# HEDONIC PRICE MODELLING IN TURKISH REAL ESTATE MARKETS: THE CASE OF BAYRAKLI, İZMİR

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# ABSTRACT


## HEDONIC PRICE MODELLING IN TURKISH REAL ESTATE MARKETS: THE CASE OF BAYRAKLI, İZMİR

Housing markets are often recognized as heterogenous structures that varies across spatial units and time. The determinants of house prices have been increasingly analzed recently in the literature, but, mostly in a linear setting, in almost all studies. Purpose of the current study is to investigate the micro-determinants of house prices in Adalet and Mansuroğlu Neighborhoods located in Bayraklı District of İzmir Province by using both linear Hedonic and nonlinear methods. In total, 278 apartments are analyzed. The data is collected in a period November 2018 - March 2019. The semi-logarithmic linear and non-parametric nonlinear forms were used as a functional form in order to analyze the significance of physical and environmental characteristics of the apartments. As a result, nonlinearity is found as weakly evident which fails to alter the results obtained from linear method. In terms of determinants, structural carachteristics (i.e. size, rooms and age of the building) are found as more significant determinants than locational caractheristics (i.e. distance from CBD).

# ÖZET

## TÜRKİYE GAYRİMENKUL PİYASALARINDA HEDONİK FİYAT MODELLEMESİ: BAYRAKLI, İZMİR ÖRNEĞİ

Konut piyasalarındaki fiyat gelişmeleri çoğu zaman mekanlar arası ve zaman içinde dengesiz bir yapıdadır. İlgili yazında konut fiyatlarının dinamikleri artan bir ilgi ile analiz edilmekte, ancak çoğu çalışma sadece doğrusal yöntemler izlemektedir. Bu çalışmanın amacı İzmir'in Bayraklı İlçesinde bulnan Adalet ve Mansuroğlu mahallelerindeki konut fiyat dinamiklerini doğrusal Hedonik ve doğrusal olmayan yöntemler ile araştırmaktır. Veriseti toplam 278 konuttan oluşmakta olup, ilgili veriler 2018 (Kasım) - 2019 (Mart) döneminde elde edilmiştir. Yarı-logaritmik doğrusal denklemler ve parametrik olmayan-doğrusal olmayan fonksiyonlar kullanılarak konut fiyatları yapısal ve çevresel etkenler bağlamında incelenmiştir. Ortaya çıkan önemli sonuç doğrusallığın hala geçerli olduğu, konut fiyat gelişiminde yapısal özelliklerin (konut yaşı, büyüklüğü ve oda sayısı), lokasyon özelliklerinden (MIA'ya olan uzaklık) daha önemli olduğudur.

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BRT: Bus Rapid Transit

CBD: Central Business District

HPI: Housing Price Index

HPM: Hedonic Price Modelling

SHP: Spatial Hedonic Price

# CHAPTER 1

# INTRODUCTION

In the literature on urban economics, local housing markets have received a considerable attention over the recent decades. Housing is the most extensively used part which covers the widest area of human life and urban space. It is described as a commodity that is produced for consumption which meets the requirements of shelter, safety, comfort, socialization, and aesthetics. (McDonald and McMillen, 2007) In particular, determinants of the house prices are of particular interest. Housing market represents one of the biggest sectors in Turkey that accounts for about 1/3 of the economic activities (together with construction industry & real estate services) (Özdoğan, 2017). Attendently, housing prices have been frequently investigated by experts from different disciplines such as economics and planning. (Çetintahra, Çubukçu, 2012) Hence, understanding the nature and evolution of price dynamics is crucial from an urban policy standpoint.

Moreover, from a methodological point of view, there are some important gaps in the literature that should be investigated. The existing literature has largely relied upon the linearity of determinants while ignoring largely the investigation of possible non-linearities.

There are some factors which has defined the value of real estate property. Fundamentally, an increase in prices of a good is related to the attraction of location and characteristics of goods (Debrezion, Pels& Rietveld, 2007). The difference in property values is correlated with physical, level of accessibility and environmental factors. (Debrezion, Pels& Rietveld, 2007) Housing market has some differences than other markets; high cost of housing supply, permanent residence, growth effect on secondary markets, the necessity of the rental market as a result of need, durability, spatial immovability, indivisibility, high purchasing cost, use as collateral in financial transactions and above all, multidimensional heterogeneity, justify the use of hedonic price technique. (Garcia & Raya, 2011)

The market value of housing is generally analyzed through the hedonic price model based on microeconomic theory. Hedonic price method helps in defining the influence of these characteristics. It is a method which used to estimation the apparent prices of features that differentiate products.

Purpose of the current study is to investigate the micro-determinants of house prices in Adalet and Mansuroğlu Neighborhoods located in Bayraklı District of İzmir Province by using both linear Hedonic and nonlinear methods. In total, 278 apartments are analyzed. The data is collected in a period between November 2018 - March 2019.

In detail, the addressed research questions are the followings;

i. Are House Prices Heterogenous?

ii. What are the major determinants behind house prices?

iii. Are the linear models relevant in hedonic price modelling?

In terms of methodology, many variables are contstructed initially, such as the structural proprties of apartments (i.e. size of a dwelling unit, number of rooms, age etc.) as well as locational caratheristics (such as distance from central locations). Following this, descriptive and explorative analyses are provided. Then, linear and nonlinear regression analyses are pursued together with a marginal impact analyses.

As a result, nonlinearity is found as weakly evident which fails to alter the results obtained from linear method. In terms of determinants, structural carachteristics (i.e. size, rooms, age of the building) are found as more significant determinants than locational caractheristics (i.e. distance from CBD).

With regard to the relevance of the field of study, Bayraklı has been transforming from a residential zone to a new Central Business District of Izmir. That’s why understanding the determinants are quite important and interesting.

Remaining part of the study is structured in a following way. In section 2, theoretical framework and literature survey is explained, in section 3, determination of functional form is pursued, in section 4 dataset, place of study, methods and results are presented. In section 5, study is concluded.

# CHAPTER 2

# THEORETICAL FRAMEWORK

Demand and supply are fundamental economic forces that determine housing market prices. To conceptualize the mechanism of the real estate markets in urban areas, supply and demand frameworks are handled as analytical tools. This chapter aims to explain the basic concepts of economic principles that operationalize housing prices.

This section will provide a summary of the main economic principles governing the urban real estate market. This course covers the basic analytical tools for conceptualizing the supply and demand and the theory of price determination mechanisms for studies in urban real estate markets.

## 2.1. Housing Demand

Conventional Economic Theory stated that real estate prices fundamentally depend on the elemental guidelines of supply and demand. Understanding this basic economic principle of law of demand; when the quantity of properties is scarce but if the demand is high, number of units are demanded at higher prices. Current prices and rents play a role as endogenous determinants of real estate demand (in Figure 2.1). However, as seen in Figure 2.2. the quantity demanded may vary not only by endogenous determinants, but also by exogenous determinants that assist the real estate appraisal such as prices of substitutes, population, employment, income/wealth and expectations. (Mourouzi-Sivitanidou, 2011)

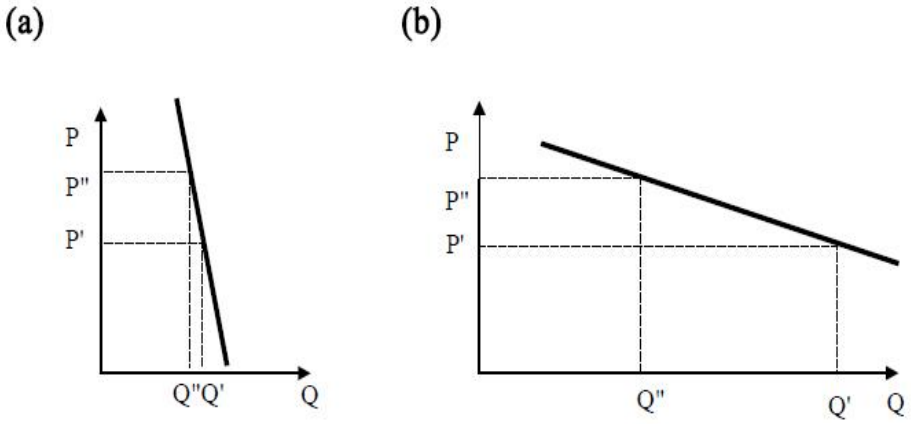



Figure 2.1. Fundamental Law of Demand
(Source: Mourouzi-Sivitanidou, 2011)

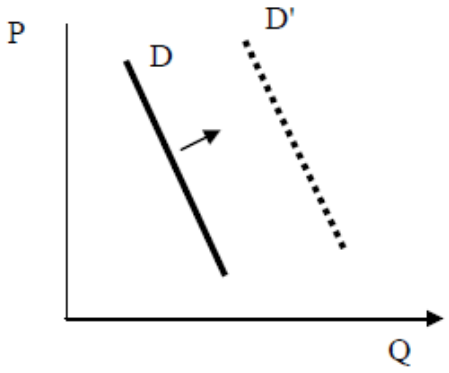



Figure 2.2. Shifts in Demand
(Source: Mourouzi-Sivitanidou, 2011)

### 2.1.1. Price Elasticity of Demand

The price elasticity of demand is the most important microeconomic concept of the price change in the quantity demanded of a product in relation to its price change.

To understand the formula for calculating the coefficient of price elasticity, it is expressed mathematically as;

$$\varepsilon D = \frac{\Delta P/Q[percentage\ change\ in\ quantity\ demanded]}{\Delta P/P[percentage\ change\ in\ price]} \quad (2.1)$$

| εD | > 1 [demand is price elastic]

| εD | = 1 [demand is unit elastic]

| εD | < 1 [demand is price inelastic]

This term shows how many percent of the amount the quantity demanded will fall in response to a 1% increase in price. If the price elasticity shows a value, which is more than 1, demand is considered as elastic, if the opposite happens that means being less than 1%, then the price is inelastic. Being inelastic of a good means that its prices do not change very much given changes in demand. In addition, this value is equal to 1 is called the unit elastic.

Substitutes are quite significant in terms of price elasticity of demand. For instance, at the middle-income housing types have more substitutes than luxury housing that high-income level consumers prefer. According to Kau and Sirmans (1985), investors generally prefer inelastic project demands. Because, even if the price of a real estate increases, the demand will not decrease at the same rate and consequently the investors will be increased their rate of profit.

## 2.2. Housing Supply

The law of supply points out that as the price of an item rises up, suppliers will endeavor to maximize their profits by increasing the amount offered price for sale. There are main drivers that manage real estate development and decision making process like the fundamental law of supply, price elasticity of supply and other factors.

In this section, real estate supply behaivor will be investigated. These concepts can be compiled in 3 notions which are firstly, long-run aggregate supply, short-run aggregate supply and lastly one of the most important supply components of the market is the new construction. (Mourouzi-Sivitanidou, 2011).

### 2.2.1. The Long-Run Aggregate Supply

The Long-Run Aggregate Supply describes the relevance between long-run price levels and the total supply of goods produced during a long time. It focuses on the long-term operation of the real estate market. (Mourouzi-Sivitanidou, 2011). As seen in Figure 2.3, quantity supplied goes up as the price rises.

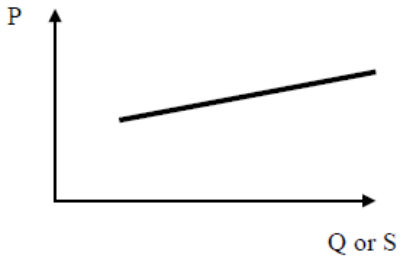



Figure 2.3. The Long-Run Aggregate Supply
(Source: Mourouzi-Sivitanidou, 2011)

### 2.2.2. The Short -Run Aggregate Supply

Aggregate supply in the short-run is designated as the total production of goods at different price levels while the real estate stock is fixed. In the Figure 2.4. it has been shown that the supply side is constant and its relation with the price. In other words, the short-run supply of real estate is unconcerned with changes in prices.


Figure 2.4. The Short -Run Aggregate Supply
(Source: Mourouzi-Sivitanidou, 2011)

### 2.2.3. New Construction

Since the real estate is a long-lived property, the new construction in this market has an important role in supply. To the extent of the fundamental law of supply, the upward trend in real estate prices also raises the supply in the market. According to Figure 2.5. $P_{min}$ represents a reasonable minimum value that suppliers can make a profit in the market. Developers to understand the affordability of property in consumer groups use this threshold.

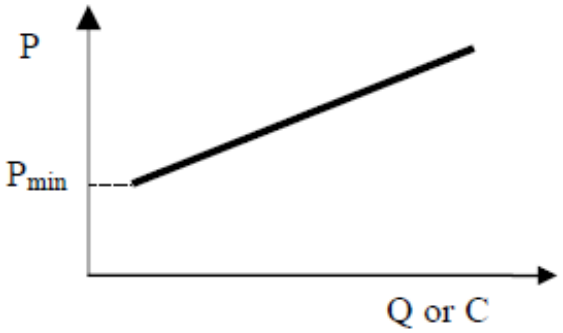



Figure 2.5. New Construction
(Source: Mourouzi-Sivitanidou, 2011)

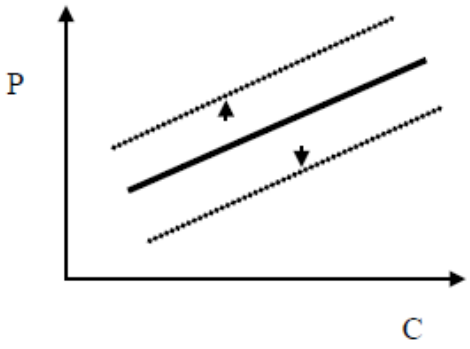



Figure 2.6. Effects of Exogenous Shifters on New Construction
(Source: Mourouzi-Sivitanidou, 2011)

New construction reflects the total of completed construction in the market. Within this scope, there are exogenous factors that impress the price in any real estate project involve capital, labor, land, building materials. The higher the cost of these factors, the lower the rate of construction. This will negatively affect the tendency of investors to make new construction, due to the lower margin of profit. Hence, as it can be seen from Figure 2.6. a downward shift occurs. (Mourouzi-Sivitanidou, 2011).

## 2.3. Price Determination Mechanism

Real estate prices are specified based on the interaction between the demand and supply. The figure 2.7 depicts that when the sellers and buyers overlaped in the graphic 'P*' which is intersection point called as equlibrium level, QD=QS.

