasionally gain statistical significance in specific years (e.g., 2017 and 2024), yet their influence remains secondary. Most notably, "distance to metro station" does not appear as a statistically significant variable in any of the regression models across all years. This lack of influence suggests that in the context of Mashhad, despite metro expansions over the study period, proximity to metro lines has not translated into measurable price premiums in residential housing. This may reflect local development patterns, land use characteristics, or even urban mobility preferences that diminish the relative role of transit infrastructure in shaping housing value.

Table 4: Hedonic linear regression & semi-log regression results (2007, 2012, 2017, 2024)

Regression Type	Dependent Variable*	Independent variable** (meaningful)	Standardized beta coefficient (enter mode)	R square/Adjusted R square
linear	House price 2024 (IRR)	House area	0.906a	0.717, 0.657
semi-log	Log House price 2024 (IRR)	House area, Room number, House age, internal equipment	0.577a, 0.257a, 0.32a, 0.239b	0.780, 0734
linear	House price 2017 (IRR)	House area, House age	0.887a, 0.194a	0.923, 0.907
semi-log	Log House price 2017(IRR)	House area, Room number, House age, House quality, internal equipment	0.486a, 0.251a, 0.482a, -0.081b, 0.238b	0.816, 0.777
linear	House price 2012 (IRR)	House area, House age	0.891a, 0.252a	0.891, 0.868
semi-log	Log House price 2012 (IRR)	House area, Room number, House age	0.492a, 0.208b, 0.496a	0.759, 0.708
linear	House price 2007 (IRR)	House area, House age	0.599a, 0.484a	0.734, 0.679
semi-log	Log House price 2007 (IRR)	House area, Room number, House age	0.399a, 0.235b, 0.566a	0.748, 0.695

Notes: *Dependent Variable: Price of the house (in IRR) for the years 2024, 2017, 2012, and 2007 (in linear mode) & Log of House Price for the years 2024, 2017, 2012, and 2007 (in semi-log mode); **Independent Variables: house area, room number, house age, floor number, house floor, house quality, internal equipment, distance to metro station (in both linear & semi-log mode) "a" coefficient is significant at the 0.05 level (2-tailed); "b" coefficient is significant at the 0.01 level (2-tailed)

III. B. Location-based analysis: nowhere metro contribution matters

Investigating the correlations between independent variables and housing value across low- and high-income neighborhoods, as shown in Table 5, indicated correlational difference across income neighborhoods. The table reveals that there was a significant positive correlation between "house area" and "house prices" in high-income study areas which means the larger houses are, the higher prices they value, while "room number" and "house age" showed moderate positive correlations. Regarding the latter, the reason is that in the Mashhad housing market, many older houses have larger areas, and therefore, because "house area" is very important and influential, it can be concluded that housing value increases once houses are getting old.

However, negative correlations were found for "floor number" and "house floor" with moderate and strong correlations, respectively. As expected, housing market showed much more preference towards buildings with lower number of floors, and surprisingly, residence located in lower floors. "Distance to metro station" appears to have a minor correlation with prices (-0.240), indicating they may not play a substantial role in determining "house price" in high-income neighborhoods.

Table 5: Correlational (Pearson) relationships between housing variables and sale price across different income neighborhoods

Independent Variables	House price 2024 (IRR)	
	High-income neighborhoods	*Low-income neighborhoods*
House type	.475**	-.121
House area (m²)	.829**	.550**
Room number	.426*	.408
House age	.395*	.050
Floor number	-.352	.117
House floor	-.179	-.079
House quality	-.472**	-.054
Internal equipment	.322	.211
Distance to metro	-.240	-.066

Notes: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

The table also presents the correlational relationships for low-income study areas which is almost the same as the high-income counterparts where "house area" and "room number" showed strong and moderate positive correlations, respectively, with "house price". However, the others have low or insignificant correlations with prices so that these factors may not be determined as contributors to "house price" in low-income neighborhoods. Accordingly, no statistically significant correlation (-0.066) between "distance to metro station" and "house price" was observed which means proximity to metro facilities does not significantly affect the price in low-income neighborhoods.

