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# HEDONIC PRICES AND ENVIRONMENTAL CLASSIFICATION OF ECONOMIC VALUES OF SELECTED AREAS OF TABRIZ

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**-Abstract-**

Among the conventional models of valuing and economic pricing of the environmental amenities, hedonic pricing method (HPM) is based on the hypothesis that people usually determine their environmental consumption preference levels through choosing their houses. In this paper we applied this methodology along with an analysis of housing prices in different zones of Tabriz, aiming at establishing a correlation between these factors and environmental characteristics. The results can be generalized within the willingness to pay principle of the consumers for buying a better house with regard to various factors including the environmental variables. We adapted through a random systematic sampling procedure a survey of residents in various areas of Tabriz that bear different environmental conditions, being followed by statistical models. Findings indicate that about 50% of the respondents seeking to buy houses were university graduated. The priority of environmental quality promotion in the questionnaire was the most imperative factor in selecting the house. The stepwise regression analysis results designated positive significant correlation in 95% confidence level between the independent variables of environmental quality, green space, and the access to services, and dependent variable of house price. The null hypothesis thereby was rejected and the amount of r2 was 68%. Final conclusion is that people "do" include the quality of environment in their choices of buying house or property and they allocate hidden prices to the environmental values and amenities for their purchase. This study showed that HPM can be a reliable method for appraisal and estimation of the effects of non-market environmental goods and services, on house prices and other amenities.

**Key Words**: *Housing Prices, Tabriz, Environment, Pollution Level, Hedonic Pricing Method.*

**JEL Classification**: Q51. P28.

## 1. INTRODUCTION

We can admit that economically the price of goods and services and welfare amount fluctuates when the price of environmental goods are changed. Generally there is not any formal and legal market for this trend to observe and record the behavior or performance of markets as a tool to measure the changes of the amount of welfare of the people connected with the quality of environment. Due to the existence of such problems, there are several methods to assess and determine the price of environment in urban or beyond urban locations and the most common of them are travel cost method, hedonic pricing method, conditioned valuating method, and imposed losses' compensation method. The two first methods are affected by perspectives based on market and in fact are emerged based on the relationship between environmental goods and the goods which are exchanged in a certain market (Khorshiddoust, 1999). On the whole hedonic method uses statistical techniques to isolate and differentiate environmental values and is related with the differences in housing prices (Ibid.). To estimate these environmental values, the price composition of houses and residential locations mostly presented by real state agencies is analyzed. Some researches carried out in this field have dealt with a comparative study of the relationship between real wages and the quality of environments. The mathematical representation of "hidden price function" is as follows:

$P = f(X_1, ....., X_n)$

Where, P is the price of good or the presupposed product and $X_1$ to $X_n$ are the characteristics of that good or product.

## 2. RESEARCH LITERATURE

A history of some researches carried out in the world by using hedonic method which have been related to environment in a certain way, is presented. Anderson & Crocker (1971), Harrison & Rubinfield (1978), McDougall & Wright (1980); Li & Brown (1980); Figuerora et al (1996); Cragg & Khan (1997); Pu et al (2005); Edwards & Anderson (1989) studied the effect of air pollution on

