A STUDY OF HOUSING PRICES IN ANKARA

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

TUBA KARAGÖL

IN PARTIAL FULLFILMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
IN CITY PLANNING
IN
THE DEPARTMENT OF CITY AND REGIONAL PLANNING

MAY 2007

Approval of the Graduate School of Applied and Natural Sciences

_____

Prof. Dr. Canan Özgen
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

_____

Prof. Dr. Melih Ersoy
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

_____

Prof. Dr. Ali Türel
Supervisor

Examining Committee Members

Prof. Dr. Tansı Şenyapılı (METU, CP) _____

Prof. Dr. Ali Türel (METU, CP) _____

Asst. Prof. Dr. Ela Babalık Sutcliffe (METU, CP) _____

Asst. Prof. Dr. Fatma Cânâ Bilsel (METU, ARCH) _____

Asst. Prof. Dr. Nil Uzun (METU, CP) _____

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : Tuba KARAGÖL

Signature :

ABSTRACT

A STUDY OF HOUSING PRICES IN ANKARA

KARAGÖL, Tuba

M.S., Department of City and Regional Planning in City Planning

Supervisor: Prof. Dr. Ali TÜREL

May 2007, 109 pages

Housing price studies is the first step of housing market analysis. Prices are determined at the intersection point of supply and demand curves, which determine equilibrium point that represents equilibrium price and quantity level. At a point in time demand factors are more important in determining the prices because short-run supply curve is almost vertical. However, in the long run supply of housing, and its certain attributes, will increase if price premium arises in the previous periods.

In most of the studies, house prices are analyzed by using hedonic price index technique, which enables us to have information about the demand side of housing sector. In the hedonic price framework, heterogeneous goods are considered as aggregations of characteristics, and implicit marginal prices for these characteristics are calculated. When 'Hedonic Price Analysis' is applied to the housing sector, it shows us the price of each housing attribute and gives information about the preferences and willingness to pay of the people for each attribute. Therefore, at the end of such an analysis it is possible to see which attributes are valued most by house buyers in the city.

The aim of this thesis is to reveal the implicit prices of housing attributes in the housing market of Ankara, for the year 2006, with the purpose of gaining more information about the demand side of the housing sector. For this purpose, hedonic pricing method is used with the data that are extracted from appraisal reports which include information about main attributes and estimated price of each dwelling unit.

Key Words: Determinants of Housing Price, Hedonic Price Index, Housing Prices in Ankara

ÖZ

ANKARA'DA KONUT FİYATLARI ÇALIŞMASI

KARAGÖL, Tuba
Yüksek Lisans, Şehir ve Bölge Planlama Bölümü, Şehir Planlama
Tez Yöneticisi: Prof. Dr. Ali TÜREL

May 2007, 109 sayfa

Konut fiyatı çalışmaları konut piyasası analizlerinin ilk basamağıdır. Fiyatlar arz ve talep koşulları tarafından belirlenir. Arz ve talep eğrilerinin kesişme noktasının, denge fiyatını ve miktarını gösterdiği kabul edilir. Belirli bir zamanda fiyatın belirlenmesinde talep faktörleri daha önemlidir, çünkü kısa vadede arz eğrisi neredeyse dikeydir. Oysa, uzun vadede konut ve onun belli özelliklerinin arzı, ileriki dönemlerde fiyat priminin doğması durumunda artar.

Çalışmaların çoğunda konut fiyatları konut sektörünün talep yönü hakkında bilgi edinmemizi sağlayan, hedonik fiyat indeksi tekniği kullanılarak analiz edilir. Hedonik fiyat çerçevesinde, heterojen mallar özelliklerin kümesi olarak düşünülürler ve bu özelliklerin örtülü marjinal fiyatları hesaplanır. 'Hedonik Fiyat Analizleri' konut sektörüne uygulandığında, bize her bir konut niteliği için fiyatları gösterir ve insanların tercihleri ve her bir nitelik için ödeme gönüllülüğü hakkında bilgi verir. Bu nedenle, bu gibi analizlerin sonunda şehirdeki konut alıcıları tarafından hangi niteliklere daha çok değer verildiğini görmek mümkün olur.

Bu tezin amacı, konut sektörünün talep yönü hakkında daha fazla bilgi edinme isteğiyle, 2006 yılı için Ankara konut piyasasındaki konut niteliklerinin örtülü fiyatlarını ortaya koymaktır. Bu amaçla, hedonik fiyat yöntemi, konutların temel nitelikleri ve tahmin edilen fiyatları hakkında bilgi içeren değerleme raporlarından çıkarılan data kullanılarak uygulanmıştır.

Anahtar Kelimeler: Konut Fiyatlarının Belirleyicileri, Hedonik Fiyat Endeksi, Ankara'daki Konut Fiyatları

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my supervisor Prof. Dr. Ali TÜREL for his guidance, contributions and understanding throughout this study.

I am thankful to my jury members Prof. Dr. Tansı ŞENYAPILI, Asst. Prof. Dr. Ela BABALIK SUTCLIFFE, Asst. Prof. Dr. Fatma Cana BILSEL and Asst. Prof. Dr. Nil UZUN for their valuable critics and inspiring comments.

I offer my greatest thanks to my family; Nuran Cinali, Recep Karagöl, Melek Nur Karagöl, Burcu Karagöl Ayan, Necip Fazıl Ayan, Ahmet Karagöl and Ahsen Karagöl for their invaluable love, understanding and unfailing support.

I should also thank to Derya Demir, Serkan Tanrıöver and Önder Arslan for sharing their appraisal reports with me, and to Fatma Gül Numanoğlu and Nihat Bezek for their contribution by providing valuable data and also for their moral support at all times.

I am grateful to my friends M. Anıl Şenyel and Banu Terzioğlu for their continuous support. I also want to express my thanks to Tuba Seyyah for her technical assistance.

Lastly, I would like to present my deepest thanks to Alperen Ayan who motivated me, without knowing, to write this thesis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 The Aim and the Subject of the Study

In this study, it is aimed to reveal implicit prices of housing attributes in the housing market of Ankara for the year 2006, with desire of gaining more information about the demand side of housing sector. For this purpose, hedonic pricing method is used with the data that are extracted from appraisal reports which includes information about main attributes and values of houses.

Although housing price studies is the first step of housing market analysis, unfortunately in Turkey there is not enough research on this subject, mainly due to the absence of housing price data. This thesis tries to fill a gap in that field.

Prices are determined by the supply and demand. Both supply and demand curves determine the equilibrium point that represents equilibrium price and quantity level. Demand factors are more important in determining prices because the short-run supply curve is almost vertical. However, in the long run supply of housing, and its certain attributes, will increase if price premium (high price) arises in the previous periods.

The real estate market is unique in that every piece of property is different from every other. Each is unique in location; each has numerous characteristics having varying appeal to each prospective buyer. A final sale is arrived at through a series of asking prices by owners and offers by prospective buyers. It is extremely difficult to gauge the level of even a small part of the market at any given time.

We are focused on prices because they are key ingredients in economies. They touch nearly all points in an economy. If buyers want to own some items badly enough, they will pay more for them. When sellers want to sell some items badly enough, they will lower their prices. Prices play such an important role in economic life that most countries are often claimed to have a price-directed market economy.

In addition, prices act as signals to buyers and sellers. One of the things that prices do is carrying information to buyers and sellers. When prices are low enough, they send a 'buy' signal to buyers, who can then afford the things they want. When prices are high enough, they send a 'sell signal to sellers, who can earn a profit at the new price. They also encourage efficient production. Prices encourage business people to produce their goods at the lowest possible cost. The less it costs to produce an item, the more likely it is that its producers will earn a profit. Firms that are efficient will produce more goods with fewer raw materials than firms that are inefficient. Producers strive for efficiency as a way of increasing their profits. While these efforts are in the best interests of the sellers, all of us may benefit because we are provided with the things we want at lower costs.

All these show that having information about prices, especially housing prices, is very important.

1.2 Method of the Study

Implicit in the hedonic price framework is the assumption that the numerous models and varieties of a particular commodity can be viewed as consisting of various combinations, bundles, or composites of a smaller number of characteristics or basic attributes. The hedonic hypothesis is that heterogeneous goods are aggregations of characteristics. Moreover, implicit marginal prices for the characteristics can be calculated as derivatives of the hedonic price equation with respect to levels of the characteristics. In brief, 'Hedonic Price Analysis' shows us the prices of each housing attribute. It gives information about the

preferences and willingness to pay of the people for each attribute. The estimated coefficients and their significance levels give us information about how much value people put for each attribute. Therefore, at the end of such an analysis it will be possible to see which attributes are valued most by house buyers in the city.

Hedonic price analysis may also show us the spatial differentiation of prices in an urban area (Türel 1981). Since there are sub-markets in the urban area (Türel 1981), housing prices may differ between sub-areas. Such a spatial variation in housing prices can be shown by estimating prices using the hedonic price analysis.

In this study, we will use hedonic pricing method in order to estimate the implicit price of individual housing attributes for the housing market of Ankara, for the year 2006. In order to carry out the hedonic price analysis of housing prices, very detailed data should be acquired, including information about main attributes and values of houses. The data, which are used in this thesis, are extracted from appraisal reports, which have been prepared by different appraisers, in 2006, in Ankara.

The thesis is composed of mainly three parts. First, in Chapter 2, a technical background will be given about real estate markets, housing markets, value and price, determinants of price of housing and hedonic price approach. Secondly, in Chapter 3, empirical studies on hedonic price models of housing prices will be mentioned. In Chapter 4, we will start with the development of Ankara and its residential districts. This will let us see the background of our study field. Then, hedonic price analysis will be estimated by regressing price of housing on the selected attributes of the dwelling units as independent variables. Different functional forms will be tested to find out implicit prices and also effects of changes in attributes on relative changes in prices. The effects of the location, both in terms of the distance from the CBD and social composition of the district where the dwelling unit is located will also be determined, in addition to the contribution of each attribute to the price of the dwelling unit.

With the results of the hedonic price analysis, it will be possible to answer questions such as: ‘What amount of money would make a household indifferent between a three and a four-bedroom house? or What is an extra bathroom worth to a potential home buyer?’. The likings and preferences of house buyers in Ankara, which embody the demand side of the housing sector, will be displayed.

CHAPTER 2

THEORETICAL FRAMEWORK

2.1 The Real Estate Market

Real estate is defined as "an integration of many specializations, an aggregation of disciplines resulting in a unique field of study" (Karvel and Unger, 1991: 6). It is not only the interrelation of marketing, economics, finance, sociology, management and law with the use of land and building, but also the study of application of these disciplines to people and their use of real estate resources. Dipasquale and Wheaton stated the most common definition for real estate as "the national stock of buildings, the land on which they are built, and all vacant. (1996: 1)

Brown, defines the real estate market as a complex of different types of properties that include the following (Brown 1965: 53):

1. Dwellings
    a. Standard new homes, in developments and elsewhere
    b. Houses, not new but not yet obsolete
    c. Obsolete houses
    d. Special types – 'submarket houses'
2. Vacant residential land
3. Commercial property
    a. Stores
    b. Offices
    c. A large amount of miscellaneous
4. Industrial properties
5. Farms

6. Natural resource property
    a. Coal
    b. Oil
    c. Other

Since real estate is a durable capital good, its production and price are determined in an asset, or capital, market. In this market, the demand to own real estate assets must equal their supply. Figure 2.1. shows the mechanism in the real estate markets.

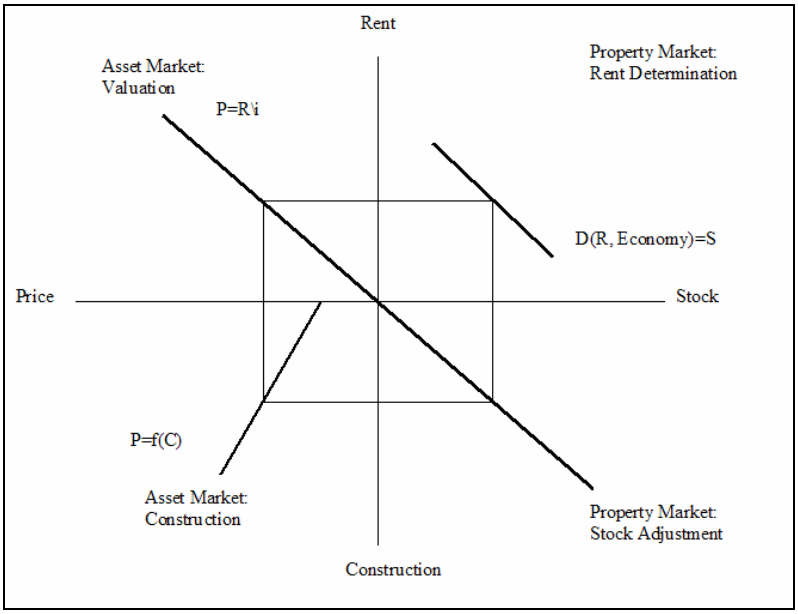

Figure 2.1. Real Estate Markets
Source: Dipasquale and Wheaton, 1996: 8

Buyers and sellers make up the market. In other words the real estate market is almost entirely and uniquely determined by the classical economic factors of supply and demand. The supply of real estate is relatively static. Additions to supply are made slowly and at great cost, even during boom years in which great offer of new building take place. The supply side of the equation, in real estate market, is much less flexible than it is for most other commodities. The supply

situation is not the same for all purchasers of real estate. For instance, “Minority groups in many places have not been able to bid in the market as a whole, they have been able to place bids in only very limited areas” (Nelson and Aschman, 1957: 82-83). On the other side of the equation, the demand for real estate varies greatly. The demand for houses for purchase is affected by the number of consumers in the market, the price of housing, the volume of additions to supply and qualitative demand for housing which is made up of the level of consumer purchasing power, the competitive position of housing in the economy and the terms of housing purchase. The demand-supply curve mechanism is shown in Figure 2.2.

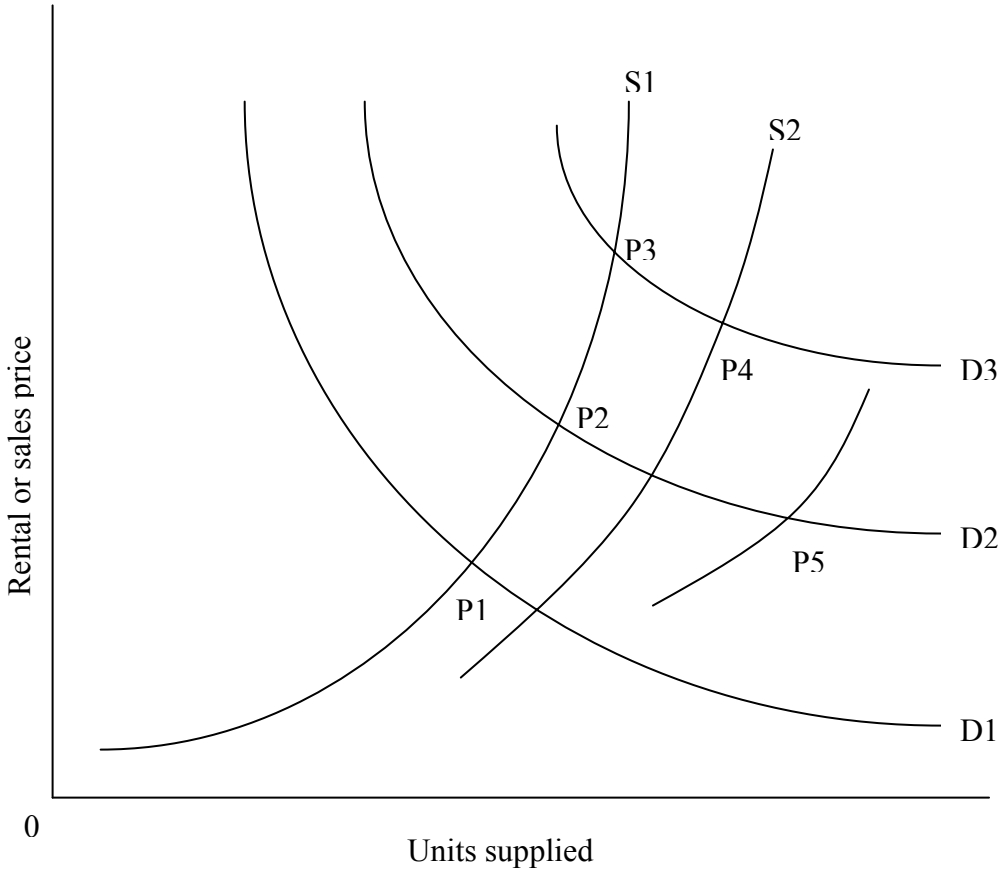

Figure 2.2. Functions of the market

Source: Cooper and Guntermann 1974: 359

Cooper and Guntermann, explained the mechanism of the market that is illustrated in Figure 2.2. as;

> The market shown is in equilibrium with P_1, the prevailing price. The influx of population in response to better jobs results in curve D_2, with price rising P_2. Continuing influx of population results in a new demand indicated by D_3, with resulting price P_3. The higher prices with their accompanying higher profits will result in more properties being supplied and a new supply curve S_2. The new supply reduces the price pressures created by rising demand, so that prices drop to P_4. As the supply demand relationships continue to change new prices will be produced, P_5, which is the point that prices had previously come to rest. (Cooper and Guntermann 1974: 359-360)

The real estate market is heterogeneous, in that there seems to be an almost indefinite number of extremely different entities. “Because there is no large number of quoted prices of homogeneous units, it is extremely difficult to gauge the level of the market or even a small part of it at any given time” (Nelson and Aschman, 1957: 81).

Because of its characteristic of heterogeneity, real estate market is less ‘operated’ than almost any other markets. As it is mentioned by Nelson and Aschman, “The real estate market is less open to manipulation by professional or large interests, and it is less sensitive to regulation either by professional organizations or by government, since there is no effective way to control prices on things that are so clearly unique as parcels of real estate. (1957: 82)

According to Kinnard, “real estate must be analyzed from three separate but interrelated points of view. It can be considered as a physical entity, a local entity and an economic good or asset” (1971: 18). Below, these will be discussed.

The Physical View Point: Real estate as a physical thing is technically known as realty. It consists of land and man-made improvements on and to the land. Land consists of the surface of the earth as well as subsurface and supra-surface area. It is fixed in location, and this immobility means that it is critically dependent on its surrounding environment, including man-made off-site improvements and access. As real estate is fixed in location, it is also extremely durable and long-lived. Since only one unit of matter can occupy the same space or location at any one time, every parcel of real estate or unit of urban space is unique; it is differentiated from every other parcel or unit.

The Legal Viewpoint: The fixed location of real estate means that it cannot physically be possessed or transferred. Rights in realty are therefore owned and marketed, and termed *real property*. The private property system protects ownership rights under law. The private property rights in realty consist of a bundle that includes the rights of use, exclusions, and dispositions. These rights are both separable and divisible. Equally important, they are transferable. Besides, they are also marketable when there is market demand for them. The possession of rights in realty is demonstrated by legal documents, which is called 'title'.

The Economic-Financial Viewpoint: Real estate is an asset that is also termed an economic good. Economic goods have the characteristics of scarcity, transferability and utility. Apart from these general attributes, real estate has distinguishing economic characteristics, which stem from the physical and legal characteristics. These can be listed as: having fixed location, dependence on environment and settings, highly differentiated, and durability.

2.1.1. Characteristics of Real Estate Markets

The peculiar and distinguishing characteristics of real estate as an asset influence the character of real estate markets (Kinnard, 1971:24). By the standards of economic theory, real estate markets are highly imperfect, in which value is determined through the interaction of the forces of supply and demand. In order to

understand real estate, it is necessary to have enough knowledge about the characteristics of the market of real estate.

Unlike most other commodities, there is no centralized market for real estate transactions. Thus, it is difficult to know the price of a particular type of a real estate at a given point in time. Besides, transactions for real estate investments are not continuous, and this makes it difficult to know how prices are changing over time.

In a perfectly competitive market, there must be sufficient numbers of buyers and sellers, so that no one can exert an appreciable influence on price or value. However, this is often not the case in real estate markets, especially when extremely high-priced or specialized properties are involved. And also, potential buyers and sellers rarely achieve full knowledge.

The real estate market is divided into numerous sub-markets functioning semi-independently of one another. The division occurs not only by property type and market area but also within each segment itself. This is because both supply and demand are stratified or compartmentalized by type of space and use, by type of potential purchaser or tenant, by type of potential seller or landlord, by type of transaction and occupancy, and even by geographic area. Fisher and Martin explain this situation with an example: “the success of one type of building in a particular neighborhood does not automatically ensure that the same building type will be successful in another neighborhood (Fisher and Martin, 1994: 8).

The supply of urban space is not readily responsive to sales or rental price changes. Both new construction and conversion are time consuming; there are physical and legal deterrents to speed. This means that under changing conditions of market demand, values can vary substantially. On the other hand, demand for urban real estate can and does vary widely and rapidly. Demand for urban space is derived from factors outside the real estate system, like combination of population, standards or tastes, and incomes. Because of population mobility, changes in employment and incomes, fluctuations in the availability and price of

credit, and changing tastes and standards of use, demand becomes volatile and causes significant fluctuations in value over short periods of time.

Unlike many investment opportunities, real estate property is tied to a fixed location. The fixed location and immobility of real estate tend to limit the geographic area within which properties of a similar type compete effectively with one another. Because of that characteristic of real estate, no two parcels of real estate can be exactly same, they are all unique.

2.1.2. Functions of the Real Estate Market

Real estate markets or sub-markets operate primarily to bring together buyers and sellers of rights in realty. This is accomplished through the interaction of the forces of supply and demand. To be able to evaluate the impact of these forces on the value of the property rights, the functions performed by a real estate market and the efficiency of its operating functions must be known (Kinnard, 1971: 26).

Firstly, a real estate market facilitates the exchange of rights in realty, by providing a mechanism in which buyers and sellers, landlords and tenants are brought together. That transfer can be through sale, exchange, leasing or loan contracting.

Secondly, market activity, in which potential buyers and sellers of real property rights are involved, establishes the 'price' of the transfers that mentioned above. These prices represent the amount that at least one potential buyer is willing and able to pay, and at least one potential seller is willing to accept. Through negotiations among buyers and sellers, market prices are set.

Thirdly, the allocation of urban space among alternative uses is occurred in the real estate market. The basic allocating mechanism in the real estate market is the price. Buyers and sellers are assumed to act rationally in their own economic self-interest. The seller accepts the highest and best offer of the buyer, whereas the

buyer doesn't offer and pay no more than the present worth of the future benefits of having the subjected real property. Since urban real estate is allocated in the private market on the basis of the highest price offered for the ownership rights, the urban space is also allocated according to its highest and best use.

Another function of real estate markets is related with market allocations of urban space through the price mechanism and the highest and best use, are made individually on each parcel and each unit (Kinnard, 1971: 27). The pattern of land and space use is established by the sum of these individual use decisions made by investing or purchasing decision-makers.

The last function of the real estate market is to adjust supply and demand. The demand for real estate rights is determined by some external factors, like changes in population, changes in the levels of incomes, or changes in tastes. The demand is also related with the needs, whereas supply adjusts to demand. It is the real estate market that provides the proper economic, financial and legal environment for supply to respond effectively to changes in demand.

2.2. Housing Markets and Housing Prices

Construction industry occupies an important place in any country's economy. It provides an appreciable share of the gross national product and generates a high proportion of the fixed capital formation. A large percentage of total construction output consists of intermediate inputs from other sectors of the economy, mainly building materials and service industries. (Bıçkıcıoğlu, 1986: 1)

Construction sector is one of the key sectors that is affected from the general demand conditions of the economy and has the power of affecting other sectors. (Korum, 1982: 124) While investments in most economic sectors tend to follow rather than to lead the overall trend, construction sector is in a leading position. It generates strong multiplier effects on other sectors. Besides being a key sector itself, those industries providing input to the construction sector – e.g. cement,

steel-iron, metal and wood industries – are considered to be amongst the key sectors. (Korum, 1982: 125)

Construction sector is also an important source of employment. Even in the developed countries, construction is relatively labor intensive in the sense that it uses a larger number of workers per unit of output than most other industries. (Bıçkıcıoğlu, 1986: 2) Besides being an important sector for skilled and well-educated workers, it also provides employment possibilities to the labor that is unskilled and seeks for a temporary work.