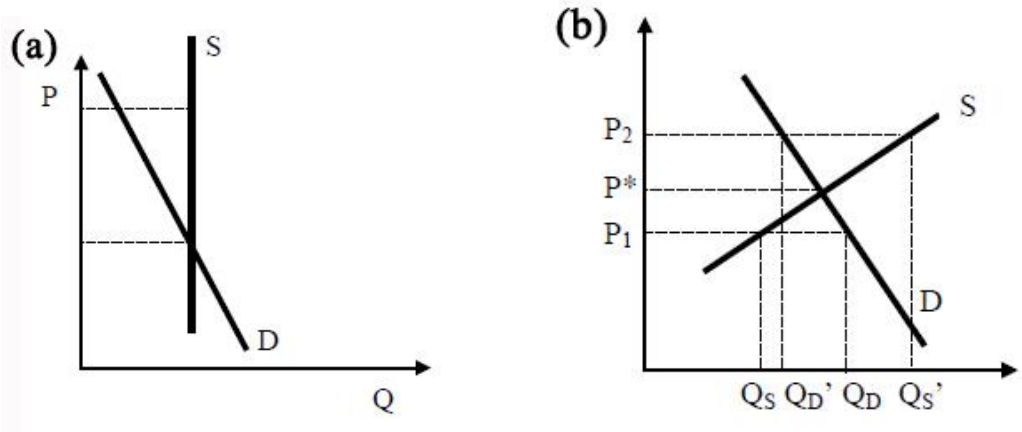



Figure 2.7. Price Determination Mechanisms
(Source: Mourouzi-Sivitanidou, 2011)

In order to understand the basic principle of this issue, it will be substantial how the supply-demand balance is applied in the real estate market.

The short-run supply and the long-run supply are different from each other. According to Figure 2.7. (a); in short-run mechanism, while price increases supply is fixed and demand indicates downward alteration.

On the other hand, at Figure 2.7.(b), the long-run mechanism, while the prices are increasing due to excessive demand in $P_1$, if we look at the $P_2$ level of that graph, this time the consumer will not want to pay more money to the property, as there is excess supply observed and therefore the sellers will have to go down in prices.

# CHAPTER 3

# RELATED EMPIRICAL LITERATURE

Hedonic Price Model is a method that is used to estimate the determinants of the properties. It is used to measure the benefits or prices of heterogeneous goods, such as housing, whose utility cannot be directly measured. Because the hedonic price model allows the calculation of the effect of the qualities of a good or service on the price of a good or service. (Ekşioğlu, 2010) Through the instrument of the Hedonic Price Model, firstly, the relationship between the properties of a property and its price is established. The effect of each additional feature on price and how these features differentiate the product are investigated. (Özkan ve Yalpır, 2005).

According to Sirmans et al. (2005), the housing unit is not a homogenous commodity. Malpezzi (2003) highlighted the rise of hedonic price modelling based upon heterogeneousness of both consumers and dwelling types. The fact that housing is a heterogeneous commodity that includes multiple variables that determine the price of a house. However, the prices of these properties in the market are not calculated. Therefore, the hedonic price model method tries to determine the effect of each property that the house has on the housing price.

Hedonic price models that help to understand consumers housing preferences support the fundamentals of conventional economic approach. This term is used to define the weights of the comparative importance of the various components while creating the "usefulness and desirability" index. (Goodman, 1998) Housing prices are determined by the combination of the value of each physical and spatial factors that the property has. These factors include many structural and environmental variables such as; living area size, number of storeys, gated site within security, risk of eartquake, neighborhood area, transportation, social facilities, travel time to job or age of the building etc.

One important study is implemented by Sirmans et al. (2005) who examined 125 empirical studies which were used Hedonic Price Modelling recently some commonly

used variables were determined in their study. The used variables were classified in various categories (Sirmans et al., 2005):

1. Constructional features: Size, number of bathrooms, number of bedrooms, number of floors etc.
2. Internal features: Flooring, quality of furniture, heting systems, design, materials, fixtures etc.
3. External features:Terrace, pool, autopark, elevator, frontage etc.
4. Environmental features related nature: Sea view, mountain view, hills, valley, river, forest or vista that has nice scenery.
5. Environmental features depend on location and district: Socio-economic status of residents, crime rate, distances to significant points or such territorial landmarks such as central business district, port and railway station.
6. Environmental characteristics resulting from public services: Quality of nearby schools, hospitals, public goods, existence of social facilities.
7. Marketing, occupancy and selling characteristics: Regional analysis of real estate appraisers, valuation criterias, while home ownership generally affects positively, being empty is not for selling price.
8. Financial issues: housing loans, being in execution has negative affect, whether the loan is eligible.

Haas (1922) first used hedonic model in the field of agriculture. Haas (1922) tried to explain the farm area, which is defined as dependent variable, with the independent variables of the size of the city and the distance to the city. (Kaya, Atan, 2014) In addition, Malpezzi (2001) claims that hedonic term was first used to create a car price index in 1939 by Andrew T. Court. Lancaster's (1966) theoretical model are one of the following studies associated with the hedonic price modelling that was not specifically improved for the housing market, but it was one of the most important pillars of the housing market literature. He provided a microeconomic basis for estimation methods based on the utility-oriented of each characteristics of the goods. Consumer demand theory argues that the consumer makes a choice according to the characteristics that constitute the goods (Lancaster, 1966). Similarly, Rosen (1974) argued that commodity prices (hedonic prices) that are a combination of different characteristics and whose benefits cannot be measured directly. According to Rosen, the price of a commodity (hedonic price) is the summation of the prices of its characteristics. Thus, the HPM is used to measure the

impact of the characteristics of property on the price. (Rosen, 1974). When both Turkey and worldwide studies that are examined, it is seen that a property price is based on a bundle of attributes. These contain structural, socio-economic, location-related, environmental characteristics and can be grouped in 4 categories: (Efthymiou & Antoniou, 2013)

I. The Features of the Residence (number of surface, rooms, floor etc.)
II. Qualification of the Community (demography, income, education level etc.)
III. Accesibility Indicators (distance from CBD, metro station etc.)
IV. Environmental Quality (noise, air, etc.)

## 3.1. Empirical Studies on the World

There are number of empirical studies implemented in the World. For instance, Ridker and Henning (1967) gave the first example of this model. They evaluated the impact of air pollution on households while making a decision on dwelling unit selection by using the linear price function. Kain and Quigley (1970) in order to test both the sale and rent dependent variable; they used the independent variables of building quality, construction quality, house characteristics, location, success of education places in the vicinity, age, number of bathrooms, typology of house, hot water and furnished house for rent. Moreover, Straszheim (1973) find out that the location of a house was a significant factor to clarify housing price changes in different regions with linear hedonic price method by the help of the independent variables that are the number of rooms, the age of the house and the size of the house in its study. Rosen (1974) made more emphasis on the determination of price and an extensive contribution is supplied for hedonic price theory. It has shown how heterogeneous products compile together with their various properties and how the marginal price ranges of these characteristics are estimated with a hedonic model. Furthermore, Rosen (1974) has described certain amounts of property-related features as hidden or hedonic prices, in the price of an observed property.

Housing price determinants can diversified in terms of the internal structure of the house, and the external structure of housing such as location, neighborhood structure,

market conditions and housing policies. (Keskin, 2008) In other words, exterior features refer to physical, spatial, demographical, and economic structure of neighborhoods. The hedonic literature assumes that both physical and spatial features of dwelling unit specifies the house prices (Watkins, 2001). Harsman and Quigley (1991) emphasized that housing market analysis needs to be made more locally than national factors because the location of the house has a decisive influence on the housing price. Clapp (2003), for example, tried to explain the house prices with the local regression model because of the differences in the location of the house. The accuracy of estimated market values can be enhanced in a considerable extent by including the spatial inputs of the housing to hedonic equations, which could reduce forecast errors in market research. (Basu and Thibodeau, 1998).

On the other hand, Goodman (1978) described the attributes as "shadow prices" that reflecting given attributes of the house and has divided the cities into city center and suburban layers. He evaluated the housing prices according to the building typology, age, number of black persons in the region and number of rooms. In addition, Palmquist (1984) divided the city into 7 metropolitan areas and the price of the houses were evaluated according to have parking space and ventilation. Kim (1992) tried to explain the average rent prices with such variables; number of bathrooms, number of rooms and income level of households.

Fletcher et al., (2000) emphasized the need to use a wide range of diagnostic statistics to describe a good model. On this subject, with 1600 property data obtained from the Midland region of England and the hedonic price model were examined with various diagnostic tests.

Wilhelmsson, (2000) tried to examine the effects of trafic noise parameter on dwelling units in Stockholm by the aid of the log-lineer function. The results of the empirical analysis show that, for a home in a noisy place in comparison with located in a quiet place, consumers prefer o pay less 0.6% per decibel or 30% less than the total price. Moreover, we look at another study of Wilhemsson, (2002) in Stockholm, it is examined that housing prices and household expenditures in his study; household size, income and price elasticities play a very important role in price estimating. Households with increasing incomes have a tendency more space and better quality interior design is preferred.

When Maurer et al., (2004) examined the Parisian housing market, while the number of floors that flat is located in the apartment complex affect positively the price of housing, the occupancy rate of flats impacts negatively in the bourgeois districts.

Toda and Nozdrina (2004) estimated that the prices of apartments in Moscow, which are far from the city center and subway station have decrease in house prices and that the spacious kitchen and well maintained houses have increased the prices.

The Hedonic price method had been used to investigate the impact of access to surface and groundwater on land prices in India. (Gundimeda et al., 2004)

Kim and Park (2005) identified the changes of the house prices concerning spatial determiners in the new towns in Seoul and surrounding areas, and found that the spatial order was not associated with housing prices.

In the study of Wen, Jia and Guo (2005) in the city of Hangzhou, they have evaluated the relationship of housing properties in terms of structural, location-based, neighborhood-related and other features. As a result of the study, it was observed that structural features were the most effective variable in determining housing prices with a rate of 60% and it is followed by %19,8 location criteria, %16,5 neighborhood and in the rate of %2,7 other features.

Cohen and Coughlin (2005) predicted the relationship between noise level and housing prices in residential areas near Atlanta International Airport and found that housing prices increased as noise decreased.

Fan et al. (2006) examined Singapore's second-hand housing market in terms of the relationship between housing prices and housing properties by using a decision-tree approach.

Kestens et al. (2006) used data interested in household such as household type, age, educational status, income, and previous lease time of buyers to measure the heterogeneity of implicit prices by using Apply Geographical Weighted Regressions.

Debrezion et al., (2007) found that the house price differences between the housings where are located near at the railway station and the backland was about 4.2% for the average dwelling unit and it is also about 16.4% for the average commercial property. Furthermore, it is determined that every 250 meters of housing is closer to any station and the price of a house is 2.3% higher than the commercial ones.

For the period between July 2004 and June 2006, all commercial residences sold in Shanghai have analyzed by separating zones. Hence, the housing price decreases 5%

on average when being located 1 km farther away from the CBD zone; this situation has a more sharp impact on outer zones. (Chen & Hao, 2008)

Wong (2008) suggested that people are generally want to pay more price to the houses that are close to successful schools, living areas, bus stops and shopping malls.

Vor and Groot's research (2009) represents to the impact of unfavorable components of industrial zones have considerably negative influence on housing sales. It is estimated that the houses, which are 250 meters away from an industrial site, will be sold 14.9% less than those in 2250 meters in Dutch industrial sites.

Sue and Wong (2010) found that in Singapore, there was a price increase, which is newer, larger, and higher floor homes.

Perdomo, (2011) analyzed the impacts of the Transmilenio BRT system on the sampled 304 residential units by way of SHP Model in Bogota, Columbia. The results of this study dispalys that if the distance to the nearest TransMilenio station increases by 1 m, the average housing price decreases by about 0.05% per square-meter. Table 2.1 contains a general review of empirical studies around the world for the determination of housing prices.

## 3.2. Empirical Studies in Turkey

The studies with hedonic price estimates has been observed in the early 2000s in Turkey. Üçdoğruk's study (2001), 2718 surveys were gathered from real estate agents in all districts of Izmir. The factors affecting the real estate prices were tested in Izmir with a hedonic approach. In the study, coefficient estimates were significant in terms of both internal and the external factors of the dwelling (the location of the dwelling, whether it is within the site). When the regional variables were attached to the model, the regions that have high housing prices are determined.

Ustaoğlu (2003) suggests that factors such as internal services, access to the office and office on the upper floors have a positive effect on office rental prices in Ankara.

Yankaya and Çelik (2005) analysed the relationship between transportation accessibility and property values in specific to zone of İzmir subway stations by using

hedonic price modelling. The results indicate positive effect on housing prices depending on the İzmir subway investment.

Baldemir et al. (2007) have estimated the housing parameters for Muğla province. Being in a site of a house and the number of rooms characteristics of a house was found to be negative on the housing price. However, it is observed that these values are positive in the observations, which are 1500-2000 meters away from city center.

Özus et al. (2007) summarized the relationship between housing prices and properties with 1468 housing on sale in İstanbul by using hedonic pricing model in linear form. When the estimation results are evaluated in general, it can be said that the most important factors affecting the housing prices at the metropolitan level are the area of the housing, the sea view and the sub-market variables.

Karagöl's study (2007) in Ankara, predicted some efficient factors in determining housing prices such as being in a site, being in the high-income area, having a park, number of floors, size of house, number of rooms, elevator, parcel area, proximity to shopping center, age of house, used material and equipment. Also in Çankaya Neighborhood in Ankara, It is estimated that the factors such as region, number of rooms, number of toilets, hall, dwelling place, total number of storeys and gross area of the residence are significant in the model and the size of the house is the variable that best describes the house price.

Selim (2008) has analyzed the drivers that define the price of housing within the help of 5741 household inputs between the dates from 1 January 2004 to 31 December 2004 by using the Household Budget Survey 2004 data in Turkey. As the most important variables affecting the housing prices, the type of housing, type of building, number of rooms, size of the house and other structural variables such as having a water system, having a pool and natural gas service were found to be meaningful. It also estimated that housing prices in urban areas were 26% higher than in rural areas.

Arıkan (2008) in his study examined the factors affecting housing rent for Istanbul province. As a consequence of the study; it has been determined that the housing in the European side and housing in the site negatively affect housing rents, having cable TV in the house, having infrastructure services in the neighborhood, increasing the number of rooms, the presence of an aspirator in the kitchen of the dwelling affects in a positive way. On the other hand, it has been determined that the deposit and the dues have an increasing effect on housing rent.

According to abayhan's study; It has tried to determine whether urban green areas have an economically measurable impact on residential real estate. The increase in the value of the vista for an average house from 1 to 7 causes an increase of approximately 75 thousand TL. Location characteristics are expressed as the relation of the region where the real estate is located with the whole geographical area. The most important fixed position feature that can be specified is proximity. Regardless of the type of proximity (proximity to the city center, proximity to transport routes, proximity to shopping centers, etc.), it has an impact on house prices. (Abayhan, 2009)

Selim and Demirbilek (2009) stated that urban dwellers pay 46% more rent than rural areas. All the variables except age had a positive effect on housing rents. Moreover, the type of housing, type of building, number of rooms, size of the house, water system, pool, natural gas, and cable broadcast as well as effective in rental prices.

Ekşioğlu (2010) has examined the effect of environmental aesthetics on housing prices in Izmir through rent or sale apartments. Within the scope of the study, a certain area was selected on the border of Karşıyaka district of İzmir and information was collected about 100 houses from 18 real estate agents. It was found that when the interest and pleasantness of the façade of the purchased houses increased, the security of neighborhood, well-being, attractiveness, pleasantness and harmony of the environment increased and the presence of the elements creating visual pollution decreased; the desire to own the house and the estimated prices increased.

