A Hedonic Analysis of Open Spaces in Urban Residential Neighborhood of Dhaka

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Thesis title: **A Hedonic Analysis of Open Spaces in Urban Residential Neighborhood of Dhaka**

Abstract

Urban open spaces and public recreation lands enhance the environment, economy and quality of life in cities by improving air quality, providing recreational opportunities, and enhancing aesthetic values, among many other benefits. Development decisions in the Dhaka city frequently fail to consider the values of such open spaces. As a result, development occurs in ways that greatly reduce or destroys these open spaces with negative environmental, economic, and social consequences. This study only concerns with the valuation of open spaces specially parks and water bodies of different urban residential neighborhoods of Dhaka city in Economic terms.

The real estate is one of the vital catalysts for a country's economy as urban land value is determinative in both urban planning and real estate activities in economies of today's world. Within the context of the economic valuation of open space, the presence and absence of open space has an effect on the residential property value in Dhaka is assumed and verified. Together with a set of structural, location and socio-economic variables use to explain residential property prices; the study focuses on three amenity or environmental variables which include the existence of views of park or lake, the distance from the housing unit to the nearest open space, and the size of that open space. To analyze the impact of open space attributes on real price of residential properties, an empirical analysis is carried out by employing Hedonic Price Method (HPM). The regression analysis results from the first stage hedonic estimation reveal that homebuyers are willing to pay only for scenic views and living in the closest proximity to open spaces especially as parks and lakes for both owned and rental houses.

This study estimates that the presence of open space views increase the house price on an average 14% of actual price for owner occupied houses and increase the rent price on an average 12% supplementary for rental houses. In the same way, distance from the house to the nearest park is negatively related to the house price. This indicates the marginal implicit price for owner occupied houses increase 5.3%, by reducing the distance between a house and the closest open space by 100ft. In contrast empirical results for proximity to open spaces for rental houses and the size of the nearest open space for both owned and rental houses do not show a statistical significant relationship on nearby property values. As in Dhaka supply of open space is far short of demand therefore less choice makes it difficult to clearly determine the value of property due to the size of nearby open space. This estimated valuation of open spaces and their amenity benefits will be useful in urban design, land use planning and open space preservation decision making.

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GLOSSARY OF ACRONYMS

BBS	Bangladesh Bureau of Statistics
CV	Contingent Valuation
CVM	Contingent Valuation Method
DAP	Detailed Area Plan
DMDP	Dhaka Metropolitan Development Plan
DRA	Dhanmondi Residential Area
DTLR	Department for Transport, Local Government and the Regions, U.K
HPM	Hedonic Price Method
NPFA	The National Playing Fields Association
RAJUK	Rajdhani Unnoyan Kartripakkha
RCC	Reinforced Cement Concrete
SMA	Statistical Metropolitan Area
TCM	Travel Cost Method
WTP	Willingness To Pay
$\chi 2$	Chi-Square Test

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CHAPTER 01: INTRODUCTION

This chapter introduces research topic with the explanation of the problem statement, research questions, objectives, context, scope, its limitations and significance of the study. Once, the research problem has been defined, and then the chapter is continued with the explanation of research procedure and method (HPM) to measure economic value of open space attributes by analyzing their impact on real estate values since various benefits of open spaces are expected to be translated economically into property values.

1.1 Problem statement

Open Spaces such as public parks, waterfronts, botanical gardens, playgrounds, reservoirs and forests, natural areas and golf courses provide numerous amenities for nearby residents including recreation opportunities and attractive views (Bolitzer and Netusil, 2000). Parks and other open spaces may contribute to quality of life in urban areas through their various benefits -social, environmental, physical and economic. The presence of parks, trails and open space not only add to the quality of life of local residents, but these natural spaces also serve as magnets that bring visitors to explore and patronize the surrounding park area. As cities grow, however, open spaces are paved over to make room for new buildings and roads needed to accommodate the increasing urban population. To ensure the contribution of open space, they must be sufficiently generated and well planned, designed and maintained.

While the open space benefits described above are clearly of importance to people, their value may be difficult to quantify. As a result, communities may overlook such benefits in their planning. The benefits of open space and other environmental amenities, however, may be capitalized in the sales prices of homes in a community. If so, estimates of the monetary value of these benefits can be derived by careful analysis of home prices.