The largest part of the construction activity is constituted by the residential construction. Its share in total construction activity may rise over 80% (Bıçkıcıoğlu 1987: 3).
Furthermore, a large volume of non-residential construction is directly generated by and dependent upon housing construction. In spite all these strengths of housing sector, housing production is highly sensitive to fluctuations and crises in economy.

Related to the fluctuations in housing development in Turkey from year to year according to economic and social conditions of the country as well as the housing policies, the housing construction industry also varies but never lost its significance. (Kayıket 2003: 37)

As an indicator of the sectoral significance of housing industry in Turkey, the share of construction in GNP and share of housing in total gross fixed investments are shown in Figure 2.3. It is clearly evident housing construction constitutes approximately 20% of gross fixed investments and in 1995s, this share reached to 40% (Kayıket 2003: 37).

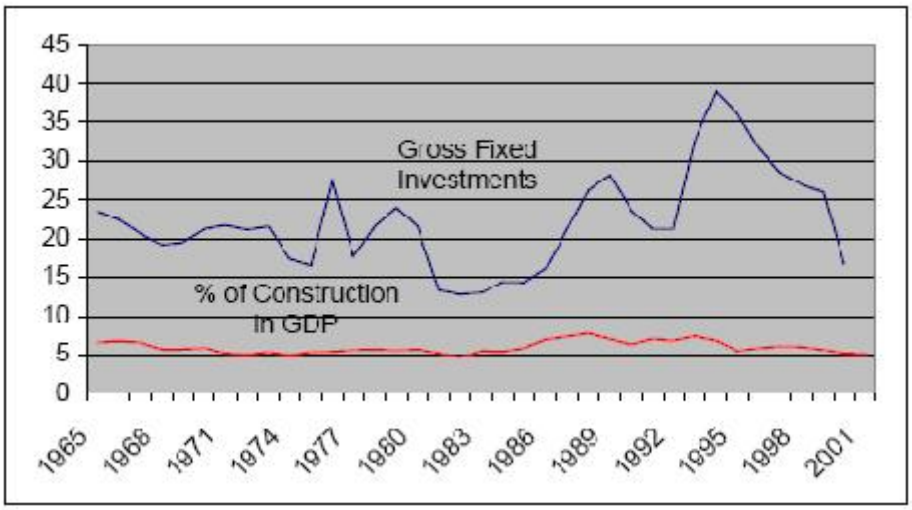

Figure 2.3. Share of Construction in GNP and Share of Housing in Total Gross Fixed Investments

Source: Kayıket, 2003: 38

Generally, housing is defined, as a shelter, a safety mechanism for individuals and families, a mediator in which community relationships are developed, a place in which labor is reproduced and an incremental unit forming the quality of environment.

Bassett defines housing more detailed, as:

> A heterogeneous, durable and essential consumer good; an indirect indicator of status and income differences between consumers; a map of social and conflict between various power groupings; and a source of profit to different institutions and agents involved in the production, consumption and relations within the city; an important facet of residential structure; a source of bargaining exchange of housing. (Bassett, 1980)

Such diverse characteristics make the study of housing a complex matter amenable to various interpretations. This draws the study of housing into the arena of interdisciplinary interaction and competing social theories.

However, the analyst faces problems that stem directly from the inherent nature of housing as being a complex or multi-dimensional commodity. Houses are fixed in their location, they are expensive and they have a very long life. Above all, the housing stock is very diverse. At its simplest, every dwelling unit of a housing stock in a country or a city is unique. Houses, even when they look exactly the same, are infinitely varied in character and quality; their occupiers buy not only bricks and mortar but also a location and all that goes with it- security of tenure perhaps, a fashionable address, proximity to work and schools, the neighbors next door and view of the park. (Murie, Niner and Watson 1977: 1)

Urban housing is a 'unique product' with three peculiarities (Hai-zhen 2005: 907):

1. Complexity of housing. As a kind of complicated goods, housing can meet a great variety of a family's demands and be closely related to such activities as residents' life, work, amusement, etc.;
2. Fixity of housing. Housing directly relates to urban land in special location. The movement of housing is basically impossible under the present technological conditions. This means choice of housing involves consideration of neighborhood relations, reachability of job site and corresponding public service facilities such as schools, shopping centers, etc.;
3. Durability of housing. This characteristic affects the new housing market and stock housing market as well. Different from other common commodity market, housing market has a corresponding stock market. Consumers can carry on replacement among new or old houses, choose building type, community environment, degree of accessibility and so on, to meet individual preferences and get the greatest utility.

These characteristics indicate that influential factors of housing price are very complicated and closely related to housing characteristics. Investigating the influencing factors of housing price inside the city from the viewpoint of housing

characteristics is a rational approach. In fact, since housing is a kind of heterogeneous product, and there are obvious differences between housing characteristics, scholars often establish a hedonic price model, which will be handled in the following section, to carry on researches.

2.3. Value and Price

As we study about the determinants of the housing value, the concepts of value and price should be clarified. In this section, they will be discussed separately with the idea of making the concepts more meaningful. Firstly, value will be defined with its elements and characteristics. Secondly, price will be defined, and then the relationship between these two will be displayed.

The concept of 'value', as pervading every segment of the real estate industry, has attracted the attention of researchers for many years. The basic problem they focused on was the problem of determining 'value'. The concept is pretty complicated to explain and it is not possible to define 'value' from one point of view. As economists, government agencies, engineers, architects, legists, appraisers, and actors of various professions have different perspectives about the concept of value, there are many different definitions of it. The confusion with respect to its meaning can be explained with this diversity and due to the common usage of the term.

One of the basic definitions about value is coming from economist perspective. As Karvel and Unger stated, "To the economists, value is the power of commanding commodities in exchange" (Karvel and Unger,1991: 419). Although, this gives us a general idea, it is not enough to understand this cloudy and versatile concept.

Having different connotations in different fields of study also brings on having various types. Some of the types of value are listed by Fisher and Martin as: "market value, cost, investment value, value in use, assessed value, insurable

value, going concern value, salvage value, book value, mortgage loan value, and liquidation value" (Fisher and Martin, 1994: 24). Market value is the focus of most real property appraisal assignment and its estimation is the purpose of most appraisals. In this study, for which the required data is obtained from appraisal reports, the concept of market value will be mentioned.

Just like 'value', 'market value' is also variously defined. Whatever the definition, there are several essential ingredients to 'market value' that must be understood. Market value assumes competitive market conditions. There must be several buyers and sellers competing with one another to provide alternatives to other market participants. These buyers and sellers must be informed about the property. They are also presumed to act rationally, in what he or she considers his or her own best interest, on the basis of the information they have. There must be no undue time pressure on either buyer or seller. In other words, a reasonable turnover or marketing period must be allowed for the transaction. Typical and normal financing and payment arrangements are presumed. Finally, it is usually viewed from the perspective of the buyer. It is most frequently expressed as the maximum price that an informed buyer, who acts rationally, would pay under the above market conditions.

By taking into account all these required conditions, market value is defined as:

> "The estimated amount for which a property should exchange on the date of the valuation between a willing buyer and a willing seller in an arm's length transaction after property marketing wherein the parties have each acted knowledgeably, prudently and without compulsion" (Dixon, 2005: 313).

It should be clear that value is not necessarily determined by usefulness, utility, or importance. Karvel and Unger explain this with an example about iron and gold; "Iron is more useful than gold, but expressed in terms of value and in terms of exchange, gold commands a far greater amount of money*"(*Karvel and Unger, 1991: 419).

There are four primary elements that influence value: physical elements, economic elements, social elements, and legal elements *(*Karvel and Unger, 1991: 420). Physical elements concern with factors that can create, condition, or destroy value. Some examples of physical elements are size, shape, area, frontage, topography, and workmanship. Economic elements cover; actual or potential income of the property, interest rates, prevailing rates of interest, and earning power of the community. Social elements deal with data about neighborhoods, population trends, noise, and urban renewal. Legal elements can also create, condition, and destroy values, and concern with zoning, deed restrictions, city plans, and even legislation.

The relationships that create value are complex, and value changes when the factors that influence value change. The characteristics or economic factors that create value, which are related to the above elements, are utility, scarcity, demand/desire, and transferability. Utility is defined as the ability of a good to render a service, fill a need or satisfy a human desire. Scarcity is a relative term related to supply and demand, and can be defined as the present or deficit supply of an item relative to the demand for it. If a product has utility, and other characteristics of value, and it is also relatively scarce, then its market price is likely to be high. The third characteristic, demand or desire can be defined in economic terms as the desire for a good or service backed by the ability to pay for the product. And the last characteristic of value, transferability, is a legal concept that shows the ability of a good of being transferred to another good. If a product cannot be transferred to another, it is impossible to talk about its market value.

In the perfect market of economic theory, informed and rational buyers would pay no more, and informed and rational sellers would get no less, than the present worth of the anticipated future benefits from ownership of an asset. Thus, all transactions would take place at prices that reflect ‘Value in Use’, and represent ‘Value in Exchange’. These two would equal to each other, and in such a case, ‘Price’ would be synonymous with Value.

The real estate market, or any real estate sub-market, however, is imperfect by the standards of market perfection in economic theory. As a result, price and value are not synonymous and are infrequently equal. "Price is a historic fact: the sum of money actually paid for a property, or offered by a potential buyer, or asked by a would-be seller. Value is the price that would tend to prevail under specified conditions, which may or may not be realized" (Kinnard, 1971: 11). Appraising involves the estimation of value, not the prediction of price. Types of appraised value generally include market value, use value, going-concern value, investment value, assessed value, and insurable value.

As mentioned before, in this study 'market value' will be used when analyzing the attributes of housing. The value of each dwelling unit has been estimated by an appraiser. Since, all the real estates that were subject to appraisals are properties that are bought and sold regularly, 'sales comparison method'[1] is mostly used in those valuations. In the sales comparison method, the appraiser produces a value indication by comparing a subject property with similar properties, which are called comparable sales. The degree of similarity or difference between subject property and the comparable sales are estimated by considering various elements of comparison. Then adjustments are made in terms of money or percentage to the sale price of each comparable property, whose price is known. Through this comparative procedure, the value is defined. In brief, the market values that will be used in analysis are appraised by using known market prices of properties, which were already sold. Consequently, in our case market value and market price, which is the price actually paid for an income-producing property, can be assumed to be equal or of which difference can be omitted.

2.4. Principal Determinants of Housing Value

Housing attributes are mainly classified into three; structural or physical attributes, locational attributes and neighborhood attributes (Chin and Chau, 2003; Türel, 1981; Ustaoğlu, 2003). These attributes encompass both quantitative and

[1] Sales comparison method will be discussed in detail in the fourth chapter.

qualitative attributes. In some studies the transfer (lease) characteristics are also used. Although each attribute type can be increased in variety according to the aim of the study or the detail level of the data, there are some characteristics that generally used in hedonic price analysis for housing. Whereas some attributes are always significant for any housing, the significance of some attributes can change over time, from nation to nation, or from city to city. In this chapter we will summarize the most common housing attributes.

2.4.1. Structural/Physical Characteristics

Structural or physical characteristics relate to man-made structures and prices of properties frequently related to them. These attributes include:

Floor area or size: The single most important structural variable is floor area. Each structure has gross building area and some structures contain common areas that serve all tenants. Deducting the common area from gross building area will give the 'net usable area' (Fisher and Martin 1994: 204). In most of the studies the gross area of the housing unit is used, but occasionally to signify the size of the dwelling, number of rooms and bathrooms are also used. Floor area and size of the dwelling - number of rooms and bathrooms - are positively related to the price of housing. Garrod and Willis discovered that an additional room increases a property's value by about 7%, and an extra bathroom collects twice that premium (Chin, Chau, 2003: 154)

Vertical location and internal accessibility: Vertical location of the dwelling unit within the building is important in the sense that it is related to the unit's prestige and accessibility (Brennan, Cannaday and Colwell, 1984: 250). Total number of floors, floor level of the dwelling unit, and availability and quality of an elevator affect the accessibility of the unit.

Construction components and internal services: The quality of construction components and existence of specific internal services add value to the building

(Ustaoğlu, 2003: 7). Some of the construction components are parking area and heating systems. Interior construction elements include floor covering, wall covering and carpentry works for doors and windows. Garrod and Willis noted that existence of a single garage adds a 6,9% differential and double garage increases three times this amount, similarly central heating adds about 6,5% to the price of dwelling (Chin, Chau, 2003: 154).

Physical structure of the building: Construction type, construction quality, architectural style and other structural elements are directly related to physical structure and image of the building. Although they are not directly related with usage, they influence the property's value due to the fact that they affect the prestige of the building. Quality of the elements of physical structure and the additional elements affect construction costs which give rise to both price and rental price of the property (Fisher and Martin, 1994: 204-205).

Age and physical depreciation: Physical depreciation due to aging as well as wear affects physical structure of the building. According to Fisher and Robert, older and worn out properties even if they have locational advantages and are designed efficiently, generally do not generate incomes equal to those of new buildings (Fisher and Martin 1994: 209). These deficiencies can be eliminated by repair and maintenance, but it is resulted in high repair and maintenance expenditures, which mean additional expenditures.

Chin and Chau mentioned that there has been relatively little research on the effects of structural quality on housing price (Chin, Chau, 2003: 154). This can be explained with the existence of difficulties in measuring structural, physical and environmental quality objectively and precisely.

2.4.2. Locational Characteristics

Land or site and improvements together constitute urban space, which is characterized by the fact that its use and value are largely determined by its

location. Therefore, locational advantages have great importance in determining the values of both urban land and built structure.

> The absolute location of each real estate parcel in an urban housing market has a unique location-value signature. Accessibility indices, distant gradients and location dummies cannot fully account for the influence of absolute location on the market price of housing because there are an indeterminable number of externalities (local and non-local) influencing a given property at a given location Furthermore, the degree to which externalities affect real estate values is not only unique at each location but highly variable over space. Hence, absolute location must be viewed as interactive with other determinants of housing value. (Fik, Ling and Mulligan 2003, 623).

The location of a property has been conceived in most studies in terms of fixed and relative locational attributes (Chin, Chau, 2003: 152). The fixed locational attributes are quantified with respect to the whole urban area, relate to some form of accessibility measure.

Distance from CBD: In the traditional view of location, accessibility is measured in terms of access to the Central Business District (CBD). Despite the growth in information technologies, there is still need for face-to-face interaction in CBD. In addition, CBD is still the most attractive site considering that it is close to the important transportation networks, bus and subway stations, and to the main shopping centers (Ustaoğlu, 2003: 8). Therefore, accessibility the the CBD has influence on housing prices.

Easement of access: Transport accessibility is frequently associated with the ease of commuting, and measured by traveling time, cost of travel, convenience, and availability of different transport modes (Chin, Chau, 2003: 152). Good public transport services have a positive influence on housing prices.

View: The view is also an attribute that is related with the location of a dwelling site. Numerous studies have indicated that buyers prefer sites with good views,

such as lakes or golf courses, and are willing to pay a premium for such sites (Gillard, 1981), whereas a cemetery view has a negative impact on housing prices.

The view amenity may not be uniform; it varies by type, like water view, mountain view or valley view, and by quality, like full view, partial view or poor partial view (Benson, Hansen, Schwartz and Smersh, 1998: 56). They classified views as oceanfront, ocean view, partial ocean view and no view, and discovered that in Bellingham, Washington, relative to no view, an ocean frontage adds 147% to a property's selling price, an ocean view 32%, and a partial ocean view 10%. There is also relationship between view and floor level, as higher floors are expected to have better views.

2.4.3. Neighborhood Characteristics

The environmental characteristics of the built are that influence the site value are called *neighborhood influences* (Greer and Farrell, 1993: 91). The general state of the built environment determines the prestige for the area by forming visual impressions. Furthermore, "the neighboring property uses together with its favorable influences create an environment that enhances profit potentials" (Fisher and Robert, 1994: 200). Consequently, the prior decision to select the location is important in order to capture the desirable external factors and it is difficult to escape from undesirable ones since real estate has long life and is physically immobile (Ustaoğlu, 2003: 9).

Goodman (1989) argued that while neighborhood attributes cannot be explicitly valued in the marketplace, they could be implicitly valued through hedonic pricing by comparing houses with differing neighborhood qualities.

Neighborhood characteristics can be in different categories, like socio-economic variables, which includes the social class of the neighborhood, the occupations, income levels and education levels of the inhabitants, local government or municipal services, like schools and hospitals, some externalities, like crime rates, traffic or airport noise and shopping centers.

2.4.4. Transfer (Lease) Characteristics

There is another characteristic attributed to a leasehold property; the transfer (lease) characteristics (Ustaoğlu, 2003: 9). Transfer characteristics refer to the specific conditions identified in a lease, which is the written contract between landlord and tenant. However, lease characteristics are mostly taken into account in studies that using rent value.

2.4.5. A Critical Review of the Housing Attributes on Price

In nearly all the studies, similar housing attributes are used in addition to the ones that are required by the reason of the specific aim of study, such as variables about view.

Chin and Chau summarized the most commonly used attributes of previous hedonic price models for housing and their expected signs on housing prices, in Table 2.1 Attributes with '+' sign have a positive impact on housing prices, the ones with '-' sign have a negative impact, and '?' sign shows that the impact of the attribute varies from place to place.

Table 2.1. List of key housing attributes used in previous hedonic price models

	Housing characteristic	Expected sign on housing price
Structure characteristic	Number of rooms, bedrooms, bathrooms	+
	Floor area	+
	Basement, garage, and patio	+
	Building services (e.g. lift, air conditional system etc)	+
	Floor level (multi-story buildings only)	+
	Structural quality (e.g. design, materials, fixtures)	+
	Facilities (e.g. swimming pool, gymnasium, tennis court)	+
	Age of the building	–
Neighborhood characteristic	Income of residents	+
	Proximity to good school	+
	Proximity to hospitals	?
	Proximity to places of worship (e.g. mosques, churches, temples)	+
	Crime rate	–
	Traffic/airport noise	–
	Proximity to shopping centers	?
	Proximity to forest	?
	Environmental quality (e.g. landscape, garden, playground)	+
Location characteristic	Distance from CBD	–
	View of the sea, lakes or rivers	+
	View of hills/valley/golf course	+
	Obstructed view	–
	Length of land lease	+

Source: Chin, Chau, 2003: 158

2.5. Hedonic Price Approach

There has been considerable interest in understanding the markets for differentiated products. There are many goods and services that are not homogeneous and consist of bundles of atomistic goods and services. For example, automobiles differ by the basic characteristics of safety, comfort, and fuel economy. Computers differ by memory capacity, display resolution, and speed. Housing differs by accessibility, privacy, cleanliness of the environment, quantity of housing services, and safety. The utility provided by such goods is based on the utility yielded by the various characteristics of the differentiated good. In many cases, prices are only perceived for the overall good or service. For many years *hedonic regressions* or *hedonic pricing methods* have been used to study the contributions of the various characteristics to the price of the composite good.

2.5.1. Hedonic Price Analysis

A hedonic model of prices decomposes the price of an item into separate components that determine the price. In other words, hedonic pricing attempts to take observations on the overall good or service and obtain implicit prices for the atomistic goods and services. The method is based on the assumption that people value the characteristics of a good, or the services it provides, rather than the good itself. A hedonic model does not necessarily separate all the factors that could be separated, only those that affect the usefulness to a buyer of what is being sold.

Implicit in the hedonic price framework is the assumption that the numerous models and varieties of a particular commodity can be viewed as consisting of various combinations, bundles, or composites of a smaller number of characteristics or basic attributes. In brief, the hedonic hypothesis is that heterogeneous goods are aggregations of characteristics. Moreover, implicit marginal prices for the characteristics can be calculated as derivatives of the hedonic price equation with respect to levels of the characteristics. (Berndt, 1991, 117)

The term ‘hedonic pricing’ is coined from hedonistic philosophies that focus on increasing the pleasure. (Berndt 1991:111) The expression ‘hedonic’ was used to describe the weighting of the relative importance of various components among others in constructing an index of ‘usefulness and desirability’. (Goodman, 1998: 292)

According to Goodman, one of the more unusual episodes in econometric work regards the invention, disappearance, and subsequent re-emergence of hedonic price analysis. (Goodman, 1998: 291)

The pioneering work about hedonic price analysis dates back to a 1939 article by Andrew Court (Goodman, 1998: 291), who was an economist for the Automobile Manufacturer’s Association in Detroit, in 1930’s. He defined hedonic price comparisons as “those which recognize the potential contribution of any commodity, a motor car in this instance, to the welfare and happiness of its purchasers and community”(Court 1939: 107). He noted that automobiles produce a number of services that consumers enjoy. It would be desirable to measure directly the amount of happiness and increased welfare provided by automobile services, but such quantification would, of course, be impossible. However, he recognized that it might be reasonable to relate the enjoyment consumers receive from automobiles to physical design and operating characteristics, such as power, speed, internal room, safety, and like that. (Berndt, 1991: 111)

In his model, he dealt with problems of non-linearity, and with changes in underlying goods bundles, and while doing these, he chose to concentrate on the dry weight w, wheelbase f, and advertised horsepower h. The fundamental equation for a three period model is

$$p = k + b_w w + b_f f + b_h h + b_1 t_1 + b_2 t_2 ,$$

with conventional time period shifts t_1 and t_2 (Goodman 1998: 293). Looking at his data, he determined that a semi-log form should be used, since preliminary

analysis indicated that this gave more nearly linear and higher sample correlations (Court 1939: 110). He also chained the index with data six different years and estimated five sets of adjacent-period indexes. Thus, the implicit prices could adjust slowly over time without being constrained to be constant, as would occur with a single set of coefficients and five time dummies.

Court's hedonic multiple regression approach to the construction of price indexes was finally revived in 1961 by Zvi Griliches. Unlike Court's, Griliches' work immediately stimulated a substantial and very influential body of new research, both theoretical and empirical, that continues to this day. (Berndt 1991: 116) Therefore, he is called as 'the father of modern hedonic price analysis'. His study was again about hedonic price indexes for automobiles. Although Court's notion of hedonic prices focused on the demand side, the post Griliches research typically envisages hedonic prices as the outcome of shifting supply and demand curves for characteristics. (Berndt 1991, p: 116)

After that, this method began to expand to other consumer goods, such as tractors, washing machines, computers, etc. However, the theoretical foundation of the hedonic price model was generally named as hedonic price theory; mainly including two contents: American scholar Lancaster (1966) first put forward a new consumer theory, and then, American economist Rosen (1976) put forward the equilibrium model of market supply and demand based on product characteristics.

The theory which also known as Lancaster preference theory, was expanded from the consumer theory of classical economics. From the product heterogeneity, Lancaster (1966) analyzed basic "element" spaces that formed the product, and argued that the demand for the product was not based on the product itself, but on its characteristics. Heterogeneous goods, especially such as housing, have a series of integrated characteristics, and the goods are sold as the gathering of inherent characteristics. These goods are purchased and used as a kind of 'investment', and are turned into utilities. The level of utilities depended on the quantity of different

characteristics. It is difficult to analyze such goods market with the traditional economic model, because it cannot be considered by a single total price. So, a series of prices (hedonic price) has to be adopted to express corresponding product characteristics. Therefore, the product price is made up of hedonic prices, with each product characteristic having its own implied price, and all hedonic prices form a price structure. Lancaster developed a sophisticated branch of microeconomic theory in which utility is generated, not by goods per se, but by characteristics of the goods. (Malpezzi 2002: 10) The applicability to housing is direct and obvious.