Çağlayan and Eban (2011) examined the relationship between house prices and their characteristics for the 992 houses using the hedonic pricing approach with semi-logarithmic Regression Model for the last 3 months period of the 2007 year from the date of October in Istanbul. They described the housing properties affecting the house prices as number of bathrooms, street, residential facade, garage, security staff, heating system, cable TV, kitchen area, number of rooms, within the site, whether the European or Anatolian side, the age of the building. According to the results obtained from model estimates; while security, heating system, garage for automobiles and cable TV, kitchen area, rooms increases the prices of the houses and the fact that the house is on the street reduces the price. In addition, interestingly, the buildings located on the Anatolian side, the age of the building had a positive impact on the housing price.

In Cingöz's study (2011) for İstanbul city, it is estimated that the district has a significant impact more than structural features on the price, the distance to the city center

affects the price negatively; the parking lot on the site of dwelling, the number of rooms and the size of the houses have a positive influence the housing prices.

Gündoğdu (2011) investigated the contribution of each variable and spatial factors to the marginal price and rental price in the central districts of Isparta. The neighborhood where the house is located, its proximity to the bazaar and its proximity to the schools increase the rent prices; traffic, noise and crime rates have been found to have a low impact on rent.

Kaya (2012) in the housing size variable after 200 square meters of an increase in price has been observed, while the price of the housing % 6.82 decreases in stove-heating, having a central heating system is increased the price % 2.54.

Koramaz and Dökmeci (2012) examined the relationship between the housing prices and the features of the house for sale in Istanbul between the May-July 2009 dates by using the hedonic pricing approach in semi-logarithmic form. In the model, it is stated that the changes in housing prices in Istanbul are mostly explained by spatial variables such as distance to MIA, distance to sub-centers, distance to public transportation and distance to coastline.

Tekel and Akbarishahabi (2013) aimed to evaluate the price changes in the houses located nearby the Ankara Botanical Park by means of hedonic price modeling and as a result, this parameter increases the housing prices.

Ayan and Erkin (2014) made a study for the Izmit province in 2012. It contains 405 apartment building observations that analysed to determine housing price influencers by the semi-logarithmic form of HPM. According to the results of the study, construction quality, residential area, having an additional bathroom and being on the ground or basement floor, swimming pool and having a security are the most effective features in determining house price and buyers willing to pay 10% more to live in the fresh air.

Yayar and Gül (2014) conducted three model experiments for 739 flats in the city center of Mersin, which are linear, semi-logarithmic and full-logarithmic forms. It has been determined that the residence has a garden, being in a site, being away from public transportation stations decrease the housing prices.

Yayar and Karaca (2014) tried to determine the factors affecting the house prices in the TR83 region by hedonic model. The most important variables affecting the apartment prices positively are the number of baths, the number of lifts, located on the

avenue and the heating; in other respects in the negative direction, it is determined that the housing location is in Çorum city center, usage of fuel-oil and being on the first floor.

Bulut et al., (2015) observed 395 sample of residential use at the three central neighborhoods in Samsun that are Canik, İlkadım and Atakum. In this context, the fact that the apartment is larger than one square meter increases its price by 0.6%. The price of buildings with a building age of 5 and higher is 8.9% cheaper than 0-4 year olds.

Daşkıran (2015) made questionnaires with 102 households by random selection in Denizli. According to the results of the model, the floor of the house, elevator, number of rooms, number of bathrooms, heating system, distance from educational institutions, health institutions and the proximity to the city center has stated that the variables significantly affect housing prices.

Uyar and Yayla (2016) used HPM to examine the relationship between the prices of and the structural, physical, spatial, payment and neighborhood characteristics of the dwellings for 2797 housing units in Istanbul for a period of last 3 months of 2013. According to the forecast results, the basement floor was negative side with 22.51% and the Bosphorus view was the most positive effect with 34.04%.

According to Afşar et al., (2017) study o Eskişehir province. In the period of November-December 2016, 4311 houses for sale were used. As a result of the study, it was determined that the size of the house, the number of rooms and bathrooms, existence of central heating system, the presence of the elevator, car park, built-in kitchen, and the en-suite bathroom, being located at the first floor, and the neighborhood where located influence housing prices.

Demircan (2018) has studied the effects of spreaded unwanted odor around surrounding real estate values in Narlıdere District-İzmir by Southwestern Advanced Biological Wastewater Treatment Plant with the help of Hedonic Price Method.

After all; according to these studies that were examined from related literature, as anticipated in introduction part, studies in general have focused on the linear setting while largely igoring possible nonlinearities. The housing price determinants generally built on a foundation of the structural features of the house, environmental factors affecting the housing price, location-dependent factors, and distance-dependent variables. Table 2.2 inludes a general review of empirical studies in Turkey and also specific to İzmir for the determination of housing prices.

Table 3.1. Relevant Empirical Studies on the World

| Authors | Study Place | Aim of the Study | Period | Method | Findings |
|---|---|---|---|---|---|
| Ridker and Henning, 1967 | St. Louis County- Missouri/ USA | Impact of air pollution on households | Census Data of 1960 | Linear Price Function | A negative relationship between property values and sulfate measures |
| Kain and Quigley, 1970 | St. Louis County - Missouri/ USA | Measuring the physical and environmental quality of dwelling unit | 1967, 1.500 households, | The linear and semi-logarithmic forms. / Interviewers ranked the quality of particular aspects from 1(excellent) to 5 (need replacement) | Number of rooms, number of bathrooms, lot size |
| Straszheim, 1973 | San Francisco (73 Geographic Zone) | Tried to explain the selling price of the house which is the dependent variable with different independent variables of the house. | 1965, Households interview data. | Linear Price Function | A significant relationship between house sale price and house age, land area and house size. Work site and accessibility have significant effects on households' choice of a location and the amount of housing consumed. |
| Goodman, 1978 | New Haven/ USA | Divided the cities into city center and suburban layers. | 1969, 1835 single family houses, from 1967 through | Hedonic Regression Method (Box-Cox) | Both structure and neighborhood the prices are up to 20% higher than in the suburbs. |
| Palmquist (1984) | 7 Metropolitan Areas: Atlanta (2863 sales), Denver (4775), Houston (3185), Louisville (2050), Miami (2390), Oklahoma City (3058), and Seattle (1976) | To implement a new estimation technique for determining the demand for the characteristics | 1977, for mortgages recorded. | Linear, Semi-logarithmic, Log-linear and Inverse semi-logarithmic. | The number of bathrooms and the year built are always positive, significant, and generally of reasonable magnitude. |

**(Cont. on next page)**

Table 3.1. (Cont.)

| Authors | Study Place | Aim of the Study | Period | Method | Findings |
|---|---|---|---|---|---|
| Wilhelmsson, 2000 | Stockholm | Tried to examine the effects of trafic noise parameter on dwelling unit. | 1990–95 | Log-lineer function | A home in a noisy place in comparison with located in a quiet place, consumers prefer o pay less 0.6% per decibel |
| Toda and Nozdrina, 2004 | Moscow | To understand relationship between house prices and housing characteristics empirically. | 2002, 5282 observations | Lineer function | Distance to the closest metro station (meter), distance to city center (km) have affected housing prices negatively |
| Wen, Jia and Guo, 2005 | Hangzhou, China | Evaluated the relationship of housing properties in terms of structural, location-based, neighborhood-related. | 2004, 2473 housing samples | logarithmic form | Structural features were the most effective variable with a rate of 60% and it is followed by %19,8 location criteria, %16,5 neighborhood and in the rate of %2,7 other features. |
| Debrezion et al, 2007 | | The impact of railway station proximity on property value | Earlier studies were examined | Linear, Semi-logarithmic and Log- linear | Housings where are located near at the railway station and the backland was about 4.2% for the average dwelling unit |
| Chen & Hao, 2008 | Shanghai | To examine the effect of geographical distance to city centre on the selling price of residential housings | July 2004 and June 2006 | Log- linear | The housing price decreases 5% on average when being located 1 km farther away from the CBD zone |
| Perdomo, (2011) | Bogota, Columbia | To estimate the impact of the TransMilenio infrastructure on the values of residential properties in the vicinity | 304 residential units | Spatial Hedonic Price | The distance to the nearest Bus Rapid Transit (BRT) station increases by 1 m, the average housing price decreases by about 0.05% per square-meter. |

Table 3.2. Relevant Empirical Studies in Turkey

| Authors | Study Place | Aim of the Study | Period | Method | Findings |
|---|---|---|---|---|---|
| Yankaya and Çelik, 2005 | İzmir | Analysed the relationship between transportation accessibility and property values in specific to zone of İzmir subway stations (LRT) | December 2003 and March 2004, 360 observations | Linear, log-linear (or semi-log), linear-log and Double-log | Distance is negative and highly significant for each model in the buffer zones of the subway station and house prices increases proximity to the station. |
| Baldemir et al. (2007) | Muğla | Investigation of the factors affecting the price of housing in the central district of Muğla | May 2007, 178 observations | Linear, log, log-linear | Being in a site of a house and the number of rooms characteristics of a house was found to be negative in city center but ıt is positive in the observations which are 1,5-2 km away from city center. |
| Özus et al. , 2007 | İstanbul | To determine the physical and functional factors that affect the sale prices in historical residential areas of Beyoğlu by using hedonic price analysis. | 1468 housing on sale | Linear form | The most important factors affecting the housing prices at the metropolitan level are the area of the housing, the sea view and the sub-market variables. |
| Selim, 2008 | Turkey | To analyze factors that determine the house prices in Turkey | 1 January 2004 to 31 December 2004, 5741 household inputs | Household Budget Survey 2004 data | The type of housing and building, number of rooms, size and having a water system, a pool and natural gas service were found to be meaningful. Housing prices in urban areas were 26% higher than in rural areas. |
| Çağlayan and Eban, 2011 | Istanbul | To investigate the relationship between house prices and housing characteristics. | 992 houses, 3 months period of the 2007 year from the date of October | Semi-logarithmic Regression Model | While security, heating system, garage for automobiles and cable TV, kitchen area, rooms increases the prices of the houses being on the street reduces the price. |

**(Cont. on next page)**

Table 3.2. (Cont.)

| Authors | Study Place | Aim of the Study | Period | Method | Findings |
|---|---|---|---|---|---|
| Koramaz and Dökmeci (2012) | Istanbul | To measure the effect of spatial characteristics on housing prices | May-July 2009 | Semi-logarithmic form | The spatial variables such as distance to MIA, distance to sub-centers, distance to public transportation and distance to coastline. |
| Ayan and Erkin, 2014 | Izmit | To examine housing price determinants. | 405 apartment buildings, 2012 | Semi-logarithmic form | Construction quality, residential area, having an additional bathroom and being on the ground or basement floor, swimming pool and having a security are the most effective features. |
| Yayar and Karaca (2014) | TR83 region (City Centers of Tokat, Amasya,Corum, Samsun) | Determining the factors that affect the sales price of the apartments in the region and determining the marginal effects of these factors | May-September 2012, 1453 flats | Semi-logarithmic Regression Model | The number of baths, the number of lifts, located on the avenue and the heating affects positively prices. |
| Bulut et al. (2015) | Samsun (Canik, İlkadım, Atakum) | Investigation of factors affecting housing prices in Samsun with hedonic price model | 2012 | log-linear | The apartment is larger than one square meter increases its price by 0.6%. The price of buildings with a building age of 5 and higher is 8.9% cheaper than 0-4 year olds. |
| Afşar et al. (2017) | Eskişehir | Determining the factors affecting the sales prices of houses and their effect levels within the framework of hedonic price model | 4311 houses for sale, November-December 2016 | Semi-logarithmic Regression Model | It is observed that each room added to the house increases the total price by 3.75%. Similarly, the fact that the house is on the first floor causes 2% decrease in the price. |

# CHAPTER 4

# DETERMINING THE FUNCTIONAL FORM OF HEDONIC PRICE MODELLING

There are few functional forms used widely in the literature. In this section, we provide information about the major ones. These functional forms are following as; Linear Model, Full-logarithmic model, Linear- logarithmic model and Logarithmic-linear models.

## 4.1. Linear Model

It is a hedonic price function which is seen when there is a full linear direction between the dependent price of housing and the independent variables. (Kaya, 2012)

$$P = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots + \beta_n X_n + \varepsilon_i \qquad (4.1)$$

$P$ = Price of housing,

$X_n$ = Characteristics of housing,

$\alpha$ = Constant term,

$\beta_n$ = Hedonic price of each characteristics

$\varepsilon_i$ = Error term

When the hedonic price function pattern is linear, it is expected that the absolute increase or decrease in the characteristics will cause absolute increase or decrease in the price of the house. However, although it is assumed that there is an absolute change, the use of the linear hedonic price function pattern is generally not preferred in the determination of the price of housing. (Triplett, 2006)

## 4.2. Full- Logarithmic Model

In this function, the hedonic price function pattern is created, where each of the dependent and independent variables is in the logarithmic form.

$$Ln\ P = \alpha + \beta_1 ln\ X_1 + \beta_2 ln\ X_2 + \beta_3 ln\ X_3 + \ldots\ldots\ldots\ldots\ldots\ldots \beta_n ln\ X_n + \varepsilon_i \quad (4.2)$$

In this model, the parameters of the properties give the flexibility values of the properties. In other words, the percentage change occurring in the properties of the independent variable gives the percentage change formed in the price dependent variable. For instance; one percent change in the $X_1$ independent variable constitutes percentage $\beta_1$ change in the house price.

## 4.3. Linear - Logarithmic Model

The linear logarithmic model is the hedonic price function pattern in which the price of the house act as linear form and the independent variables (properties of the house) are in logarithmic form.

$$P = \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \ldots\ldots\ldots\ldots\ldots\ldots \beta_n \ln X_n + \varepsilon_i \quad (4.3)$$

With this model, the amount of absolute change in the price of the housing is determined by the percentage change occurring in each independent variable. Briefly stated, one percent change in the independent variable $X_1$ leads to a change in house price, $P$.

## 4.4. Logarithmic - Linear Model

The logarithmic linear model is called the hedonic price function pattern in which the dependent variable (price of the house) is in logarithmic form and the independent variables (properties of the house) are in linear form. A unit change in the independent variable $X_1$ results $\beta_1$ percent change in housing price, $P$.

$$Ln\ P = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots \beta_n X_n + \varepsilon_i \quad (4.4)$$

Mason and Quigley (1996) stated that the determination of the hedonic price function pattern in the housing market is quite difficult because it includes both consumer preferences and production activities and various variables that are not measurable and cannot be explained theoretically.

Triplett (2006) claimed that neither the classic theory of utility nor the theory of production was sufficient to determine a fully correct functional form.

According to Goodman's study (1978) the results show that the linear model is an overly restrictive model. Halvorsen and Palmquist (1980) emphasized that the logarithmic-linear model should be preferred because of the fact that the coefficients obtained from the logarithmic linear model can be determined their share in the price of the goods. The empirical studies mostly support the use of logarithmic-linear pattern for housing market analysis. Logarithmic-linear form is the most commonly proposed functional form in the literature of the Hedonic Price Index. (Selim, 2008) Also, another

reason for choosing the logarithmic-linear model is that there are no problems in the dummy variables added to the model.

