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Housing price estimation in order to sustainable housing: Niyavaran area,Tehran, Iran

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Abstract

Housing composite commodity as a one of the most important property of households, has been interesting for researchers and planners in last years. Hedonic pricing, estimating the value of housing characteristics through the use of transactions data. For this purpose, the main aim of this paper is to evaluate the factors affect housing prices in the Niyavaran region of Tehran, Iran. Nowadays, the housing planning tries to meet the needs of users, which this subject is one of the important factors in sustainable housing scheduling. To achieve this objective, first of all the variables influence the housing price have been determined and then, data was collected via the survey and was analyzed, using the Hedonic price model. The empirical results of this paper showed that variables: the building age, number of rooms, house view side, Interior decoration, lighting and distance to school are significant and positive and Parking, education and road traffic were significant and negative in this study. By applying these results in urban projects eventually can lead to the better life quality and sustainability in urban life.

Keywords

Hedonic price model, Housing, Physical variables, Environmental variables, Tehran.

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1. Introduction

People choose where to live and which house to buy by considering a bundle of housing characteristics, and housing space is one of the most important contributors to the total willingness to pay for the unit. From the demand side, adequate housing space is a critical screening factor used in narrowing a property search. Space constraint is also a key determinant when consumers decide to upgrade their residence. From the supply point view, the size of a housing unit is a key parameter that developers adjust to maximize profits. Since housing space plays a pivotal role in determining the bid and offer functions that underlie the hedonic price equation, it is important to have a good understanding of the hedonic price of housing space. However, estimates obtained from a standard hedonic regression could suffer from potential functional form misspecifications and endogeneity arising from omitted variables (Collen & Hoekstra, 2001; Johansson, 2012; Scheiner & Holz-Rau, 2007)

Changes in supply and demand, which determine the competitive conditions of real estate, are directly reflected in real estate values and especially changes in supply and demand of housing seriously affect economic growth. The controlling of these changes in real estate values and the determination of economic factors that cause them are possible through objective valuation studies. However, the fact that each property has different and unique characteristics makes valuation a time consuming and costly process. Due to the fact that real estate valuation has not been in line with scientific principles and international standards, it is necessary to facilitate value appreciation processes in both academic and commercial studies as well as to develop certain statistical models such as the hedonic valuation model. The hedonic valuation process consists of the steps of converting the characteristics of properties into massive data in a collective sense and relating these properties to the (sales) price. With the hedonic method developed, it is expected that sales price valuations will be performed in a standardized manner. In overall, the hedonic model examines the impact of a product's characteristics on its price. When considered within the context of real estate, the hedonic valuation model enables a statistical association between the characteristics of properties and sales prices(Adair, Berry, & McGreal, 1996; Ali, Bashir, & Ali, 2015; Czembrowski & Kronenberg, 2016).

An evolution was occurred in pattern and settlement system, in consequence of industrial revolution improvement and urbanization growth and house supply was become to one of the most urban district difficulties (Mirkatouli, Samadi, & Hosseini, 2018; Muhallab Taha, 2001, 12).

Other parameters, on the other hand, such as population growth, new household formation, immigration from the rural areas, Destruction and renovation of places because of the old building amortization, and getting residential units smaller and so on, have duplicated the housing supply problem.

Technical and scientific advances, sustainable development theories and plans, made the main humankind demands and stable housing construction achievements, more complicated (Chiu, 2004; Zimmermann, Althaus, & Haas, 2005). Housing problem has been raised all around the world but it has been turned to a critical problem in developing countries due to fast population and urbanization growth, internal migrations, lack of financial sources, problems in land and building material supply and shortage of the manpower beside the lack of policy and proper plans about the land and housing (Malpezzi & Mayo, 1987; Pjanic, 1967; Sinclair, 2017)

The growing up role of housing, especially in sustainable development of mankind living, has made the governors, put the house planning on their main priorities. The plans such as new city construction, improvement and renovation of worn tissues and etc. are the attempts for this problem solving. The price of land and housing is an important factor for wrapping up the private and governmental plans and projects; while the price is a function of various time dependent, situations and

factors (Dieleman, 2017). Recognition of effective factors in housing price, therefore, can be utilized as a powerful tool for housing policymakers and planners.