Like Lancaster, Rosen focuses on characteristics, but has less to say about their utility-bearing nature and more about how suppliers and consumers interact within a framework of bids and offers for characteristics. He analyzed theoretically the long term and short-term equilibrium of the heterogeneous product market, under the condition of perfect competition market, with maximizing consumer's utility and producer's profit as the goal, Rosen (1976) analyzed theoretically the long term and short-term equilibrium of the heterogeneous product market (Hai-zhen 2005: 908). Rosen's work established the modeling foundation for the hedonic price theory, based on which, econometrics method can be used to estimate the hedonic price function, get implicit prices of product characteristics, and then analyze the demand of product characteristics.

Most applications of hedonic price analysis use residential housing prices to estimate the value of environmental amenities. The method is based on the assumption that people value the characteristics of a good, or the services it provides, rather than the good itself. Thus, prices will reflect the value of a set of characteristics, including environmental characteristics, that people consider important when purchasing the good.

The housing is a heterogeneous commodity; houses differ in structure size and characteristics, as well as the in the location and type of lot on which they sit. Because housing units are fixed in space, a household implicitly chooses many

different goods and services when it selects a house, including neighborhood and school district, as well as the components of the structure itself.
Households examine each house in the market and choose that unit which, considering price, makes them best off. Assuming that households have similar tastes and incomes, the price of each house will have to compensate exactly for its varied attributes. (Dipasquale and Wheaton 1996, p: 67)

When households evaluate a housing unit they apply a valuation process that is based on the unit's various individual attributes. It is important for both sellers of existing units and builders of new units to understand this implicit valuation process of buyers. Because, explicit prices for individual attributes are never directly observed in the housing market. (Dipasquale and Wheaton 1996, p: 67)

Hedonic price analysis for housing tries to answer questions like: 'What amount of money would make a household indifferent between a three and a four bedroom house? or What is an extra bathroom worth to a potential home buyer?'

The multiple regression analysis, which is used to estimate the implicit price of individual housing attributes, is called hedonic price equation. A hedonic price equation considers the market price paid for a house, P, to be a function of the levels of all observable characteristics of that house, X_i , i = 1,…,n. The dependent variable, housing price or rent, can be developed by tracking actual sale or lease transactions or by surveying current unit occupants and obtaining estimates of market price or rent. The characteristics used as independent variables include continuous variables such as square meter, integer variables such as number of baths, as well as discrete variables such as identifying whether the unit has a garage or a swimming pool. Estimating such hedonic equation requires housing unit data that combines information on housing price or rent with a complete set of measures for the characteristics of the house and neighborhood. (Dipasquale and Wheaton 1996, p: 67-68)

The hedonic regression assumes that the following determinants of a unit's rent or value are known:

$$V \text{ or } R = f(S, N, L, C, T),$$

Where

V = value (substitute; R = rent)

S = structural characteristics,

N = neighborhood characteristics,

L = location within the market, and

C = contract conditions or characteristics, such as whether utilities are included in rent,

T = the time rent or value is observed.

In its most simple form, linear hedonic equation look like;

$$P = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_n X_n \qquad \text{(Dipasquale and Wheaton 1996: 68)}$$

In this equation, the estimated coefficients on the housing characteristics, β_i, may be interpreted as estimates of an implicit price that households are willing to pay for more of each attribute. A linear hedonic equation assumes that this price is constant and does not depend on how much of each attribute the unit has. In other words, it assumes that all of a unit's square meter or space add the same value and that there is no diminishing marginal utility with additional space.

In the equation, t-statistics are shown in parentheses beneath the coefficients. More positive attributes, like the presence of a garage or more bedrooms, mean that the price will be increase, whereas negative attributes, such as age of the building or poor quality, mean decline in the price of the dwelling unit.

While linear hedonic equations are frequently used in property valuations, they do have the unrealistic feature of assuming that each additional attribute, such as

additional room or bathroom has the same value. However, it seems reasonable to expect that the law of diminishing marginal utility[2] applies and that the value of additional bedrooms or bathrooms declines as more are added to a unit. By altering the specification of the hedonic model, the curvature can be permitted between price and attributes implied by the law of diminishing marginal utility. A common model specification designed to address this issue takes the form:

$$P = \alpha X_1^{\beta 1} X_2^{\beta 2} .... X_n^{\beta n}$$ (Dipasquale and Wheaton 1996, p: 70)

To statistically estimate the parameters of this equation, it is transformed into a linear equation by taking the natural logs of both sides. This yields:

$$\log P = \log \alpha + \beta_1 \log X_1 + \beta_2 \log X_2 + \ \ldots + \beta_n \log X_n$$ (Dipasquale and Wheaton 1996, p: 70)

The coefficients in this model are obtained by estimating a linear regression equation in which the dependent variable is the natural log of price, and the independent variables are the natural log of the original attribute measures. Rather than determining the constant value of an additional unit of each attribute, X_i, the coefficients of this equation represent the elasticity of price with respect to increases in the attribute: the percentage change in the dependent variable that results from a percentage change in the independent variable. (Dipasquale and Wheaton 1996, p: 71) In the equation, for a discrete variable, such as the presence of a garage, instead of dealing with percentage changes, we only think about a house either having or not having this variable. If house has that variable, it is coded with value 2, if it does not, it is coded with 1.

[2] The "Law of Diminishing Marginal Utility" states that for any good or service, the marginal utility of that good or service decreases as the quantity of the good increases, ceteris paribus. In other words, total utility increases more and more slowly as the quantity consumed increases.

By using the equation, it can be explored how households value individual attributes of a housing unit, as well as how they value an entire house with specific set of attributes.

The hedonic pricing method is relatively straightforward and uncontroversial to apply, because it is based on actual market prices and fairly easily measured data. If data are readily available, it can be relatively inexpensive to apply. If data must be gathered and compiled, the cost of an application can increase substantially. In this study, we have a very reliable set of data, which is obtained from appraisal reports of different appraisers.

2.5.2. The Application of the Hedonic Price Model to the Housing Market

In the next chapter empirical studies on hedonic price models of housing prices will be discussed. Before starting to examine previous studies, we will describe some key assumptions that the application of the hedonic price model to the housing market rests on.

First, the housing is assumed as a homogeneous product. This assumption is arguable, as housing products are differentiated in terms of locational, structural or physical and neighborhood attributes as explained in the previous section and also based on other criteria, such as type of dwelling. Therefore, it would be more accurate to view housing as a heterogeneous product. Another assumption is that the market operates under perfect competition, and there are numerous buyers and sellers. Chin and Chau (2003) verified that statement by the existence of many buyers seeking housing in the market and many housing developers that supply the housing. Therefore, no individual buyer or supplier, who are free to enter and exit the market, can significantly affect the price of the properties as the purchases or sales of each housing unit generate a negligible fraction of the market.

The assumption that buyers and sellers have perfect information about housing product and price is reasonable to some degree. Although, it can be still contended that achieving perfect knowledge is impossible, as buying a house involves a substantial capital outlay, potential buyers try to acquire as much information as

possible about the attributes of the units they desire before purchasing (Chin and Chau, 2003: 150). They can find most of the relevant information, such as availability of the housing unit, its attributes and price from newspapers, brokers and real estate agents. For the suppliers, the perfect knowledge of their core business and the market price is necessary to increase their profits and utility, but in practice, such perfect information may never be realized, mainly due to the fact that housing search could not cover all available units in every district of an urban area.

The last assumption about the hedonic price model is that, it works in market equilibrium, and there are no interrelationships between the implicit prices of attributes. Chin and Chau interpreted this assumption as;

> Market equilibrium is not plausible because there are imperfections in the real world property market. It is idealistic to assume that the price vector will adjust instantaneously to change in either demand or supply at any point in time. The notion that there are no interrelations between the implicit prices of attributes and is also fallacious because it implies that the implicit price of an attribute does not vary throughout all areas and property types. Of course, it is not necessarily true that all attributes will give the same level of utility or identical levels of disutility to all buyers. (Chin and Chau, 2003:151)

Despite these disputable assumptions, the hedonic price model has been deployed extensively in housing market research. As Freeman (1979) mentioned, even if the data is inadequate, variables are measured with error, or the definitions of empirical variables are seldom precise, the hedonic price technique still will be valid for empirical purposes. Because, this approach has its merits. Chin and Chau (2003: 151), explains the main advantage of hedonic price approach as; one only needs to have certain information, such as the price of the property, the composition of housing attributes and a appropriate specification of the functional relationships. By estimating the parameters of the hedonic price function, the marginal attribute prices are obtained.

> It is a straightforward approach because only the coefficients of the estimated hedonic regression are needed to indicate the

> preference structure. No information whatsoever about individual characteristics or personal particulars of either the house buyers or the suppliers are required. (Chin and Chau, 2003: 151)

Residential properties are multidimensional commodities characterized by durability, structural inflexibility, and spatial fixity. As it is mentioned in the previous section, housing attributes are classified into locational attributes, structural attributes and neighborhood attributes. The market prices of properties can be expressed as a function of these variables. The implicit price of each housing attribute can be derived from the regression coefficients. Thereby, the hedonic price approach allows us to estimate the individual effects of each housing attribute on housing prices, holding all other factors constant.

Hedonic pricing technique has been widely applied to the analysis of housing markets as referring to efforts to understand the relative importance of various attributes of a particular commodity and to associate those attributes with the market price of the commodity.

> A hedonic equation for single-family homes relates some market value estimate (the owner's estimate, a real estate appraiser's estimate, a tax assessor's estimate, or, if the property was recently sold, the transaction price) to the property's characteristics (square feet of living space, lot size, dwelling age, whether the property has a swimming pool, variables measuring proximity to transportation arteries, variables measuring the quality of public services, etc.) (Goodman and Thibodeau 1995: 25)

CHAPTER 3

EMPIRICAL STUDIES ON HEDONIC PRICE MODELS OF HOUSING PRICES

3.1. Review of Literature on the Determinants of Housing Prices

The hedonic price model is widely used in the studies about urban housing markets because of the heterogeneity of housing products. In this chapter, some of these studies will be discussed. In all the studies that will be examined, the hedonic price model is used in order to analyze the determinants of housing prices; while some of them try to find out the contribution of a specific attribute in the housing price, some of them aim to display implicit prices of different housing characteristics. At first, some studies will be mentioned very briefly, in order to show variety, then two studies will be examined in detail.

The hedonic price approach is applied in residential properties for the first time in 1967, by Ridker and Henning (Chin and Chau, 2003: 151). The aim of their study was to analyze the relationship between air quality and property values. But it was Freeman, who gave the first theoretical justification for the application of this technique to housing, in 1979 (Freeman, 1979). He used the hedonic price equation to measure the marginal implicit prices and the willingness to pay for housing attributes, such as environmental quality.

In 1981, Jud and Watts worked on schools and housing value and found out that the racial composition of a school had little effect on housing prices (Jud and Watts, 1981). In 1990, Dubin and Sung aimed to explore the nature of household preferences for neighborhood characteristics and the results showed that race and

socio-economic status of neighborhood were important determinants of neighborhood quality (Dubin and Sung, 1990). Another interesting attempt came from Palmquist, in 1992. He tried to display effects of a specific localized externality, highway noise (Palmquist, 1992). Do, Wilbur and Short examined the externalities of neighborhood churches on housing values, in 1994 (Do, Wilbur and Short, 1994). Clapp and Giaccotto, modeled the age coefficient within a rational expectations framework in which, the age coefficient measured depreciation plus expectations about the present value of the future returns to homeownership, in 1998 (Clapp and Giaccotto, 1998). And, in 1999, Chattopadhyay, applied a structural estimation approach involving two-stage hedonic estimation to a large household-level data set to derive new estimates of willingness to pay for air quality, in Chicago (Chattapadhyay, 1999).

As the above overviews show, there are various studies about determinants of housing prices. Although, they differ from each other in terms of aims and variables that were used, in all of them hedonic price approach is used. Below, two studies will be examined in detail. In the former one, a kind of a log-linear function was used with a detailed variable set; in the second one a linear function was used. As we will see in the next chapter, in this study we applied both linear and log-linear functional forms, so these set a good example for us.

The first study is a hedonic price model that is applied to find out the value of 'view' amenity in single-family residential real estate market. It is undertaken by Earl D. **Benson**, Julia L. **Hansen**, Arthur L. **Schwartz, Jr** and Greg T. **Smersh**, in 1998. Their study field was Bellingham, Washington, a city that includes ocean, lake and mountain views together and allows for differentiation of the view amenity by both type and quality.

The authors first browsed previous studies about the value of view amenities and summarized their findings. In those studies, which are small in number, the type and quality of view were not specified and results were often reported in dollar terms only, which make it difficult to make comparisons across studies. The

common finding of all these studies was the positive impact of the view on the price of housing.

Then they attempted to distinguish between views on the basis of quality and type, so as to compose a more detailed hedonic price model. In order to determine the best functional form, a maximum-likelihood Box-Cox hedonic model was estimated for each year of the data. This model provides a flexible functional form. The Box-Cox transformation of a variable z is written as $z^{(\lambda)}$ and is defined as;

$$z^{(\lambda)} \equiv \frac{z^{\lambda} - 1}{\lambda}$$

The following variant of the Box-Cox model was estimated;

$$y^{(\lambda)} = \alpha + \beta \mathbf{D} + \gamma \mathbf{X}^{(\lambda)} + \varepsilon,$$

where,

y is the dependent variable,

D is a vector of dummy variables,

X is a vector of continuous variables,

β and γ are parameter vectors,

λ is the Box-Cox parameter.

The sample of properties was obtained from a computer data file, which includes information about real estate sales transactions, provided by the Whatcom County Assessor's Office in Bellingham. After getting the sales prices, date of sales, and characteristics describing each property, like year built, year remodeled, square footage and condition of the structure, from that data set, the authors conducted a personal inspection in 1995 of all potential view properties in the sample to obtain the view information. In order to classify each property according to their view quality, the properties were inspected from street level and from above and along

the side where possible. The inspection also included walking onto the property when necessary.

The classification was made depending on the type of view, as ocean, lake or mountain, and depending on the quality of view, which is determined on the basis of degree of obstruction. The view dummy variables are shown in Table 3.1.

Table 3.1. View dummy variables

OCNVIEW1	=	1 if the dwelling has a full (unobstructed) ocean view, otherwise 0
OCNVIEW2	=	1 if the dwelling has a superior partial ocean view (some obstruction by buildings, trees, and so on), otherwise 0
OCNVIEW3	=	1 if the dwelling has a good partial ocean view (significant obstructions), otherwise 0
OCNVIEW4	=	1 if the dwelling has a poor partial ocean view (some water could be seen), otherwise 0
LAKEFRONT	=	1 if the dwelling has a lake view from lakefront property, otherwise 0
LAKEVIEW	=	1 if the dwelling has a lake view from nonlakefront property, otherwise 0
MTNVIEW	=	1 if the dwelling has an unobstructed view of snow-covered mountains, otherwise 0

Source: Benson, Hansen, Schwartz, Smersh, 1998: 60

Definitions of variables other than view and distance are listed in Table 3.2. The average age of the properties was 44 and the mean square footage was 1378. The share of houses with an unobstructed ocean view was 6.4%, with a superior partial ocean view was 1.9%, with a good partial ocean view was 4.2% and with a poor partial ocean view was 6.8%. 0.6% of sales was for lakefront properties, 2.3% was for lake view properties and 0.9% was for mountain view ones.

The results of some tests, which were made to find out the best functional form, showed that it was better to use log-linear functional form. As a second step, they transformed continuous variables by computing natural logs. The coefficients on the continuous variables were estimated elasticities, measuring the percentage change in sales price associated with a 1% change in the property characteristics. For the dummy variables, the percentage impact on sales price was computed as

$100*(e^{\beta} - 1)$, where β is the coefficient value for the particular characteristic. The transformed coefficients for dummy variables in all models are shown in Table 3.3.

Table 3.2. Variable Definitions

AGE	=	the year of sale minus the year built.
ACREAGE	=	A dummy variable equal to 1 if the property includes 1 or more acres, otherwise 0.
REMODEL	=	A dummy variable equal to 1 for houses that were remodeled after 1960, otherwise 0.
QUALITY	=	a vector of four dummy variables based on the assessor's classification value of 1, 2, 3, 4, 5 or 6 depending on the quality of construction of the dwelling, with 1 being the lowest quality and 3 being average quality, (QUAL1 for 1, QUAL2 for 2, QUAL4 for 4, QUAL5 for 5 or 6).
QUALPM	=	a vector of two dummy variables based on the assessor's additional quality classification of a plus or minus to refine the 1 through 6 classification given in QUALITY above QUALM=if the additional quality classification is a minus and QUALP=if the additional quality classification is a plus.
CNDTN	=	a vector of four dummy variables based on the assessor's classification value of 1, 2, 3, 4, 5 or 6 depending on the condition of the dwelling, with 1 being the lowest condition and 3 being average condition, (COND1 for 1, COND2 for 2, COND4 for 4, COND5 for 5 or 6).
ROOF	=	a vector of two dummy variables defined as ROOFCSSB = if the roof is composite, wood shake, wood shingle or buildup and ROOFTILE = if the roof is tile.
HEAT	=	a vector of two dummy variables defined as HEATFA = if the heat is forced air and HEATHWHP = if the heat is hot water or heat pump.
TOTSF	=	total square feet in the dwelling, excluding the basement.
GARAGE	=	A dummy variable equal to 1 if garage square footage exceeds 100, otherwise 0.
FINBASM	=	a dummy variable equal to 1 if finished basement square footage exceeds 50, otherwise 0.
DECK	=	a dummy variable equal to 1 if deck square footage exceeds 100, otherwise 0.

Source: Benson, Hansen, Schwartz, Smersh, 1998: 69

The study included three models. Model 1 is the basic hedonic valuation model with a generic view variable, VIEW, which is a 0-1 dummy variable, included. The value of the variable is 1 if the property had a view and 0 if the property has no view. That model was designed only to make a comparison with previous studies that used a single view dummy variable and showed that in 1993, houses with a view (any view) sold for approximately a 25.9% higher price than those with no view, if all other characteristics are constant.

In the second model, the complete set of view variables, which are shown in Table 3.1 and Table 3.2, was added. Results showed that a full ocean view, superior partial ocean view, good partial ocean view and poor partial ocean view added 58.8%, 30.8%, 29.4% and 8.2% to market price respectively. A lake frontage added 126.7% and a lake view added 18.1% to market price relative to a no-view house. The authors explained the high premium for lake frontage with the fact that such locations provide not only view amenities, but recreational amenities as well. The mountain view also had a positive effect on the prices of houses but not significant. The large variation in estimated view coefficients by type and quality of view denoted that Model 1 was not adequate.

Table. 3.3. Transformed coefficients for dummy variables, 1993

	MODEL 1		MODEL 2		MODEL 3	
Variable	Coefficient	Percent Impact	Coefficient	Percent Impact	Coefficient	Percent Impact
VIEW	0.2301	25.87				
OCNVIEW1			0.4625	58.80		
OCNVIEW2			0.2686	30.81		
OCNVIEW3			0.2578	29.41		
OCNVIEW4			0.0784	8,16		
LAKEFRNT			0.8182	126.64	0.8197	126.99
LAKEVIEW			0.1665	18,11	0.1656	18,01
MTNVIEW			0.0853	8,90	0.0755	7,84
REMODEL	0.0854	8,91	0.0844	8,81	0.0740	7,68
ACREAGE	0.3926	48.09	0.4088	50.49	0.4251	52.97
QUAL1	- 0.2836	- 24.69	- 0.2453	- 21.76	- 0.2410	- 21.42
QUAL2	- 0.1017	- 9,67	- 0.0867	- 8,30	- 0.0905	- 8,65
QUAL4	0.2709	31.11	0.2330	26.24	0.2305	25.93
QUAL5	0.0898	9,39	- 0.1502	- 13.94	0.0002	0.02
QUALM	- 0.0695	- 6,71	- 0.0692	- 6,68	- 0.0739	- 7,12
QUALP	0.0286	2,90	0.0160	1,61	0.0136	1,37
COND1	- 0.1671	- 15.39	- 0.1591	- 14.71	- 0.1661	- 15.30
COND2	- 0.0864	- 8,28	- 0.0840	- 8,05	- 0.0817	- 7,84
COND4	0.0530	5,44	0.0508	5,22	0.0547	5,63
COND5	- 0.0190	- 1,88	- 0.0004	- 0.04	0.0192	1,93
HEATFA	0.0402	4,10	0.0331	3,36	0.0221	2,24
HEATHWHP	0.1359	14.56	0.1004	10,56	0.0859	8,97
ROOFCSSB	0.1016	10,69	0.1182	12,55	0.1108	11,72
ROOFTILE	0.1367	14.65	0.2014	22.31	0.1892	20.83
GARAGE	0.0215	2,17	0.0340	3,46	0.0370	3,77
FINBASM	0.1934	21.34	0.1484	16.00	0.1452	15.63
DECK	0.0577	5,94	0.0436	4,45	0.0461	4,72

Source: Benson, Hansen, Schwartz, Smersh, 1998: 64

In Model 3, the impact of a view was measured by a combination of the coefficient on view and the coefficient on the interactive distance variable. The underlying hypothesis for that model was the more distant the view, the smaller the view premium, holding the quality of the view constant. The results showed that distance had a negative effect on the premiums of views; in other words, greater distance lowered the value of a view.

The signs of other variables were as expected. All the results of three models, coefficients, signs and percentage of impacts are displayed in Table 3.3.

Although this study aimed to observe the value of one specific variable, view, it is a useful example for us, showing the importance and effectiveness of using variables in detail and using log-linear functional form in the hedonic model.

The second study we will describe in detail is a hedonic price analysis of urban housing for Hangzhou City, in China. It is prepared by **Wen Hai-zhen**, **Jia Sheng-hua** and **Guo Xiao-yu** from Zhejiang University, in 2005.

The main goals of this study are to display the relation between housing characteristics and housing price, to estimate the implicit prices of housing characteristics, and to analyze the supply and demand characteristics of the housing market by setting up a hedonic price model for Hangzhou City.

In this study, the five old districts, which are all in the urban area of Hangzhou City, were taken as the research districts. The research objects were the multi-storey housing and litter-tall-storey housing (>7 storeys). The model was tested with 2473 housing samples and field survey data of 290 housing communities (Wen, Jia, Guo 2005: 907, 910). 18 housing characteristics were chosen as independent variables. Among them, seven were structural characteristics, seven were neighborhood characteristics, three were locational characteristics and one of them was transaction time, which was used to measure how housing price changes

along with time. The measure methods and expected signs of these housing characteristic variables are shown in Table.3.4.

Among three kinds of functions, linear, logarithm and logarithm-linear, which are frequently used in hedonic price model, linear function was chosen as the one that meet the requirements of this research. The relationship between housing characteristics and housing price was expressed as;

$$P = \alpha_0 + \Sigma\, \alpha_i Z_i + \varepsilon \qquad (i = 1 \sim 18)$$

Where;

α_i = under-decided coefficients (as the independent variables and dependent variable are in the linear model, regression coefficients α_i in the corresponding hedonic prices are constant)

Z_i = relevant housing characteristics,

ε = random error

Table.3.4. Measure methods and signs of housing characteristic variables

Characterist. Class	Variable	Variable meanings and measure methods	Sign
Structure characteristic	Floor area	Total floor area of one housing (square meter)	+
	Housing age	Housing age (Year, the age of housing built in 2003 is 1)	-
	Orientation	Dummy variables: south-north is scored 1, other is 0	+
	Decoration degree	Divided into 5 degrees: no decoration (scored 1), simple decoration (scored 2), medium decoration (scored 3), high-level decoration (scored 4), exquisite decoration (scored 5)	+
	Housing storeys	Number of the storey	?
	Garage	Dummy variables: having garage os parking space is scored 1, or else is 0	+
	Attic	Dummy variables: having attic is scored 1, or else is 0	+
Neighborhood characteristic	Environment	The environmental quality around the community is divided in to 5 degrees: quite bad (scored 1), bad (scored 2), common (scored 3), good (scored 4), very good (scored 5)	+
	Inner environment	The environmental quality inside the community is divided into 5 degrees: quite bad (scored 1), bad (scored 2), common (scored 3), good (scored 4), very good (scored 5)	+
	Community management	The service quality around the community management is divided into 5 degrees: quite bad (scored 1), bad (scored 2), common (scored 3), good (scored 4), very good (scored 5)	+
	University nearby	Dummy variables: college or university within 1000 m. is evaluated 1, or else is 0	+
	Life establishment	Supermarket, terminal market, bank, post office, hospital within 1000 meters from the community, each items scored 1, total is 3	+
	Education establishment	Kindergarten, elementary school and middle school within 1000 meters from the community, each item is scored 1, total is 3	+
	Entertainment facility	Natatorium, body-healthy facility, basketball court, tennis court, entertainment stage for the elderly residents inside the community,each item is scored 1, total is 5	+
Locational characteristic	Distance to CBD	The linear distance from the community to the Central Business District (CBD) of Hangzhou (km)	-
	Distance to West Lake	The linear distance from the community to West Lake (km)	-
	Traffic condition	The total number of the bus routes within 500 meters of the community	+
Other characteristic	Transaction time	Transaction time of the housing sample, expressed in month, from 1 to 7	+

Source: Wen, Jia, Guo 2005: 910

The estimation method of the model was the ordinary least squares (OLS). The multiple-regression was obtained by SPSS10.0 software, and the law of "Enter" was chosen as the analytical method. The index of VIF (variance inflation factor) was used to monitor the multi-collinearity between independent variables (Wen, Jia, Guo 2005: 910).