residential houses' price, Ridker & Hening (1967) studied the effect of air pollution on residential houses' price in locations where a lot of people with different ancestors live, Witte et al (1979); Brookshire et al (1982); Graves et al (1998) studied the effects of social and economic factors on houses' price. McMillan et al (1980); Hughes & Sirmans (1992) estimated the effect of sound pollution on houses' price. Benson et al (1998) studied the role of access to public welfare services on houses' price. Nelson (1980); Levesque (1994); Uyeno et al (1993), went through the effects of sound pollution resulting from closeness to airport on houses' price. Palmquist et al (1997) focused on closeness to mines and its effect on price of residential areas, while Kawasaki & Mitsuru (1996) studied the effects of earthquake on the price of residential areas before and after incident had happened. Smith & Palmquist (1993); Lansford & Jones (1995) estimated the effect of closeness of houses to seaside and their prices, and Bejranonda (1996); Dorfman et al (1996) studied the relationship between soil decay and reducing houses' price. Crane, et al (1997) viewed different environmental indexes on the price of residential areas, and Khorshiddoust (1994) studied the influence of pollution resulting from waste aggregation and solid waste materials in public locations on the price of residential areas. Sheng-hua and GUO Xiao-yu (2005), and Wen Hai-zhen (2005) used linear hedonic price model for Hangzhou City, China and tested 2473 housing samples and field survey data of 290 housing communities. Brasington, and Hite (2005) found the demand for environmental quality based on the estimation of relationship between house prices and environmental dis-amenities and confirmed that nearby point-source pollutants depress house price. Chau, et al. (2006) investigated how air pollution affects the transaction prices of high-rise apartments in Hong Kong using a three-dimensional Reynolds-stress turbulence model and simulated the air pollution level of each unit in high-rise apartment buildings in a densely populated area. Chekmezova (2007) estimated marginal willingness to pay for the air quality improvement using hedonic price analysis, being conducted for housing market in Kyiv, Ukraine. Komarova (2009) valued environmental impact of air pollution in Moscow and calculated implicit prices of the environmental level of air quality in the city on the basis of housing property prices, Cebula (2009) studied housing market of the city of Savannah, Georgia and its historic landmark district. Coulson and Zabel (2012) questioned "How can we interpret the coefficient estimates for environmental goods in hedonic property value models where markets are

dominated by foreclosures?" Beekmans (2013) applied a hedonic price analysis of the value of industrial sites of an urban area, the industrial site. The literature did not indicate any research to be carried out in a third world city, which is the main subject of our study in this paper.

## 3. RESEARCH GOALS

The main questions in using hedonic method in the present research are: is the relationship between environmental services (for example clean air, or the concentration of atmosphere particles) and houses price clear for the owners of the houses and do they value it practically? Can we evaluate the environmental goods and services considered (especially the residential houses' environment) in the framework of prices posed by real estate agency consultants? What effects have the household's income structure and even the demographic features of it had on the environment? Which information and data are needed to carry out hedonic method to determine variables? How can we design the demand curve for environment from estimating the amount of tendency to pay for a healthier environment in the selected habitat location? The comparison of different social-economic information is one of the topics which can be utilized in estimating the amount of demand. Hedonic theory or perspective is based on the presupposition that real estate agency market is in a balanced state.

## 4. MATERIALS AND METHODOLOY

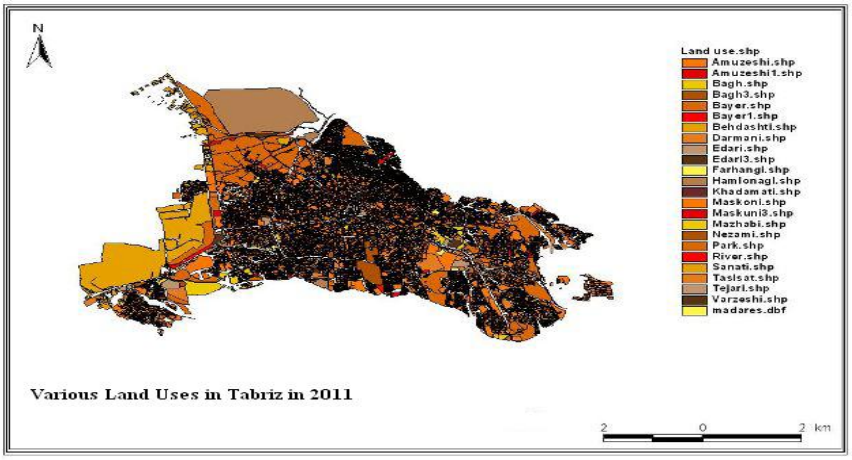
As researchers such as Geoghegan (2002), Habb and McConnell (2002), Kooper et al (1988), and Beekmans (2013) emphasize that sales price or the price of housings can be considered as an index of the tendency amount, to pay for some characteristics such as environmental features, our overall model also is as follows: $HP=\alpha+S\beta+L\gamma+G\iota+\varepsilon P$, Where, HP is house price vector, S is the matrix of house characteristics, L (nx1) is the matrix related to lane characteristics, G (nx1) is the matrix of area position, $\alpha$, $\beta$, $\gamma$, and $\iota$ are the vectors and indexes related to the variables and $\varepsilon$ (nx1) is the random error vector. The information related to the variables of this research is presented in Table (1).