From the data in Table 6, the Hedonic regression analysis for high-income study areas indicates that the price is significantly influenced by "house area" (sig 0.05), with a strong standardized beta coefficient (0.839). This suggests a strong positive relationship between them which means the price increase significantly occurs with "house area" increase. The R square value of 0.786 confirms that 78.6 per cent of the variance in "house price" can be explained by the model, indicating a good fit. When including an additional variable (i.e., house quality) (sig 0.1), the negative coefficient can imply that, in this specific context, higher quality does not correlate positively with price, which may seem counterintuitive and could warrant further investigations. Another reason could be the unrivaled effect of "house area", which even gives priority to lower quality yet larger houses. The adjusted R square value of 0.690 indicates that when accounting for the number of predictors in the model, about 69% of the variance is explained, which is still relatively strong.

Table 6: Hedonic linear regression & semi-log regression results by income neighborhoods

Regression Type	Dependent Variable*	Study area	Independent (meaningful) variable**	Standardized beta coefficient (enter mode)	R square/ Adjusted R square
Linear	House price 2024 (IRR)	High income neighborhood	House area	0.839 (sig 0.05)	0.786, 0.690
			House area, House quality	0.839, -0.479 (sig 0.1)	
		Low income neighborhood	House area	0.834 (sig 0.1)	0.411, 0.003
Semi-log	Log House price 2024 (IRR)	High income neighborhood	House type, House area, Internal equipment	0.549, 0.654, 0.619 (sig 0.05)	0.881, 0.827
			House type, House area, Internal equipment, Metro distance	0.549, 0.654, 0.619, -0.177 (sig 0.1)	
		Low income neighborhood	House area	0.814 (sig 0.05)	0.693, 0.481

Notes: *Dependent Variable: Price of the house (in IRR) for the years 2024 (in linear mode) & Log of House Price for the years 2024 (in semi-log mode); **Independent Variables: house area, room number, house age, floor number, house floor, house quality, internal equipment, distance to metro station (in both linear & semi-log mode)

A breakdown of hedonic regression results by neighborhood income level reveals striking contrasts in how housing attributes influence price. In high-income neighborhoods, both linear and semi-log models show strong explanatory power (R^2 up to 0.88), with "house area," "house type," and "internal equipment" as significant predictors of housing value. Surprisingly, distance to metro appears with a negative beta (β = -0.177) in the semi-log model. This inverse relationship suggests that, for wealthier residents, proximity to metro stations may actually be seen as a disamenity, possibly due to concerns over crowding, noise, or associated land uses. In these contexts, privacy, exclusivity, and spatial detachment may be more valued than access to transit. In contrast, the picture is quite different in low-income neighborhoods. Here, "house area" remains the dominant explanatory factor (β = 0.814), and although the overall explanatory power is slightly lower (R^2 = 0.69), no influence of metro distance emerges at all. This suggests that in less affluent areas, housing value is driven by basic spatial characteristics rather than access to infrastructure. Metro may be necessary for mobility, but it doesn't yet function as a value enhancer. Perhaps due to lack of integration, perceptions of safety, or because other needs dominate price sensitivity. In short, metro investment in Mashhad seems to reflect a paradox: it neither enhances property value in low-income neighborhoods nor is embraced in wealthier zones. Its negative association with price in affluent areas raises deeper questions about how transit is perceived and who it is really serving.

Concerning low-income study areas, "house area" also shows a positive relationship with price, with a standardized beta coefficient of 0.834. This suggests that, while still significant, the effect of "house area" on price is less pronounced than in high-income neighborhoods. The R square value of 0.411 indicates that about 41% of the variance in house prices can be explained by the model, which is comparatively weaker in high-income neighborhoods. The significance level of 0.1 suggests a trend but not a strong statistical significance in the context of common thresholds (0.05).

IV. Discussion and Conclusion

The present study was designed to determine the effect of metro development on housing values among other factors with respect to the factor of time and location. The most obvious finding to emerge from this study is that, unexpectedly, the presence of the metro does not affect housing prices, which are determined solely by the physical attributes of the properties instead.

When comparing different income-based study areas, "house area" and "room number" emerged as reliable predictors of "house price" in both high- and low-income neighborhoods, though the correlation for "room number" was slightly stronger in high-income areas. On the other hand, "floor number" and "house floor" had a notable negative impact on prices, an effect not observed in low-income neighborhoods. Suggesting differences in buyer preferences or market dynamics.