R^2 of the model was 0.852, adjusted R^2 was 0.851, the *D-W* (Durbin-Watson) value was 1.991, and all these values indicated that the fitness of the model was high. The *F* value was 787.431 and p-value was 0.000, which indicated that the fitness of samples data to the model was statistically meaningful and the regression equation was effective (Wen, Jia, Guo 2005: 910).

The significance level of *t* test of most coefficients was smaller than 10% (Table 3.5), which indicated the corresponding coefficient had significance influence, and *VIF* values of all variables indicated that the multicollinearity degree between the independent variables was not serious.

Housing age, orientation state, life establishment and education establishment had significance level greater that 10%. These four coefficients were not different from zero statistically, i.e., they did not enter into this model. The signs of all the variables, except 'university nearby' variable, were as expected and shown in Table 3.6. Floor area, decoration degree, housing storey, garage attic, environment, inner environment, community management, entertainment facility, traffic conditions and transaction time had positive influence, whereas the distance to CBD and West Lake had negative influence on housing price. The only variable with unexpected sign, showed that in Hangzhou city, universities had negative influence on price of housing.

Table.3.5. Regression coefficients

	Unstandardized coefficients		Standardized coefficients	*T*-value	*VIF*
	B	Std. error	*Beta*		
Constant	−15.082	3.010		−5.011***	
Z_1	0.594	0.008	0.833	72.664***	2.186
Z_2	−3.324E-03	0.005	−0.006	−0.713	1.012
Z_3	0.269	0.080	0.029	3.379***	1.222
Z_4	6.101	1.060	0.048	5.758***	1.179
Z_5	5.528	1.293	0.036	4.275***	1.159
Z_6	−1.166	1.098	−0.008	−1.062	1.023
Z_7	1.212	0.214	0.046	5.656***	1.096
Z_8	1.758	0.381	0.041	4.611***	1.296
Z_9	1.963	0.426	0.067	4.612***	3.508
Z_{10}	0.924	0.339	0.044	2.728***	4.304
Z_{11}	−1.328	0.680	−0.016	−1.953*	1.094
Z_{12}	−7.689E-02	0.452	−0.002	−0.170	1.459
Z_{13}	0.626	0.478	0.013	1.310	1.654
Z_{14}	1.613	0.838	0.020	1.924*	1.794
Z_{15}	−1.122	0.289	−0.059	−3.877***	3.803
Z_{16}	−3.624	0.302	−0.154	−12.020***	2.747
Z_{17}	0.506	0.084	0.056	6.015***	1.420
Z_{18}	0.520	0.183	0.022	2.835***	1.014

* significant level was10%; ** significant level was 5%; *** significant level was 1%

Source: Wen, Jia, Guo 2005: 910

The hedonic price of each characteristic is shown in Table 3.6. The hedonic prices mean the price for one unit change in variables. In other words, it is the price for one square meter if we are talking about floor area. In the price of the standard housing, which is the housing with numerical value of every characteristic equaling to the mean value of the whole market, the contribution rate of architecture or structure characteristics was 60%, neighborhood characteristics was 16,5%, locational characteristics was 19,8% and the other characteristics, transaction time in that study, was 2,7%.

Table 3.6. Hedonic price of housing characteristics

Characteristics class	Variable	Hedonic price	Standard housing		
			Mean value of variable	Total characteristic value	Contribution ratio
Structure characteristic	Floor area	0.594	93.86	55.753	55.4%
	Housing storeys	0.269	4.9634	1.335	1.3%
	Garage	6.101	7.97E-02	0.486	0.5%
	Attic	5.528	4.21E-02	0.232	0.2%
	Decoration degree	1.212	2.144	2.599	2.6%
	Total				60.0%
Neighborhood characteristic	Environment	1.758	3.6247	6.372	6.3%
	Inner environment	1.963	3.5677	7.003	7.0%
	Community management	0.924	2.7222	2.515	2.5%
	University nearby	−1.328	0.2087	−0.277	0.3%
	Entertainment facility	1.613	2.2321	0.374	0.4%
	Total				16.5%
Location characteristic	Distance to CBD	−1.122	3.8273	−4.294	4.3%
	Distance to West Lake	−3.624	3.6613	−13.269	13.2%
	Traffic condition	0.506	6.7744	3.428	3.4%
	Total				19.8%
Other characteristic	Transaction time	0.520	5.243	2.726	2.7%
	Total				2.7%
	Total				100%

Source: Wen, Jia, Guo 2005: 911

The authors of the study summarized the deficiencies of their model as not considering the sub-markets and using a function form, which gives the average hedonic price of the housing characteristics on the whole.

It is a successful model and sets a precedent for our study with its aim, variables and the method that is used.

3.2. Review of Literature on the Determinants of Housing Prices & Office Rents in Turkey

The studies, which were explained in the previous section, were all the examples of empirical studies related to hedonic price analysis for housing prices from other countries. In this section, studies from Turkish literature will be discussed. There is very limited number of studies about Turkey in that area; on the other hand we have an advantage of having different approaches in the studies. As all of them touch the subject from different point of views, they can be evaluated as variant but also related parts of a picture.

All the studies that will be examined are about determinants of housing/office prices in Turkey. The studies will be discussed in two sections; first one includes studies that estimate determinants of housing/office prices in Turkey by using hedonic price analysis method, and the second section covers a study about determinant of housing prices in Turkey at macroeconomic level.

3.2.1 The Determination of Housing Prices in Turkey with Hedonic Approach

In this section two studies about determinants of housing/office prices in Ankara will be discussed. The first study is prepared by Türel (1981) and examined the spatial differentiation of housing prices in Ankara, second study is a Master's Thesis which is prepared by Ustaoğlu (2003) on hedonic price analysis of office rents in Ankara. In both studies, hedonic price analysis is used. These studies provide valuable bases for the analysis in this thesis using the data for Ankara as well as the same analysis methods.

Türel's (1981) study, 'Spatial Differentiation of Housing Prices in Ankara', is important as being the first study on housing price determinants in Turkey.

In Türel's study, before the case study, specific features of urban housing markets in developing countries and Turkey is discussed. The implications of disequilibrium in the labour and housing markets on the production and consumption of housing is evaluated, and it is shown that under these conditions price of housing will increase in time with the growth of housing stock. (Türel, 1981: 108)

In the second part of the study, prices of housing attributes are estimated for the authorized housing stock in Ankara. To reach these results, 'the technique of hedonic price index' is used. In that technique, a good, which has different attributes that can be determined, can be expressed as basic characteristics that is obtained by assembling these attributes into groups. The price of that good is

expected to be equal to the sum of prices of its characteristics. In this regard, housing can be defined as a vector of basic attributes:

$$X = (X_1, X_2, \ldots\ldots, X_n) ,$$

Where

X_i = the amount of *i* attribute in each dwelling unit

Same as, the price of a dwelling unit can be expressed as a vector of prices of attributes:

$$P(X) = P (X_1, X_2, \ldots\ldots, X_n) ,$$

Where

P(X) = the price of the dwelling unit

$P(X_i)$ = the price of *i* attribute

Using this formula, the unit price of each attribute can be calculated as $P(X_i)/ X_i$, and the result equals to the marginal cost of the attribute in a market that is in equilibrium.

In the light of this information, Türel first estimated the prices for the whole city. In this way, it is intended to determine the basic characteristics that form the price of a dwelling unit. At the same time, this helps to determine the sub-areas by using variables about environmental factors. In the second stage, after designating the boundaries of sub-areas, prices for dwelling unit attributes are estimated for each sub-area.

His hedonic rent model, which is estimated by employing the cross section data collected in 1969-1970, can be specified as;

$$R_i = R(X_{1i}, X_{2i},\ldots\ldots, X_{ni})$$

Where

The dependent variable R_i = the annual rent of the i^{th} housing unit

And, the independent variables X_i consist of;

- Physical characteristics of the building (area of garden, existence of central heating system, hot running water and elevator, building's age, whether the building is new or not, whether the building is one or two storey),
- Physical characteristics of the housing unit (number of rooms, gross floor area, unit's vertical location within the building-whether it is a basement floor or a ground floor),
- Lease characteristics (whether the leaseholder is new or residing in the dwelling unit longer than three years)
- Locational characteristics (straight line distance to the CBD (Central Business District), straight line distance to the employment nodes),
- Characteristics of the sub-areas (air pollution, education quality, total public services (in m^2) per person, percentage of people in managerial-professional occupation residing in the sub-area).

The metropolitan area of Ankara is divided into two areas with reference to the railway as the south and the north. Each part is also divided into four sub-areas. In other words, the whole area is divided into eight sub-areas in order to capture the rental price variations, which is assumed to perform a spatial variation in the housing market in Ankara. To determine the straight line to the CBD, Kızılay is assumed as the CBD for the southern sub-areas, and Ulus is assumed as the CBD for the northern sub-areas. Air pollution variable represents the percentage of families who complain about air pollution in the sub-area. Percentage of families who are satisfied with the education provided by schools situated in the sub-area is used as a measure of the education quality.

The hedonic rent model is estimated in four stages by using linear functional form. In the first stage, four sets of equations are estimated. The variables representing the characteristics of the sub-areas are excluded from these

equations. Some variables including gross floor area, building's age and straight line distance to the employment nodes are dropped from the model since they are correlated with the other included variables. (Ustaoğlu, 2003: 39)

In the second stage, characteristics of the sub-areas are included in the model and three sets of equations are estimated. Variables of education quality and total public services per person are found to be statistically insignificant. The air pollution variable is significant, though it has a positive relation with prices. This indicates a direct relationship between rental prices and air pollution levels. He explains this result by claiming that air pollution level is higher in the centrally located neighborhoods because of the existence of high building densities in those areas. In other words, high air pollution level represents central locations where building rents are also high, because of externalities like locational advantages to the CBD.

The other attributes have expected signs. Basement floor, one or two storey buildings, existing tenant and distance to the CBD have negative signs. Central heating system, hot running water, land area, number of rooms, new building and percentage of managerial-professional groups residing in the sub-area have positive signs.

Rental price variations across different sub-areas are observed from the equation. From this equation, the variables representing the three sub-areas located in the northern region are found to be insignificant indicating that rental prices of the houses located in the northern region do not vary compared with the houses located in Ulus. (Ustaoğlu, 2003: 40) On the other hand, the variables representing the four sub-areas located in the southern region are significant. Consequently, it is inferred that houses located in the southern region are heterogeneously distributed compared with the houses located in northern region.

One more equation is estimated for each region, in order to observe the hedonic price variations between the northern and the southern regions. The variables of

elevator and hot running water are excluded from the equation of the northern region because of their insignificance in that region. Same as, the variable including one or two storey buildings have an insignificant coefficient in the equation estimated for southern region. In both equations, distance to the CBD has an insignificant coefficient, although its coefficient is significant in the equations estimated for the whole Ankara. Türel explains this result in two different ways; the housing stock located in each region is homogeneous compared with the housing stock in the whole area or the distance to the CBD variable acts as a proxy for the non-included variables in the model estimated for the whole city. The coefficients of the other variables confirmed that there are significant differences in the hedonic prices estimated for the two regions of the city.

Finally, equation is estimated for each of the eight sub-areas. Locational characteristics and characteristics of sub-areas are excluded from the model. It is stated that the spatial price differentiation of housing prices is especially realized in the prices of central heating system and number of rooms. The results are also evaluated as a confirmation of the fact that prices of housing attributes show spatial variation. According to him, this variation is related to the locational concentration of high-income groups and the externalities come from locational advantages and environmental conditions.

The absence of continuous price surfaces with respect to distance from the city center, and discrete variation of prices along certain neighborhood boundaries imply that the choice of residential location cannot be formulated as a continuous function of distance from the city center. (Türel, 1981: 108)

The second study is master thesis prepared by **Ustaoğlu (2003)** about determinants of housing prices in Ankara. Ustaoğlu, tries to fill a gap by working on commercial property, which has been subject to very limited studies compared with residential property. In this study, the variations in office rents in Ankara, is analyzed. The theoretical background is related to the hedonic methodology,

which is extensively applied for explaining price or rental price variations of the real property. (Ustaoğlu, 2003: iii)

Firstly, theoretical framework is built with principal determinants of rental value of the office property, which is grouped into three, as; physical characteristics, locational characteristics and lease characteristics, and with hedonic price analysis. Secondly, empirical studies on hedonic price models are mentioned as two sections; one is for studies from the World literature, and the other is for studies from the Turkish literature. Thirdly, hedonic model is implemented in order to identify the significant determinants of rental value for the office property in Ankara.

Given this theoretical framework, hedonic regression model is utilized for the estimation of hedonic price indices by using the cross sectional data of the office market in Ankara for 2002. The data that is used in analysis is obtained from a detailed questionnaire. It included 32 questions and has been conducted in 16 neighborhoods, which are densely populated by office buildings. The hedonic price model that is used in this study is constructed based on the hedonic theory specified by Rosen.

Hedonic price function is specified in the log linear functional form;

$$\text{InRENT}_i\,(Z,D) = \alpha_0 + \sum_{k=1}^{n} \alpha_k \ln Z_{ki} + \sum_{j=1}^{m} \beta_j D_{ji} + \varepsilon_i \,,\ i = 1,\ldots..,N$$

Where

InRENT_i = the natural log of net actual monthly rent per square meter of the i^{th} office unit,

α_0 = the constant

α_k , β_j = the regression coefficients,

$\ln Z_{ki}$ = natural log of the quantitative explanatory variables,

D_{ji} = the qualitative explanatory variables specified as 0-1 dummies,

ε_i = the error term, N = the sample size.

The hedonic price function is estimated with the Ordinary Least Squares technique for two models and the estimation process is carried out by using SPSS 11.0 and Microfit 4.0 softwares. Two models include same variables, except the locational variables. These are included only in Model 1. The two models, which are constructed in order to compare the effect of the use of locational characteristics with the use of their proxies, are specified in general terms as;

MODEL 1: R = f (Locational Characteristics, Lease Characteristics, Physical Characteristics)
MODEL 2: R = f (Lease Characteristics, Physical Characteristics)
Where

R = the rental price of the office unit per square meter

The estimation results obtained from the models suggest that the height and the construction quality of the building act as proxies for the locational characteristic. Also, it is found from Model 1 that locational characteristics have the greatest effect on the rental prices of the office units. In order to verify this fact, Model 1 is tested against Model 2 and vice versa based on alternative tests for non-nested models. The results of non-nested tests indicate that Model 1 is preferred to Model 2. This result is important in the sense that locational characteristics are found to be significant in explaining the rental price variations. Besides locational variables, the other variables related to physical attributes and lease characteristics of the office property are also evaluated from the estimation results of Model 1. From the empirical results, it is finally concluded that locational characteristics explain the spatial rent variations of office property in Ankara to a large extent.

3.2.2. Determinants of Housing Prices in Turkey at Macroeconomic Level

Hasekioğlu (1996), studied on determinants of housing prices and focused on the factors, which affect the asset prices of housing at macroeconomic level. The aim of her model is to determine the real asset price of housing out of the variables of income, housing stock, housing credits and real interest rates. She explains the

main point that differentiates her model from others as not determining housing investment through the classical housing market i.e. demand and/or supply. Instead, it is the real asset price that is determined reflecting all the dimensions of housing investment in a complete theoretical framework. (Hasekioğlu, 1996: iii)

She claims that, in her model, housing investments are evaluated in a way, which reflects all the dimensions of the problem in a single equation system and besides; an efficient estimation technique is used referring to the latest Turkey data.

The study's theoretical base that lies under the asset market is the "Wealth Holder's Portfolio" in which demand desicion is based on wealth and the return on housing capital reative to returns from alternative competing asset. (Hasekioğlu, 1996: iii) The model is estimated from Turkish annual data over the 1968-1994 period with an efficient estimation technique named as "cointegration". The final structure of the model has mostly affected from articles of Kearl-1979 and KEKSKOD-1996, in terms of determination of dependent variables and the mechanism.

There are two stages in the mechanism of the model; stage I- having the asset market and stage II- having the inflation induced asset market in which it is distorted through the effects of inflation. (Hasekioğlu, 1996: 84)

The model is based on the equilibrium in which demand and supply prices of the housing are equal. The demand and supply functions for the housing stock, are specified as;

$$PH(rm) = R/rm,$$

$$Hd = [PH(rm), P, Yp, hh],$$

$$Phs = \Gamma (hs,c),$$

Where

PH = asset price of housing,

R = price of services (rent),

rm = real interest rates of deposits having one year maturity,

P = price index (consumption),

Yp = disposable income,

hh = vector of household characteristics,

Phs = supply price of housing,

hs = flow of housing investment,

c = vector of costs faced by the residential construction industry.

Equilibrium is determined by the equality of demand and supply prices for the flow of new housing units, as;

$$PH = Phs.$$

Where

PH = asset price of housing,

Phs = supply price of housing,

The implicit form of the model is;

$$PH/P = f (K, rm, KH\text{-}1/hh, Yp),$$

Where

P = price index (consumption),

K = housing credits,

rm = real interest rates of deposits having one year maturity,

KH -1/hh = housing of the previous year per household.

hh = vector of household characteristics,

Yp = disposable income,

There are two estimations in the model; in the first one, the dependent variable is derived from the rent index of Turkey and in the second estimation, an asset price index statistic is derived from the formula:

$$PA = R/(i-h),$$

Where

PA = real asset price index of housing,

R = rent,

i = interest rate,

h = rate of change in rent.

The two stages of the model can be written as;

$$\Delta LPAR = \alpha_0 \Delta LX + \alpha_1 \Delta LOCCP + \alpha_2 \Delta LRKREDI + \alpha_3 LRR + u$$

$$\Delta LRPAY = \beta_0 \Delta LX + \beta_1 \Delta LOCCP + \beta_2 \Delta LRKREDI + \beta_3 LRR + v$$

Where

Δ LPAR = difference of the logarithm of the real asset price referring to rent index data,

Δ LRPAY = difference of the logarithm of the real asset price referring to derived asset price index data,

ΔLX = difference of the logarithm of GNP per capita,

ΔLOCCP = difference of the logarithm of the total area of housing according to occupancy permits,

ΔLRKREDI = difference of the logarithm of cumulative annual real estate credits,

LRR = logarithm of the real interest rate,

u, v = disturbance terms.

α , β = coefficients of variables

In the study, housing credits are stressed instead of mortgage finance systems, because of the importance of credits in Turkish system.

As it is mentioned before, the model is based on the equilibrium, which is determined by the equality of demand and supply prices of the housing. To reach the equilibrium in the system, the asset price of housing adjusts such a way as to induce wealth holders to willingly hold the existing fixed stock of housing in their asset portfolios.

The estimated results show that; real asset price of housing is sensitive to changes in income, there is an inverse relationship between the real asset price of housing and the housing stock at the previous period per household, real asset price of housing and housing credits are positively related and the real asset price of housing is negatively related with interest rate variable. This last result confirms the hypothesis that increase in real interest rates causes an increase in the demand for alternative assets rather than housing, which results in lower asset price of housing. All of the results have been expected.

CHAPTER 4

HEDONIC PRICE INDEX FOR THE ANALYSIS OF HOUSING PRICES IN ANKARA

4.1. Development of Ankara and Its Residential Districts

In Turkey, urban development process and at the same time housing issues have different characteristics from developed countries. Şenyel (2006: 51) summarizes these differences in three parts; the first one is having the whole transformation process within a relatively short period of time, when compared to developed countries. Secondly, in Turkey urban planning was developed as an aspiration to the modern world, whereas in developed countries it emerged as a reaction to the negative outcomes of industrialization. This is also a consequence of the late beginning of Turkey's industrialization process. Thirdly, urban fringe, which is occupied by the high and middle-income groups in developed countries, was initially occupied by the low-income migrants in Turkey.

Urbanization level in Turkey reached to 71 % in 2000, whereas it was 33 % in 1960 and 24 % in 1927 (Yüceşahin, Bayar, Özgür, 2004). Urbanization rapidly spread from western sides of the country to central and southern sides from 1927 to 2000. Urbanization process of Turkey is continuing in its own dynamics, which is mostly shaped by the economic development of the country and political interventions. Problems about housing finance, unauthorized housing, lack of services, population movements and increasing densities have been always on the agenda since the beginning years of the transformation.

As being the capital city, Ankara was affected from political, social and economical changes in Turkey almost in the same way with other cities, and has mirrored the urban transformation process of the country. The urbanization process of Ankara, is generally explained in five major stages; The Early Republican Period, the Period of Jansen Plan, the Period of Yücel-Uybadin Plan, the Period of Ankara Metropolitan Plan Bureau and the period of the Greater Ankara Municipality.

The most significant event of the early Republican Period for Ankara, was the declaration of the city as the capital. Tekeli (2000: 317) named this, as being an example of a reconstitution of a capital city, as the most significant change experienced in urban sphere. Great attention was paid to the restructuring of the city while emphasizing the revolutionary and modern ideals of the new regime, such as strengthening of the nation-state and creating modern citizens. It can be asserted that Turkish urbanization starts with Ankara (Tankut 2000: 301).

Urban population began to rise gradually due to the increasing birth rates and migration from rural areas and other cities, which were caused by new job opportunities that were provided by the new capital.

The only step about urban planning was the execution of Municipal, Public Sanitation and Building and Roads Law (Belediye, Umumi Hıfzısıhha ve Yapı ve Yollar Kanunu) Until the 1930s, city was planned partially (Şenyel 2006: 80). As the need for a comprehensive plan was noticed, a restricted entry planning competition was arranged in 1927, and the plan of a German planner, Herman Jansen, was selected as the plan of the capital, in 1928.

The plan prepared for 300.000 inhabitants for the projected 50 years, and its priorities were sensitivity for natural environment, considering aesthetics and economic conditions and obtaining low-density residential areas. However, the plan couldn’t respond to rapid growth of the city. Urban population exceeded

what had been projected for the fifty years in just twenty years time, while the unexpected growth resulted in land speculation (Şenyel 2006: 82).

In these years, unauthorized housing, which was going to bedevil for the city for years, began to increase. On the other hand, some attempts also were made about the authorized housing supply in order to meet housing need. One of them was Bahçelievler Housing Cooperative, which was founded in 1935 as the first housing cooperative in Turkey.

After the Second World War, Turkey faced the outcomes of the war, and was affected significantly, although it had not participated in it. Before 1950, it was already understood that the Jansen Plan was no more sufficient for Ankara because of its rapidly growing population. So, it was decided to arrange another planning competition in 1955. Yücel-Uybadin Plan was the winner. Unfortunately, it was worse in population projection than the Jansen Plan, the projected number of inhabitants for the year 2000 exceeded the limit of 750.000 soon before 1965. According to Bademli, the plan was born dead, in a sense (Bademli 1986: 107). Those were the years that the migration from rural to urban areas continued. The technological improvements, which mean less need for labor power in agricultural areas and new job opportunities in urban areas, were the engine power for those migration movements.