This concept which is commonly referred to in review of literature as the "hedonic pricing model" instead of "hedonic valuation" (Bozkurt, 2016; Hayrullahoğlu, Aliefendioğlu, Tanrıvermiş, & Hayrullahoğlu, 2017, 2018; Kara, Gültekin, Aliefendioğlu, & Tanrıvermiş, 2016) is widely used for the creation of a price index for goods, estimating their values, and performing prosperity analysis of public goods. The hedonic pricing model emerged with a new approach in consumer theory by Lancaster (1966), and is called the Lancaster Preference Theory (Adams & Crawford, 2015; de Oliveira Santos, 2016). In his essay (1966), Lancaster emphasized that a product is heterogeneous and offers no benefit to consumers alone, and that the benefits stem from the characteristics it possesses. Hedonic models, which are basically regression equations, are estimated with the help of regression analysis. The model is based on the assumption that goods are heterogeneous, and each property is described as the sum of its individual properties (Hayrullahoğlu et al., 2018). At the forefront of addressing the need for shelter in urban spaces, which has been shaped in our days through large population movements, houses have changed form in line with social behavior, economic status and demands of individuals over time, have started to carry different qualitative and quantitative features, and even regarded as important investment and financing tools. This situation necessitated the examination of factors affecting the housing market in all types of real estate. Just like any other heterogeneous property, houses also contain more than one feature, and are sold as a collection of the features they have. Since it is very difficult to specify the price of goods with multiple features at a single total price and to analyze the market, the price of the goods is identified by determining the price of each feature of the good, and it is called hedonic pricing (Hayrullahoğlu et al., 2018; Hülagü, Kızılkaya, Özbekler, & Tunar, 2016; Selim, 2008; Hidano, 2002).

Many of studies have been done in housing domain and its effective factors, that some of them will be mentioned henceforward:

Farzanegan, Gholipour, and Nguyen (2016) is an example of the association between housing prices and income inequality in Iran over the last three decades. In the recent period, Iran has had the highest average Gini coefficient in the Middle East, a region where inequality has triggered social tension, political instability, and armed conflict.

Gholipour and Farzanegan (2015) in "marriage crisis and housing costs: empirical evidence from provinces of Iran" examines the link between housing costs and the marriage rate in Iran, controlling for other relevant economic determinants of marriage. their results reveal that there is a negative relationship between housing costs and the marriage rate.

Pour Mohammadi, Ghorbani, and Taghipour (2014) investigated factors affecting the price of housing in the city of Tabriz using hedonic model. The results have shown that some variables including the area of land, building view side, salary and education, access to the radiator, the width of alley or street and the traffic of the alley or street have the positive effect on price while the building view, the number of rooms, distance from the downtown, the age of building and the kind of ownership document have the negative effect.

Mohammadi (2017) aims to identify and prioritize effective factors on willingness to pre-purchase demand of housing in the city of Ilam in Iran and to present a conceptual model. The results indicated that economic, financial, fiscal-behavioral, motivational, and social factors influence on housing pre-purchase and economic factors including poverty, economic efficiency and economic crisis.

Also, Varesi and Musavi (2010) did a study, entitled: "effective factor survey on housing price, using the Hedonic model". Their findings showed that the land area, infrastructure area and the number of floors are the most important parameters on housing price in

Yazd. As the housing price has changed to 0.49 and 0.38 due to one percent increasing in land and infrastructure area, respectively. Some variables, also, had the negative sign. Results show that housing price will reduce 0.22 % in consequence of one unit change in building age. The housing price, in addition, will decrease 0.25 percent due to one unit change in building distance from the downtown.