According to Kahveci and Sabaj (2017) the semi-logarithmic functional form is most commonly used method for empirical attitude of hedonic model, because it provides an opportunity to interpret ratios of prices.

# CHAPTER 5

# DATA, METHODOLOGY, STUDY PLACE AND RESULTS

## 5.1. Definition of the Study Area

As a developing country, the urbanization process is still proceeding in most of the metropolitan settlements in Turkey. Izmir is third largest city of Turkey in terms of both in socio-economic development and population size. Izmir Metropolitan Municipality has made a replanning of urban area, which is pointed as the "New City Center". New City Center discourse includes three main district: Port and its back, Salhane and Turan Districts.

When the usage decisions of 1/25000 Scale İzmir Metropolitan Area Environmental Plan from Figure 5.1. are examined for Bayraklı District, it is seen that Bayraklı District is determined as mainly settled area and central business area. In the Salhane region, which is considered as the New City Center of İzmir, there are Central Business Areas where official institutions and commercial activities take place, and the Archeological Site Area where Smyrna Ancient City, the oldest settlement of İzmir, is located. In the 1 / 25.000 scale İzmir Metropolitan Area Environmental Plan, it is determined as 2nd and 3rd Degree Centers (M) and residential area. In the provisions of the Plan 2 nd and 3 rd Centers: In the provisions of the Plan 2 nd and 3 rd Centers: Settlements are the regions where there are smaller office and residential uses that are specialized in serving the resident population and have strong relations with the CBD in terms of service, trade, tourism functions.

According to new plan’s vision, Salhane District has embraced a relatively more significant objective. Because of this, it has been designated as the city's administrative center for future projection and it contains the ancient city center of İzmir-Smyrna. The district is localized among the main roads is going to be the Central Business District which is surrounded by ancient Smyrna square and the bayside are organized to be used

for trade investments. For that reason, the area is planned to play host for the multi-storey hotels, high-rise residence constructions and office and residential towers in the sea fronts and inner parts. (Erdik & Kaplan, 2009)

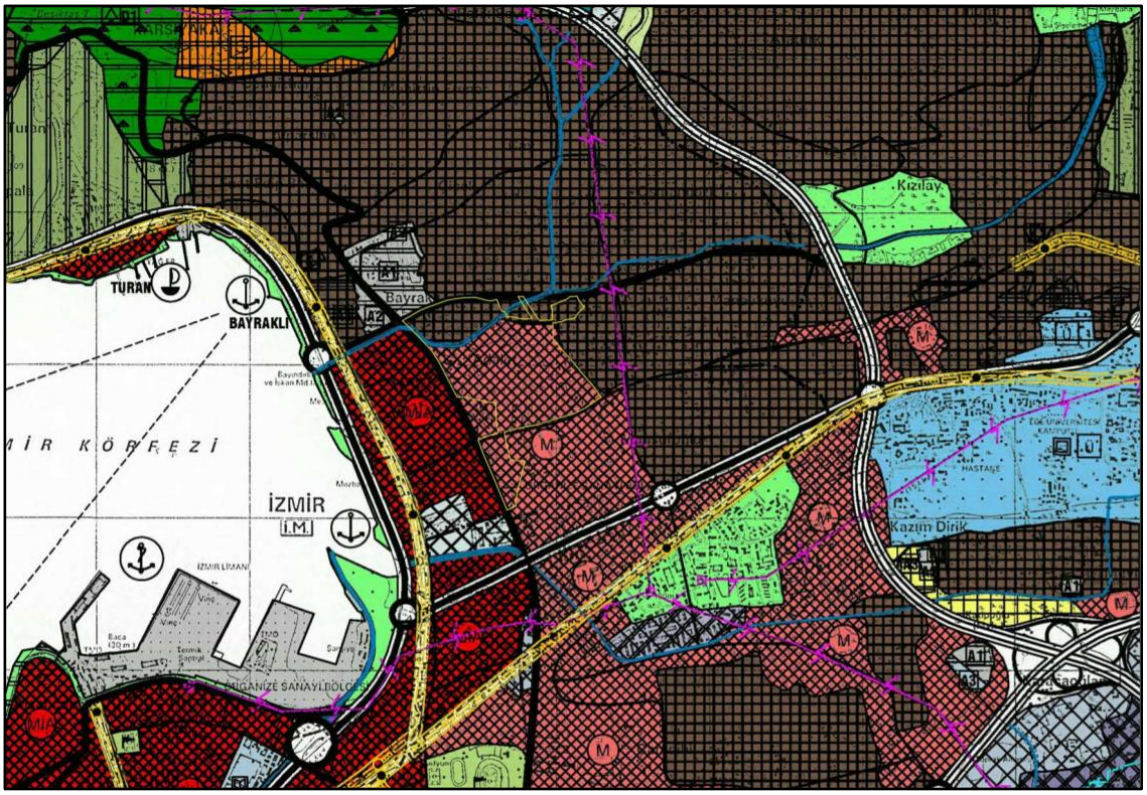



Figure 5.1. 1/25000 Scale İzmir Metropolitan Area Environmental Plan
(Source: kentrehberi.izmir.bel.tr/izmirkentrehberi, 2019)

The study area comprises the boundaries of the Adalet District and Mansuroğlu District of İzmir Province, Bayraklı. (Figure 5.2.) With the plan of Izmir New City Center, it has focused on the attraction of economic investments in the region with large-scale projects and thus increasing the building values in the built environment. Especially, Bayraklı District is in the central position of the current housing projects. The definition of Skyscrapers Region is the most obvious indicator of this situation. (Figure 5.3.) This region, which is foreseen as the new city center, within the role that took in metropole scale, has been selected as the study area to understand how the region and its associated background changed in terms of housing prices.

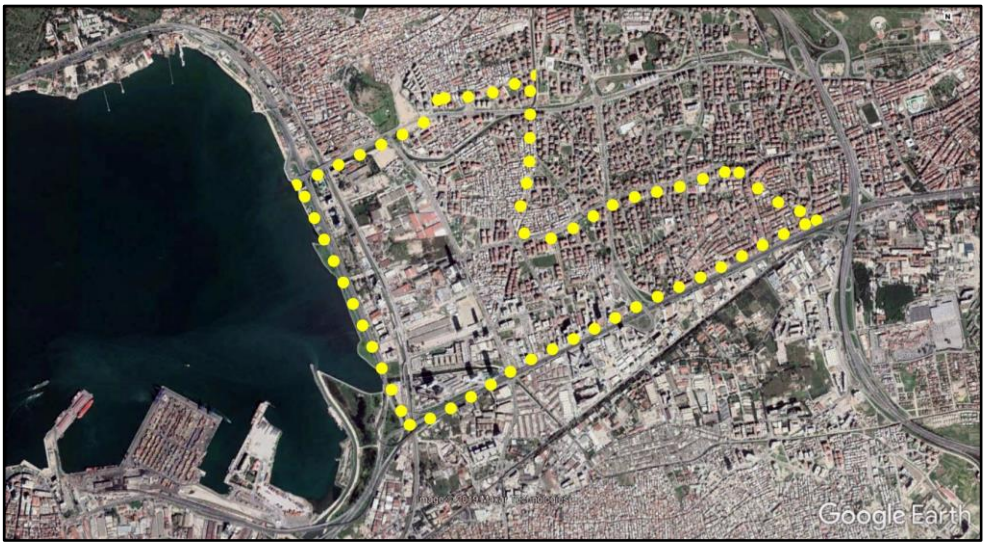



Figure 5.2. Boundary of Study Area
(Source: Google Earth image dated March 22, 2019)

Figure 5.3. A View From the Central Business District
(Source: Taken by Nilay Akçay on April 21, 2019)

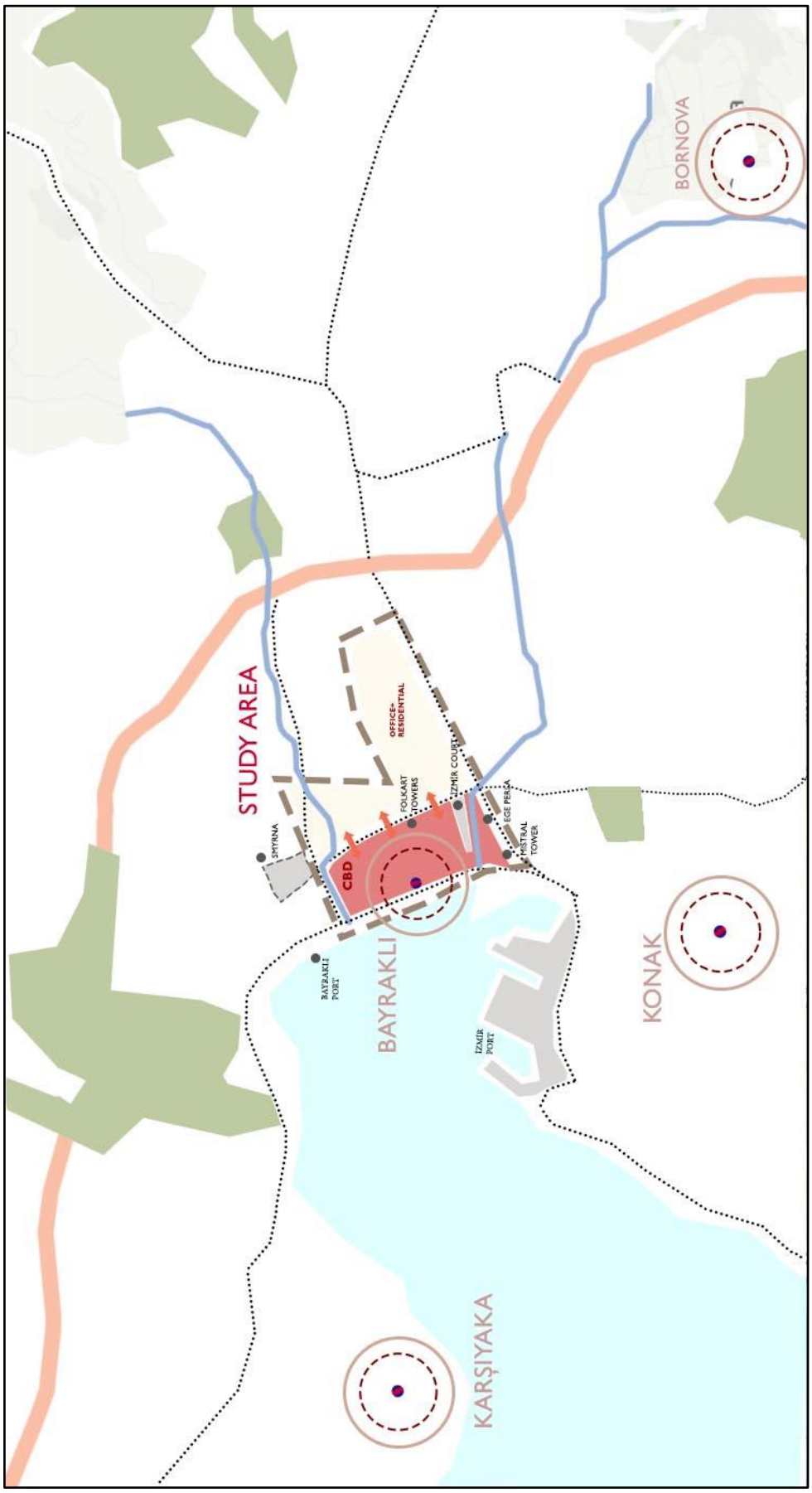



Figure 5.4. Description of the Study Area

When the study area is taken into consideration from the upper scale, it is seen that it is located at the midpoint of Bayraklı, Bornova, and Alsancak Districts. The area is bounded by some main axis that is Antınyol Avenue from the west that is one the most powerful main axis of the city. Also, there is another main artery Ankara Avenue which has connection between the Bornova District from the south-line of the field and Alsancak District. Moreover, Izmir Ringroad surrounds from the east side to study area. On the other hand, the area is restricted to Sakarya Street from north which is a strong and intense inner axis coming from center of Bornova Disrict. It is correct to say that traditional texture and new settlement areas are distributed in a very heterogeneous way in the study place. (Figure 5.4.)

First of all, to introduce the study area, house sales and rent prices are examined for the last 4 years to understand the tendency of price changes whether there is an increase or a decrease. This analysis includes a comparison between İzmir City and Bayraklı District and then they are followed with Bayraklı Districts and its selected neighborhoods Adalet and Mansuroğlu, too.

Figure 5.5. shows the HPI based on the price changes occurring in the housing sales in Izmir and Bayraklı District from the recent year to the last 4 years. While housing sale price average is 353.065 TL in March 2015, this value fall down into 347.415 TL in March 2019 for İzmir. Besides, in Bayraklı District, the average housing sales prices in March 2015 were 295.330 TL, this value increased to 386.306 TL in March 2019 for. (www.sahibinden.com, 2019)

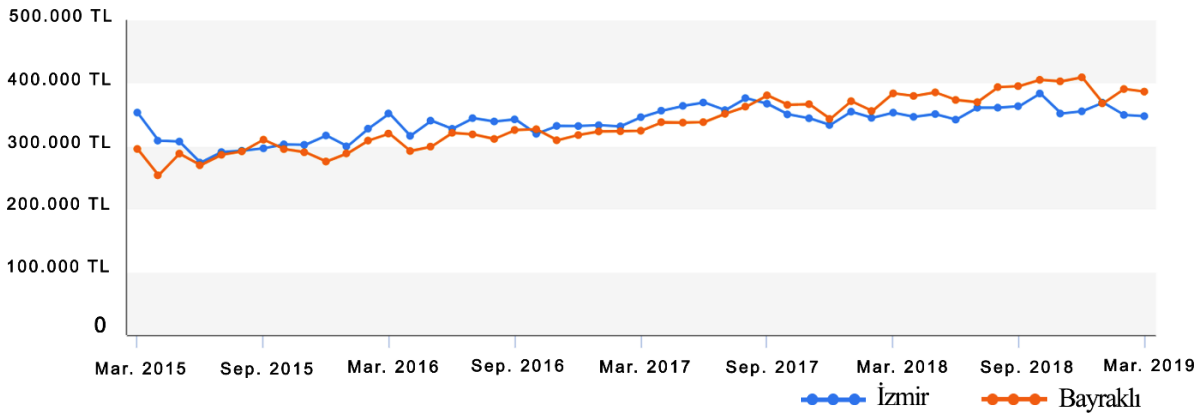



Figure 5.5. The Change Trend at the Housing Sale Prices for the Last 4 Years (Bayraklı- İzmir)
(Source: Edited from www.sahibinden.com, 2019)

Additionally, Table 5.1. (%) represents the percentage increase in housing prices between HPI_March-2015 and HPI_March-2019. To the extent that there is a decrease in overall İzmir in all periods except the two-year period has an increase by the rate of 0.47%. In the last 1 year period, housing sales in İzmir decreased by 1.57%, also in the last 4 year period there was a decrease of 1.60 percent. Furthermore, the housing prices in the Bayraklı District increased by 0.71% in the recent year while the highest change occured between the HPI_March-2015 and the HPI_March-2019. It was found to be 30.80% increase in the last 4 years.