In 1965, the Condominium Law (Kat Mülkiyeti Kanunu, 634) was enacted. Due to the effects of the Law, number of stories of buildings in urban areas increased rapidly and low-rise housing stock were replaced by high-rise apartments within a short period of time (Şenyel 2006: 57). This law stimulated housing production by small capital builders (Bıçkıcıoğlu 1987:31). In a few years time, these house builders called as ‘yap-satçı’ have become dominant in housing production.

Another important law that affected urban structure was Gecekondu Law (775), which was enacted in 1966. The aims were upgrading the existing unauthorized housing areas or clearing those that upgrading is not possible and preventing the

future squatter developments by creating 'Gecekondu Prevention Areas' (Şenyel 2006: 58).

In Ankara, there was a Master Plan on the agenda, which was prepared by Ankara Metropolitan Plan Bureau and approved in 1982. This structure plan, Ankara 1990 Metropolitan Plan, offered corridor type development spreading of the city. It was trying to bring solutions for high-density settlements, concentrations on specific locations and lack of services. The plan proposed a city development towards the western direction and Sincan, Fatih, Batıkent, Eryaman, Çayyolu, Koru Sitesi and Konutkent were the new neighborhoods that were created in accordance to the plan.

After 1970s, mass housing developments supported urban decentralization of Ankara. Those large scale projects were mostly located 10 –15 km. away from the city center, and let the city expand in the planned way. Most of them were undertaken by non-profit housing cooperatives. Batıkent, Eryaman and Or-An projects are some examples of mass housing developments of those years. Both the Batıkent Project, which aimed to provide low-cost housing in a well planned and controlled way, and the Eryaman Project were initiated by non-profit housing cooperatives and the Housing Develoment Administration (TOKİ). Both were located at the northwest of Ankara and both involved high-rise and low-rise housing units in the same project area. Both of the projects made a great contribution to the development of north-western corridor while providing low-cost housing particularly to the middle income households (Şenyel 2006: 93). On the other hand, Or-An Project was the example of first private mass housing project in Turkey. Having planned in 1970's as a new self-sufficient settlement outside the city center, a new lifestyle was offered by resolving technical and design problems (Tuna Ultav, Sahil, 2004: 247). As the project area, the southern part of Ankara was chosen. Or-An project is important since it reflects the initial tendency of private sector to invest high-rise developments at the remote areas from the center (Şenyel 2006: 96). Today, both Batıkent and Or-An are considered as setlement on the fringe.

After the elections in 1984, some new regulations were introduced, and three important laws were enacted; the 2nd Mass Housing Law (2985), Urban Physical Development Law (3194) and the Law of Greater Municipalities (3030). Greater Ankara Municipality was established according to Law 3030 and empowered with plan making responsibilities. It was determined to direct housing development through two major paths: mass housing projects on new development areas at the fringe and urban redevelopment projects on declining residential areas at the urban center (Şenyel 2006: 96).

The southwestern part of Ankara was preferred for new housing investments, and consequently Çayyolu, Konutkent and Ümitköy started to evolve as residential areas. On the other hand, northern and northeastern parts of the city, particularly Mamak, Keçiören and Ulus had been invaded by unauthorized housing. The socio-economic segregation throughout the city, which is apparent even today, started to arise in those years. The northern and northeast parts are occupied by middle-income and low-income groups, whereas southern and southwestern parts mainly preferred by high-income groups. The expansion of the capital through southwest and south was mainly in the form of housing estates, most of which were built by housing cooperatives.

Through the second path of housing development, urban redevelopment projects were implemented at the beginning of the 1990s. Some of them were Dikmen Vadisi Project, Portakal Çiçeği Vadisi Project and Doğukent Southeastern Ankara Development Project. Şenyel, summarized the aim of these projects as; "to sweep away *gecekondu* areas and control the urban development pattern within the city, while providing livable residential estates equipped with infrastructure facilities and better urban services" (Şenyel 2006: 103). The projects that were implemented in Çankaya, not only met the expectations, but also became attraction points for high-income groups as residential areas and for the house builders as profitable opportunities for new investments.

In the 1990s, while the expansion of urban development in the southwestern part of the city was continuing, some villages, such as İncek, Alacaatlı and Dodurga also met this urbanization process. These newly devoloping areas addressed high-income groups.

In the 2000s, urban expansion in the southeastern corridor of Ankara continued. Nearly all of the new projects that located in this part of the city included low-rise and high-rise housing together.

The increase in the number of residential buildings and dwellings is shown in the Table 4.1. This increase is related with the population change in the urban area of Ankara, which reached to 3540522 in 2000, while being 2836802 in 1990 (SIS, www.die.gov.tr/nufus-sayimi/2000tablo3.xls).

Table 4.1. The increase in the number of residential buildings and dwellings between 1984 and 2000, in Ankara

	Number of Residential Buildings	Number of Dwellings
1984	203984	561973
2000	304837	986865
Ratio of Increase	49%	76%

Source: Şenyel 2006: 106, cited in SIS

The results of the interview survey that was undertaken by the SIS in 1999 for the Housing Development Administration show some of the features of housing in Ankara. The number of households by the type of building including the dwelling unit is shown in Figure 4.1. 70% of households are living in apartment dwellings and 14% of households residing in housing estates (Figure 4.1). The ownership status of the dwelling unit is displayed in the Figure 4.2. It is seen that nearly 60% of the dwellings owned by its household.

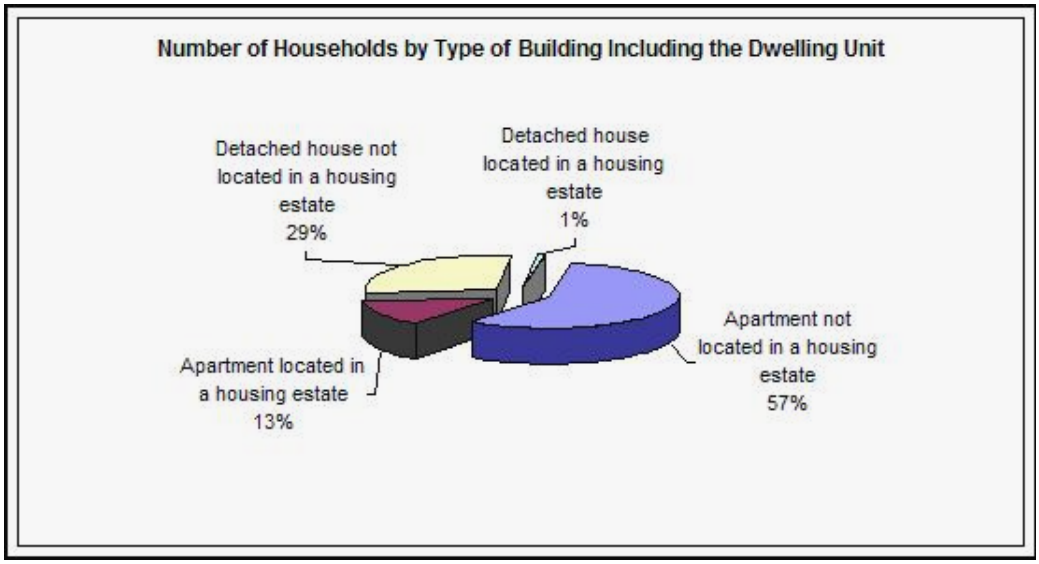

Figure 4.1: Percentages of households by type of building including the dwelling unit in Ankara

Source: SIS, 2004:79

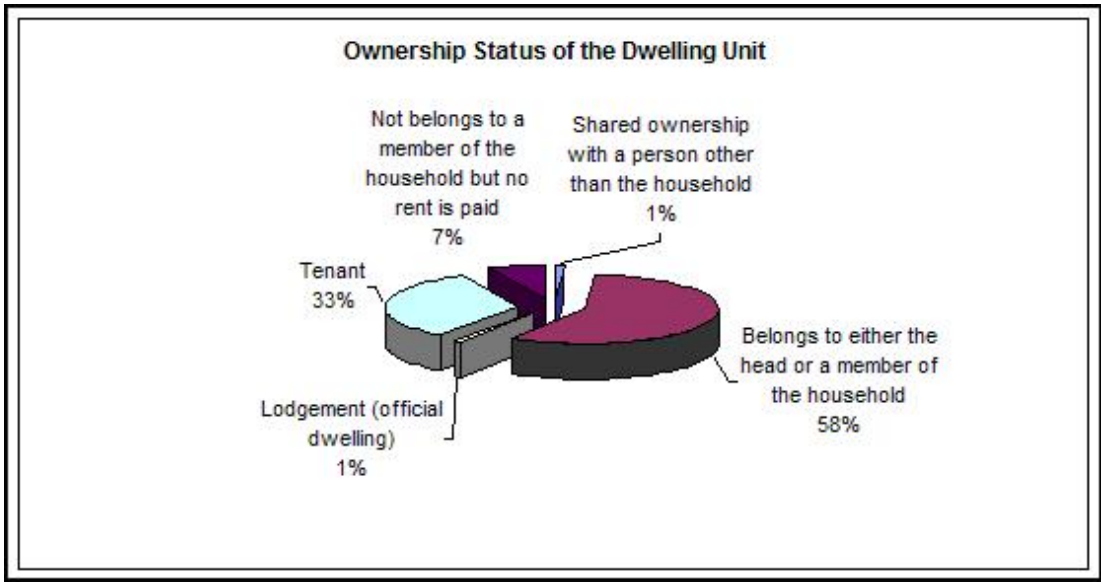

Figure 4.2: Percentages of ownership status of the dwelling units in Ankara

Source: SIS, 2004:92

Another important finding is about the preferences of households about the type of building for living (Figure 4.3). 74% of the households prefer to live in single house instead of an apartment unit.

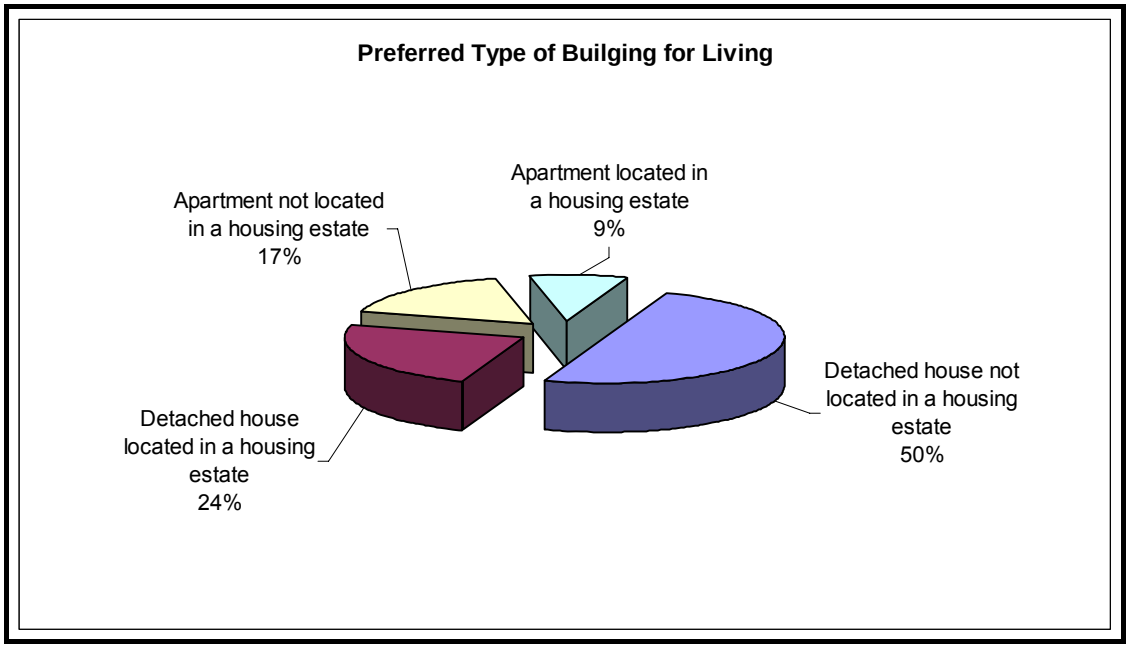

Figure 4.3: Percentages of preferred type of building for living in Ankara

Source: SIS, 2004:107

When the supply side of housing is considered, it is seen that private sector dominates the sector. The methods of construction of the building including the dwelling unit are shown in the Figure 4.5. Topçu (2004), showed the spatial distribution of quarters in the Greater Ankara Municipality borders with respect to the dominant producer type of residential and mostly residential buildings. In the Figure 4.4 it can be easily seen that building cooperatives and public enterprises mostly choose the western side and partially the south-western side of the city for housing provision. H e also mentioned that these agglomerations on the west and the south-western corridors are along the main roads to some important cities, namely; İstanbul and İzmir. (Topçu 2004: 88).

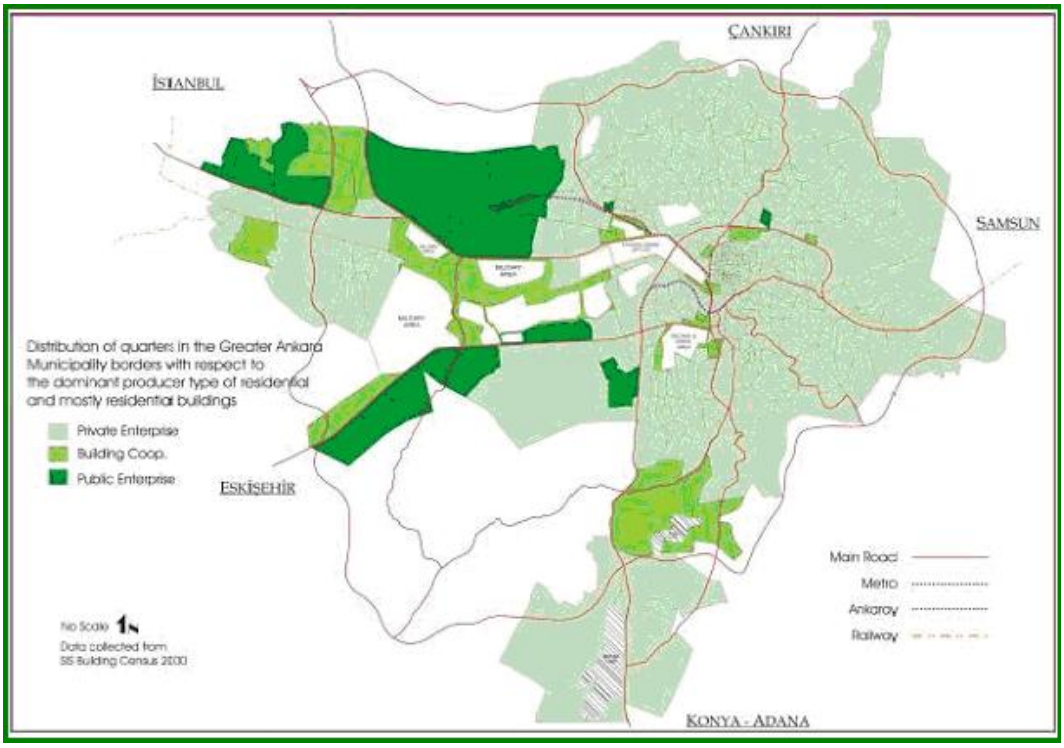

Figure. 4.4 Distribution of quarters in the Greater Ankara Municipality borders with respect to the dominant producer type of residential and mostly residential buildings

Source: Topçu 2004: 87

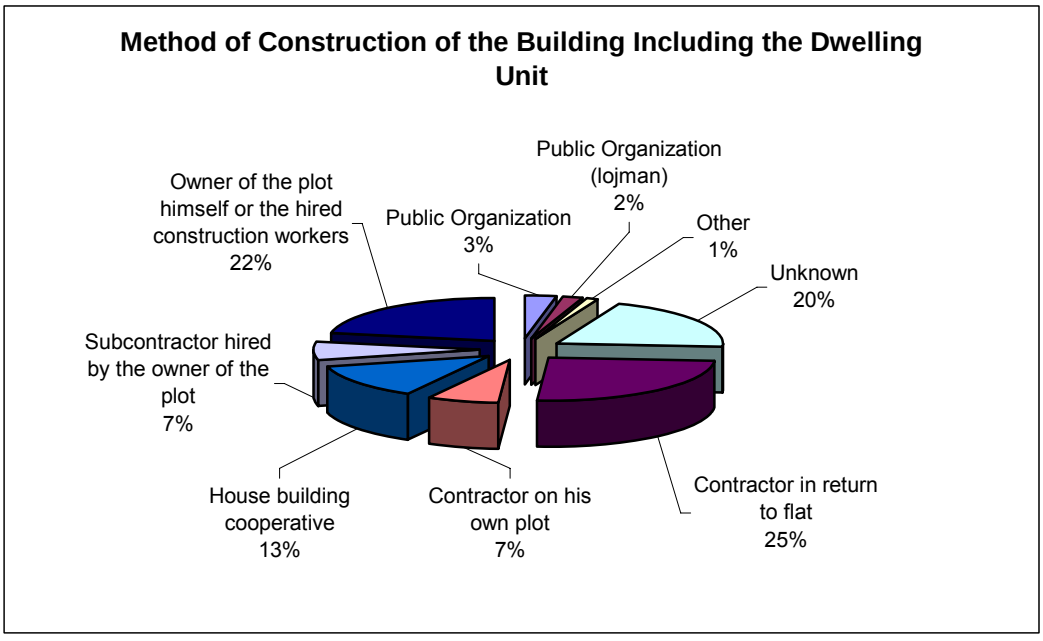

Figure 4.5. Methods of construction of the building including dwelling unit

Source: SIS, 2004:83

Between 1955 and 1970, approximately 60% of the housing stock is renovated through demolition and reconstruction process. Lots of neighborhoods experienced the transformation from 'gecekondu' to apartments. Yücel-.Uybadin Plan supported vertical expansion of city, which increased densities. After 1980's, the city started to spread towards west and south-west with housing cooperatives and private sector. This movement is continuing, and both the housing market and housing structure is being shaped by demand and supply forces.

4.2. The Data

For the hedonic price analysis of housing prices in Ankara, very detailed data should be acquired, including information about main attributes and values of houses. The data, which is used in this thesis, is mainly extracted from appraisal reports, which have been prepared by different appraisers, in 2006, in Ankara.

Although, estimating housing prices during the whole year, without making time adjustments, would lead to misleading results, the year 2006 was an exception. The downturn of housing prices in the middle of the year, brought the prices closer to each other in 2006. Therefore, the sample of prices can be used without any adjustment.

Following information has been extracted from appraisal reports;

Features of the main property;

- District (the district that is written on title deed)
- Neighborhood (the neighborhood that is written on title deed)
- Block number
- Building lot (parcel) number
- Area of the parcel
- Address (this information also let us know if the building is on the main street or not)

- Age of the building (is very important to be able to calculate the depreciation)
- Total number of individual divisions in the building
- Number of floors in the building
- Existence of elevator
- Existence of garage or parking lot

Features of the individual division;

- Owner's share in the land
- Floor number
- Gross area
- Number of rooms
- Number of bathrooms
- Number of balconies and terraces
- Existence of dependent room (a room that directly attached to living room)
- Frontispiece
- Heating System
- Material and workmanship quality
- Intended use
- Existence of the certificate for occupancy
- Depreciation rate

Transportation and shopping facilities;

- Transportation facilities
- Shopping facilities

Date and the value;

- Date of the report
- Expertise value of the property

While some of this information was directly used as a variable in the study, some variables were reproduced from the existing ones.

4.2.1. How the Data is Obtained?

The data for this study were obtained from appraisal reports, which have been prepared by different appraisers, in 2006, maps and surveys that applied to appraisers. First, brief information about these reports and the main techniques that are used in valuation of residential units will be given, and then the usage of maps and the content of the survey will be mentioned.

4.2.1.1. Appraisal Reports

As a profession, requiring the ability to determine a value for a property that has not been sold or brought to the market, appraising is a difficult and important occupation.

"Appraisal", which is also known as "property valuation", is determining the value of a real estate, real estate project or the benefits and rights of a real estate on a certain date with independent and neutral view.

A correct and reliable appraisal report plays a very important role in the revaluation of real estates, in using foreign sources, in merger and acquisition valuations, collaterals, debt restructuring, debt to asset swap, project valuation, analysis of high and best use, and Real Estate Investment Trusts' transactions. In Turkey, appraisal reports are demanded mostly by banks and other financial institutions. The real estate that is subject to appraisal, generally serves as collateral, if it is acceptable and justifiable.

Good appraisal practice requires that the method selected be adequate for the purpose, embrace consideration of all the factors that have a bearing on the value, and be presented in a clear and logical manner. The method that is being used during valuation can vary according to the type of demand, the intended use of the appraisal report, the type of real estate and also the data that are available about real estate. It may cause misleading results to use the same technique in appraisal

of an ordinary house and an extremely high-priced or specialized property. The flow chart of an appraisal report is shown in the Figure 4.6.

There are three techniques that are used in valuation of residential units;

1. Cost Approach; in this method the value of a property is derived by adding the estimated value of the land to the current cost of construction and then subtracting the amount of depreciation in the structures from all causes. This approach is particularly useful in valuing new or nearly new properties that are not frequently exchanged in the market.

2. Sales Comparison Approach; this approach is most useful when a number of similar properties have recently been sold or are currently for sale in the subject property market. (Milgrim, 1987 p: 80) The appraiser produces a value indication by comparing a subject property with similar properties, which are called comparable sales. The degree of similarity or difference between subject property and the comparable sales are estimated by considering various elements of comparison. These elements can be real property rights conveyed, financing terms, conditions of sale, market conditions, location, physical characteristics, economic characteristics, use, and non-realty components of value. Then adjustments are made in terms of money or percentage to the sale price of each comparable property, whose price is known. Through this comparative procedure, the value is defined.

3. Income Capitalization Approach; in this method, the present value of the future benefits of property ownership is measured. The basic formula is; 'income/rate=value'. After income and expenses are estimated, the income stream is capitalized by applying an appropriate rate or factor, or converted into present value through discounting. (Milgrim, 1987: 81)

In this study, through the existence of enough comparable sales, for most of the residential units 'sales comparison approach' is used in valuation.