Nijënstein, Haans, Kemperman, and Borgers (2015) With the use of a mixed logit model, the importance and influence of the housing characteristics and taste heterogeneity have measured. Individual differences were explained with the use of socio-demographics and human values. The results show that heterogeneity is present in the housing preferences of students. These differences can be explained partly by socio-demographics and human values. Human values are thought to give additional understanding of differences in students' housing preferences on top of socio-demographics. Within this experiment, hypothetical student houses were defined by systematically varying nine housing characteristics: price, size, kitchen sharing, bathroom sharing, cycling time to city center, cycling time to campus, outdoor space, walking time to supermarket, and walking time to park.

Liao and Wang (2012) have estimated the housing price in some areas of China during the 2009. In this study the effective parameters on housing price, have been recognized in economic-social variables framework and physical-environmental properties. Empirical results of this study showed that the per capita income and population density are the most significant variables on housing price in these areas. Results also reveal that some variables including the distance from the downtown, the area of each floor, distance from the urban park and the number of rooms were meaningful and effective on housing price.

Kim, Park, Lee, and Xue (2015) estimated house price determinants in the Korean housing market, focusing on Seoul and employing the method of a quantile regression of a hedonic price model. The hedonic variables employed in this research include building age, size, floor height, and floor level, proximity to metro station and high school and scenic view. The empirical analysis finds that school proximity has the largest effect on the prices among dummy variables and that the level of the effect is larger in lower quantiles (lower-priced houses).

Lehner (2011), estimated the housing price in Singapore, using the Hedonic model. Results have showed that the area of each floor, access to urban services and the type of ownership have the positive effect, while the building age, the distance from the downtown, the distance from the nearest public transportation station, distance from the shopping centers and educational centers in addition to dealing season have the negative effect on housing price.

Vichiensan and Miyamato (2010) evaluated the effect of urban rail transport lines on housing price in Bangkok, Thailand, using the Hedonic model. In this study the house selling price, land area, the number of bath in each residential unit, the building age, infrastructure of each residential unit, the spent average time, reaching to the city center and the nearest railway station, have been utilized. Results show that the land area, the number of bath in each residential unit and infrastructure of each residential unit have the positive effectiveness, whereas, the variables including the building age, the spent average time, reaching to the city center and the nearest railway station have the negative effect on housing price.

Xiaolu and Yasushi (2005) studied the various parameters effect on housing price in Japan. In this study the consequence of different variables on housing price have been assessed; the findings reveal that the area and infrastructure have the positive correlation with land price, while the population density, the land use and road cover ratio in Seijo area have had the positive and meaningful effect on land price.

2. Materials and methods

Heterogeneity and diversity is one of the most important properties of housing composite commodity, as it can

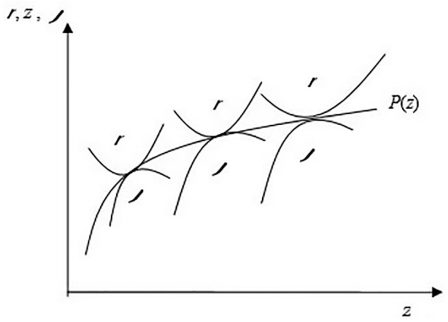

Figure 1. *Hedonic price function (Rosen,1974., 39).*

be claimed that any two house are not same as each other. Heterogeneity is searchable in many ways such as physical properties from the geographic and environmental aspects (King, 2017).

In physical properties viewpoint, houses have different ages. It is possible for a house to be usable after many years old whereas another new house can be destroyed after few years; this state depends on the house quality and its materials. Houses, also, are different in number of rooms, having a good ventilation and hygiene in physical standard aspects beside the geographic viewpoint. Only building and its plan has similarity in mass production and houses always are different from each other in location, neighboring, light, sound and landscape factors. Also, houses are different in accessibility to urban services such as schools, parks, hospitals, cultural centers and etc. and their distance to downtown.