Table 5.1. The Percentage Change at the Housing Sale Price for the Last 4 Years (Bayraklı-İzmir) (Source: Edited from www.sahibinden.com)

| Provinc./Dist. | 1 Year | 2 Years | 3 Years | 4 Years |
|---|---|---|---|---|
| **İzmir** | ▼ % 1,57 | ▲ % 0,47 | ▼ % 1,20 | ▼ % 1,60 |
| **İzmir/Bayraklı** | ▲% 0,71 | ▲ %19,14 | ▲% 20,83 | ▲% 30,80 |

On the other hand, according to the results of Figure 5.6. while the average housing rent prices in March 2015 were 1.224 TL in Izmir, Bayraklı has an average of 1.146 TL. For March 2019, the averge of housing rents increase 1.506 TL in İzmir, the value of rents reach at 1.626 TL in Bayraklı District. (www.sahibinden.com, 2019)

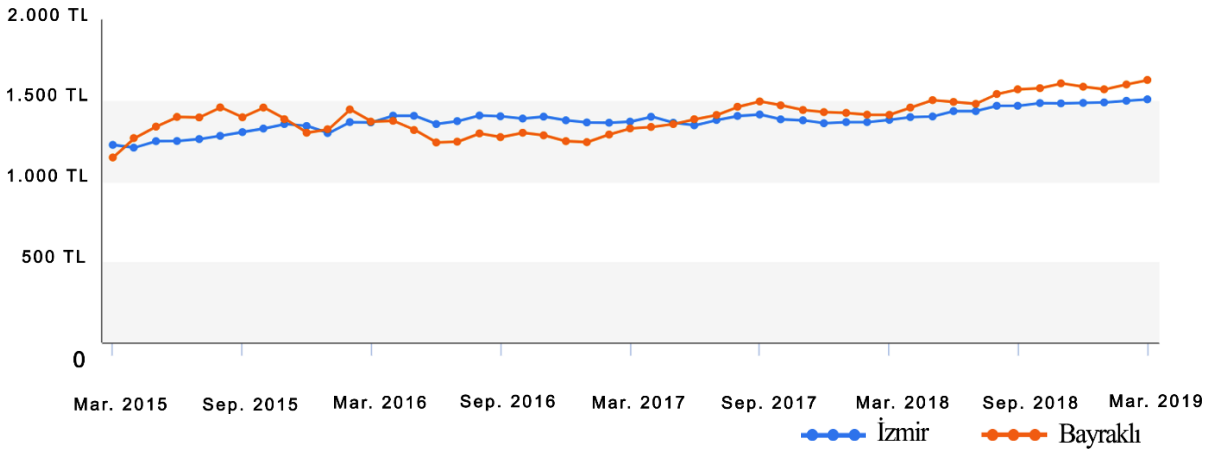



Figure 5.6. The Change Trend at the Housing Rent Prices for the Last 4 Years (Bayraklı-İzmir) (Source: Edited from www.sahibinden.com, 2019)

In addition, Table 5.2. shows the rental price changes in İzmir and Bayraklı neighborhood in the past 4 years. It is possible to say that there is an increase in rent prices both in İzmir and Bayraklı. In the recent year, while rents increased by 9.24% in İzmir and 15.26% in Bayraklı, this value increases by 23.05% in İzmir and 41.88% in Bayraklı District in the last 4 years as well.

Table 5.2. The Percentage Change at the Housing Rent Price for the Last 4 Years (Bayraklı-İzmir) (Source: Edited from www.sahibinden.com, 2019)

| **Provinc./Dist.** | **1 Year** | **2 Years** | **3 Years** | **4 Years** |
|---|---|---|---|---|
| **İzmir** | ▲ % 9,24 | ▲ % 10,06 | ▲% 10,49 | ▲% 23,05 |
| **İzmir/Bayraklı** | ▲% 15,26 | ▲ % 22,58 | ▲% 18,84 | ▲% 41,88 |

The average housing sale prices in Bayraklı District are compared with the prices in the neighborhoods of the Adalet and Mansuroglu, which have been located in the study area. In March 2015, the average of Bayraklı District is 295.330 TL, Adalet Neighborhood is 348.087 TL and the Mansuroğlu Neighborhood has an average selling price of 365.746 TL. Among these, Bayraklı has the lowest average and Mansuroğlu Neighborhood has the highest value. According to 2019 housing price index values; Bayraklı has an average house sale price of 386.306 TL, Adalet has an average of 521.605 TL, also Mansuroğlu Neighborhood has 509.815 TL average. In this process, Adalet Neighborhood has ranked first. (Figure 5.7.) Table 5.3. demonstrates that the price increase in Mansuroğlu Neighborhood was %39,39 while it was 49,85% in the Adalet Neighborhood for the last 4-year period. As it can be that, the reason for this alteration among compared regions is the increase of the construction of luxury residential housing projects especially after the construction of Folkart Towers in the Adalet Neighborhood depending on the skyscrapers region and the New City Center discourses.

When examining the Figure 5.8. while the average sales price per square-meter for İzmir in March 2015 is 2.202 TL, Bayraklı District fell behind with 2.118 TL average by a narrow margin. In addition to that, while Izmir rises to 2.919 TL, Bayraklı is seen to be ahead with 3.153 TL at the sales price per square-meters in March 2019.

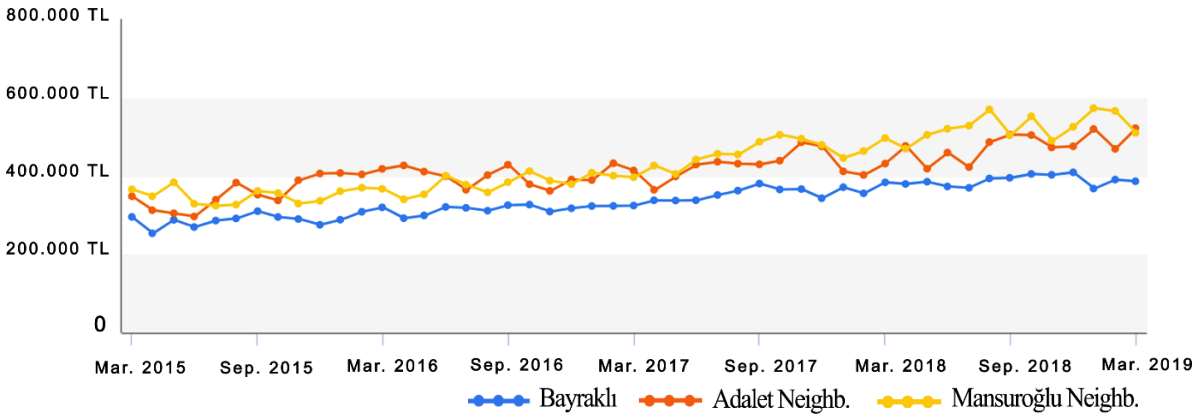



Figure 5.7. The Change Trend at the Housing Sales Price for the Last 4 Years (Bayraklı- Adalet-Mansuroğlu) (Source: Edited from www.sahibinden.com, 2019)

Table 5.3. The Percentage Change at the Housing Sale Price for the Last 4 Years (Bayraklı- Adalet-Mansuroğlu) (Source: Edited from www.sahibinden.com, 2019)

| Provinc./Dist./Neighb. | 1 Year | 2 Years | 3 Years | 4 Years |
|---|---|---|---|---|
| İzmir/Bayraklı | ▲ % 0,71 | ▲ % 19,14 | ▲% 20,83 | ▲% 30,80 |
| İzmir/Bayraklı/Adalet | ▲% 20,91 | ▲ % 26,06 | ▲% 24,82 | ▲% 49,85 |
| İzmir/Bayraklı/Mansuroğlu | ▲ % 2,69 | ▲ % 28,58 | ▲% 38,91 | ▲% 39,39 |

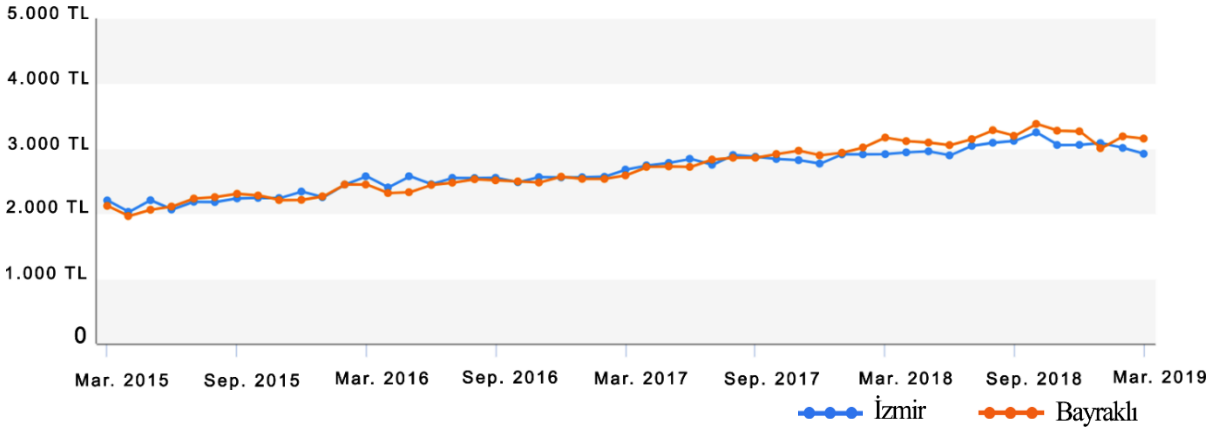



Figure 5.8. The Change Trend at the Housing Sale Price per Square-Meter for The Last 4 Years (Bayraklı-İzmir) (Source: Edited from www.sahibinden.com, 2019)

Table 5.4. The Percentage Change at The Housing Sale Price per Square-meter in The Last 4 Years (Bayraklı-İzmir) (Source: Edited from www.sahibinden.com, 2019)

| Provinc./Dist. | 1 Year | 2 Years | 3 Years | 4 Years |
|---|---|---|---|---|
| **İzmir** | ▲ % 0,16 | ▲ % 9,07 | ▲% 13,44 | ▲% 32,54 |
| **İzmir/Bayraklı** | ▼ % 0,49 | ▲ % 21,86 | ▲ % 28,90 | ▲% 48,83 |

Furthermore, it is observed from Table 5.4. sales prices per square meter have generally increased in İzmir and Bayraklı districts except for the last one year period.

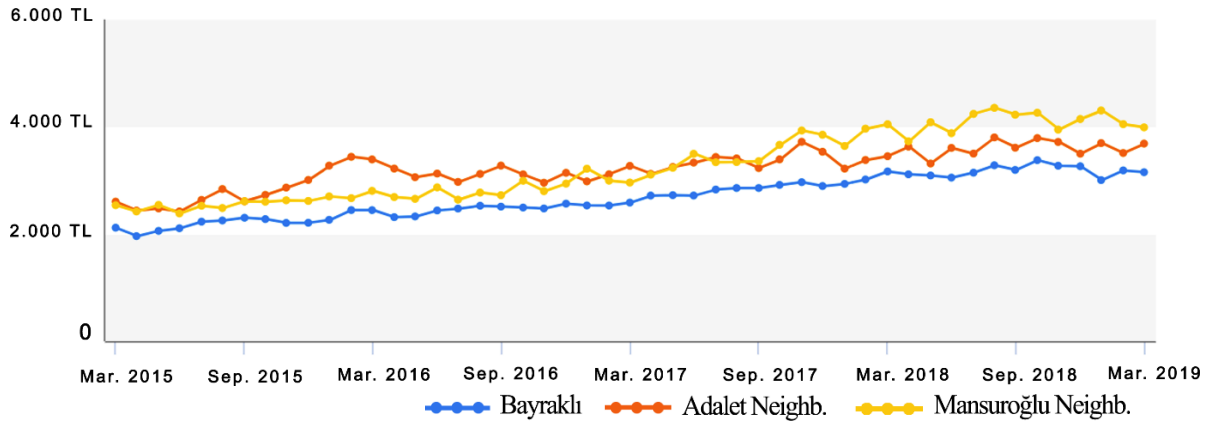



Figure 5.9. The Change Trend at the Housing Sales Price per Square-meter for The Last 4 Years (Bayraklı- Adalet-Mansuroğlu) (Source: Edited from www.sahibinden.com, 2019)

Table 5.5. The Percentage Change at The Sales Price per Square-meter in The Last 4 Years (Bayraklı- Adalet-Mansuroğlu) (Source: Edited from www.sahibinden.com, 2019)

| Provinc./Dist./Neighb. | 1 Year | 2 Years | 3 Years | 4 Years |
|---|---|---|---|---|
| **İzmir/Bayraklı** | ▼ % 0,49 | ▲ % 21,86 | ▲% 28,90 | ▲% 48,83 |
| **İzmir/Bayraklı/Adalet** | ▲ % 6,80 | ▲% 12,72 | ▲ % 8,73 | ▲% 41,59 |
| **İzmir/Bayraklı/Mansuroğlu** | ▼ % 1,42 | ▲ % 34,79 | ▲% 42,20 | ▲% 57,13 |

According to Figure 5.9.that is the last one related with the housing sales price indexes. Adalet Neighborhood has average of 2,604 TL and it is seen as 2,539 TL at Mansuroğlu Neighborhood in March 2015. Also, Adalet Neighborhood has the average value that is 3.687 TL, Mansuroğlu Neighborhood 3.989 TL sales price per square-meters in March 2019. (www.sahibinden.com, 2019)

## 5.2. Data Collection Process

The house price used as the dependent variable in the study consists of sales prices which constitute the data set. The data set is gathered from major real estate websites that are ‘sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com’ and it includes 278 different transactions that is advertised for sale for the period from November 2018 to March 2019. This dataset constitutes gathered observations from Adalet and Mansuroğlu Neighborhoods. All processed data are calculated and implemented by the help of Ewiews, Excel and Adobe Photoshop CS6 programs.