The correlation for "distance to metro" also revealed divergent effects based on neighborhood income levels. A weak correlation in low-income areas indicates that price may depend on factors other than metro proximity, whereas a stronger correlation in high-income areas suggests that as distance to the metro increases, prices tend to decrease more noticeably. This finding contradicts previous studies, which argued that low-income neighborhoods are more significantly affected by metro accessibility.

Overall, the differing correlations between metro distance and property values across income neighborhoods likely stem from a complex interplay of buyer behavior [49], market conditions ([50]–[53]), property types ([53], [54]), and socioeconomic factors ([49], [53], [55]) in Iran. In high-income neighborhoods, housing is often treated as a financial asset, where proximity to metro stations enhances property value primarily due to investment potential rather than practical commuting benefits. In contrast, low-income buyers may prioritize affordability or access to essential services over public transport, making them less sensitive to metro distance.

On the other hand, properties in high-income neighborhoods tend to be more standardized, meaning features like room number and house area exhibit a stronger direct correlation with price. In contrast, low-income neighborhoods often have greater variation in property types and conditions, making it more difficult to establish consistent price relationships with specific features. Additionally, while properties in both high- and low-income areas serve as commodities and investment opportunities, their perceived value differs significantly. In high-income neighborhoods, investors primarily view properties as financial assets, making them more sensitive to factors like metro proximity that may affect future resale potential. Conversely, in lower-income neighborhoods, properties are more commonly valued as homes or shelter rather than pure investments, resulting in distinct pricing dynamics.

Social dynamics and community characteristics also influence how different demographics value proximity to public transportation. For instance, families and professionals in high-income areas often prioritize convenient transit access for commuting, while low-income residents may place greater importance on local job opportunities or social networks. Additionally, high-income neighborhoods tend to emphasize access to amenities and services well-connected by public transit, whereas low-income residents may be more accustomed to their area's existing layout, reducing their sensitivity to metro distance. Urban development policies further shape these dynamics. High-income neighborhoods undergoing gentrification or infrastructure investment often see metro access become a key factor in property valuation. In contrast, low-income neighborhoods which typically experience less development, exhibit different pricing determinants.

Understanding these differences is crucial for real estate professionals, policymakers, and urban planners addressing housing needs and promoting equitable development. Insights into the relationship between housing characteristics and neighborhood income levels can guide zoning reforms to encourage mixed-income developments. For instance, policymakers could incentivize affordable housing integration in high-income areas, distributing the benefits of improved infrastructure and amenities across income groups.

The study's findings on the varying significance of public transport proximity can also inform transportation investment decisions. While enhancing transit options in high-income neighborhoods may spur further investment, low-income areas might benefit more from prioritizing local amenities and community services. Such data-driven approaches enable efficient resource allocation. This study also underscores the value of evidence-based housing policy. By continuously analyzing property characteristics, neighborhood dynamics, and market trends, policymakers can make adaptive decisions that support long-term sustainability. Lastly, acknowledging that low-income communities often value social infrastructure such as public spaces, community centers, and local services, over property features can guide investments that strengthen community ties and enhance quality of life.

Beyond the conventional contributors identified by the Hedonic model, macroeconomic factors also strongly influence housing prices. For example, Iran has experienced significant housing price fluctuations, with near-semiannual shifts in market valuations. Empirical observations suggest sellers can typically expect profits to rise by 25-33% with each transaction.

Consequently, urban housing in Mashhad and likely other major Iranian cities, has become highly commodified. Properties are now primarily treated as investment vehicles rather than spaces for shelter, belonging, or community. From the seller's perspective, purchasing any residential unit serves as a short-term (six-month) wealth accumulation strategy, enabling either upgrading to higher-value neighborhoods, or generating discretionary income for non-housing expenditures.

A key limitation of this study is the lack of reliable systemic data on housing values, environmental factors, and locational variables. This constraint necessitated reliance on physical characteristics and limited field surveys, resulting in a relatively small sample size. Future research should prioritize collecting comprehensive data on housing values and environmental attributes to strengthen the validity of findings.

The integration of advanced Geographic Information Systems (GIS) could significantly enhance our understanding of location's impact on housing values, particularly regarding metro accessibility. GIS would enable detailed spatial analyses and visual representations of how variables like land use patterns, urban density, and transportation infrastructure influence pricing dynamics. Furthermore, expanding the research sample through large-scale field surveys or remote sensing techniques would yield more robust and generalizable data. Implementing these methodological improvements would provide deeper insights into the complex interplay of factors shaping housing markets while increasing the reliability of conclusions.