Communities rarely intentionally omit such amenities from their planning; rather, they fail to consider them because they lack direct economic justification for incorporating them into market driven land use decision-making or because they are unaware of their values. In this market driven world, if these spaces have an economic value it would help to protect them against over development and co modification of land use. Most cities have not yet realized the values that open spaces can play in revitalizing communities. Often their importance is

forgotten in the debate of architecture and built form. This is particularly evident in the developing countries like Dhaka where cities sprawl extensively.

Dhaka, the capital of Bangladesh, has come to be known as a fast growing megacity of South Asia in recent times. It began with a manageable population of 2.2 million in 1975, which reached 12.3 million in 2000. According to 2001 census report, Dhaka Statistical Metropolitan Area (SMA) accommodates 10.7 million people, which is 37.45% of total urban population of Bangladesh (BBS, 2003). It is predicted by United Nations that Dhaka would be the 6th largest mega city by the year 2010 and it would continue to uplift its position as second largest mega city of the world by the year 2015 (Islam, 2005). As population is growing in this mega city, considering the dwelling places required for these large numbers are very inadequate. As a result residential areas of Dhaka city are turning into overcrowded, dirty, and unhealthy environment and lack of open spaces. Shortage of open space due to the population growth and urbanization is considered in the keynote as the most alarming threat to the living environment of Dhaka. Dhaka has experienced, and will continue to experience, increased demand for housing. As a result, land is being consumed for housing subdivisions at rapid rates, often with little attention paid to the protection of the environmental amenities associated with undeveloped land. These increases in growth have additionally led to concerns about the negative effects of urban sprawl. Experts suggested that an ideal city needs to keep its 40%-50% of land open or free. However Dhaka structure plan urges to have 20% of open spaces for its future generation (Mowla, 2005). In Dhaka urban greenery, park greenery or tree-covered spaces constitutes less than 15% of the city landscape (Nilufar, 1999). According to the DMDP'95, old Dhaka (organically developed neighborhood) has only 5% and new Dhaka (planned neighbourhood) has about 12% open space (Mowla 2005).

Problem of private encroachment on to public land, for instance influential real state interest being allowed to site new development on public land, including parks and green corridors along water body is quite common in Dhaka (Mowla, 2006). Development decisions in the Dhaka city frequently fail to consider the values of such open spaces. As a result, development occurs in ways that greatly reduce these open spaces with negative environmental, economic, and social consequences. This study is concerned with the valuation of open spaces specially parks and water bodies of different urban residential neighborhoods of Dhaka city in Economic terms.

Due to the limitation of land and high population density in Dhaka, high-rise residential buildings are dominating in the property market. Property is transacted in term of apartment in the market. Apartment is treated by people as a place of shelter, accommodation, leisure, study, work and entertainment. Occupants' demand of functionality and comfortableness from the apartment is increasing as their required standard of living is rising. Apartment is a package of attributes for satisfying the consumption objectives.

Knowing the factors affecting the urban land values is an important advantage in identifying the future of urban development and anticipating probable changes. From an economic perspective, the valuation of urban open space is difficult to calculate because it is a classic public good, where there is no market price. Its apparent lack of value in monetary terms prevents urban open space from being properly evaluated in cost-benefit analyses. The real estate is one of the vital catalysts for a country's economy as urban land value is determinative in both urban planning and real estate activities in economies of today's world. An attractive environment is likely to influence house prices. Houses in attractive settings will have an added value over similar, less favorably located houses (Luttik, 2000). The study has put forward that a public open space has a relative measurable economic value; it impacts the rental price of residential properties. Consequently, the approach developed in this study has advanced the knowledge about open space valuation and provided the evidence in the impacts of open space on residential property's prices of Dhaka city.

The study involves a two stage procedure as theoretical analysis and empirical analysis. In the first stage, fundamental concepts and approaches are evaluated by reviewing related literatures of urban design and environmental economics disciplines. In the second stage, to analyze the impact of open space attributes on rental price of residential properties, an empirical analysis is carried out by employing Hedonic Price Method (HPM) which is basically a regression analysis estimating the effect of each relevant variable on the price of the asset in question. The analysis is realized with a sample of 107 observations (79 owned houses and 28 rental houses) in the case of urban residential properties within the different neighbourhoods of Dhaka city. Using home transaction data from two different residential neighborhood of Dhaka, the study employs hedonic regression analysis to estimate the effect of proximity to open space (parks, and water bodies) on home sales price, controlling for home structural attributes, neighborhood characteristics, home location, and other amenities.