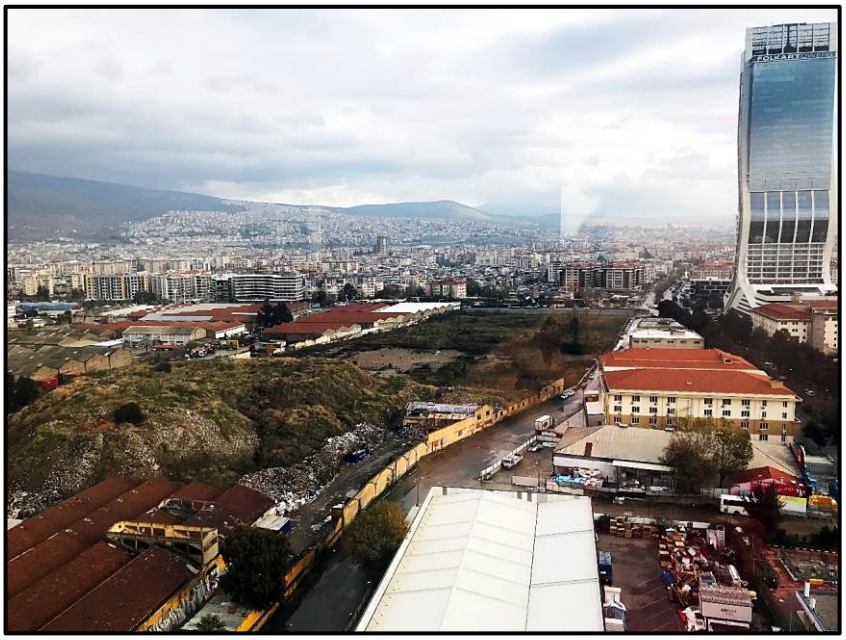


Figure 5.10. A view from the Adalet Neighborhood in the study area.
(Source: Taken by Nilay Akçay on April 21, 2019)

In Figure 5.10. it can be seen that a view towards to Adalet Neighborhood's residential type apartment complexes Moreover, the locations of the dwellings are marked on the satellite image on Figure 5.11. It is important to see in which areas the regional distribution of sales are concentrated.

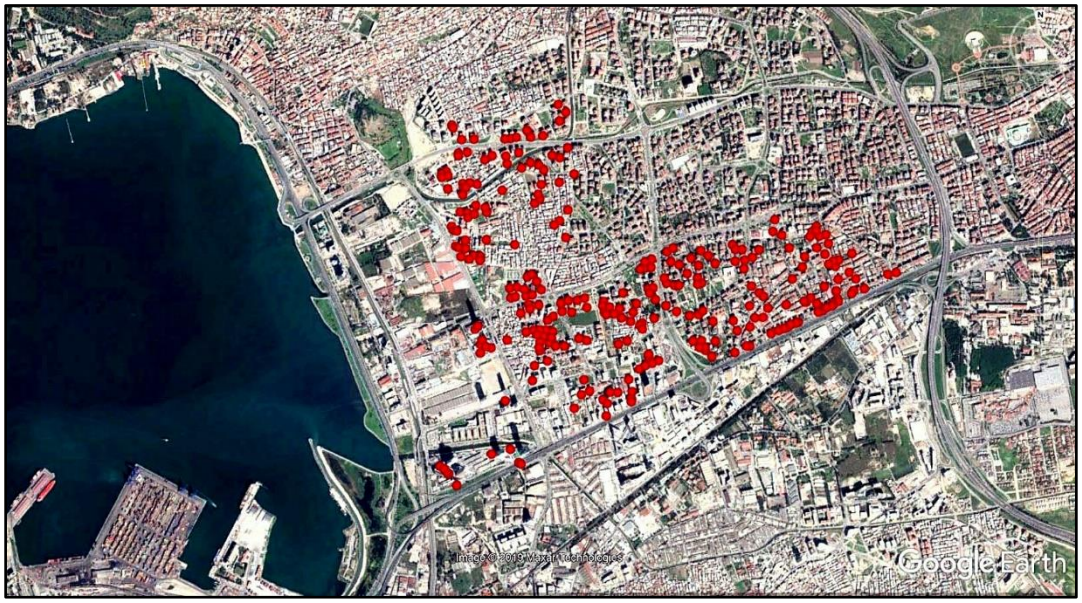



Figure 5.11. Demonstrations of the Observed Housings on Sale.
(Source: Location Data Obtained from Websites are Marked on Google Eart

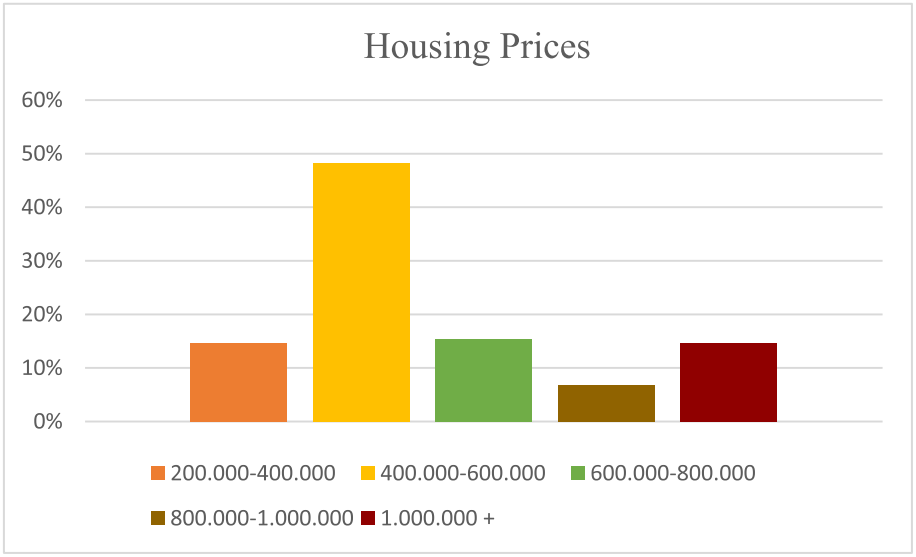



Figure 5.12. Distribution of the Housing Prices in the Study Area

When the total samples of 278 number are divided into 5-price group (Figure 5.12.). These data are measured in percentages by the help of data set on Excel and applied on maps with the help of Adobe CS 6. The dark red color represents the housing price which has a minimum of 1 million TL and over, whereas brown colored spots are the ones which between the price of 800.000 TL and 1 million TL, this range also exhibits minimum observation in the study field. Green colored refers to between the value of 600.000 and 800.000 TL. While the color shown in yellow represents between 400-600 thousand TL, the orange color represents the level of lowest price range of this region with 200.000-400.000 TL.

According to Figure 5.12. when we look at the price distribution of housing data launched on the market in this period; the most observed price range is seen between 400.000 and 600.000 TL with the number of 134 housing units. Moreover, this value constitutes 48.20% of the total number of observations. In addition, it can be said that the houses in the price range of 200.000 T.L- 400.000 TL and 1 million and over follow as the secondary most common housing prices in this region with the number of 41 housing units that correspond to 14.70% of total observations.

In light of these descriptions, in Figure 5.13. geographical distribution of the observed housing price transactions and the important places at the study place is visualised to envision the dispersion of the price ranges. The locations of the selected residences are marked gathering the "location, street view, advertisement details data" that has been on the real estate websites and Google Earth views. Moreover, these locations have been verified by doing phone interview with the real estate agents.

These are demonstrated by the help of the notations. The colored dots are the sign of price groups that described in Figure 5.13. İzmir Port, Folkart Towers, and the four closest railway stations in surroundings. There are 4 different railway stations in the immediate vicinity of the region which are; Bayraklı Izban, Salhane Izban, Sanayi Metro and Bölge Metro.

While there are more residential type settlements between the Yüzbaşı Ibrahim Hakkı Caddesi and Sakarya Street, due to the influence of Folkart Towers and courthouse and other high-rise residences between Sakarya and Ankara Streets it is seen that office and residential settlements are at the forefront. It can be realized that from Figure 5.13. high appraisals accumulate on west part of the study place which is called as Central Business District particularly around the court house in Salhane District.

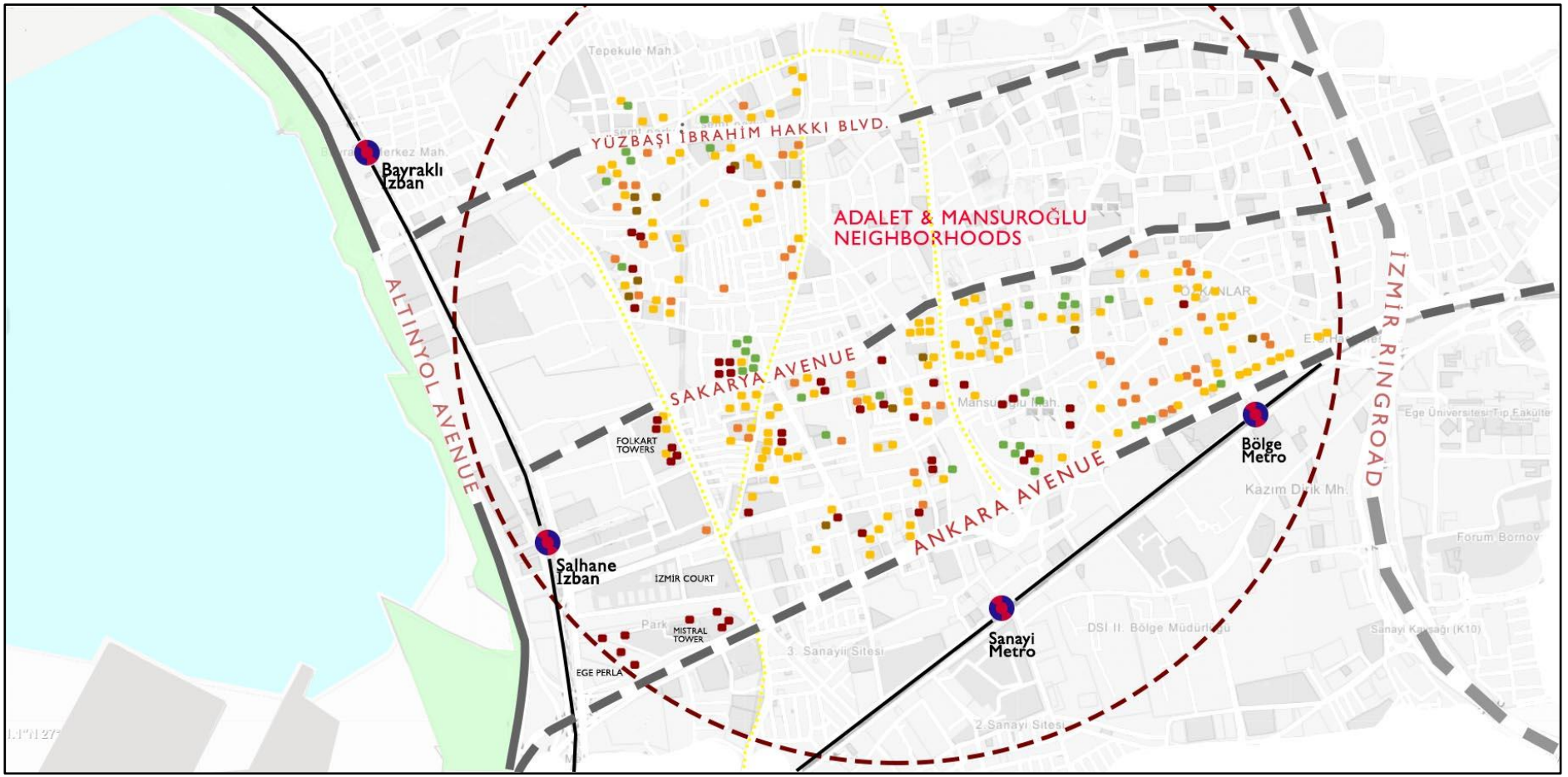



Figure 5.13. Notations of the Important Places and the Observed Houses on Sale
(Source: Visualised from the image taken from wikimapia.org, 2019)

Table 5.6. Definition of the Variables

| *Variable* | *Definition* | *Measure of Unit* | *Spatial Units* | *Data Source* |
|---|---|---|---|---|
| ***Price*** | Offered price of flats | Turkish Lira | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Size*** | Gross size of flats | Metersquare | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Rooms*** | Number of rooms exclusing living room | number | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Age*** | Number of years since built | years | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Floor*** | Number of floors at which flat is located | number | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Gated*** | 1: if flat is in a gated site, 0 otherwise | dummy variable ( 1 or 0) | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Pool*** | 1: if there is a pool facility, 0 otherwise | dummy variable ( 1 or 0) | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Autopark*** | 1: if there is a private parking facility, 0 otherwise | dummy variable ( 1 or 0) | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Vista*** | 1: if there is a sea view, 0 otherwise | dummy variable ( 1 or 0) | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Distance_CBD*** | Travel (walking) Distance to Central Business District (Folkart) | kilometers | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Distance_Sea*** | Travel (walking) Closest Distance to Sea | kilometers | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |
| ***Distance_Rail*** | Travel (walking) Closest Distance to any Railway Station | kilometers | 278 flats | Sahibinden.com, hurriyetemlak.com, milliyetemlak.com, emlakjet.com |

Herein after, some variables were selected that might be affect housing prices. The variables of housing units are defined and summarized at Table 5.6. The variables used to determine housing prices have been selected by taking into account the common data available on real estate sites. For this reason, a selection is made among the whole housing characteristics that are categorized in the literature above, physical and locational properties are taken as basis in this study. While the physical properties of the house are expressed as the presence or absence of a residential property or the quantitative value of a property, the properties depending on the location are expressed over the shortest walkable distance of the residence to the selected location. This distance is calculated by measuring the shortest travel route recommended for pedestrians with the help of Google Maps application. This table presents 12 different variable that is concerned study area. ***"Price"*** variable acts as dependent one and refers to the offered price of the flats by TL– denominated. The independent variables are divided into two groups, which are explanatory and dummy.

In this study, the explanatory variables are composed as size, rooms, age, floor, distance to Cbd, distance to sea and distance to rail. ***"Size"*** variable refers to gross size of a flat as meter-square, "***Rooms"*** variable implies total number of rooms that a housing unit has, ***"Age"*** of a house refers the years of apartment since built, ***"Floor"*** displays the number of floors at which flat is located. Distance to Cbd, Distance to sea, Distance to rail and Distance to port are location-oriented varibles which will show us the how much important is location of a house. The dataset for these parameters was created by taking into consideration the walking distances in kilometers unit. Other characteristics of a housing unit are represented as dummy variables, which are ***"Gated", "Pool", "Autopark"***, and ***"Vista"***. These variables do not have a quantitative value; It is evaluated only if it exists or not in the dwelling. In this case, '1' is used to indicate that the property is in the house, if it is not '0'.

## 5.3. Empirical Analysis and Results

In this chapter, it is tried to provide a general overview with respect to the descriptive and explanatory analysis. There are mainly two sub-section for examination.

### 5.3.1. Descriptive Analyses

At the beginning, descriptive statistical analyzes were implemented to define the general characteristics of the houses in the region and to give an overview of the characteristics of the study field. In Table 5.7. it is represented that Descriptive Statistics for the observations of 278 housing units for İzmir's two neihborhoods mentioned above. According to descriptive statistics, the maximum price of observed samples is 3.250.000 TL, the minimum value is 205.000 TL. While the average price is 662.122 TL, standard deviation of the price analysed as 425.479 TL. Because of the heterogenous distribution, the standard deviation indicates quite high value. While the average property size has 138,23 meter-square, the largest house has 300 meter-square with 6-roomed, the narrowest one is 55 meter-square with 1-roomed and the mean value is 2.80 for number of rooms variable. The oldest houses are 32 years old and there are 29 new constructed buildings according to the data. The flat has been on the highest storey number is located on the 22$^{nd}$ floor and is located in the Mistral Tower.