In housing price study, thus, the hedonic model is used generally for the assessment. In Hedonic studies, supposed that the housing price is a reflect of inhabitants' desire to pay for the facilities accessibility, in and out of the building (Xiao, 2017). In other words, it supposed that the differences of property prices are because of the differences in housing properties. Considering the abovementioned definitions, the housing price shows the maximum money, which people desire to pay for the better life quality, a certain amount of internal equipment and building situation and its accessibility to urban services(Abidoye & Chan, 2017). The Hedonic price concept has been founded on Lancaster (1966), Griliches (1971) and Rosen (1974) theories. Most of specialties affect the life quality, then, should be considered, buying a home (Gouriéroux and Laferrère, 2009: 207; Sadeqi et al., 2008). Hedonic method states that the economic target of goods and services production should be the customer satisfaction. Hedonic method is applicable when the higher satisfactory is desired

$$Z = z(z1, z2, ..., zn) \quad (1)$$

than the general one (Rosen, 1974: 34).

The housing Hedonic model, then, is a function of various consumer goods (X), Environmental prosperity features (z), a vector of physical properties such as number of rooms, used

$$U = f(x, z_1, z_2, ..., z_n, \alpha) \quad (2)$$

materials, view and infrastructure and etc. (S) and a vector of accessibility and neighboring (N) (Freeman, 1993 & Batalhone and etal 2002). Rosen (1974) considers the distinct goods Z with different properties z1, z2, …, zn as below:

If the price of each stuff properties shown as p(z), then the p(z) reveals the distinct properties price changes due to

$$y = x + p(z_1, z_2, ..z_n) \quad (3)$$

changes of each variable. On the other hand, the utility function can be displayed as below:

In Utility function, x is the compound goods rather than housing and is a parameter identifier that maximize the consumer desirability. The bud-

$$\frac{\partial U / \partial z_i}{\partial U / \partial x} = \frac{\partial P(z)}{\partial z_i} = p(Z) \quad (4)$$

get limitation should be considered in consumer utility maximization. The budget limitation function supposed as below:

Budget limitation function, y, shows the consumer income and supposed that x equals to one. The final rate of displacing between the certain goods properties and compound goods other than housing will be as below:

Equation 3 shows that changing in z goods properties will cause the price changing and it affects the final utility ratio towards the goods x. The consumer final utility, therefore, could be in relation with housing properties and its price (Xiao, 2017). Figure 1 shows the Hedonic function concept.

In figure one, the residential unit properties have been shown in horizontal axis with Z and r is the desirability of costumers for residential units. The Hedonic price curve then, shows the different prices and costumers various pays. In other words, each vendee pays different price for residential unit based on his satisfaction or desirability of residential unit properties. This function, thus, is expressed as a curve. Considerable point in this graph is that desirability price is different person to person (Xiao, 2017; Ham, 2011).

3. Study area recognition and variables of model

Nyavaran is one of the northern parts of Tehran in southern slopes of the Alborz mountains. At the moment, Nyavaran is located in district four area one. It limited to Jamalabad- Bahonar campsite from the north, to Shahid Bahonar Street from the south, to Pour Ebtehaj from east and to Jamshidieh from the west. This district has about 1699379 m2 area and its population was 8979 people upon to 2006 census. There is an especial architecture in this area due to region slope. Also its height is about 1700 m, caused the cooler weather than the other districts in Tehran.

In present study the first part related to the literature review and theoretical bases and has been gathered from the library documents and various texts; residential units' data has been earned, using the questionnaire and field surveys. Real estate consultants were subjected to the questionnaire in addition to residential units' inhabitants, determining the market value of residential units. Eventually the SPSS 16 and EVies 7 were used for the questionnaire data analysis and model estimation.

Utilized variables will be as below, considering the Hedonic model:

1. Dependent variable (the housing price (LPRICE)): in present study the housing price was expressed in Iranian Rial. The various properties of housing affect the price in addition to supply and demand law.