The context of the study - economic valuation of open spaces- is basically based on the appreciation of open space benefits because well designed and managed open spaces are the key for more livable and sustainable cities within the competitive processes of globalization through their various sets of benefits such as social, environmental and physical, and economic. To protect all these benefits of open spaces, and so to ensure the contribution to the quality of urban life, they must be sufficiently generated and well planned, designed and maintained. Otherwise, an open space that is poorly designed and maintained, and dangerous likely to hurt the quality of life.

1.2 Research Questions

In the direction of the needs for this study, three major research questions were determined to be answered:

Research Question 1: Do open spaces have a relative measurable economic value?

Research Question 2: Do Open Spaces have an impact on the price of residential properties or houses? If yes, how this value varies with the presence and absence of Open Spaces?

Research Question 3: Which attributes of houses affect its impact on the price of residential properties?

1.3 Objectives of the Study

The purpose of this study is to analyze possible impact of public open spaces on the price of residential properties. Through the use of data from actual market transactions, the effect that housing and lot attributes have on the sale price of properties is investigated. Controlling other factors, such as a home's structural, location or neighborhood and amenities or environmental attributes, an econometric model is used to estimate the economic value of each housing attribute, at different neighborhoods of Dhaka city. The existing system of parks and other open spaces represents an important economic value for Dhaka city. Developing a more thorough understanding of the economic value will help with public policy decisions related to park expansions and conservation for future. This study was intended to identify and estimate the economic value—according to current scenario— of parks and water bodies of Dhaka at different neighborhoods. To perform these valuation analyses, the study focus on three components:

- To recognize the main determinants of residential property prices in Dhaka.
- To access the implication of these determinants on the property price by constructing the hedonic price model.
- To Estimate the implicit price in monetary terms that individuals are willing to pay to consume the benefits of Open Spaces.

1.4 Limitations of the study

It can be considered that Hedonic Price Method is promising in measuring the impact of open spaces on residential property values. Nevertheless the application of this method into open space is not without problems. Mainly the data collection is time consuming and many people and real easte agents resist participating to the survey. Hedonic analysis requires a huge amount of data set to minimize the standard error. But due to the limited time in carrying out the research, only 107 observations (79 owned houses and 28 rental houses) are considered. This creates certain degree of bias in the model. Incorporating more transactions can solve this setback. Another problem is that, the graphical representations and results of each variable is not possible to show in detail in data analysis chapter as the size of the paper become massive, only the variables those are significant in the hedonic model are presented in this chapter. The graphical results and resultant tables of other variables are shown in the appendix A and appendix B respectively in the short form. Furthermore, because this specification classifies open space areas by type, it does not consider relevant differences between particular open space areas in the same category. For instance, it may be that some parks generate positive externalities, while others generate negative externalities, as this model does not consider those factors. Finally the hedonic price method requires advance technical knowledge. These aspects can be an obstacle for wide spread use of hedonic price method in urban affairs.

1.4 Scope of the study

In addition to population growth, the demand for urban parks and open space is likely to grow in the future with citizen awareness of environmental issues and demand for ecosystem services. Effective urban land use planning and supplying additional acreage of such parks

require a clear understanding of their amenity values and demand in our society. Our current knowledge on the economic value of such parks is limited. This study is concerned with the valuation of open spaces in Economic terms. Most of the previous studies are relied only on the Implicit Price of the park acreage, but this research attempts to combine the observed quantity of urban park acreage with the implicit prices to estimate the demand for recreation park acreage in urban neighborhoods. Estimates of the economic values or amenity benefits of urban parks and public open spaces have emerged recently (Tyrvainen, 1997; Tyrvainen and Miettinen, 2000; Bolitzer and Netusil, 2000; Lutzenhiser and Netusil, 2001; Geoghegan, 2002; Hobden et al., 2004; Salazar and Menendez, 2007). But in Dhaka no research has been carried out so far on economic valuation of open spaces, therefore, overseas studies are tested in Dhaka's Urban Neighborhood Open Space context, to assess the valuation of open space in the property market.

Expected Outcome

- Finding from the research will be useful in enhancing and defining the Quality and Amenity Value of open spaces at residential neighborhoods of Dhaka city.
- The estimated amenity benefits of urban open spaces will be useful in urban land use planning and open space preservation, besides pricing the land with relation to open spaces. i.e. Price α 1/ distance of open spaces.