Appraising involves the estimation of value, not the prediction of price. Every appraisal is a forecast. If Market Value is to be estimated, it is a forecast of a transaction price that would most probably occur, provided that specified market conditions are met. (Kinnard, 1971: 11)

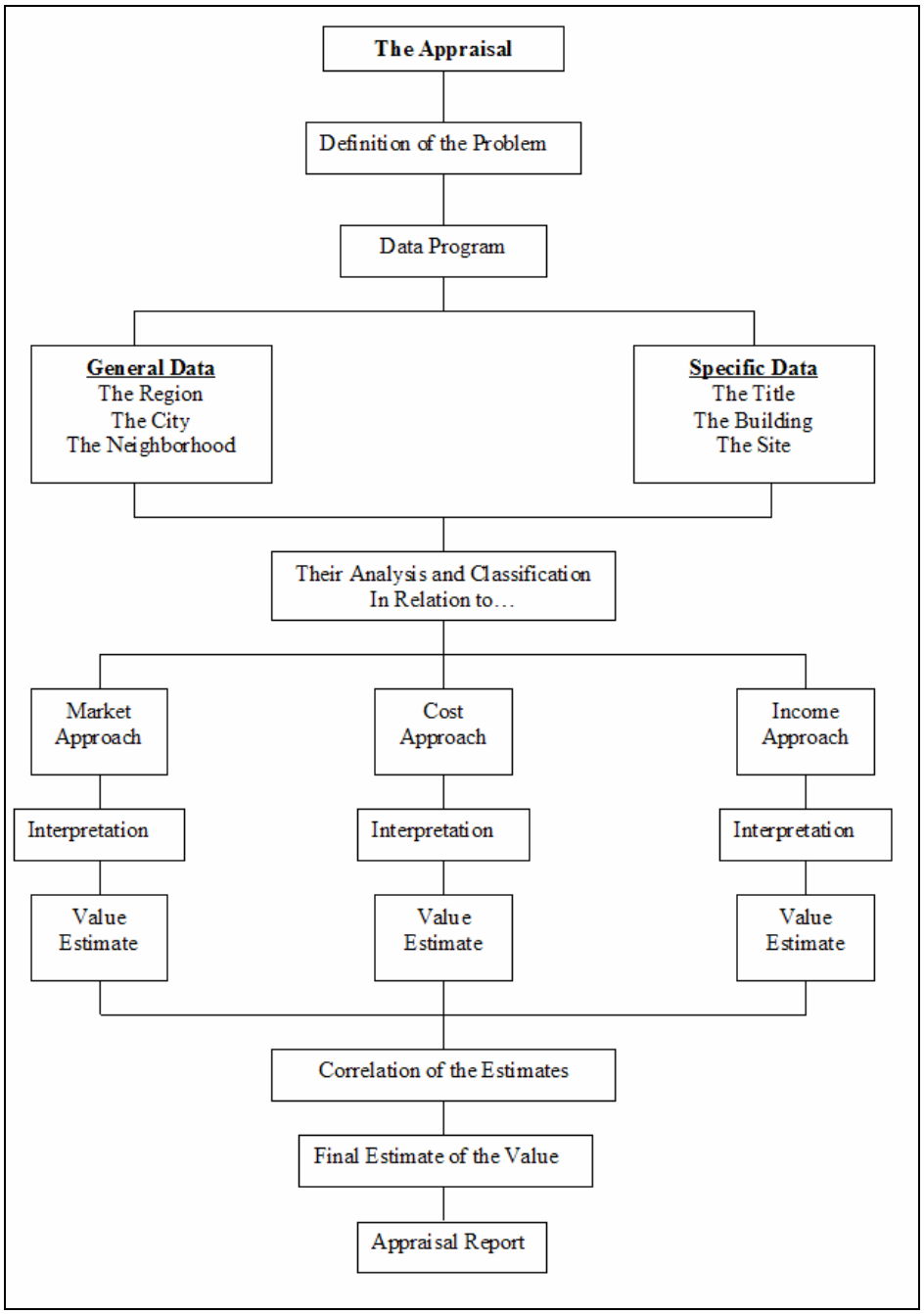

Figure 4.16 The flow chart of an appraisal report

Source: Wendt, 1956: 49

4.2.1.2. Map of Ankara

Although appraisal reports provided us detailed information, there are still some missing attributes on location, which are distance from CBD and the rating of the street of house.

As mentioned above, some variables were reproduced from the information that gained from appraisal reports. By using block number, building lot (parcel) number or address of each dwelling unit, straight-line distance from CBD was measured, by making Kızılay Square as the central point for the CBD. The rating of the street for each dwelling unit was also determined by using addresses. The criteria of this rating will be explained in section of 'Variable Definitions'.

4.2.1.2. The Survey

Another missing attribute, that were not included in appraisal reports, was income distribution of each neighborhood. This important neighborhood attribute is usually obtained from Census Data (Freeman 1979: 168, Cheshire and Sheppard 1998: 360). Unfortunately, in this study we couldn't reach to income level statistics for neighborhoods for the year 2006. In order to get updated and detailed data, we carried out a survey among 24 appraisers. These experienced experts were asked to rank each neighborhood according to income level. Their rankings were the same for almost all neighborhoods, which supported the reliability of the survey results.

4.2.2. The Distribution of Data

As the study field, central districts of Ankara; Altındağ, Çankaya, Etimesgut, Gölbaşı, Keçiören, Mamak, Sincan and Yenimahalle were chosen.

Table 4.2. The Distribution of data among districts and neighborhoods

Districts	Distance to CBD	Area of districts	Number of neighborhoods included in this study	Number of dwelling units included in this study
ALTINDAĞ	1 km.	573 km2	10	18
ÇANKAYA	9 km.	1157 km2	69	307
ETİMESGUT	20 km.	10 km2	6	13
GÖLBAŞI	20 km.	1810 km2	5	8
KEÇİÖREN	3 km.	759 km2	27	64
MAMAK	7 km.	90 km2	11	15
SİNCAN	27 km.	364 km2	9	27
YENİMAHALLE	5 km.	295 km2	20	49
			157	**501**

The sample included 501 dwelling units, from 157 different neighborhoods of eight districts. The distance between each district and CBD, areal size of districts, number of neighborhoods and dwelling units included in this study are shown in Table 4.2. The distribution of dwelling units among districts and neighborhoods are displayed in Figure 4.8 and Figure 4.9.

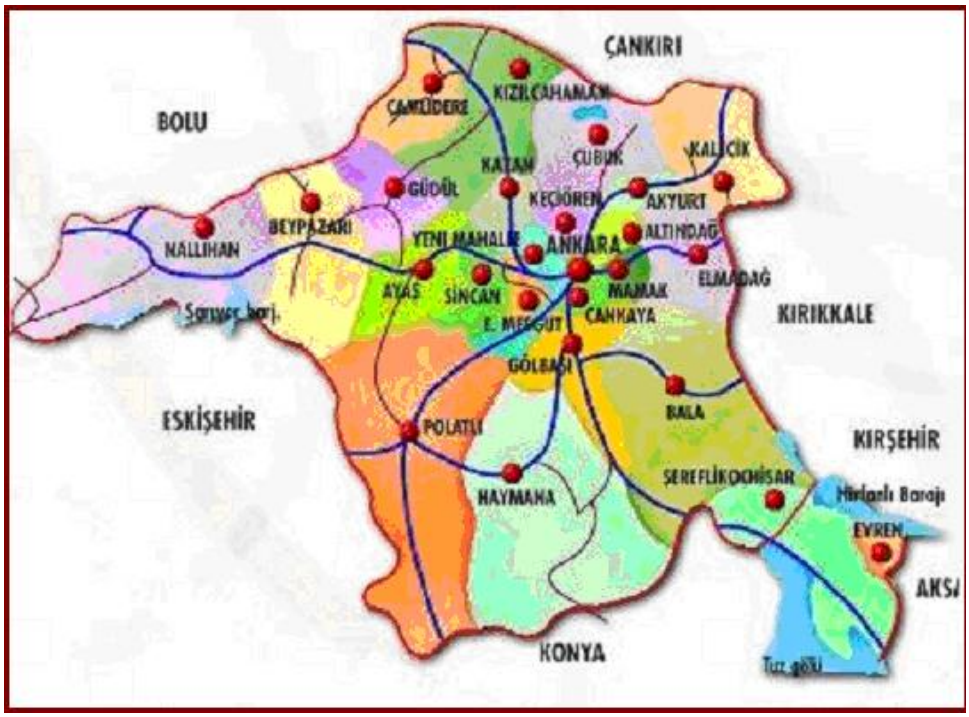

Figure 4.7. The Districts of Ankara

Source: http://www.ankara.bel.tr/ankara/ankilce.htm

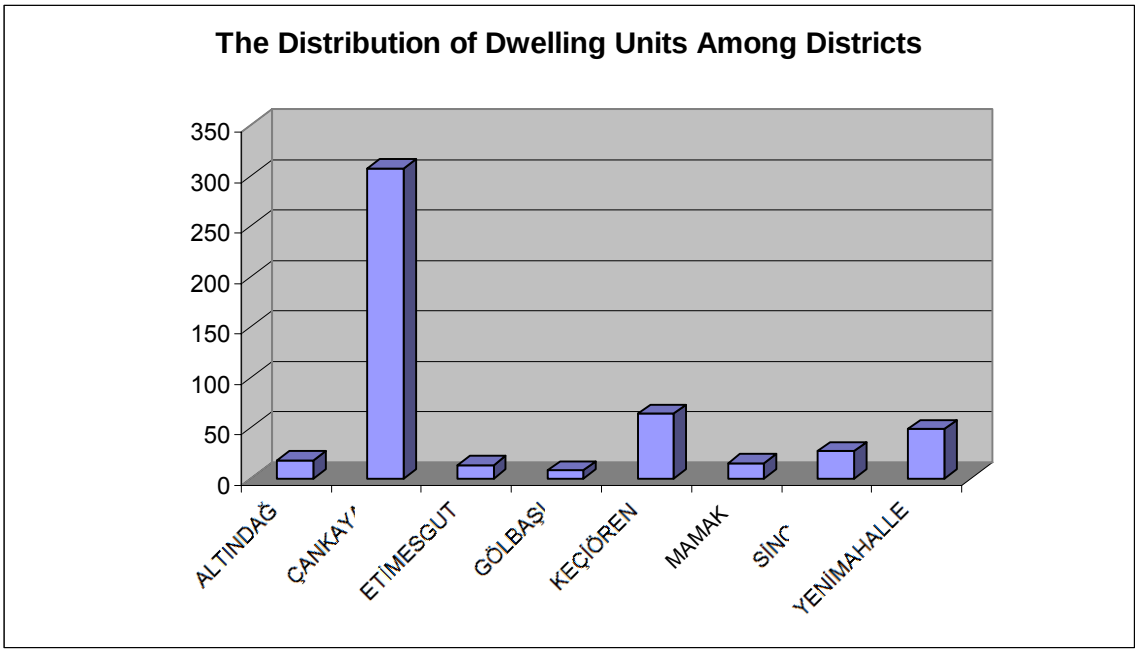

Figure 4.8. The number of dwelling units from each districts

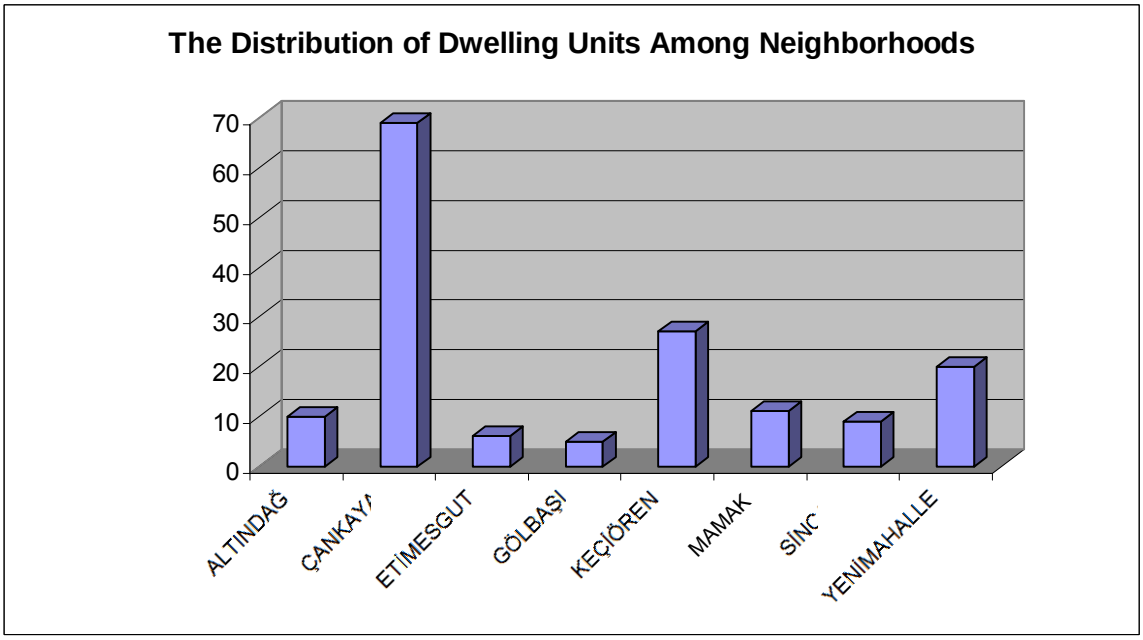

Figure 4.9. The number of neighborhoods in each districts where from dwelling units are used.

4.3. Specification of the Model

"A class of differentiated products is completely described by a vector of objectively measured characteristics" (Rosen 1974: 34). According to the Rosen's hedonic theory, implicit prices are estimated by the first-step regression analysis, in which product price regressed on characteristics, in the construction of hedonic price indexes. Hedonic equation, which is subject to the regression analysis, is written as:

$$P = \alpha_0 + \Sigma\, \alpha_i Z_i + \varepsilon$$

Where;

α_i = estimated coefficients of independent variables in the linear model; regression coefficients α_i are the corresponding hedonic prices of the variables

Z_i = relevant housing characteristics,

ε = random error

Based on the hedonic theory constructed by Rosen (1974), this study concerns with the estimation of hedonic price function in order to identify and quantify the significant determinants of housing value in the form of implicit or hedonic prices. In the present study firstly, a similar model with the one constructed by Wen, Jia and Guo (2005) was used (see Chapter 3). Price of each house is used as the dependent variable and physical (structural), locational and neighborhood characteristics of the dwelling units are included in the estimated equation as independent variables. The details of the variables will be explained in the next section.

After applying this linear form, we also used the log-linear (semi-log) form by taking into account its advantages. These advantages were summarized by Malpezzi (Malpezzi 2002, 20). First, the semi-log model allows for variation in the dollar or YTL. values of a particular characteristic so that the price of one component depends in part on the house's other characteristics. For example, with the linear model, the value added by a third bathroom to a one-bedroom house is

the same as it adds to a five-bedroom house, which seems unlikely. On the other hand, the semi-log model allows the value added to vary proportionally with the size and quality of the home. Second, coefficients of a semi-log model have a simple and appealing interpretation. The coefficient can be interpreted as approximately the percentage change in the rent or value given a unit change in the independent variable. For example, if the coefficient of a variable representing central air condition is 0.219, then adding it to a structure adds about 22 percent to its value or its rent. Third, the semi-log form often mitigates the common statistical problem known as heteroskedasticity, or changing variance of the error term. Fourth, semi-log models are computationally simple, and so well suited to examples. The log-linear function form is written as;

$$\ln P = \beta_0 + S\beta_1 + N\beta_2 + L\beta_3 + C\beta_4 + \varepsilon$$

Where;
ln P = the natural log of imputed price (or rent)
S, N, L, C = structural, neighborhood, locational and contract characteristics of the dwelling
B_i = hedonic regression coefficients
ε = error term

And finally we used our variables in a log-log function form. This form is gained by taking the natural logs of both sides in a linear hedonic equation, and it is written as (Dipasquale and Wheaton 1996, p: 70);

$$\log P = \log \alpha + \beta_1 \log X_1 + \beta_2 \log X_2 + \ \ldots + \beta_n \log X_n$$

The coefficients in this functional form are obtained by estimating a linear regression equation in which the dependent variable is the natural log of price, and independent variables are the natural log of the original attribute measures. This form provides us percentage change in the dependent variable that results from a percentage change in the independent variable, rather than determining the

constant value of an additional unit of each attribute (Dipasquale and Wheaton 1996, p: 71).

By using linear, semi-log and log-log functional forms for housing prices in Ankara, we obtained detailed and comparable results.

4.4. Variable Definitions

Three main types of data such as physical characteristics, locational characteristics and neighborhood characteristics are included in this study;

1) Physical Characteristics

- Description of the individual division (It can be a dwelling, a duplex house or a villa)
- Size (Gross area of the dwelling unit)
- Land (Owner's share in the land)
- Area of the parcel
- Rooms (Total number of living room(s) and bedrooms)
- Bathrooms (Number of bathrooms)
- Balconies (Number of balconies and terraces)
- Existence of a dependent room (A room that directly attached to living room)
- Existence of a changing room
- Quality of material and workman
- Age of the building
- Total number of floors in the building
- Floor number of the dwelling unit
- Frontispiece
- Intended use (Residence or office)
- Heating system (Heating stove, kombi or central heating)
- Elevator
- Parking facilities (parking lot or garage)
- Housing estate or not

2) Locational Characteristics

- Distance from CBD (km.)
- Rating of the street
- Easement of access (public transportation facilities)
- Shopping facilities

3) Neighborhood Characteristics

- Income level of the neighborhood
- Çankaya (If the dwelling unit is located in Çankaya or not)

We used as many variables as possible. For each variable the characteristics class, variable code and variable type is listed in Table 4.3. In addition, variable definitions and measurement methods are given in Table 4.4.

Table 4.3 Variables

Characteristics Class	Variable	Variable Code	Variable Type
Structure characteristic	Description of the individual division	DESCRIP	Dummy
	Gross area	GAREA	Continuous
	Owner's share in the land	LAND	Continuous
	Area of the parcel	PARCEL	Continuous
	Number of rooms	ROOMS	Continuous
	Number of bathrooms	BATHS	Continuous
	Number of balconies and terraces	BALCON	Continuous
	Dependent room	DEPROOM	Dummy
	Changing room	CHANROOM	Dummy
	Age of the building	AGE	Continuous
	Quality of material and workmanship	QUALMW	Continuous
	Total number of floors	TOTFLOOR	Continuous
	Floor number of the dwelling unit	FLOOR	Continuous
	Frontispiece	FRONTIS	Dummy
	Intended use	INUSE	Dummy
	Heating System	HEATING	Dummy
	Elevator	ELEVATOR	Dummy
	Parking facilities	PARKING	Dummy
	Housing estate	HESTATE	Dummy
Neighborhood characteristic	Income level of the neighborhood	INCOME	Dummy
	Çankaya	CANKAYA	Dummy
Locational characteristic	Distance to CBD	DISTANCE	Continuous
	Rating of the street	STREET	Dummy
	Public transportation	TRANSPO	Dummy
	Shopping Facilities	SHOPP	Dummy

Table 4.4. Variable Definitions

Characteristics Class	Variable Code	Variable definitions and measurement methods
Structure characteristic	DESCRIP	Description of the individual division that is written on the title deed; if it is a dwelling scored as 1, if it is a duplex house scored as 2, if it is a villa scored as 3
	GAREA	Gross area of the dwelling unit
	LAND	The owner's share in the land; it is calculated by owner's share ratio in the land multiple the area of the parcel
	PARCEL	The area of the parcel
	ROOMS	Total number of living rooms and bedrooms
	BATHS	Total number of bathrooms
	BALCON	Total number of balconies and terraces
	DEPROOM	If there is a dependent room, which is a room that directly attached to living room, is scored as 2, otherwise 1
	CHANROOM	If there is a changing room in at least one of the bedrooms, scored as 2, otherwise scored as 1
	AGE	Age of the building is calculated by subtracting the building year from 2006
	QUALMW	Quality of materials and workmanship scored as 1 for bad quality, scored as 2 for middle quality, scored as 3 for good quality, and scored as 4 for very good quality
	TOTFLOOR	Total number of floors in the building except basement floors
	FLOOR	The floor of the dwelling unit is calculated by considering all basement floors as 1, basement floors and ground floor as 2, and all other floors as 2 + the floor number
	FRONTIS	For the frontispiece of the dwelling unit; north is scored as 1, west is scored as 2, east is scored as 3 and south is scored as 4 (there are two frontispieces for each dwelling unit)
	INUSE	If the dwelling unit is being used as a residence it is scored as 2, if it is being used as an office it is scored as 1.
	HEATING	If there is a heating stove, scored as 1, if there is a central heating system or kombi, scored as 2
	ELEVATOR	If there is a elevator in the building it is scored as 2, otherwise scored as 1
	PARKING	If there is not any parking facility; scored as 1, if there is a parking lot; scored as 2, if there is a garage; scored as 3, if there is a garage and a parking lot; scored as 4
	HESTATE	If the dwelling unit is located in a housing estate, it is scored as 2, otherwise scored as 1
Neighborhood characteristic	INCOME	Income level of neighborhoods; low income is scored as 1, middle income is scored as 2, high income is scored as 3
	CANKAYA	If the dwelling unit is located in Çankaya it is scored as 1, otherwise scored as 0
Locational characteristic	DISTANCE	The linear distance to from dwelling unit to CBD (in km.)
	STREET	The rating of the street is scored from 1 to 5, according to its width and intensity
	TRANSPO	The existence of public transportation facilities scored as 2, if not scored as 1
	SHOPP	The existence of shopping facilities in short distance to dwelling unit scored as 2, if not scored as 1

4.5. Hypotheses and Comments on the Expected Signs of the Coefficients

Before estimating the hedonic price model, several hypotheses were developed about the expected signs of the coefficients. The hypotheses will be given in three sets, which were composed according to class of the characteristic. For each attribute, the effect of the increase in the quantity of variable, or just the existence of the variable (for dummy variables) will be explained.

The first set of hypothesis is related to the structural or physical characteristics. The single most important structural attribute is the floor area or the gross area of the dwelling unit. In this study, it is displayed by GAREA variable and is expected to be positively related with price. Similar with gross area, number of rooms, ROOMS, is also expected to have a positive impact on housing price. This is because people are willing to pay more for more space, especially functional space. According to Chin and Chau, the attributes relating to the number of rooms and floor area are relatively important across nations, other attributes can change with the tradition of building style or the climate (Chin and Chau, 2003: 153).

Most of the time, larger parcel area is a sign of the existence of a parking area, garden and a better environment. Consequently, in this study PARCEL, which means the area of the parcel, is expected to effect price positively.

Owner's share in land, LAND variable, may include larger parcel area and also larger gross area. This combination determines its sign as positive.

Number of bathrooms; BATHS, number of balconies and terraces; BALCON, existence of a changing room; CHANROOM, all facilitate the usage of the dwelling, and are assumed to have positive effect on sale price of housing. On the contrary, existence of a dependent room, which means a room that directly attached to the living room, is out of style and contradicts with privacy. As a result, DEPROOM variable is expected to be inversely related to the housing price.

Age of the dwelling is a measure for the physical depreciation. Clapp and Giaccotto defined depreciation as the decline in value with respect to age because of increased maintenance costs and decreased usefulness (Clapp and Giaccotto, 1998: 417). Older buildings necessitate high repair and maintenance expenditures. These additional expenditures have a negative influence on the price of housing. As a result, the coefficient of AGE is expected to be inversely related to the housing price. It should be noted that in some exceptional cases older dwellings may have higher sale prices related to the historical significance or vintage effects of the building (Chin and Chau, 2003: 154).

Quality of material and workmanship is shown with QUALMW. The coefficient of this variable is expected to be positive. The quality of the construction elements and the additional elements affect construction cost and as a result give rise to the sale price. It is also important as being one of the most easily realized attributes by potential buyers. Anybody, even if he is not informed about the construction sector, may know the quality of paint and flooring material.

The variables TOTFLOOR and FLOOR are expected to be positive. Ustaoğlu explained the effect of TOTFLOOR as;

> TOTFLOOR represents the total number of floors in a building and its coefficient shows the relationship between the height of the building and the rental price. The rationale is that higher buildings tend to be built where land is more expensive. Therefore, not only construction costs but also high land prices affect the cost of high buildings which is resulted in high prices (Ustaoğlu 2003: 59)

Dwelling units, which are located in higher floors, have better views and more chances to benefit from sunlight.

The frontispiece is represented by variables FRONTIS 1 and FRONTIS 2, and scored increasingly in turn from the north, to the west, then to the east and to the

south. It is an attribute, which is related to the orientation towards the sun, and expected to have positive effect on the price of the housing.

The INUSE variable displays if the dwelling unit is being used as a residence or an office. It is always preferable to use any real property in the way that it has been designed for. As all the dwellings in this study were designed for residential use, INUSE variable is expected to have a positive sign.

Existence of a central heating system or kombi, elevator, and a parking area or better a garage, are expressed with HEATING, ELEVATOR and PARKING, and respectively all are expected to affect the house buyer to pay more.

The last structural attribute denotes if the dwelling unit is located in a housing estate or not, and is displayed by HESTATE in this study. A housing estate means more than the dwelling unit, by including an image, security, well kept garden, and even recreation and sports grounds. All of these factors make HESTATE a preferable attribute.