Author Contribution

Atefeh Sedaghati: Methodology, Investigation, Software, Visualization, Writing- Original draft preparation, Data curation, Resource. Mohammad Hamed Abdi: Conceptualization, Data curation, Writing- Reviewing and Editing.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Sharing Agreement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics, Consent to Participate, and Consent to Publish declarations

Not applicable.

Clinical trial number

Not applicable.

References

[1] C. R. Innes and B. Casabianca, *Creating Housing Markets in Emerging Market Economies*. World Bank Group: International Finance Corporation, Note 106, 2021.
[2] L. Chiquier and M. Lea, *Housing Finance Policy in Emerging Markets*. The International Bank for Reconstruction and Development/The World Bank, Washington, DC, 2009.
[3] D. M. Behr, L. Chen, A. Goel, T. K. Haider, S. Singh, and A. Zaman, "Estimating House Prices in Emerging Markets and Developing Economies: A big data approach," World Bank Group: International Finance Corporation, Policy Research Working Paper, 10301, 2023.
[4] C. Mulley, L. Ma, G. Clifton, B. Yen, and M. Burke, "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*, vol. 54, pp. 41-52, 2016.
[5] W. Wu, S. Zheng, B. Wang, and M. Du, "Impacts of rail transit access on land and housing values in China: a quantitative synthesis," *Transport Reviews*, vol. 40, no. 5, pp. 629-645, 2020.
[6] X. Liu, C. Jiang, F. Wang, and S. Yao, "The impact of high-speed railway on urban housing prices in China: A network accessibility perspective," *Transportation Research Part A*, vol. 152, pp. 84-99, 2021.
[7] G. Debrezion, E. Pels, and P. Rietveld, "The impact of railway stations on residential and commercial property value: a meta-analysis," *Journal of Real Estate Finance and Economics*, vol. 35, pp. 161-180, 2007.
[8] S. I. Mohammad, D. J. Graham, P. C. Melo, and R. J. Anderson, "A meta-analysis of the impact of rail projects on land and property values," *Transportation Research Part A: Policy and Practice*, vol. 50, pp. 158-170, 2013.
[9] F. Erdoğanaras, K. Cihangir Çamur, and G. Satoğlu, "A Study of the Metro and Housing Value Interaction with Hedonic Price Model: Comparison of Ankara Batıkent and Koru Metro Stations," *Journal of Architectural Sciences and Applications*, vol. 8, no. 1, pp. 161-177, 2023.
[10] D. Efthymiou and C. Antoniou, "Measuring the effects of transportation infrastructure location on real estate prices and rents: investigating the current impact of a planned metro line," *EURO Journal on Transportation and Logistics*, vol. 3, no. 3, pp. 179-204, 2013.
[11] C. Lee, K. Ryu, K. Choi, and J. Y. Kim, "The dynamic effects of subway network expansion on housing rental prices using a repeat sales model," *International Journal of Urban Sciences*, vol. 22, no. 4, pp. 529-545, 2018.
[12] S. Rohit and N. Peter, "Does urban rail increase land value in emerging cities? Value uplift from Bangalore metro," *Transportation Research Part A: Policy and Practice*, vol. 117, pp. 70-86, 2018.
[13] E. A. Hopkins, "The influence of public transportation on housing values," *International Journal of Sustainable Development & World Ecology*, vol. 25, no. 3, pp. 206-215, 2018.
[14] K. Bartholomew and R. Ewing, "Hedonic price effects of pedestrian-and transit-oriented development," *Journal of Planning Literature*, vol. 26, no. 1, pp. 18-34, 2011.
[15] Z. H. Chen and K. E. Haynes, "Impact of high speed rail on housing values: an observation from the Beijing-Shanghai line," *Journal of Transport Geography*, vol. 43, pp. 91-100, 2015.
[16] M. Diao, Y. Zhu, and J. Zhu, "Intra-city access to inter-city transport nodes: the implications of high-speed-rail station locations for the urban development of Chinese cities," *Urban Studies*, vol. 54, no. 10, pp. 2249-2267, 2017.
[17] A. Forouhar and M. Hasankhani, "The effect of Tehran metro rail system on residential property values: A comparative analysis between high-income and low-income neighbourhoods," *Urban Studies*, vol. 55, no. 16, pp. 3503-3524, 2018.
[18] H. Bohman and D. Nilsson, "The impact of regional commuter trains on property values: price segments and income," *Journal of Transport Geography*, vol. 56, pp. 102-109, 2016.
[19] K. Wang and M. Woo, "The relationship between transit rich neighborhoods and transit ridership: Evidence from the decentralization of poverty," *Applied Geography*, vol. 86, pp. 183-196, 2017.
[20] R. Kheyroddin, A. Taghvaee, and A. Forouhar, "The Influence of Metro Station Development on Neighbourhood Quality the Case of Tehran Metro Rail System," *International review for spatial planning and sustainable development*, vol. 2, no. 2, pp. 64-75, 2014.
[21] D. Salon and S. Shewmake, "Opportunities for value capture to fund public transport: a comprehensive review of the literature with a focus on East Asia," 2011.
[22] M. Kuby, A. Barranda, and C. Upchurch, "Factors influencing light-rail station boardings in the United States," *Transportation Research Part A: Policy and Practice*, vol. 38, no. 3, pp. 223-247, 2004.
[23] G. Debrezion, E. Pels, and P. Rietveld, "The impact of rail transport on real estate prices: an empirical analysis of the Dutch housing market," *Urban studies*, vol. 48, no. 5, pp. 997-1015, 2011.
[24] L. Yang, Y. Liang, B. He, H. Yang, and D. Lin, "COVID-19 moderates the association between to-metro and by-metro accessibility and house prices," *Transportation Research Part D: Transport and Environment*, vol. 114, p. 103571, 2023.
[25] B. Geng, H. Bao, and Y. Liang, "A study of the effect of a high-speed rail station on spatial variations in housing price based on the hedonic model," *Habitat International*, vol. 49, pp. 333-339, 2015.
[26] R. Tan, Q. He, K. Zhou, and P. Xie, "The effect of new metro stations on local land use and housing prices: The case of Wuhan, China," *Journal of Transport Geography*, vol. 79, p. 102488, 2019.