1.5 Significance of the Research

Green areas perform important environmental and recreational functions as outlined by Costanza et al (1997). In many cities, parks and other open spaces have traditionally been publicly provided facilities for which no price has been established in the market place (Nicholls 2002). But, as Luttik (2000) indicated it is conceivable that future residents and/or urban developers will finance the creation of new open spaces. Due to the increasing demand for green areas, which is not met by an increase in public finance, this is exactly what the governments are looking for; financing possibilities from private sources. In the case of private finance of them, a careful analysis of their economic value particularly property value increasing effect has of course great importance.

While there is an increasing need for open spaces, yet there is an increasing trend of cutting the budgets for creation and maintenance of these areas. Local governments have some

financial problems and decisions concerning with open spaces. A planning approach, which value open spaces also as an economic entity can solve these problems by helping governments in managing financial obstacles to generate open spaces. In this context, their economic value should be systematically measured in monetary terms in urban affairs (Tyrvainen and Vaananen 1998).

Although having value, urban open spaces are public goods without a market price. Therefore, as noted by Tyrvainen and Miettinen (2000), the benefits are more difficult to estimate although the cost of supplying open spaces can be calculated in a relatively straightforward way. Because most of the values attached to open spaces are non-priced environmental and social benefits such as pleasant landscape and recreation opportunities. As a result, they are valued generally qualitatively but not quantitatively. However, qualitative valuations of them are difficult to integrate into the assessment procedure. Their lack of value, expressed in monetary terms, prevents open spaces from being properly considered in the cost-benefit analyses of urban planning and design policies (Morancho 2003). Consequently, these values are underestimated or not reflected in urban planning and design processes (Kwak, et al. 2003). Therefore, quantitative information concerning urban open space benefits is needed as a component in urban affairs (Tyrvainen and Miettinen 2000, Tyrvainen and Vaananen 1998).

Nicholls (2002) suggested that particularly in the times of budgetary cutbacks and other financial constraints, positive economic valuation of open spaces is crucial, to both their continued existence and further development or designation. Because as Luttik (2000) mentioned, decision-makers compare economic factors like contribution to the tax base and employment or value added to local economy against the value of environmental factors. By expressing value of open spaces in monetary terms they become comparable to the former. This will put more weight on environmental factors in the decision making process.

In the direction of these considerations explained above, limited amount of researches to measure the economic value of open spaces have been carried out mostly in the form of measuring their property value increasing effect. For instance, Luttik (2000) in Netherlands, Tyrvainen (1997) in Finland, Irwin (2002) and Nicholls (2002) in USA, Morancho (2003) in Spain, and more recently, Anderson and West (2006) in USA investigated the value of open spaces. But, in Dhaka nothing has been done so far to evaluate open spaces in monetary terms. Thus there is still a need for further researches on economic valuation of open space.

1.6 Research Methodology

A three-step approach was developed as a research methodology (Figure 1.1).