**Table (1): Variables Utilized**

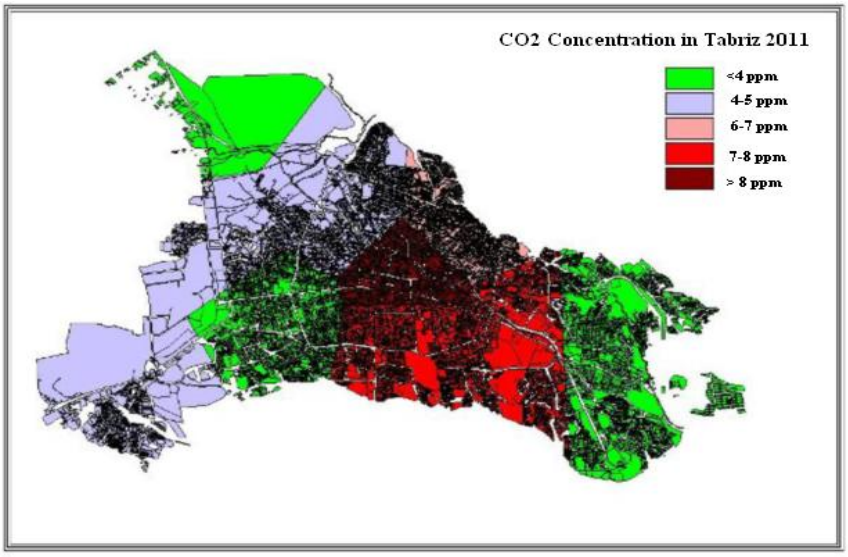
| Variable | Description | Coding unit | Title |
|---|---|---|---|
| House price | Relative price of housing in the region | 15 million Rials (per $m^2$) (equal to $10,000 in 2011 currency rates) | HP |
| House features | Relative quality of the house | 1 (weak), 2 (average), 3 (good) | S |
| Position 1 | Being located in business and exchange environment | 1 (yes), 0 (no) | G1 |
| Position 2 | Closeness to transportation services | 1 (yes), 0 (no) | G2 |
| Position 3 | Closeness to offices and city center | 1 (yes), 0 (no) | G3 |
| Environmental characteristic 1 | Area position regarding environment | 1 (has green area), 0 (does not have green area) | L1 |
| Environmental characteristic 2 | Area position regarding environment | 1 (without relative air pollution), 0 (with relative air pollution) | L2 |

The selection of different regions to find out the meaningfulness level and correlation between environmental variables and other variables above was carried out by referring to real estate agencies and different house buyers in different parts of Tabriz. We tried to determine the priorities of people to supply housing in the field of items under investigation in this research by designing 220 questionnaires which were randomly distributed among house buyers through housing real estate agencies. 40 questionnaires were put away from among the questionnaires distributed due to the lack of precision in responses and lack of absolute answers. Concurrently the average housing price for the total regions regarding the housing price with similar physical characteristics (number of floors, quality and area of the building) was estimated and the results are presented in map (3) by using ArcGIS software. The basis of this map is the data collected through more than 60 real estate agencies in Tabriz. Of course it should be noted that the prices told by the consultants in agencies were relative and were a reflection of their intended numbers and they are not %100 guaranteed. Also the criterion for relative pollution of the regions was gained through stations measuring air pollution and also the average green area present in each region. The environmental element considered in this research was air pollution dispersion level (the concentration of monoxide carbon) in different regions in

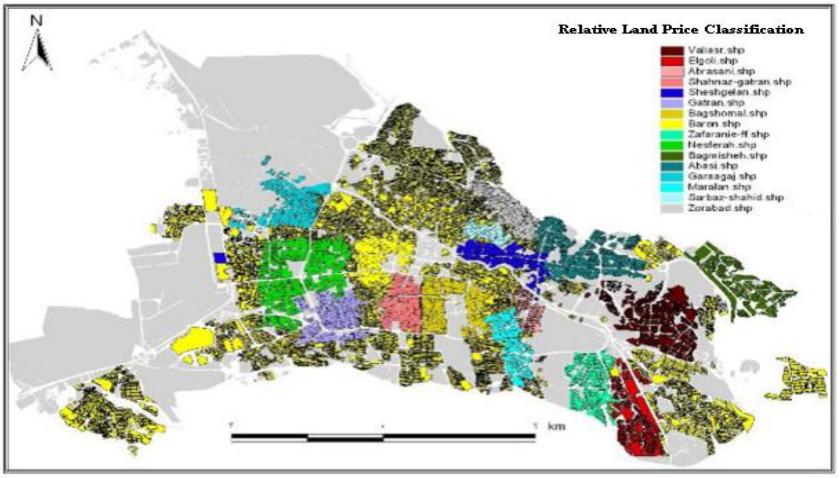
Tabriz firstly and then it was due to the region's position regarding having an average green area. Map (2) shows the relative dispersion level of air pollution (the concentration of monoxide carbon) in different regions in Tabriz.