Table 5.7. Descriptive Statistics of data set *(N: 278)*

| ***Variables*** | ***Maximum*** | ***Minimum*** | ***Mean*** | ***Std. Deviation*** |
|---|---|---|---|---|
| ***Price*** | 3250000 | 205000 | 662122,3 | 425479,3 |
| ***Size*** | 300 | 55 | 138,23 | 39,276 |
| ***Rooms*** | 6 | 1 | 2,80 | 0,653 |
| ***Age*** | 32 | 0 | 13,21 | 9,697 |
| ***Floor*** | 22 | 0 | 4,78 | 3,213 |
| ***Gated Site*** | 1 | 0 | 0,58 | 0,494 |
| ***Pool*** | 1 | 0 | 0,14 | 0,352 |
| ***Autopark*** | 1 | 0 | 0,69 | 0,464 |
| ***Vista*** | 1 | 0 | 0,11 | 0,310 |
| ***Distance_Cbd*** | 2,6 | 0 | 1,29 | 0,634 |
| ***Distance_Sea*** | 4,5 | 1,1 | 2,91 | 0,859 |
| ***Distance_Rail*** | 1,9 | 0,3 | 1,15 | 0,364 |

By the way, on average, 58% of the apartments are located on a gated site and 69% have a parking lot or indoor parking. In addition, 14% have a pool in the garden of the site or inside of the apartment complexes, while only 11% see the sea view. When we examine the variables related to the location, the evaluation is made with regarded to walkable distances. For example, the maximum distance to the CBD was 2.6, to the seaside was 4.5, to the nearest rail transportation was 1.9 and to the port of Alsancak was 8.9 kilometers are measured for the selected housing units.

The correlation matrix between the variables of the housing characteristics was also examined and the results are demonstrated in Table 5.8. The correlation matrix shows the relation between the variables and the direction of this relation. The high correlation of variables means that these variables can be represented by each other. As a result, the use of variables that are highly related to each other in the same analysis can lead to some misleading results.

According to Table 5.8. meanwhile housing size, number of rooms, number of floors, gated site, having pool, parking lot, and sea vista have a positive correlation with housing prices; the age of the building, the distance to CBD, the distance to the sea, and the distance to the rail transportation stations have a negative correlation with housing prices. In addition to this, the variables with one of the highest relation which is ***'0,72'*** between each other are the size of the dwelling (***Size***) and the number of rooms (***Rooms***) and also, the distance to rail stations (***Distance_Rail***) and the distance to seaside (***Distance_Sea)*** has another high correlation with ***'0,66'*** value. It shows that these two variables can be used interchangeably in regression models at the next phase. The correlation between distance to sea (***Distance_Sea***) and ***Price*** of the dwelling has *'-0,16'* coefficient and the distance to rail transportation (***Distance_Rail***) variable has *'-0,021' estimation* are the variables where housing prices are relatively less related. The reason for this can be summarized as follows: There are 4 different railway stations in the study area which are close to the houses and the maximum distance to these stations is 1.9 km. For this reason, it can be concluded that the distance variable to railway stations is not very effective on housing prices.

According to the correlation results of distance to sea variable, it is seen that the relationship with the housing price is weak. The fact that Altınyol Avenue is the main artery of vehicles, because of the divided traffic way, pedestrians cannot walk across the road directly so this situation protracts the walking distance to the seaside. (Figure 5.14.) Hence, distance to the sea does not have a significant effect on the housing prices.

Table 5.8. Pearson Correlation Coefficients Matrix

| | *Price* | *Size* | *Rooms* | *Age* | *Floor* | *Gated* | *Pool* | *Autopark* | *Vista* | *Distance_Cbd* | *Distance_Sea* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Size*** | 0.67 | | | | | | | | | | |
| ***Rooms*** | 0.30 | 0.72 | | | | | | | | | |
| ***Age*** | -0.49 | -0.20 | 0.17 | | | | | | | | |
| ***Floor*** | 0.37 | 0.11 | -0.10 | -0.17 | | | | | | | |
| ***Gated Site*** | 0.33 | 0.17 | 0.034 | -0.22 | 0.22 | | | | | | |
| ***Pool*** | 0.43 | -0.03 | -0.36 | -0.50 | 0.36 | 0.32 | | | | | |
| ***Autopark*** | 0.43 | 0.26 | 0.06 | -0.31 | 0.24 | 0.60 | 0.27 | | | | |
| ***Vista*** | 0.46 | 0.14 | -0.17 | -0.32 | 0.48 | 0.24 | 0.58 | 0.18 | | | |
| ***Distance_Cbd*** | -0.33 | -0.20 | -0.016 | 0.35 | -0.21 | -0.34 | -0.28 | -0.43 | -0.32 | | |
| ***Distance_Sea*** | -0.16 | -0.19 | -0.06 | 0.41 | -0.03 | -0.39 | -0.13 | -0.37 | -0.19 | 0.59 | |
| ***Distance_Rail*** | -0.021 | 0.15 | 0.19 | -0.11 | -0.12 | 0.32 | -0.20 | 0.34 | -0.14 | -0.45 | -0.66 |

Because the coastline does not play an active role in the daily use of local dwellers. At this point, it is more preferable to have a house with a sea view from İzmir bay rather than accessibility to the seaside.

Figure 5.14. An Image Showing the Relationship Between the Study Place and The Coastline. (Source: Taken by Nilay Akçay on April 21, 2019)

### 5.3.2.Methodology and Results of the Hedonic Price Modelling

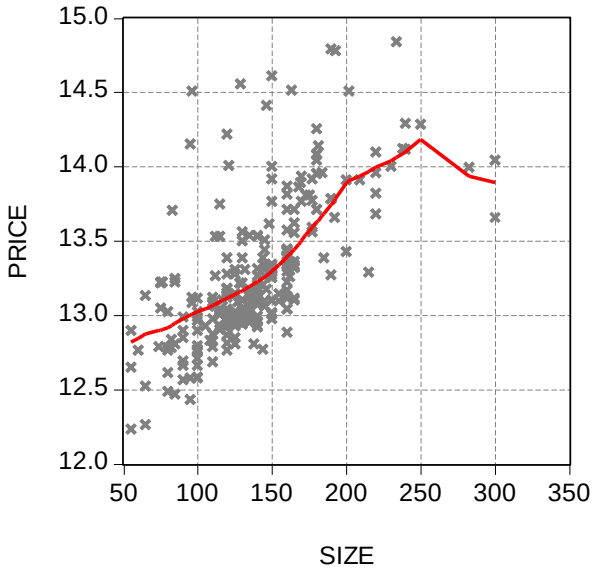
A hedonic price function should be created to determine whether the characteristics are a significant variable that has a determinant impact on the housing price in association with the influence of these variables on the house price and the hedonic price function should be subjected to regression analysis. In this study, information was collected about the houses purchased in a period of 5 months. In order

to compare the characteristics that affect the housing prices for different months, the prices of the houses offered for sale are indexed according to March -2019.

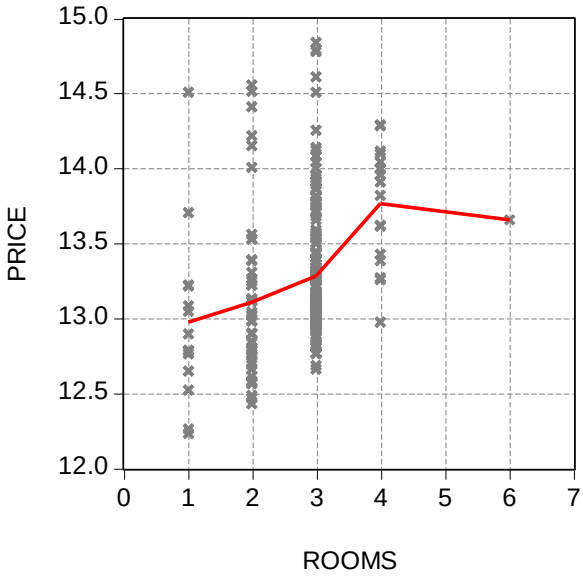
At firtst stage, scatter graphs were analysed to understand the tendency of independent variables. Figure 5.15. and Figure 5.16 shows the Kernel R Nadaraya Watson Nonparametric Regressions. The function of the Kernel probability provides to comprehend the distribution of the housing price appreciations that are gathered together from Eviews program. While Figure 5.15. represents price-size, price-rooms, price-age, and price-flor correlations, Figure 5.16. represents price-distance_CBD, price-distance_sea, price-distance_rail correlations In these graphs, some weak non-linearities are observed. For instance, apartment size, age and number of rooms tend to increase the price particularly after a certain threshold. However, these are not so clear nonlinearities. Other explanatory variables, indeed, have a linear impact on house prices. That's why, it is proceeded to the analysis with a linear analyses.

The results of the Hedonic price model that we applied for the selected area are compiled in Table 5.9. These analyses indicates the estimated coefficients, significance and level of explanatoriness of the different models and the results will interpret according to these indicators. The models set up for Adalet and Mansuroğlu Neighborhoods in Bayraklı District. Also, in total observation number is 278 housing unit in study area. The residential apartment type houses had taken into consideration while composing the data set. There are 11 different variables selected for testing housing prices with hedonic price function which are 8 of them are structural and the remaining 3 are locational variables to specify housing price determinants.

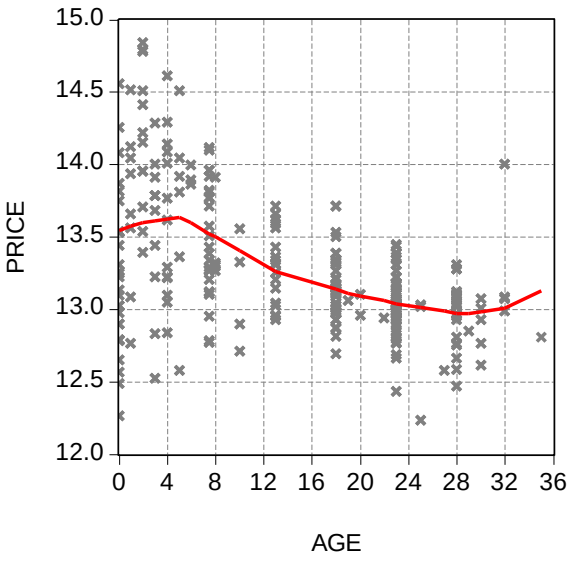
The structural ones can be decribed as size of the house (***Size***), number of the rooms (***Rooms***), age of the building (***Age***), the floor number of flat (***Floor***), whether gated site or not (***Gated***), having car parking (***Autopark***), having sea view (***Vista***), having pool (***Pool***) and also, distance to Central Business District- Folkart Towers- (***Distance_Cbd***), distance to seaside (***Distance_Sea***) and distance to a nearest railway station - İzban or İzmir Metro- (***Distance_Rail***) were selected as the locational variables of the study area. The nearest rail stations are Salhane İzban, Bayraklı İzban, Bölge and Sanayi Metro in this region.



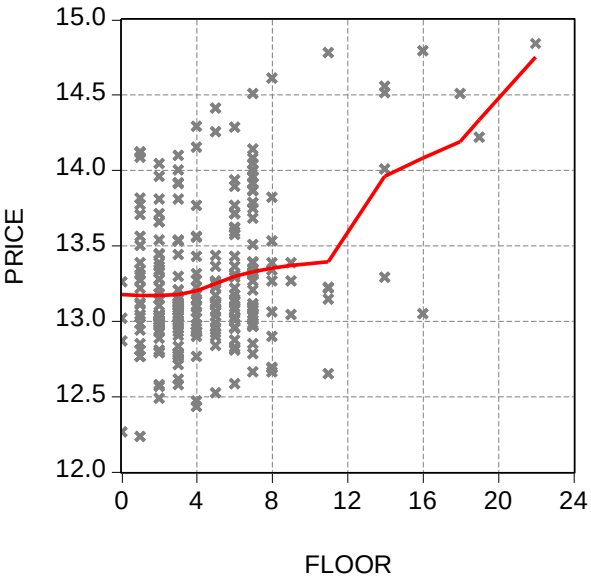

a) Price-Size Correlation




b) Price- Rooms Correlation

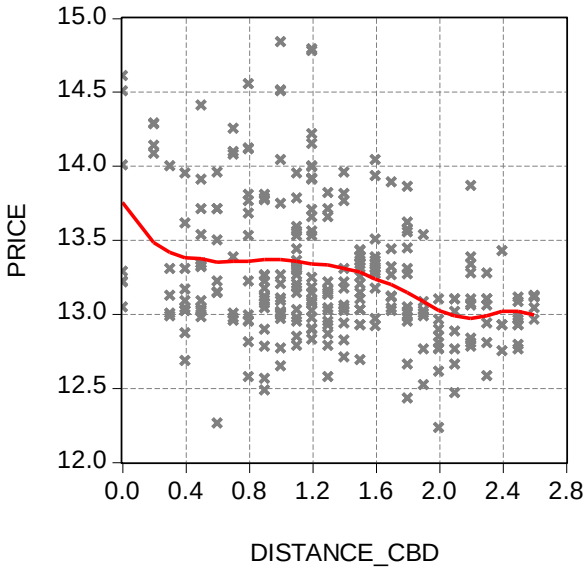



c) Price-Age Correlation

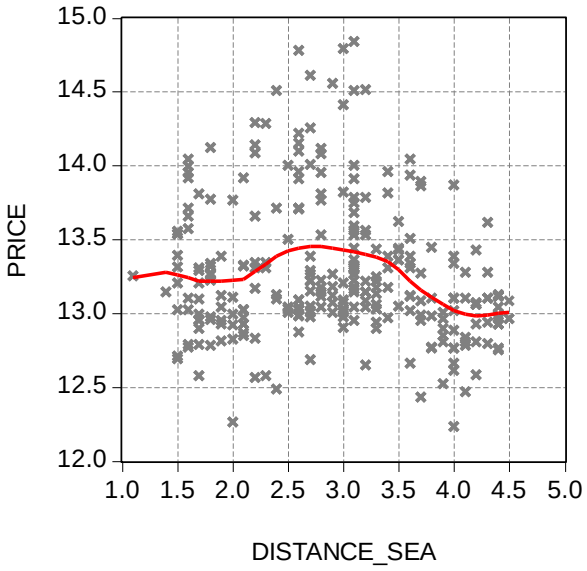



d) Price-Floor Correlation

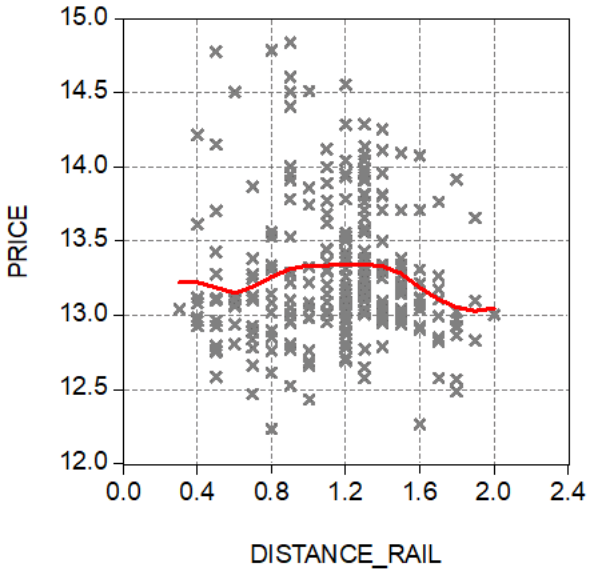
Figure 5.15. Kernel R Nadaraya Watson Nonparametric Regressions-1




e) Price-Distance_Cbd Correlation




f) Price-Distance_Sea Correlation




g) Price-Distance_Rail Correlation

Figure 5.16. Kernel R Nadaraya Watson Nonparametric Regressions-2

Specifically, the model takes the following form:

$$Ln\ P = \alpha + \beta_1\ Size + \beta_2\ Rooms + \beta_3\ Age + \beta_4\ Floor + \beta_5\ Gated + \beta_6\ Autopark + \beta_7\ Vista + B_8\ Pool + \beta_9\ Distance\_Cbd + \beta_{10}\ Distance\_Sea + \beta_{11}\ Distance\_Rail + \varepsilon_i \quad (4.1.)$$

In the model above, size and rooms, distance to sea and port are not included simultaneously since the correlation between these variables are high. In order to avoid multicollinearity, these variables are added separately into the model. In Table 5.9. the hedonic price model's outcomes are summarized.