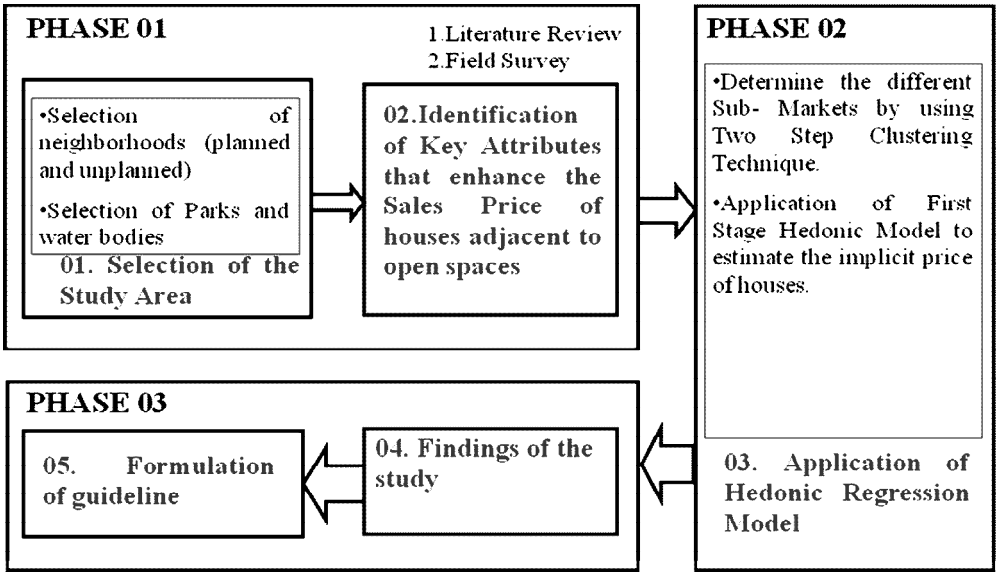

Figure 1.1: Research Methodology

First of all sample areas are selected and its characteristics are described and also demonstrated with visual material. The selection of the research area assured including different segments of the housing market, which offer houses in different prices with different structural, location-neighborhood, and amenity characteristics. In selection of the research area, one another important consideration is the familiarity with the area (types of open space and existing situation). In the direction of these considerations, Dhanmondi and Gulshan of Dhaka are selected as the sample area (for detail, see 3.1.1) as these two neighborhoods consist high density and high class residence where the effects of amenity attraction including parks and water bodies have a significant impact on their home transaction. Then survey is conducted on sample sites and their surrounding areas to collect objective data. Critical factors those influences home sales price are extracted from extensive literature review and variety of data analysis. Data sets have been used in this study come from a variety of sources.

Conducting a theoretical analysis through an extensive review of the literature, in the second phase the research, adopt a hedonic approach to examine if the principal characteristics of Open spaces are critical determinants of land prices. The study carries out theoretical and empirical analysis to answer the research questions, and it has employed the Hedonic Price

Method (HPM) as the research method. This study employed HPM as a research method to value open space since it considered HPM as the most suitable method for valuation of open space among other methods because of the advantage of using data obtained from real behavior; although it has several strict requirements.

By using HPM it is possible to measure economic value of open space attributes by analyzing their impact on real estate values since various benefits of open spaces are expected to be translated economically into property values. Presently, it is an accepted and reliable method in measuring the value of urban amenities and environmental externalities because of basing on actual data (rent/purchase price). It obtains the value through the influence exercised by the environment on the market price of another good (Freeman 1993, Palmquist 1991, Tyrvainen and Miettinen 2000). The detail of the research design applied in this dissertation is discussed in chapter 3.

Lastly, at final phase the results from the data analysis are analyzed and discussed. (for detail, see 4.1 at Chapter 4). The findings from this study have several policy implications in urban land use planning, open space preservation, and real estate management. The results suggested some guidelines for further researches.

1.7 Study Organization

The study was organized in six chapters:

Chapter 1 (Introduction) begins with the explanation of the aim, scope, context and importance for the study. It defines, first, the big picture, in which the research took place in general, and then introduced the point, in which the research problem took place specifically. Later, it listed the research questions of the study. Once, the research problem has been defined, and then the chapter is continued with explanation of the research procedure, methodology and significance. It is ended with presentation of the organization of the thesis.

Chapter 2 (Literature Review) as the first part of the literature review from both urban design and environmental economics disciplines' perspective, is designed to acquainted readers with the theoretical base of the study. It has two main sections. In the first section from urban design perspective, the concept of open space is explained; open space benefits are demonstrated dividing into three groups: social, environmental and physical, and economic benefits. Then the next part from an environmental economics discipline perspective is

designed to comprehend the method used in the study -HPM- by reviewing it in terms of definition, emergence and historical development, assumptions, advantages disadvantages, variables used in price models, and functional forms. Finally, the HPM was evaluated after reviewing its previous applications.

The second section of literature review is organized from environmental economics discipline perspective to understand the basic concepts, methods, and previous studies on economic valuation through a review of vast literature. Here, the basic concepts of valuation are determined as value, total economic value, Valuation of non market goods. Later, the methods developed to value environment are examined dividing them into two groups: revealed preference methods and stated preference methods. Then the method used in the study – Hedonic price method is to comprehend by reviewing it in terms of definition, emergence and historical development, assumptions, advantages disadvantages, variables used in price models, and functional forms. Finally, the HPM is evaluated after reviewing its previous applications. This part is concluded with a review of the previous studies on economic valuation of environment in general, and specifically, on open spaces.