2. Independent variables, categorized in 3 group:

A. Physical variables

B. Accessibility variables

C. Environmental variables

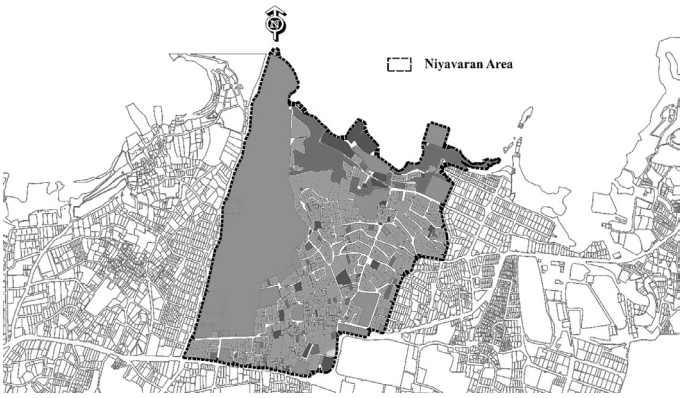

Figure 2. *Nyavaran District, Tehran, Iran.*

Table 1. *Independent variables of the study.*

Name	Code	Name	code
Aristocratic	X18	Area of the arena.	X1
Distance to educational centers	X19	The number of stairs	X2
Distance to health center	X20	The number of rooms	X3
Distance to the center of the green area and the park	X21	Used materials	X4
Distance to shopping center	X22	Building view	X5
Distance to restaurant	X23	garden	X6
Distance to mosque	X24	Building view side	X7
Distance to mall	X25	Backyard	X8
Proper space for walking	X26	Terrace	X9
security	X27	Kitchen	X10
Street width	X28	Bathroom	X11
Street condition	X29	WC	X12
The social status of neighbors	X30	Ramp	X13
Traffic condition	X31	Residential unit lighting	X14
Road slope	X32	Parking	X15
noise	X33	Type of unit	X16
		yard	X17

Table 1 introduces the independent variables of present study.

4. Empirical results

4.1. Model estimation and results analysis

The overall model was designed first, for the Hedonic model estimation and finding of each variable's coefficient and some variables were omitted for the best result achieving.

In present study the log-log model could not be used because some variables were virtual and select the zero or one; therefore, a linear-logarithmic form was applied for the model estimation. The initial form of model is as below and the related results of model estimation have been shown in table 2.

$$LPRIC_i = \beta_0 + \beta_1 LX_{1i} + \beta_2 X_{2i} + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_{6i} + \beta_7 LX_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + \beta_{10} X_{10i} + \beta_{11} LX_{11i} + \beta_{12} LX_{12i} + \beta_{13} LX_{13i} + \beta_{14} LX_{14i} + \beta_{15} X_{15i} + \beta_{16} X_{16i} + \beta_{17} X_{17i} + \beta_{18} X_{18i} + \beta_{19} LX_{19i} + \beta_{20} LX_{20i} + \beta_{21} LX_{21i} + \beta_{22} LX_{22i} + \beta_{23} LX_{23i} + \beta_{24} LX_{24i} + \beta_{25} LX_{25i} + \beta_{26} X_{26i} + \beta_{27} X_{27i} + \beta_{28} X_{28i} + \beta_{29} X_{29i} + \beta_{30} X_{30i} + \beta_{31} X_{31i} + \beta_{32} X_{32} u_i$$

Based on table 2, it can be said that applied variables have different effect coefficient whereas all variables could

Table 2. *Results of housing price function estimation in Nyavaran].*

PV	t	C	variable	PV	t	C	variable
0/09	1/07	42/49	Kitchen design	0/07	1/61	166/64	C
0/42	-0/69	-22/47	Neighborhood security	0/00	6/34	0/86	Building age
0/07	-1/58	-42/677	noise	0/02	-2/17	-0/37	Education level
0/23	1/02	23/773	traffic	0/23	-0/84	-0/09	area
0/31	-0/54	-11/51	slope	0/72	-0/3	-0/05	The number of stairs
0/2	1/63	0/14	Commute	0/30	0/54	28/3	backyard
0/07	0/88	0/28	Walking space	0/24	-0/8	-44/2	Terrace
0/09	-0/95	-0/21	Street width	0/22	-1/29	-71/08	yard
0/23	-0/9	-40/86	Neighboring situation	0/02	-2/57	-156/16	parking
0/007	-1/44	-0/31	Street Commute	0/70	0/29	14/8	Aristocratic
0/002	-2/53	0/1	Distance to educational centers	0/24	1/08	53/4	Main materials
0/19	-0/9	-0/05	Distance to shopping center	0/00	-5/07	1/37	Number of rooms
0/91	0/06	0/005	Distance to health center	0/02	-1/68	0/13	Building view side

not be referenced in price estimation analysis. On the other words, only the meaningful variables have interpretation capability. The meaningful variables can be interpreted as below:

The age and building antiquity is meaningful and positive, The shorter the life of the building, the housing price increases by 0.86%.