Looking at the results in general, size (+), rooms (+), age (-), floor (+), Autopark (+), vista (+), pool (+) and distance to sea (-) are robustly significant variables with expected signs. The majority of these variables have coefficients significant at 1 %. The rest of the variables are rather insignificant or inconsistently significant across methods. The Jarque-Bera test in the last raw indicates the well behavior (normal distribution) of the error terms.

Hence, one can interpret the results in a following way; on the one hand, structural charactheristics are quite influential. Apartments, which are bigger in size, having more rooms, younger ones, located in higher floors, those of which include parking, pool, vista facilities have significantly higher prices.

On the other hand, locational properties are relatively less influential. The only robustly significant variable is the distance to sea that implies the fact that apartments are that are far away from the sea have higher prices. This looks plausible, as the sea in this area is not used for recreative purposes.

In Model 7, the observations in the CBD region were removed from the number of observations and it is investigated that how the characteristics of the housing prices in the hinterland of the CBD changed. In total, it was studied on 262 residences for the hinterland observations. When we look at the results of model 7; the results are in parallel with the first 6 models; the size and age characteristics of houses are significant at the level of 1% were concluded. In addition, the pool and floor properties also have 1% level

significance. The most important point in these results is that the vista variable does not have any significance in this field. Because most of these samples do not have a sea view. Furthermore, the distance to CBD gave robustly significant result in determining housing prices. It can be the reason for this is that the residential properties' advertisements on sale in the CBD hinterland emphasize that being in a location close to this region is prestigious.

Another important analysis is about the relative magnitude of the impact of structural and locational charactheristics. To do so, an impact analysis is implemented in Table 5.10. Also, the impact coefficients are calculated and presented in Table 5.10:

**Impact Coefficient= (SD of independent variable x Estimated Coefficient)/SD of dependent variable** (4.2)

It shows the change in 1 SD deviation in house price in response to change in 1 SD independent variable

At a glance, it can be observed from Table 4.10 that relative impact of variables varies considerably. The most influential variable is the size variable. It indicates that 1 SD deviation increase in size and these results averagely leads to 0.58 SD increase in house price. In a similar vein, respectively rooms (0.48), age (-0.40) , vista (0.22), distance to sea (0.21), pool (0.17), distance to railway (-0.19) , autopark (0.17), floor (0.11) are the most influential variables.

Table 5.9. The Results of the Models

| | *MODEL 1* | *MODEL 2* | *MODEL 3* | *MODEL 4* | *MODEL 5* | *MODEL 6* | *MODEL 7* |
|---|---|---|---|---|---|---|---|
| ***Constant*** | 12,09727*** | 12.12864*** | 12.47748*** | 12.55612*** | 11.96937*** | 11.95335*** | 12.01411*** |
| ***Size*** | 0,006953*** | | 0.006966*** | | 0.006963*** | | 0.006980*** |
| ***Rooms*** | | 0.349200*** | | 0.347283*** | | 0.349139*** | 0.008726 |
| ***Age*** | -0,011100*** | -0.018873*** | -0.008813*** | -0.016354*** | -0.011205*** | -0.019030*** | -0.010946*** |
| ***Floor*** | 0,010953 | 0.015736** | 0.012844* | 0.017826** | 0.011366* | 0.016315** | 0.020179*** |
| ***Gated*** | 0,059716* | 0.054400 | 0.038381 | 0.031090 | 0.053727 | 0.046158 | 0.052841 |
| ***Autopark*** | 0,122827*** | 0.185241*** | 0.133619*** | 0.197728*** | 0.116456*** | 0.176640*** | 0.102004** |
| ***Vista*** | 0,192174** | 0.342120*** | 0.146975 | 0.292663*** | 0.205255** | 0.360576*** | 0.126721 |
| ***Pool*** | 0,226293*** | 0.198694** | 0.235074*** | 0.206263** | 0.245230*** | 0.224343*** | 0.248632*** |
| ***Distance_Cbd*** | -0,068136* | -0.079566* | -0.034379 | -0.042445 | -0.060406* | -0.068909* | -0.098785*** |
| ***Distance_Sea*** | 0,106766*** | 0.117971*** | | | 0.121928*** | 0.138998*** | 0.120791*** |
| ***Distance_Rail*** | -0,065810 | -0.091195 | -0.194543*** | -0.233440*** | | | -0.038011 |
| ***N*** | 278 | 278 | 278 | 278 | 278 | 278 | 262 |
| ***R-Square*** | 0.74 | 0,66 | 0,73 | 0,64 | 0,74 | 0,66 | 0,77 |
| ***Histogram Normality (Jarque-Bera)*** | 170,9 *** | 51*** | 107.7*** | 29,9*** | 171,2*** | 49,1*** | 41,9*** |

Note: *** denotes statistical significance at 1 %, ** at 5 %, * at 10%.

Table 5.10. The Results of the Impact Analysis

| | *MODEL 1* | *MODEL 2* | *MODEL 3* | *MODEL 4* | *MODEL 5* | *MODEL 6* | *MODEL 7* |
|---|---|---|---|---|---|---|---|
| ***Size*** | 0,586624545 | | 0,587721355 | | 0,587468 | | 0,601660699 |
| ***Rooms*** | | 0,489822043 | | 0,48713307 | | 0,489736 | 0,005261282 |
| ***Age*** | -0,237419052 | -0,403676556 | -0,18850217 | -0,3497974 | -0,23966 | -0,40703 | -0,015211098 |
| ***Floor*** | 0,075614815 | 0,108634597 | 0,088669469 | 0,12306306 | 0,078466 | 0,112632 | 0,43125883 |
| ***Gated*** | 0,063367406 | 0,057726353 | 0,040727852 | 0,03299104 | 0,057012 | 0,04898 | 0,354237546 |
| ***Autopark*** | 0,122562756 | 0,184842482 | 0,133331539 | 0,19730262 | 0,116205 | 0,17626 | 0,112178013 |
| ***Vista*** | 0,128312765 | 0,22843029 | 0,09813382 | 0,19540832 | 0,137047 | 0,240753 | 0,090885293 |
| ***Pool*** | 0,170914263 | 0,150069328 | 0,177546364 | 0,15578603 | 0,185217 | 0,169441 | 0,200396754 |
| ***Distance_Cbd*** | -0,092862714 | -0,108440688 | -0,04685522 | -0,05784839 | -0,08233 | -0,09392 | -0,102694051 |
| ***Distance_Sea*** | 0,197013393 | 0,217689779 | | | 0,224992 | 0,256491 | 0,165706812 |
| ***Distance_Rail*** | -0,051885162 | -0,071898912 | -0,15337935 | -0,18404608 | | | -0,073814843 |

In sum, it is understood that structural caractheristics is very important and relative more curical than locational features. It might be because in that zone services sector has not yet been well developed homogenously. Hence, location is not as important as in other districts.

The results obtained so far indicate some policy implication.

## 5.4. Policy Implications

The residential real estate network has a multi-component market and puts forward an extensive perspective for review. Housing price determinants have important role to understand the connection between urban land use and drivers of housing sector. By using more than one group of variables together, it is analyzed how the variables affect each other.

Demand models of differentiated housing units are frequently used in the analysis of public policies. The main purpose of estimating housing demand is to formulate policy recommendations for determining the type of housing to be paid. Knowing the prices of housing properties allows buyers to develop policy recommendations about the type of housing they want most to pay. (Garcia & Raya, 2011) For this purpose, hedonic equations have been established for the Adalet and Mansuroğlu Neighborhoods of Bayraklı District in İzmir. This chapter summarizes the some policy implications according to the results of the hedonic price model.

The empirical results of the study provide an insight related with the tendencies in these districts on housing preferences by extension some policy implications can be developed with regards to the future studies and policy makers, local authorities and real estate market developers. On the basis of the model's results, to take some policies provide to create a more livable environment for citizens.

The results of the models clearly show that housing size is the most important structural variable. However, this variable can be examined in terms of age groups for more detailed research. The general trend is that demand increases when thea size increases, but it will be useful to specify the survey analysis for the preferences of university students and working young people about the size of the housing units.

The fact that the vista variable is a significant determinant in housing prices makes it possible for people from the high-income group to reach the sea view as the parcels on the seaside are open to large-scale projects and investors directly. Because of the high floor area ratio at the coastal band in the development plan, it creates a disadvantageous and unaffordable situation for middle and low-income households. Hence, when local authorities give permission to structure decisions, the value of floor area ratio should be considered as more balanced and integrated. Due to high land prices and an increase in production costs, investors prefer capital-intensive real estate investments instead of land-intensive investments. This led to the construction of different units in high-rise buildings in central locations.

According to the regression results, it is seen that the distance of the selected houses to the sea does not have a negative effect. This situation can be considered as the result of the construction and design that is disconnected from the sea. The fact that Bayraklı coastline is not used actively by the city dwellers living in the region and the surrounding settlements reveals that it is not an effective variable as a house price determinant. Therefore, making more usable designs for pedestrians in the coastline may make the distance to the sea a more important criterion in determining the housing price. In this way, a public space that can be used actively is supported in the inner parts, which do not have sea views.

To conclude, although the area of study is currently a district that houses the historic city center, public buildings, residential settlements and office uses, it has also started to gain a new identity with the mission of being a central business district. Therefore, it is necessary to relate this multidimensionality not only in terms of the structural and location-related features of the housing, but also to the socio-economic status and income levels of the users. The more systematic use of a richer set of variables in housing valuation studies, including socio-economic factors, public goods and environmental impacts, the more will deeply enrich our understanding of the demand side in the city’s housing markets.

# CHAPTER 6

# CONCLUSION

This empirical study, which examines the relations between the characteristics and prices of the houses, provides detailed information on the preferences of the consumers at Adalet and Mansuroğlu Neighborhoods in Bayraklı District and this information can be helpful in terms of proper implementation of housing policies.

The data of 278 dwelling unit's sale prices which were on the market, were collected between the dates of November 2018-March 2019, housing and location characteristics were examined. The function has been constituted which indicates the the parameters affecting the price and the coefficients of influence based on multiple regression analysis in the hedonic price model.

Hedonic regression analysis is applied so that the price of each of the properties of the products is determined which are purchased according to the requests of the consumers. Hedonic price modeling is a preferred method in real estate because of the heterogeneous characteristics of the houses. With this method, the effect of a certain feature is investigated on housing rather than the price of the house.

In this study, in the case of Bayraklı District that is defined as the new city center in İzmir. The study place is organized as Adalet and Mansuroğlu Neighborhoods where besides the old residential settlements located, also it is frequently preferred by investors for the construction of high-rise residential buildings are investigated by hedonic price modeling method to understand what are the effective determinants of the housing prices.

In Descriptive Statistics, the Kernel Probability graphs are found to chase a normal distribution as also shown by Jarque Bera Test statistics. According to the correlation coefficient statistics, as expected, among the housing prices and size, number of rooms, number of floors, being located in a gated site, having a pool, parking lot and sea view sign a positive relationship and these increase the price of housing. Another expectable result is an opposite relation between the price of the house and the age from the year it was built and the travel distance to the important locations vice versa. When an increase has occurred in the value of these properties, the housing price decreases.

The housing price was highest in relation to the size of the dwelling, which was 67%, and it was found to be 49% with the age of the dwelling and 46% if the dwelling had a sea view (vista). Looking at the relationship between the independent variables, “size and rooms”, in addition to that “Distance to Sea and Distance to Rail” variables are high correlated ones.

When we examine the functions of hedonic models in chapter 3, we said that mainly 4 different models are used in total in literature. In this study, all models were analyzed in E-views program, and it was found that the most significant magnitude and signals yielded the log-linear function.

In addition, we have analyzed how much it affects the price in dummy variables in the log-linear function. For this reason, the log-linear model was chosen. By using preferred functional form, 6 different models were created and some of them were limited by removing the variables of size or number of rooms, while others were limited by subtracting the distance to sea or distance to the railway stations.

In the regression analysis, the logarithmic-linear function was used and it was estimated how many percent of each residential property affected the price. In this context, 6 different models were analyzed. According to the results of the correlation analysis, the highly correlated values were not used in the same model in order to avoid incorrect conclusions. The models can be inferred from Table 4.9. which includes all results and siginificance level of the varibles. The results of the 7 different models mostly denotes the significant level of 1%.

All these findings give an indication to some common points; it is concluded that structural variables are more effective than locational variables. While the distance to the sea variable gives results out of the expectations, the findings of other variables are consistent with the literature.

When the distance to rail and distance to sea variables were substituted each other, the results are significant at 1%. In general, 6 of the 7 models were not found to be significant in the gated site. The reason why having sea view is so effective in the price can be said to be due to the fact that high-rise new residence-type structures are located close to the sea in the study area. As the number of floors of these high-rise residential buildings increases, the probability of seeing the sea increases, which makes it more valuable in terms of vista variable. Notwithstanding that Folkart Towers, Mistral Towers and Ege-Perla Residence are the most well known examples of the high-rise buildings; there are many other projects in the region that appeal to the people with luxury

preference. Overall, all these findings should be taken into consideration for both consumers and investors in the decision making process. Creating and analyzing data sets in explaining changes in house prices in Turkey will be useful to understand the complex structure of the housing sector.

In this respect, for this study area and its surroundings, it is expected that future studies on house prices will be more comprehensive and it can be useful that comparing the findings of different periods. Also, the number of observations can be increased depending on the boundaries of the study area and new parameters can be added to improve the discussion about nonlinearity.

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