**Map (1): Area categorization of different parts of Tabriz on land application map in the year 2011**



**Map (2): The relative dispersion level of air pollution (the concentration of monoxide carbon) in different regions in Tabriz (Raw data source: Central bureau of environment preserving office in Eastern Azerbaijan)**




**Map (3): The relative land price classification in different regions of Tabriz (darker: more expensive)**

## 5. RESULTS AND DISCUSSION

The calculations carried out based on hedonic equation were trying to find a meaningful relationship between house price and other characteristics such as environmental features of the regions. According to the results gained it was found that from among those who are trying to buy a house, nearly %50 have academic degrees and the average house price bought at the time of research (2011) was between 1700 to 2500 million Rials ($114,000 to $167,000 in 2011 currency rates) for a two bedroom apartment, having an area of 120 $m^2$ in average. Improving the conditions of living place has been the most important reason to buy houses which has been presented in Table (2). Also some customers of the houses were first trying to rent the houses and these were omitted from our statistics because most of them were people whose main aim was to find an appropriate shelter and did not notice the quality of environment of the houses much. Of course there were some people among this group who paid attention to this issue but they did not considered it very crucial. As it can be seen in Table (2), the priority of enhancing and improving the environmental quality of living

location has been the most important factor and the main priority of buying houses in Tabriz and thus the highest rank belong to this factor. Also the other priorities are determined in the Table. In Table (3) the environmental element or variable considered by the respondents were assessed and the results were presented in summary. Based on the findings of this research (Table 3) some factors such as green area and the quality of the environment have been chosen to be the most important priorities in buying houses compared to other factors with a considerable difference. It seems that people consider green area and the quality of environment the most important issues in supplying housing for them and there are some other minor factors such as playgrounds for children and other factors related to environmental quality and the existence or lack of existence of green areas.

**Table (2): Reasons and priorities in buying houses**

| **Factors and characteristics under investigation** | **Acceptable responses (%)** | | | | | | |
|---|---|---|---|---|---|---|---|
| Motives and reasons to buy housing | very important | important | indifferent | unimportant | very unimportant | SD | average mark |
| Improving the environmental quality of living place | 56.6 | 40.3 | 2.4 | 0.6 | 0.0 | 0.61 | 1.44 |
| Improving housing level | 37.5 | 35.5 | 19.8 | 0.03 | 0.02 | 0.75 | 1.10 |
| Investing | 10.7 | 0.413 | 0.653 | 11.6 | 3.1 | 0.96 | 0.40 |

Average mark is determined through weighting the ordinal-descriptive numbers as: very important (2), important (1), indifferent (0), unimportant (-1), and very unimportant (-2). SD is standard deviation of the data.

**Table (3): Environmental characteristics with priorities in buying houses**

| **Factors under investigation** | **Acceptable responses (%)** | | | | | | |
|---|---|---|---|---|---|---|---|
| Environmental factor | very important | important | indifferent | unimportant | very unimportant | SD | average mark |
| Green area | 32.1 | 45.5 | 17.4 | 2.5 | 2.5 | 0.57 | 1.13 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Environmental characteristics | 42.6 | 37 | 14.7 | 2.6 | 3.1 | 0.68 | 1.15 |
| Open spaces | 22.9 | 39.5 | 22.3 | 11.8 | 3.5 | 0.73 | 0.79 |
| Children's playground | 19.4 | 28.6 | 24.8 | 17.5 | 8.8 | 0.77 | 0.71 |

Average mark is determined through weighting the ordinal-descriptive numbers as: very important (2), important (1), indifferent (0), unimportant (-1), and very unimportant (-2). SD is standard deviation of the data.