[27] Comprehensive Development Planning of Mashhad Metropolis (CDPM), "Map of Residential Sub-Zones in the City of Mashhad," Ministry of Roads and Urban Development of Khorasan Razavi Province, Specialized Working Group on Infrastructure and Urban Development, 2017.
[28] P. Calthorpe, *Next American Metropolis: Ecology, Community, and the American Dream*. Princeton Architectural Press, Princeton, 1993.
[29] Comprehensive Transportation Studies of Mashhad (CTSM), Traffic Organization of Mashhad, Transport Studies Office of Mashhad, Sharif University of Technology, 1995.
[30] R. J. Hill, "Hedonic price indexes for residential housing: A survey, evaluation and taxonomy," *Journal of economic surveys*, vol. 27, no. 5, pp. 879-914, 2013.
[31] T. H. Kuethe, K. A. Foster, and R. J. G. M. Florax, "A Spatial hedonic model with time-varying parameters: A New method using flexible least squares," Florida, American Agriculture Economics, July 27-29, 2008.
[32] C. W. Kim, T. T. Phipps, and L. Anselin, "Measuring the benefits of air quality improvement: a spatial hedonic approach," *Environmental and Management*, vol. 45, pp. 24-39, 2003.
[33] R. G. Ridker and J. A. Henning, "The Determinants of Residential Property Values with Special Reference to Air Pollution," *The Review of Economics and Statistics*, vol. 49, no. 2, pp. 246-257, 1967.
[34] A. Sedaghati, M. T. Pirbabaei, F. Nourian, and H. Beyti, "Explaining the Conceptual Model of Valuing Indicators of Urban Housing; Hedonic Method Meta-Analysis," *International Journal of Sustainable Construction Engineering and Technology*, vol. 12, no. 4, pp. 46-56, 2021.
[35] K. Lancaster, "A new approach to consumer theory," *The Journal of Political Economy*, vol. 74, no. 2, pp. 132-157, 1966.
[36] S. Rosen, "Hedonic Prices and Implicit Markets: Product Differentiation in pure competition," *Journal of Political Economy*, vol. 82, no. 1, pp. 34-55, 1974.
[37] K. C. Bishop, N. V. Kuminoff, H. S. Banzhaf, K. J. Boyle, K. von Gravenitz, J. C. Pope, V. K. Smith, and C. D. Timmins, "Best Practices for Using Hedonic Property Value Models to Measure Willingness to Pay for Environmental Quality," *Review of Environmental Economics and Policy*, vol. 14, no. 2, pp. 260-281, 2020.
[38] C.-H. C. Bae, M.-J. Jun, and H. Park, "The impact of Seoul's subway Line 5 on residential property values," *Transport Policy*, vol. 10, no. 2, pp. 85-94, 2003.
[39] A. B. Morancho, "A Hedonic valuation of urban green areas," *Journal of Landscape and Urban planning*, no. 66, pp. 35-41, 2003.
[40] M. C. Coley, "House and landscape value: An Application of hedonic pricing technique investigating effects of lawn area on house selling price," The University of Georgia, Athens, 2005.