The second set of hypotheses is developed concerning the neighborhood characteristics. In this model there are two neighborhood attributes; one is INCOME, which shows the income level of each neighborhood, and CANKAYA that represents if the dwelling unit is located in Çankaya or not. The former one is composed by rating the neighborhoods as low-income, middle-income or high-income, and reflects the economic profiles of occupants. Being in the same income level, usually coincides with the same education level and having similar life styles of inhabitants. It is always preferable being close to similar ones. If there is a willingness to pay more for housing, for this purpose prices trend to rise in that area. This also makes it difficult for lower income groups to reside with higher income groups. Consequently, the coefficient of INCOME variable is expected to be positively related with housing price.

The second neighborhood variable is CANKAYA. Çankaya has a more homogeneous structure and a prestigious district in the city. Almost 90% of high-income group neighborhoods are in the boundaries of Çankaya, whereas there is only one that is classified as low-income. It is also the second largest district of Ankara. In this study, being located in Çankaya is expected to have a positive effect on price.

The last set of hypotheses is introduced considering locational characteristics, which include variables DISTANCE, STREET, TRANSPO and SHOPP. In the traditional view of location, accessibility is measured in terms of access to the Central Business District. Accessibility, in whatever form it has been measured, has some influence on housing prices (Chin and Chau, 2003: 152). The distance to the CBD, which is represented by the DISTANCE variable in this study, is expected to have a negative influence on housing price.

Transport accessibility is frequently associated with the ease of commuting to and from amenities, and is measured by travel time, cost of travel, convenience, and availability of different transport modes. The positive influence of good public transport services on housing prices has been empirically proved (Chin and Chau, 2003: 152). It is also important for inhabitants, to satisfy their daily shopping needs in the immediate area. Consequently TRANSPO and SHOPP variables, which show the existence of public transportation facilities and shopping facilities, are expected to respectively affect housing prices positively.

The last locational attribute, STREET, is about the rating of the street according to its width and intensity of traffic. The residential units, which are located on main streets, are expected to have higher prices than the ones on secondary roads.

4.6. Estimation Results

As it is mentioned in previous sections, linear functional form is used in the hedonic price analysis of this study in order to find out the prices of each housing

attribute. So as to display the preferences of buyers about different characteristics of housing more clearly in the second step log-linear (semi-log) functional form and log-log functional form are used. These functional forms give us percentage change in the price that results from a percentage change in independent variables.

The models' estimation method is the ordinary least squares method (OLS), which is most frequently used. The multiple-regression is obtained by SPSS 11.0 software.

Before starting hedonic price analysis, we examine the variables. First of all, minimum, maximum and mean values and standard deviations are calculated for each variable (Table 4.5). According to these values some variables are considered to be insignificant. These are TRANSPO, HEATING, INUSE, CHANROOM, and DEPROOM. 93% of all dwelling units have the opportunity to use public transportation, 96% of dwelling units have a central heating system or kombi, 92% of the sample is being used as residence, 97% of them don't have a changing room and the ratio of dwelling units without a dependent room is 95%. Because of such concentrations in the values of these dummy variables, they are excluded from the analysis.

After that, we view the correlations between variables, and compose the Table A (Appendix A). Being correlated with each other means that such variables are represented by each other. Consequently, using these in the same analysis may produce some misleading result. It is seen from the table that some variables are correlated with each other.

The number of bathrooms is highly related both with the number of rooms and the gross area of the dwelling unit. In addition to these high correlations, it is also highly related with the owner's share of land, the existence of a parking facility, the quality of materials and workmanship and the number of balconies and terraces.

Table 4.5. Means and Standard Deviations of Variables

Variables	Minimum	Maximum	Mean	Standard Deviation
STREET	1	5	2,4591	0,76212
DESCRIP	1	3	1,1737	0,44248
DISTANCE	0,5	24,4	7,2988	5,76023
HESTATE	1	2	1,1976	0,39859
PRICE (VALUE)	30.000	900.000	157.307,4	112817,7
AGE	1	51	13,0978	11,56687
GAREA	40	412	140,5549	59,78688
LAND	13	4607	101,7365	254,66352
TOTFLOOR	2	47	5,1277	3,42632
FLOOR	1	19	4,0758	2,29570
FRONTIS1	1	4	2,7006	1,30468
FRONTIS2	1	4	2,3726	0,90596
INUSE	1	2	1,9202	0,27132
ELEVATOR	1	2	1,3473	0,47659
PARKING	1	4	2,1238	0,86986
ROOMS	1	8	4,2715	0,95612
BATHS	0	4	1,3114	0,56112
BALCON	0	5	1,8323	1,01972
CHANROOM	1	2	1,0319	0,17601
QUALMW	1	4	2,8004	0,68123
HEATING	1	2	1,9601	0,19597
TRANSPO	1	2	1,9321	0,25176
SHOPP	1	2	1,8782	0,32733
OCCULICENCE	1	2	1,7026	0,45757
PARCEL	225	125605	4318,9541	13825,802
DEPROOM	1	2	1,0519	0,22204
ÇANKAYA	0	1	0,6427	0,47968
INCOME	1	3	2,1976	0,65336

The quality of material and workmanship is positively related with the gross area, the existence of elevator and parking facility, the number of rooms and bathrooms, heating system and income level of the neighborhood.

There is a high correlation between the gross area and the number of rooms. In addition, both are related with the number of bathrooms, number of balconies and terraces and the quality of materials and workmanship.

Being located in a housing estate is positively related with the distance from the CBD, the total number of floors and the area of the parcel. Some other correlations are between, the existence of an elevator and the total number of floors, being located in Çankaya and income level of the neighborhood, the floor number and the total number of floors, the existence of a parking facility and an elevator. The other values can be monitored from Table A, in Appendix.

We take into account these relations and decide to exclude some variables from the analysis, and to construct three models with different sets of remaining variables, as we can not use all variables together. BATHS and BALC variables are excluded from the analysis because they are represented by the other variables. The first model includes GAREA, HESTATE, DISTANCE, INCOME, PARKING, FLOOR, STREET, FRONTIS1 and LAND variables. The second model is composed of ROOMS, ELEVATOR (or TOTFLOOR), AGE, INCOME, PARCEL, SHOPP, FRONTIS2 and STREET variables. QUALMW, HESTATE, INCOME, LAND, ELEVATOR and SHOPP are variables of the third model. The models can be summarized as;

MODEL 1: P = f (GAREA, HESTATE, DISTANCE, INCOME, PARKING, FLOOR, STREET, FRONTIS1, LAND)

MODEL 2: P = f (ROOMS, ELEVATOR (or TOTFLOOR), AGE, INCOME, PARCEL, SHOPP, FRONTIS2 and STREET)

MODEL 3: P = f (QUALMW, HESTATE, INCOME, LAND, ELEVATOR, SHOPP)

As the first step, hedonic prices are estimated with the model 1 by using linear functional form. Nine independent variables are entered into the hedonic price analysis. R^2 of the model is 0.777, adjusted R^2 is 0.773, all indicate that the fitness of the model is high. Other details of the model are shown in Table 4.6 and Table 4.7.

Table 4.6 Summary-1 of Model 1 in linear functional form

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,881[a]	,777	,773	53830,09635

a. Predictors: (Constant), STREET, INCOME, HESTATE, FRONTIS1, PARKING, LAND, FLOOR, GAREA, DISTANCE

Table 4.7. Summary-2 of Model 1 in linear functional form

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4,94E+12	9	5,490E+11	189,474	,000[a]
	Residual	1,42E+12	490	2897679273		
	Total	6,36E+12	499			

a. Predictors: (Constant), STREET, INCOME, HESTATE, FRONTIS1, PARKING, LAND, FLOOR, GAREA, DISTANCE

b. Dependent Variable: PRICE (VALUE)

The expected signs as hypothesized in Section 4.5, are obtained by the estimation results of this model. However, there are some variables proved insignificant. These are FRONTIS1 and STREET. It is understood that these two don't have a significant effect on the price of housing. As the linear functional form is used, the β coefficients give us implicit prices that house buyers are willing to pay for more of each attribute. The coefficients are shown in Table 4.8. Some of them can be

interpreted like this; each additional m^2 in the gross area of the dwelling unit is worth 1.159 YTL., being located in a house estate is worth 29.908 YTL., the existence of a parking facility adds approximately 15.524 YTL. to the price, willingness to live in a higher income neighborhood costs 36.824 YTL. and each km. from CBD decreases the price 1.351 YTL.

It is obvious that, the gross area, the owner's share in the land, being located in a housing estate, existence of a parking facility, income level of the neighborhood and distance from CBD, all have significant effects on the sale price of housing. On the other hand the floor number of the dwelling is not that much effective. The most remarkable result of this model is the great impact of being in a housing estate. This can be interpreted as; the decentralization of the city will continue towards areas where large parcels can be obtained. Another important finding is about a neighborhood characteristic, INCOME. The willingness to pay to be in a neighborhood with a higher income level is really high.

Table 4.8. Coefficients of Model 1 in linear functional form

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-175565	15248,281		-11,514	,000
	GAREA	1159,505	47,166	,614	24,583	,000
	HESTATE	29908,738	7378,316	,106	4,054	,000
	DISTANCE	-1351,725	519,668	-,069	-2,601	,010
	LAND	85,274	10,288	,193	8,289	,000
	FLOOR	1605,178	1145,260	,033	1,402	,162
	PARKING	15524,534	2957,675	,120	5,249	,000
	INCOME	36824,124	4419,243	,213	8,333	,000
	FRONTIS1	2061,739	1855,114	,024	1,111	,267
	STREET	3767,473	3192,556	,025	1,180	,239

a. Dependent Variable: PRICE (VALUE)

As the second step, hedonic price analysis is carried out with the Model 2 by using linear functional form. Eight independent variables are entered into the

hedonic price analysis. R^2 of the model is 0.595, adjusted R^2 is 0.588, all that indicate the fitness of the model is high. Other details of the model are shown in Table 4.9.

Table 4.9 Summary-1 of Model 2 in linear functional form

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,771[a]	,595	,588	73296,65267

a. Predictors: (Constant), STREET, INCOME, FRONTIS2, SHOPP, PARCEL, ROOMS, ELEVATOR, AGE

Table 4.10 Summary-2 of Model 2 in linear functional form

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,67E+12	8	4,591E+11	85,460	,000[a]
	Residual	2,50E+12	466	5372399293		
	Total	6,18E+12	474			

a. Predictors: (Constant), STREET, INCOME, FRONTIS2, SHOPP, PARCEL, ROOMS, ELEVATOR, AGE

b. Dependent Variable: PRICE (VALUE)

The ELEVATOR and TOTFLOOR variables are positively related so the second model is applied for each of them separately. But the results show that the significance level of number of total floors is very low. Therefore, in all functional forms only the variable ELEVATOR is used instead of TOTFLOOR variable.

Estimation results show that almost all the variables in this model have the expected signs as hypothesized in Section 4.5. However variable SHOPP has a negative sign, which was not been assumed. This can be explained with the respectively low significance level of the variable. The AGE, also has a rather low significance level. In addition, the FRONTIS2 and STREET variables are insignificant again (in model 1 FRONTIS1 and STREET are insignificant). It is

then found out that these two don't have a significant effect on the price of housing. The β coefficients of this linear functional form are shown in Table 4.11.

The results show that number of rooms, existence of an elevator, income level of neighborhood and area of the parcel, all have significant effects on the sale price of housing. Some coefficients can be interpreted as; each additional room is worth 59.398 YTL., the existence of an elevator adds approximately 28.058 YTL. to the price, each additional m^2 in the area of the parcel increases the housing price by 2 YTL. and this time willingness to live in a higher income neighborhood is worth 58.283 YTL.

Table 4.11. Coefficients of Model 2 in linear functional form

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-243692	33236,992		-7,332	,000
	ROOMS	59398,490	3905,241	,495	15,210	,000
	ELEVATOR	28058,757	7982,251	,117	3,515	,000
	INCOME	58283,734	5910,494	,334	9,861	,000
	PARCEL	2,063	,243	,254	8,477	,000
	SHOPP	-16231,3	10739,259	-,046	-1,511	,131
	AGE	-46,374	346,659	-,005	-,134	,894
	FRONTIS2	-7305,087	3731,677	-,058	-1,958	,051
	STREET	8579,896	4635,274	,056	1,851	,065

a. Dependent Variable: PRICE (VALUE)

As the third step, hedonic price analysis is carried out with the Model 3 by using linear functional form. R^2 of the model is 0.589, adjusted R^2 is 0.584 and there are 6 independent variables. Other details of the model are shown in Table 4.12 and Table 4.13.

Table 4.12 Summary-1 of Model 3 in linear functional form

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,768[a]	,589	,584	72728,59187

a. Predictors: (Constant), SHOPP, ELEVATOR, LAND, INCOME, HESTATE, QUALMW

Table 4.13 Summary-2 of Model 3 in linear functional form

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,75E+12	6	6,252E+11	118,189	,000[a]
	Residual	2,61E+12	494	5289448075		
	Total	6,36E+12	500			

a. Predictors: (Constant), SHOPP, ELEVATOR, LAND, INCOME, HESTATE, QUALMW

b. Dependent Variable: PRICE (VALUE)

Estimation results show that almost all the variables in this model have the expected signs as hypothesized, however variable SHOPP has a negative sign again, which was not been assumed. The β coefficients of this linear functional form are shown in Table 4.14.

The results show that quality of material and workmanship, existence of an elevator, income level of neighborhood, being located in a housing estate and area of the parcel, all have significant effects on the sale price of housing. Some coefficients can be interpreted as; rise in the level of quality of material and workmanship is worth 68.620 YTL., the existence of an elevator adds approximately 16.978 YTL. to the price, each additional m^2 in the area of the parcel increases the housing price by 139 YTL. and willingness to live in a higher income neighborhood is worth 53.278 YTL.

Table 4.14. Coefficients of Model 3 in linear functional form

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-168486	27873,814		-6,045	,000
	QUALMW	68620,880	5373,202	,414	12,771	,000
	HESTATE	16256,466	8707,459	,057	1,867	,062
	INCOME	53278,808	5347,565	,309	9,963	,000
	LAND	139,204	13,338	,314	10,437	,000
	ELEVATOR	16978,457	7578,390	,072	2,240	,026
	SHOPP	-21277,6	10149,363	-,062	-2,096	,037

a. Dependent Variable: PRICE (VALUE)

After the analysis with linear functional form, hedonic price analysis is carried out with the Model 1 by using log-linear (semi-linear) functional form. It is aimed to find out the percentage changes in the prices that result from one unit changes in the independent variables, rather than determining the constant value of an additional unit of each attribute. This time, less significant attributes of first application, the FRONTIS1 and STREET variables, are excluded and 7 independent variables are entered into the hedonic price analysis. R^2 of the model is 0.811; adjusted R^2 is 0.808. Other details of the model are shown in Table 4.15 and Table 4.16.

Table 4.15 Summary-1 of Model 1 in log-linear functional form

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,901[a]	,811	,808	,26648

a. Predictors: (Constant), INCOME, HESTATE, PARKING, LAND, FLOOR, GAREA, DISTANCE

Table 4.16 Summary-2 of Model 1 in log-linear functional form

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	150,016	7	21,431	301,805	,000[a]
	Residual	34,936	492	,071		
	Total	184,952	499			

a. Predictors: (Constant), INCOME, HESTATE, PARKING, LAND, FLOOR, GAREA, DISTANCE

b. Dependent Variable: LNPRICE

The results (Table 4.17) show that 1 m^2 change in the gross area changes the price 5%, being located in a housing estate means 15% change in the price, each km. from the CBD decreases price 1%, 1 m^2 change in the owner's share in land changes the price 0,1%, the existence of a parking facility increases the price approximately 9%, being located in a upper floor means 2% increase, willingness to live in a higher income neighborhood make buyers to pay 29% more.

Table 4.17 Coefficients of Model 1 in log-linear functional form

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9,893	,062		158,305	,000
	GAREA	5,946E-03	,000	,584	25,507	,000
	HESTATE	,159	,037	,104	4,344	,000
	DISTANCE	-1,67E-02	,003	-,158	-6,494	,000
	LAND	1,129E-04	,000	,047	2,219	,027
	FLOOR	2,857E-02	,006	,108	5,065	,000
	PARKING	9,782E-02	,015	,140	6,687	,000
	INCOME	,290	,022	,312	13,298	,000

a. Dependent Variable: LNPRICE

Secondly, hedonic price analysis is carried out with the Model 2 by using log-linear (semi-linear) functional form. Again, less significant attributes of the first application, the FRONTIS2 and STREET variables, are excluded and 6 independent variables are entered into the analysis. R^2 of the model is 0.689;

adjusted R^2 is 0.685. Other details of the model are shown in Table 4.18 and Table 4.19.

Table 4.18 Summary-1 of Model 2 in log-linear functional form

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,830[a]	,689	,685	,34131

a. Predictors: (Constant), AGE, PARCEL, SHOPP, INCOME, ROOMS, ELEVATOR

Table 4.19 Summary-2 of Model 2 in log-linear functional form

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	127,448	6	21,241	182,335	,000[a]
	Residual	57,549	494	,116		
	Total	184,996	500			

a. Predictors: (Constant), AGE, PARCEL, SHOPP, INCOME, ROOMS, ELEVATOR

b. Dependent Variable: LNPRICE

The findings prove the signs of linear form, but for some attribute very high percentages are estimated. These values are listed in Table 4.20, in unstandardized β coefficients.

Table 4.20. Coefficients of Model 2 in log-linear functional form

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9,056	,132		68,751	,000
	ODA	,308	,017	,485	17,668	,000
	GELIRDUR	,428	,027	,460	16,032	,000
	ASANSOR	,248	,035	,194	7,012	,000
	PARSELBU	6,010E-06	,000	,137	5,366	,000
	ALISVERI	5,838E-02	,047	,031	1,231	,219
	YAS	-8,86E-04	,002	-,017	-,575	,566

a. Dependent Variable: LNDEGER

Lastly, hedonic price analysis is carried out with the Model 3 by using log-linear (semi-linear) functional form. R^2 of the model is 0.657; adjusted R^2 is 0.652. Table 4.21 and Table 4.22 show other details of the model.

Table 4.21 Summary-1 of Model 3 in log-linear functional form

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,810[a]	,657	,652	,35862

a. Predictors: (Constant), SHOPP, ELEVATOR, LAND, INCOME, HESTATE, QUALMW

Table 4.22 Summary-2 of Model 3 in log-linear functional form

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	121,464	6	20,244	157,410	,000[a]
	Residual	63,532	494	,129		
	Total	184,996	500			

a. Predictors: (Constant), SHOPP, ELEVATOR, LAND, INCOME, HESTATE, QUALMW

b. Dependent Variable: LNPRICE

The findings prove the signs of linear form. Unstandardized β coefficients, which show the percentage changes in the prices that result from one unit changes in the independent variables, are listed in Table 4.23.

Table 4.23. Coefficients of Model 3 in log-linear functional form

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9,483	,137		68,992	,000
	QUALMW	,396	,026	,443	14,937	,000
	HESTATE	5,877E-02	,043	,039	1,369	,172
	INCOME	,391	,026	,420	14,845	,000
	LAND	3,721E-04	,000	,156	5,658	,000
	ELEVATOR	,165	,037	,129	4,414	,000
	SHOPP	-5,49E-03	,050	-,003	-,110	,913

a. Dependent Variable: LNPRICE

For all models log-log functional form is also used, and results verify the findings of former analysis, which applied with linear and log-linear functional forms.

The results of analysis clearly display that the preferences of households have changed since Türel analyzed the housing prices in Ankara, in 1981. Although in his study it was aimed to show the spatial variation of prices, the results pointed out that the most valued attributes were number of rooms and existence of central heating system, both of which are structural characteristics. On the other hand, the findings of this study show that house buyers no more give importance only to structural characteristics, but also to locational and neighborhood characteristics.

Ankara in 1970's, had a compact structure, where the attributes inside the dwelling unit were distinguishing. However, after the 1970s urban decentralization started to relieve increasing urban density's pressure on the central districts. The increase in house buyers' interest in locational and neighborhood characteristics together with structural characteristics, can be explained with the rise in differentiation which is caused by decentralization of the city and also with increasing standards of living.

While preferences were mostly about the internal attributes of dwellings, such as the heating system, these attributes have become common in time and their distinguishing effect on choices of households diminished.

One of the most dramatic findings of the analysis is the high impact level of being located in a housing estate, which is mostly related with environmental factors, rather than those which are inside of dwellings. A housing estate usually means more than those which are the dwelling unit, by including an image, security, well kept garden, and even recreation and sports grounds. It seems that city will continue to spread out, especially by means of housing estates.

CHAPTER 5

CONCLUSION and SUMMARY

In this thesis, it is aimed to reveal the implicit prices of housing attributes in the housing market of Ankara, for the year 2006, with a desire of gaining more information about the demand side of the housing sector. For this purpose, hedonic pricing method is used with the data that are extracted from appraisal reports, which include information about main attributes and values of houses.

The thesis is composed of three main parts; theoretical framework, empirical studies and hedonic price analysis of housing prices in Ankara. In the first part, a theoretical framework is constructed for analyzing the determinants of housing. At first, real estate markets are defined with their characteristics, functions and mechanism. Then, housing markets and formation of housing prices are explained. After clarifying the meaning of 'value' and 'price', the principal determinants of housing value; structural (physical) characteristics, locational characteristics, neighborhood characteristics and transfer (lease) characteristics, are identified. Most common attributes are defined and their expected signs on housing prices are listed. Following these explanations on determinants of housing value, hedonic price approach is discussed. A hedonic model decomposes the price of an item into separate components that determine the price. The method is based on the assumption that people value the characteristics of a good or a services it provides, in this case a house, rather than the good as a whole. After presenting basic equations of the model, its applications to the housing market, and some key assumptions that underlies these applications are summarized.

In the second part, empirical studies on hedonic price models of housing prices are presented. First, some studies are mentioned vary briefly in order to show the variety of its applications in housing markets. Then two studies are examined in detail. One of them is undertaken by Benson, Hansen, Schwartz and Smersh, in 1998, to find out the value of "view" amenity in a single family residential real estate market in Bellingham, Washington. Their study exemplifies to our study by showing the importance and effectiveness of using variables in detail and using log-linear (semi-linear) functional form, which is also used in this study. The second one is a hedonic price analysis of urban housing for Hangzhou City, in China. It is prepared by Wen, Jia and Guo, in 2005. The main goal of the study is to display the relationship between housing characteristics and housing price, to estimate implicit prices of housing attributes, and to analyze the supply and demand characteristics of the housing market for the city. Linear functional form is used with a set of structural, locational and neighborhood characteristics. Its aim, variables and functional form makes this study an appropriate precedent for our analysis.

In the following part of the empirical studies three studies from the literature of Turkey are discussed. Two of them are successful basis for hedonic price analysis for the housing market of Ankara. One is a hedonic price analysis of office rents in Ankara, which is prepared by Ustaoğlu, in 2003. The other one is the first study on housing price determinants in Turkey that undertaken by Türel, in 1981. Both of the studies guide us about applying hedonic approach to our data, and the results of Türel's analysis also give us the opportunity to monitor the changes in the preferences of households about the attributes of housing.

The third part includes the hedonic price index for the analysis of housing prices in Ankara. It starts with a summary of development of Ankara and its residential districts, intending to show the background of housing settlements. Then, the sources of data, which are mainly extracted from appraisal reports of different appraisers, and their distribution among districts and neighborhoods are displayed. In the specification of the model, linear and log-linear functional forms are

explained, and also the log-log form is mentioned. Each variable is described with measurement units, variable codes and variable type, and hypotheses and comments on expected signs of coefficients, which show whether the impact of each attribute on housing price is positive or negative, are given. Before we start to the hedonic price analysis, each variable is examined, and minimum, maximum and mean values and standard deviations are calculated. Because of high concentration in some values, some variables are excluded from the analysis. The correlations between variables are viewed, and by taking into account these relations, some variables are excluded, and three models are constructed with different sets of remaining variables. Highly correlated variables are not used together as they represent each other.