Step by step regression analysis of the variables shows the effective and meaningful correlations. As it can be seen in Table (4), the meaningfulness of dependent and independent variables is apparent in an assurance level of %95. Also the independent variables of the quality of environment and green area and the variable of closeness to residential application in step by step regression show a meaningful relationship with housing price more than other variables although in the assurance level defined all variables entered and accepted in the Table are meaningful regarding the mentioned level.

**Table (4): Results related to regression analysis of variables**

| p amount in %95 level | t ratio | Estimated coefficient | Variables |
|---|---|---|---|
| 0.02 | -0.124 | -0.018 | Closeness to business centers |
| 0.01 | 2.455 | 0.103 | Closeness to residential complexes |
| 0.02 | 0.242 | 0.072 | Closeness to transportation |
| 0.00 | -0.312 | -0.211 | Distance from workplace |
| 0.01 | 0.335 | 0.014 | Green area |
| 0.00 | 3.951 | 0.208 | Environmental characteristics |
| | 16.15 | 8.92 | Fixed coefficient |

In the linear regression equation N=180, while $r^2$=0.73 and adjusted $r^2$ equals 0.68.

Some variables were put aside due to the pseudo-correlation doubts. All variables were meaningful in %95 level and the variables such as distance from city center were omitted due to being not meaningful in %95 level. The dependent variable

was house price and other variables were considered as independent ones. Location, closeness to residential complexes, distance from workplace, green area and the environmental quality are all independent variables which affect housings' prices. Distance from workplace has a meaningful but direct on housing price. It means that the farther house purchased to workplace, the price will be lowered. As it was pointed out earlier, the statistical society under investigation was mainly entailing educated people and the existence of such correlations and effects was not unpredictable. In other words, in all cases presented in Table (5), the zero hypothesis of the research was rejected and the alternative hypothesis was accepted. Null hypothesis was based on the assumption that there is not a meaningful correlation between different factors and variables under investigation, that is the tendency to buy a housing, or residential unit and the determinant variables such as environment and closeness to canters and the distances. The alternative hypothesis was defined accordingly. An adjusted coefficient equal to 0.68 is an index of the existence of an acceptable correlation equal to %68 among the variables under investigation and their effects on house price. The two independent variable of quality of environment and green area which form the core and basis of the hypotheses f this research are highly effective in housing prices. To avoid the concurrent effect of these two variables in questionnaires' completion time it was described that the quality of environment was considered to be independent of green area and it mainly entails the existence or lack of existence of environmental pollution in the region. Therefore, each of the variables calculated solely and also on the whole has had an effective role in determining the prices of houses in different regions. Since the identification of the hidden environmental value or the amount of tendency to pay more due to a better environmental quality was one of the main goals of the present research we can absolutely claim that people consider value added because of environmental quality of the housings when they decide to have a decent housing for themselves without having direct calculations on the paper which is considered as a demand for a better environment generalized into the supply and demand curve. In a recent research by Pu, et al (2005) similar results were achieved in China. Also there were similar results in researches carried out by Witte et al (1979), and Khorshiddoust (1994), and Wen Hai-zhen (2005). Regarding the fact that most people and even authorities and governmental incumbents consider environment as a free service there are several methods to

remove this historical ignorance. Maybe the frequency and high accessibility of environmental gifts has been one of the reasons to consider it free and priceless in the past which has caused the free utilization of it during long years in the past. Thus, the question is that how can we price the seemingly priceless environmental services which cannot be exchanged in the market? The over-exploitation of environment and natural gifts is done due to the presupposition that it is supplied freely. Thus, most environmental services or goods are not priced and their consumption costs are not reflected in production and consumption market. But the demolition of environment and environmental pollutions impose a lot of expenses on the society and government. The maps presented in this research show a relative schematic representation of the quality of environment in different urban regions in Tabriz and present different land uses and relative dispersion of housings' prices in different parts of this city. Also the estimation of demand curve shows the economic importance of the quality of environment on the part of buyers of the housings and their indirect participation in dealing with environment. On the other hand, government authorities and the incumbents in urban and environmental issues will understand that spending more costs, credits and investments on preserving or improving the quality of environment in different urban areas will not be an invalid effort or wasting the resources.

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