[41] C. Mansfield, S. K. Pattanayak, W. McDow, R. McDonald, and P. Halpin, "Shades of green: measuring the value of urban forests in the housing market," *Journal of forest economics*, vol. 11, no. 3, pp. 177-199, 2005.
[42] O. C. Ashenfelter and K. Storchmann, "Using a hedonic model of solar radiation to assess the economic effect of climate change: The case of Mosel Valley vineyards," *Review of Economics and Statistics*, vol. 92, no. 2, pp. 333-349, 2006.
[43] C. Y. Jim and W. Y. Chen, "Impacts of urban environmental elements on residential housing prices in Guangzhou (China)," *Landscape & Urban Planning*, vol. 78, pp. 422-434, 2006.
[44] C. Y. Jim and W. Y. Chen, "Consumption Preferences and environmental externalities: A Hedonic analysis of the housing market in Guangzhou," *Geoforum*, vol. 38, pp. 414-431, 2007.
[45] R. van der Kruk, *Hedonic valuation of Dutch wetlands*. Thela Thesis/Tinbergen Institute, 2005.
[46] R. van der Kruk, "The hedonic price method," in *Sustainable Urban Development*, vol. 2, pp. 1-14. Routledge, 2007.
[47] J. S. Dodgson and N. Topham, "valuing residential properties with the hedonic method: a comparison with the results of professional valuations," *Housing Studies*, vol. 5, no. 3, pp. 209-213, 2007.
[48] S. Sheppard, "Measuring the impact of culture using hedonic analysis," Center for Creative Community Development, 2010.
[49] N. Sharifi Asadi Malafe, S. Gholipour Fereydoni, and S. A. Nabavi Chashmi, "The impact of advertising values on impulsive and compulsive buying," *Journal of Internet Commerce*, vol. 22, no. 3, pp. 349-394, 2023.
[50] A. Soltani, N. Zali, R. Mirzaei, M. Heydari, A. Rahimi, and A. Hamidi, "Multilevel impacts of urban amenities on housing price in Tehran, Iran," *Journal of Urban Planning and Development*, vol. 149, no. 4, p. 05023028, 2023.
[51] H. N. Kashkooli, K. Hajipoor, M. Arasteh, and A. Soltani, "The impact of subway station proximity on apartment prices in shiraz," *Transportation in Developing Economies*, vol. 10, no. 2, p. 16, 2024.
[52] G. Moradi, E. Operajuneghani, F. Dehghan Benadkuki, S. Ghanbari, and M. Moradi, "The effect of green spaces on housing prices using Hedonic method in Iran," *Environmental Resources Research*, vol. 10, no. 2, pp. 279-290, 2022.
[53] S. Rezaeian, H. Asgari, and B. Darvishi, "The study of determinants of rent housing in Ilam City based on hedonic spatial econometrics," *Journal of urban economics and management*, vol. 7, no. 26, pp. 17-30, 2019.
[54] E. Bozorgi, R. N. Esfahani, and B. Saffari, "The Impact of Public Transport Accessibility on Commercial and Residential Property Prices: A Hedonic Pricing Model Analysis in Mashhad, Iran," *Transportation in Developing Economies*, vol. 11, no. 2, p. 22, 2025.
[55] A. Forouhar, "Estimating the impact of metro rail stations on residential property values: evidence from Tehran," *Public Transport*, vol. 8, no. 3, pp. 427-451, 2016.