Level of Literacy is a meaningful and negative variable. In other words, the lower the level of education will decrease the housing price by 0.37%; it can be deducing as the low purchasing power with lower education level.

The lack of parking in residential unit is negative meaningful variable and reduces the price by -16.156%.

The number of rooms is positive, so that one extra room can increase the price by 1.37%. the building view side on the other hand is positive and meaningful and rises the building price by 0.13 %.

Interior architecture and elements such as stucco, flooring, walls and decorations are effective factors in price, the higher the quality of the interior architecture, the more expensive the housing by 1.3%.

The better lighting of building can raise the price, this variable is positive here and has a coefficient equal to 48.83%.

The traffic situation on alley or street for the house, located there is a negative variable. The residential units located in dead-end alleys or streets are cheaper than the others. The coefficient amount is -0.31%.

The distance from schools is a positive variable, in other word, people prefer to pay more money to be farther away from schools due to their noise. Results show that the price will increase by 0.1 % per unit farther away from school.

5. Conclusion

One of the most important subjects in housing sustainable planning, is the willingness to pay from the residential units' buyers. In other word, each buyer likes to pay more money for one or more especial properties of housing that will cause the rising of customer satisfaction which is the final goal of sustainable housing planning. Present study which has been done in Nyavaran-Tehran, tries to find the most important variables that consumers ready to pay more for them. The variables were categorized in three classes including physical, accessibility and environmental indicators. The building age, parking, the number of rooms and interior architecture were the meaningful variables and interpretable among the physical indicators.

It can be found that present study is in accordance to the other studies, for example the building age variable

has been a meaningful and interpretable variable in all studies such as Pour Mohammadi et al. (2014), Gholipour and Farzanegan (2015). The price of the building decreases, in consequence of building age increasing. Also the number of rooms was meaningful in all studies. The accessibility indicator also has the effect on housing price. Only the distance from school has been meaningful and reveals that the housing price will be more in consequence of more distance from school. This variable has not been considered in other studies; in Varesi and Musavi (2010) this variable has become meaningless. In environmental indicator and its variables, model results show that street traffic and the level of education can be effective on housing price in Nyavaran. It seems that in previous studies only Pour Mohammadi et al. (2014) considered the street traffic and the level of education, upon to their studies these variables were meaningful and increase the housing price.

Present study tries to estimate the price, using the housing Hedonic price function for Nyavaran district, Tehran, Iran and move towards the final target that finds the consumer priorities in house selection and move on the way to housing sustainable planning. Custodians want to determine either consumers prefer a house with more rooms, interior furniture, land area and etc. or the accessibility is their priority. The satisfactory level of the city will be grow, satisfying the demands and consumers' priorities; satisfactory rising, therefore, is one of the city sustainable parameters. For this aim a questionnaire was made which effective variables on housing price in it, have been divided in 3 group including Physical, Accessibility and Environmental variables.

data was gathered, asking the families and the housing price was obtained asking the real estate consultants. Then the intended Linear- Logarithmic function was estimated by SPSS and EViews 7 software. Results show that all variables are not meaningful and cannot be interpreted. Some of them were positive and the others were negative. Positive effect means that housing price will be increased due to variable rising and vice versa.

Positive meaningful variables include building age, the number of rooms, building view side, interior architecture of building, lighting, distance from school, while the negative variables are lack of parking, low level of education and street traffic. Obtained results can be applied in civil and technical projects; also mass producers and custodians should pay attention to consumer desires to buyers feel more satisfaction due to their purchase and subsequently this satisfactory will rise the life quality and sustainability in urban environments.

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