Once the theoretical background of the study had been established, then, the empirical analysis, which is carried out to understand the impacts of open space attributes on price of residential properties, is presented in **Chapter 3** (Research Design). This chapter is composed of three parts: definition of the research design, presentation of the data analysis, and establishing the hedonic price functions. The research design is defined in five steps: In the first step, the variables' set was defined. Dependent variable was determined as the rental price of housing unit; and independent variables are defined as three sets of attributes: housing's structural, location or neighborhood, and amenity attributes. In the second step, statistics hypotheses to be tested through inferential statistics techniques are defined. In the third step, selection of the sample area –Dhanmondi and Gulshan residential neighborhood- was explained, and the sample area is described and demonstrates with visual material. In the fourth step, data collection techniques and sampling design is explained. In the fifth step, statistical data analysis techniques used in the study are defined and explained very briefly.

Once the research design is defined, then, the chapter presented the results of data analysis in two parts: descriptive and inferential statistics results. Finally, **Chapter4** (Data Analysis and Discussions) presented the hedonic price functions.

In Chapter 5 (Conclusion and recommendation), results of the study are summarized, and contribution of the variables describing open space attributes to the HPM is evaluated. Further, suggestions for further researches were given.

1.8 Summary

Parks and other open spaces contribute to quality of life in urban areas through their various benefits. Estimates of the monetary value of these benefits can be derived by careful analysis of home prices. Its apparent lack of value in monetary terms prevents urban open space from being properly evaluated in cost-benefit analyses. This study is concerned with the valuation of open spaces specially parks and water bodies of different urban residential neighborhoods of Dhaka city in economic terms. The fundamental concepts and approaches to the valuation of open spaces are evaluated by extensively reviewing related literatures of urban design and environmental economics disciplines, as well as evaluating Dhaka's open spaces in terms of the yardstick development from overseas studies.

CHAPTER 02: LITERATURE REVIEW

This chapter reviews both urban design and environmental economics disciplines' to develop the theoretical base of the study. In the first section of literature review, from urban design perspective, the concept and benefits of open space are demonstrated. On the other hand, the second section, from environmental economics discipline perspective, is organized to understand the basic concepts, methods including hedonic price method in terms of its emergence and historical development, assumptions, advantages and disadvantages, variables used in the hedonic models, types of functional forms. Finally this chapter reviews the previous studies on economic valuation through a review of vast literature.

2.1 The Concept of Open Space: Definitions

In general open space is used to refer to the whole external environment outside buildings in urban areas. The term "open space" has different meanings to different people. Most of these meanings have in common the idea of lands that have not been developed with structures for residential, commercial, industrial or institutional use. Open space is defined as "publicly or privately owned land that is publicly accessible and has been designated for leisure, play, or sport, or land set aside for the protection and/or enhancement of the natural environment" (MOE, 2001, p.3D-1). Gold (1980) has suggested that open space is not only land or the water on the land in or around urban areas, which is not covered by buildings, but is also the space and the light above the land. Nevertheless, as Dunnett et al. (2002) indicated, the term "open space" seems to be used alternately with the term "green space" which is a more recent term and particularly used to emphasize the green environment of urban areas. Thus an open space can be defined as that part of the urban area which contributes to its amenity, either visually by contributing positively to the urban landscape, or by virtue of public access. It is therefore defined as combining urban green spaces and civic spaces. It includes all areas of parks, play areas, waterfronts and other green spaces specifically intended for recreational use, as well as other green spaces with other origins.

2.2 Definitions of Urban Open Spaces

Urban open spaces are typically undeveloped land within urbanized areas that are set aside to provide public recreational opportunities as well as the chance to experience natural areas and wildlife habitat. They may also be developed areas that are available to the public to provide a feeling of openness, which has value for recreational purposes, amenity, conservation and other natural resources, historic or scenic views or areas of outstanding natural beauty such as water bodies, valleys, hills, maintains, (Alabi, 2009). However open spaces are defined and developed, or whatever state they are in, there can be no doubt that each urban metropolis has many of them to improve the quality of life for people Wooley (2005).

Urban open space is a term used in land-use planning to define areas of “parks”, “green spaces”, and other open areas. The landscape of urban open spaces can range from playing fields to highly maintained environments to relatively natural landscapes. Areas outside of city boundaries, such as state and national parks are not considered urban open space.

2.3 Benefits of Open Spaces

Open spaces provide numerous amenities for nearby residents including recreation opportunities and scenic views (Bolitzer and Netusil, 2000). Open spaces in urban neighbourhoods are defined as any un built land within the boundary or designated envelop of a neighbourhood which provide or has the potential to provide environmental, social and economic benefits to communities whether direct or indirect (Campbell 2001). The Ontario Federation of Parks and Recreation identifies four categories of benefits of parks and recreation as being personal, social, economic and environmental (Collins, 1994).