Firstly, hedonic prices are estimated with Model 1, Model 2 and Model 3 by using the linear functional form. Results indicated that the fitness of every estimated model is high, and the β coefficients give us implicit prices for each attribute. In Model 1, the expected signs as hypothesized are obtained by the estimation results of this model. However, the FRONTIS1 and STREET variables are found not to have a significant effect on the price of housing. On the other hand, findings show that increase in the gross area of the dwelling unit, being located in a housing estate, existence of a parking facility, living in a neighborhood with higher income level significantly affect the price of housing in positive direction, whereas distance from CBD decreases the price.

In Model 2, estimation results show that almost all the variables in this model have the expected signs as hypothesized, except the SHOPP variable, which has a negative sign. This can be explained with the respectively low significance level of the variable. The AGE variable, also has a rather low significance level. In addition, the FRONTIS2 and STREET variables are insignificant again (in Model 1 FRONTIS1 and STREET are insignificant). It is then found out that these two don't have a significant effect on the price of housing. The results show that number of rooms, existence of an elevator, income level of the neighborhood and size of the parcel, all have significant effects on the sale price of housing.

In Model 3, except SHOPP variable, which has a negative sign again, all variables have expected signs as hypothesized. Quality of material and workmanship, existence of an elevator, income level of neighborhood, being located in a housing estate and having larger parcel area, all have significant effects on the sale price of housing.

After the analysis with linear functional form, hedonic price analysis is carried out, by including estimated of the models' significant variables by using log-linear (semi-linear) functional form. It is aimed to find out percentage changes in prices that result from one unit change in independent variables, rather than determining the constant value of an additional unit of each attribute. Again, the results indicated that the fitness of every model is high. The findings of Model 1 are consistent with the result of the linear functional form. In Model 2 and Model 3 the findings are in similar directions with the signs of the linear form, but for some attributes relatively high percentages are estimated.

The results of analysis clearly display that preferences of households have changed since Türel analyzed housing prices in Ankara, in 1981. Although the main aim of his study was to show the spatial variation of prices, the results pointed out that the most valued attributes were number of rooms and existence of a central heating system, both of which are structural characteristics. On the other hand, the findings of this study show that house buyers no more give importance only to the structural characteristics, but also to locational and neighborhood characteristics.

When we look over the impact level of structural characteristics on housing prices, after inevitable and expected impact of gross area or number of rooms, we see being located in a housing estate is at the top of the list, which is mostly related with other factors, rather than with the inside of dwellings. A housing estate usually means more than the dwelling unit, by including an image, security, well kept garden, and even recreation and sports grounds.

The increase in house buyers' interest in locational and neighborhood characteristics together with structural characteristics, can be explained with the increase in differentiation which is caused by the decentralization of the city and the rise in the standard of living. While the preferences were mostly about the inherent attributes of the dwellings before, such as age, number of rooms, floor number or heating system, in time, some of these attributes which were distinguishing initially turned to be common and standard features. As the city spreads out, housing units are diversified, now dwelling units in Yıldız and in Ümitköy have different characteristics and identity, although both have the same sale price. On the other hand, when the city had a compact structure, differentiation in the attributes of housing units, which had close sale prices, was less.

It seems that city will continue spreading out by means of housing estates and other housing units which are located in large parcels. As the prices are determined by demand and supply factors, the attributes that mentioned in this thesis as having significant effects on price will continue to shape the housing market, together with other determinants.

Although housing price studies is the first step of housing market analysis, unfortunately in Turkey there is not enough emphasis on this subject. This study is important, as being the second one after Türel's hedonic price analysis about housing prices in Ankara, with 1970's data. A weakness of this study is not having homogeneously distributed data from every district of the city. It is worthwhile to undertake hedonic price analysis with more homogeneous data that includes equal number of samples from all districts in further studies, in order to have a better understanding of the demand side of housing sector of Ankara.

REFERENCES

(2004) *Turkish Housing Survey 1999*, State Institute of Statistics Prime Ministry Republic of Turkey, SIS, Ankara

Bademli, R. (1986) "Ankara'da Kent Planlama Deneyi ve Ulaşılan Sonuçlar" in *Ankara 1985'den 2015'e*, 105-114, Ankara Büyükşehir Belediyesi

Ball, M., Lizieri, C., Macgregor, B. D. (1998), *The Economics of CommercialProperty Markets*, Routledge, London and New York.

Bartik, T. J., (1987), "The Estimation of Demand Parameters in Hedonic Price Models", *The Journal of Political Economy,* Vol. 95, No.1, pp: 81-88.

Basset K., Short J. R., (1980), *Housing and Residential Structure*, Routledge & Kegan Paul, London.

Basu S., Thibodeau T. G., (1998), "Analysis of Spatial Autocorrelation in House Prices", *Journal of Real Estate Finance and Economics*, Vol. 17:1, p: 61-85.

Beaton, W. R., Bond, R. J. (1976), *Real Estate*, Goodyear Publishing Company, Inc., Santa Monica, California.

Benson, E. D., Hansen, J. L., Schwartz Jr, A. L., Smersh, G. T., (1998), "Pricing Residential Amenities: The Value of a View", *Journal of Real Estate Finance and Economics*, Vol. 16, No 1, p: 55-73

Berndt, E., R., (1991), The Practice of Econometrics Classic and Contemporary, Addison-Wesley Publishing Company, Massachusetts.

Bıçkıcıoğlu, H., (1987), "Housing Producers in Ankara in 1980's - The Effects of Stabilization Policies on the Housing Industry" *Master's Thesis,* METU, June 1987.

Brennan, T. P., Cannaday, R. E., Colwell, P. F., (1984), "Office Rent in the Chicago CBD", *Journal of the American Real Estate and Urban Economics Association*, Vol. 12, Issue 3, p: 243-260.

Brown, R. K., (1965), Real Estate Economics, Houghton Mifflin Company, Boston.

Chattopadhyay, S., (1999), "Estimating the Demand for Air Quality: New Evidence Based on the Chicago Housing Market", Land Economics, Vol. 75, No. 1, p: 1-22.

Cheshire, P., Sheppard, S., (1998), "Estimating the Demand for Housing, Land, and Neighbourhood Characteristics," Oxford Bulletin of Economics and Statistics, Department of Economics, University of Oxford, Vol. 60 (3), p: 357-382.

Chin, T. L., Chau, K. W., (2003), "A critical Review of Literature on the Hedonic Price Model", *International Journal for Housing Science and Its Applications*, Vol. 27, Issue 2., p: 145-165.

Clapp, J. M., Giaccotto, C., (1998), "Residential Hedonic Models: A Rational Expectations Approach to Age Effects", Journal of Urban Economics, Vol. 44, p: 415-437.

Cooper, J. R., Guntermann, K. L., (1974), *Real Estate and Urban Analysis*, Lexington Books, London

Coulson, N. E., Bond, E. W., (1990), "A Hedonic Approach to Residential Succession", *The Review of Economics and Statistics*, Vol.72, p: 433-444.

Court, L. M., (1939), "Hedonic Price Indexes with Automotive Examples" in *The Dynamics of Automobile Demand*, General Motors, New York.

Court, L. M. (1941), "Entrepreneurial and Consumer Demand Theories for Commodity Spectra", *Econometrica*, Vol. 9, p: 135-162.

DiPasquale, D., Wheaton, W. C. (1996), *Urban Economics and Real Estate Markets*, Prentice-Hall, Inc., Englewood Cliffs, N.J.

Dixon T., Thompson B., McAllister P., Marston A., Snow J., (2005), *Real Estate and The New Economy*, Blackwell Publishing, Oxford.

Do, A. Q.,Wilbur, R. W., Short, J. L., (1994), "An Empirical Examination of the Externalities of Neighborhood Churches on Housing Values", The Journal of Real Estate Finance and Economics, Vol. 9, No. 2, p: 127-136.

Dubin, R. A., Sung, C. H., (1990), "Specification of Hedonic Regressions: Non-nested Tests on Measures of Neighborhood Quality", *Journal of Urban Economics*, Vol. 27, p: 97-110.

Fik T. J., Ling D. C., Mulligan G. F., (2003), "Modeling Spatial Variation in Housing Prices: A Variable Interaction Approach", *Real Estate Economics*, Vol. 31, p: 623-646.

Fisher, J. D., Martin, R. S., (1994), *Income Property Valuation*, Dearborn Financial Publishing, Inc., USA.

Freeman, A. M., (1979), "Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues", *Scandinavian Journal of Economics*, Vol. 81, p: 154-173.

Gillard, Q., (1981), "The Effect of Environmental Amenities on House Values: The example of a View Lot", Professional Geographer, Vol. 33, p: 471-482.

Goodman, A. C., (1989), "Topics in Empirical Urban Housing Research" The Economics of Housing Markets, p: 49-146.

Goodman, A. C., (1998), "Andrew Court and the Invention of Hedonic Price Analysis", *Journal of Urban Economics*, Vol. 44, p: 291-298.

Goodman, A. C., Thibodeau T. G., (1995), "Age-Related Heteroskedasticity in Hedonic House price Equations", *Journal of Housing Research*, Vol. 6, Issue 1, p: 25-42.

Goodman, A. C., Thibodeau T. G., (1997), "Dwelling-Age-Related Heteroskedasticity in Hedonic House price Equations: An Extention", *Journal of Housing Research*, Vol. 8, Issue 2, p: 299-317.

Greer G. E., Farrell M. D., (1992), Investment Analysis For Real Estate Decisions, Dearborn Financial Publishing, Inc., USA.

Hai-zhen, W., Sheng-hua, J., Xiao-yu, G., (2005), "Hedonic Price Analysis of Urban Housing: An Empirical Research on Hangzhou, China", Journal of Zhejiang University Science, Vol.6A(8), p: 907-914.

Hasekioğlu, G. (1996), "*Determinants of Housing Prices in Turkey*", Master's Thesis, METU, Ankara.

Hough, D. E., Kratz, C. G. (1983), "Can "Good" Architecture Meet the Market Test?", *Journal of Urban Economics*, Vol. 14, p: 40-54.

Işık, O., "Past Experience of Residential Construction in Turkey" *Master's Thesis,* METU, September 1984.

Jud, G. D., Watts, J. M. (1981), "Schools and housing value", *Land Economics*, Vol. 57, No 3, p: 459-470.

Karvel, G. R., Unger, M. A., (1991), Real Estate: Principles and Practices, South Western Publishing Co., USA.

Kayıkent A., (2003), "The Process of Intergenerational Transmission of Housing Wealth" *Master Thesis*, METU, September 2003.

Kinnard W. J., (1971), *Income Property Valuation*, Heath Lexington Books, Lexington, Massachusetts.

Korum, U., (1982), "1980 ve 1981 Yıllarında Konut Piyasası", Konut'81, s:107-143, Kent-Koop Yay., Ankara.

Lancaster, K. J. (1966), "A New Approach to Consumer Theory", *Journal of Political Economy*, Vol. 74, p: 132-156.

Malpezzi, S., (2002), "*Hedonic Pricing Models: A Selective and Applied Review*", In Kenneth Gibb and Anthony O'Sullivan (eds.), Housing Economics: Essays in Honour of Duncan Maclennan. Forthcoming, Routledge.

Milgrim, M. R., Development Writer (1987), *The Appraiser of Real Estate*, American Institute of Real Estate Appraisers of the National Association of Realtors, an Illinois Not For Profit Corporation, USA.

Murie A., Niner P., Watson C., (1977), *Housing Policy and Housing System*, George Allen and Unwin, London.

Muth, R. F. (1966), "Household Production and Consumer Demand Functions", *Econometrica*, Vol. 34, p: 699-708.

Nelson, R. L., Aschman, F. T. (1957), *Real Estate and City Planning*, Prentice-Hall, Inc., Englewood Cliffs, N.J.

Palmquist, R. B., (1984), "*Estimating the Demand for the Characteristics of Housing*", The Review of Economics and Statistics, Vol. 66, No.3, p: 394-404.

Palmquist, R. B., (1992), "Valuing Localized Externalities", *Journal of Urban Economies*, Vol. 31, p: 59-68.

Rosen, S. (1974), "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition", *Journal of Political Economy*, Vol. 82, p: 34-55.

Şenyel, M. A., (2006), Low-Rise Housing Development In Ankara, unpublished MS thesis, METU

Tankut, G. (2000) "Jansen Planı: Uygulama Sorunları ve Cumhuriyet Bürokrasisinin Kent Planlama Yaklaşımı" in *Tarih İçinde Ankara 2nd edition*, ed. Ayşe Tükel Yavuz, 301-306, TBMM Basımevi, Ankara

Tekeli, İ. (2000) "Ankara'nın Başkentlik Kararının Ülkesel Mekan Mekan Organizasyonu ve Toplumsal Yapıya Etkileri Bakımından Genel Bir Değerlendirmesi" in *Tarih İçinde Ankara 2nd edition*, ed. Ayşe Tükel Yavuz, s: 317-335, TBMM Basımevi, Ankara

Topçu, M. (2004) *Spatial Variation of Apartment Housing in Ankara*, unpublished MS thesis, METU

Tuna Ultav, Z., Sahil, S., (2004), The Analysis of OR-AN Case Within the Context of Social Structure and Spatial Environment Interaction, Journal of Fac. Eng. Arch. Gazi Univ. Vol. 19, No: 3, p: 247-259.

Türel, A. (1981), "Ankara'da Konut Fiyatlarının Mekansal Farklılaşması", *ODTÜ Mimarlık Fakültesi Dergisi*, Cilt 7, Sayı 1, s: 97-109.

Ustaoğlu, E., "*Hedonic Price Analysis of Office Rents: A Case Study of the Office Market in Ankara*", Master's Thesis, METU, September 2003.

Wen, H., Jia, S., Guo, X., (2005), "Hedonic Price Analysis of Urban Housing: An Empirical Research on Hangzhou, China", Journal of Zhejiang University Science, 6A(8), p: 907-914.

Wendt, P. F., (1956), *Real Estate Appraisal: A Critical Analysis of Theory and Practice,* Henry Holt and Company, New York.

Yüceşahin, Bayar, Özgür, (2004), "Spatial Distribution of Urbanization and Its Change in Turkey", *University of Ankara Turkish Journal of Geographical Sciences*, Vol.2 Issue:1 p:23-39

APPENDIX

Correlations

	VASITI	YOLMERKEZ	MERUZAK	SITEMI	YAS	BRUTALAN	ARSASI	TOPKAT	KAT	CEPHE1	CEPHE2	KAMACI	ASANSOR	OTOPARK	ODA	BANYO	DALTERAS	GIYODA	ICOZEL	DAGODA	ISINMA	ULASIM	ALISVERIS	OKAN	PARSELBU	CANKAYA	GELIRDUR
VASITI	1	-0,083	,105(*)	,134(**)	-,191(**)	,497(**)	,119(**)	-,124(**)	0,062	-0,041	0,011	0,032	-0,049	0,027	,527(**)	,394(**)	,285(**)	0,083	,199(**)	-,092(*)	0,011	-,127(**)	-,144(**)	-0,07	0,037	-0,018	0,033
YOLMERKEZ	-0,083	1	-0,037	0,01	,140(**)	0,054	-0,04	,132(**)	,114(*)	0,012	-0,052	-,248(**)	,149(**)	0,032	-0,004	-0,003	0,025	-0,05	0,042	0,083	0,002	0,069	0,072	0,037	-0,044	0,05	-0,062
MERUZAK	,105(*)	-0,037	1	,408(**)	-,330(**)	-0,052	0,031	,105(*)	0,022	0,035	0,068	,221(**)	-0,055	-0,058	0,018	-0,015	0,058	0,027	-,093(*)	0,056	-,149(**)	-,172(**)	-,214(**)	-0,087	,151(**)	-,555(**)	-,393(**)
SITEMI	,134(**)	0,01	,408(**)	1	-0,027	0,083	,199(**)	,485(**)	,316(**)	0,006	0,05	,128(**)	,228(**)	0,027	0,069	0,073	0,006	0,052	0,072	-0,026	0,024	-0,026	-,183(**)	0,049	,456(**)	-0,069	0,042
YAS	-,191(**)	,140(**)	-,330(**)	-0,027	1	-,257(**)	-0,041	-0,057	-0,065	-0,005	-0,039	-,286(**)	-,275(**)	-,405(**)	-,272(**)	-,294(**)	-,284(**)	-0,028	-,315(**)	,120(**)	-0,064	,184(**)	,117(**)	,298(**)	-0,024	,152(**)	,236(**)
BRUTALAN	,497(**)	0,054	-0,052	0,083	-,257(**)	1	,325(**)	-0,029	,148(**)	0,036	-0,046	0,008	,243(**)	,323(**)	,771(**)	,722(**)	,435(**)	,306(**)	,535(**)	-,173(**)	,142(**)	-,145(**)	-,163(**)	-0,066	,131(**)	,318(**)	,336(**)
ARSASI	,119(**)	-0,04	0,031	,199(**)	-0,041	,325(**)	1	-0,027	-0,059	0,015	-0,012	0,03	0,016	,096(*)	,253(**)	,302(**)	0,011	0,067	,187(**)	-0,031	0,013	-0,033	-0,063	0,03	,385(**)	,165(*)	,132(**)
TOPKAT	-,124(**)	,132(**)	,105(*)	,485(**)	-0,057	-0,029	-0,027	1	,540(**)	-0,009	0,025	0,058	,529(**)	,131(**)	-0,077	0,036	0,015	-0,032	,141(**)	-0,048	0,082	0,077	-0,031	-0,062	,258(**)	0,007	0,07
KAT	0,062	,114(*)	0,022	,316(**)	-0,065	,148(**)	-0,059	,540(**)	1	0,019	-0,034	0,08	,391(**)	,110(*)	,105(*)	,050(*)	,240(**)	0,014	,198(**)	-0,043	,113(*)	,089(*)	0,023	-0,057	0,062	0,066	0,066
CEPHE1	-0,041	0,012	0,035	0,006	-0,005	0,036	0,015	-0,009	0,019	1	-,153(**)	-0,006	0,039	0,056	-0,012	-0,006	0,001	-0,019	0,043	-0,05	-0,047	0,005	-0,039	0,021	0,063	0,03	0,046
CEPHE2	0,011	-0,052	0,068	0,05	-0,039	-0,046	-0,012	0,025	-0,034	-,153(**)	1	0,033	-0,009	-0,017	-0,04	-0,007	-0,029	-0,021	-,095(*)	,126(**)	0,045	-0,006	-0,025	0,037	0,03	-0,03	-0,032
KAMACI	0,032	-,248(**)	,221(**)	,128(**)	-,286(**)	0,008	0,03	0,058	0,08	-0,006	0,033	1	-0,002	0,05	0,084	0,059	,176(**)	0,054	-0,054	0,036	-0,022	-0,079	-0,02	-0,063	0,061	-,204(**)	-,204(**)
ASANSOR	-0,049	,149(**)	-0,055	,228(**)	-,275(**)	,243(**)	0,016	,529(**)	,391(**)	0,039	-0,009	-0,002	1	,465(**)	,144(**)	,280(**)	,137(**)	0,034	,343(**)	-,133(**)	,149(**)	0,063	0,015	-,149(**)	,107(*)	,238(**)	,235(**)
OTOPARK	0,027	0,032	-0,058	0,027	-,405(**)	,323(**)	,096(*)	,131(**)	,110(*)	0,056	-0,017	0,05	,465(**)	1	,234(**)	,335(**)	,181(**)	,105(*)	,406(**)	-,147(**)	0,064	-0,053	0,032	-,108(*)	,098(*)	,236(**)	,221(**)
ODA	,527(**)	-0,004	0,018	0,069	-,272(**)	,771(**)	,253(**)	-0,077	,105(*)	-0,012	-0,04	0,084	,144(**)	,234(**)	1	,647(**)	,429(**)	,234(**)	,413(**)	-,123(**)	,133(**)	-,173(**)	-,150(**)	-0,057	0,025	,177(**)	,206(**)
BANYO	,394(**)	-0,003	-0,015	0,073	-,294(**)	,722(**)	,302(**)	0,036	,050(*)	-0,006	-0,007	0,059	,280(**)	,335(**)	,647(**)	1	,288(**)	,264(**)	,445(**)	-,130(**)	0,077	-,147(**)	-,185(**)	-,098(*)	,116(*)	,288(**)	,236(**)
DALTERAS	,285(**)	0,025	0,058	0,006	-,284(**)	,435(**)	0,011	0,015	,240(**)	0,001	-0,029	,176(**)	,137(**)	,181(**)	,429(**)	,288(**)	1	0,063	,271(**)	-,103(*)	0,057	-,091(*)	-0,007	-0,034	-0,016	0,076	0,06
GIYODA	0,083	-0,05	0,027	0,052	-0,028	,306(**)	0,067	-0,032	0,014	-0,019	-0,021	0,054	0,034	,105(*)	,234(**)	,264(**)	0,063	1	,220(**)	-0,012	0,037	0,004	-,106(*)	-0,006	-0,025	,112(*)	,119(**)
ICOZEL	,199(**)	0,042	-,093(*)	0,072	-,315(**)	,535(**)	,187(**)	,141(**)	,198(**)	0,043	-,095(*)	-0,054	,343(**)	,406(**)	,413(**)	,445(**)	,271(**)	,220(**)	1	-,262(**)	,315(**)	-0,044	-0,055	-0,043	,179(**)	,332(**)	,331(**)
DAGODA	-,092(*)	0,083	0,056	-0,026	,120(**)	-,173(**)	-0,031	-0,048	-0,043	-0,05	,126(**)	0,036	-,133(**)	-,147(**)	-,123(**)	-,130(**)	-,103(*)	-0,012	-,262(**)	1	-,182(**)	0,063	0,005	0,073	-0,029	-,145(**)	-,126(**)
ISINMA	0,011	0,002	-,149(**)	0,024	-0,064	,142(**)	0,013	0,082	,113(*)	-0,047	0,045	-0,022	,149(**)	0,064	,133(**)	0,077	0,057	0,037	,315(**)	-,182(**)	1	0,026	0,049	0,023	0,027	,188(**)	,171(**)
ULASIM	-,127(**)	0,069	-,172(**)	-0,026	,184(**)	-,145(**)	-0,033	0,077	,089(*)	0,005	-0,006	-0,079	0,063	-0,053	-,173(**)	-,147(**)	-,091(*)	0,004	-0,044	0,063	0,026	1	,385(**)	,189(**)	0,016	,097(*)	0,07
ALISVERIS	-,144(**)	0,072	-,214(**)	-,183(**)	,117(**)	-,163(**)	-0,063	-0,031	0,023	-0,039	-0,025	-0,02	0,015	0,032	-,150(**)	-,185(**)	-0,007	-,106(*)	-0,055	0,005	0,049	,385(**)	1	,172(**)	-0,011	,090(*)	-0,018
OKAN	-0,07	0,037	-0,087	0,049	,298(**)	-0,066	0,03	-0,062	-0,057	0,021	0,037	-0,063	-,149(**)	-,108(*)	-0,057	-,098(*)	-0,034	-0,006	-0,043	0,073	0,023	,189(**)	,172(**)	1	0,051	,098(*)	,090(*)
PARSELBU	0,037	-0,044	,151(**)	,456(**)	-0,024	,131(**)	,385(**)	,258(**)	0,062	0,063	0,03	0,061	,107(*)	,098(*)	0,025	,116(*)	-0,016	-0,025	,179(**)	-0,029	0,027	0,016	-0,011	0,051	1	0,036	,145(**)
CANKAYA	-0,018	0,05	-,555(**)	-0,069	,152(**)	,318(**)	,165(*)	0,007	0,066	0,03	-0,03	-,204(**)	,238(**)	,236(**)	,177(**)	,288(**)	0,076	,112(*)	,332(**)	-,145(**)	,188(**)	,097(*)	,090(*)	,098(*)	0,036	1	,626(**)
GELIRDUR	0,033	-0,062	-,393(**)	0,042	,236(**)	,336(**)	,132(**)	0,07	0,066	0,046	-0,032	-,204(**)	,235(**)	,221(**)	,206(**)	,236(**)	0,06	,119(**)	,331(**)	-,126(**)	,171(**)	0,07	-0,018	,090(*)	,145(**)	,626(**)	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).