2.3.1 Social Benefits

The social value of public space is wide ranging and lies in the contribution it makes to ‘people’s attachment to their locality and opportunities for social interaction, social mixing and social inclusion, and can facilitate the development of community ties (Dines and Cattell et al., 2006). The contribution of open spaces such as parks is significant for social inclusion because they are freely accessible to all ranging from teenagers to adults, (Dunnett et al, 2002) people of different cultures and ages to meet and interact.

The most significant social benefit is provision of recreational opportunities such as children's play areas, walking paths, and so on (Sherer 2003). Dunnett et al, (2002) and Woolly (2003) indicates that play is proved to be important for social development that includes collaborative skills, negotiating skills, confrontation and resolution of emotional crisis, management of conflicts, and developments of moral understanding, development of language, experimentation and problem solving techniques (Taylor, 1998). The National Playing Fields Association (NPFA, 2000) also identified the importance of play in the outdoor environment that provides opportunities for freedom, physical activities and to take different challenges for children.

As a social space open spaces provide an outdoor room within a neighbourhood, somewhere to relax, and enjoy the urban experience, a venue for a range of different activities, from outdoor eating to street entertainment; from sport and play areas to a venue for civic or political functions; and most importantly of all a place for walking or sitting-out (Thompson 2002, Montgomery 1997). Another social benefit of open spaces is that it may reduce crime (Nicholls, 2002).

2.3.2 Health Benefits

Open space also benefits human health by providing a location for outdoor exercise or to escape the stresses of urban environments (Giles-Corti et al., 2005; Krenichyn, 2006; Maller et al., 2006; Roemmich et al., 2006; Song et al., 2007) and may provide ecological benefits, for example, by acting as habitat for wildlife or improving water or air quality. People value open space as somewhere to relax and get away from all stresses (Dunnett et al, 2002). Accessibility to open space or view of greenery and presence of trees and woodlands can have marked benefits for the health of urban dwellers. People have a link with greener environment report fewer health complaints and have a better perceived general health as well as mental health (Dunnett et al, 2002).

The provision of safe, clean and expansive outdoor green spaces provide opportunities to urban people for physical exercise. In recent days urban design there is now great interest in linking urban open spaces to provide pedestrian and cycle routes between residential areas and community facilities such as shops and schools. In particular, many authorities are highlighting safe routes to school that enable children to make off-road journeys between homes and school (Woolley, 2003) and enhance the health of our young people (Armstrong, 1993).

2.3.3 Environmental Benefits

In the cities, the main environmental function performed by open spaces through their living elements is to absorb CO2 emissions, which come mainly from the use of private vehicles in urban transport. Laurie (1986) stated by grounding previous researches that to improve the air of Berlin to any marked degree, a green area of 300.000 hectares would be needed (Golden Gate Park in San Francisco is 100 hectares). Conservation of urban open areas therefore becomes indispensable to curb the growing contamination of cities.

Open spaces also maintain a certain degree of humidity in the atmosphere, regulate rainfall, and tend to stabilize temperatures and reduce the extremes sheltering wind and sun, and providing ventilation channels. Laurie (1986) indicated that plants act as an absorbent material in open spaces, blotting up heat and light, work as an acoustic screen and therefore open-green areas with organic surfaces reradiate less heat than do places having inorganic surfaces such as concrete.

Other environmental and physical benefits of open spaces are filtering pollutants and cleaning the air, controlling storm water runoff and protecting against natural hazards such as flood in natural and man-made urban environment, contribution to cost effective sustainable urban drainage systems, reducing erosion, protecting ground water, screening obtrusive views, contributing to landscape and cultural heritage, and improving the aesthetic quality of a city offering cases of green in predominantly gray environs. They also contribute to maintain biodiversity through the conservation and enhance the distinctive range of urban habitats (Dunnett, et al. 2002, Kwak, et al. 2003, Laurie 1986, Morancho 2003, Rogers 1999, Sherer 2003, Thompson 2002).

2.3.4 Economic Benefits

Finally, open spaces serve certain economic benefits. Dunnett et al. (2002) divided these benefits into two groups: on-site benefits such as direct employment and revenue generation, and less tangible off-site benefits including increased nearby property prices (residential, commercial, agricultural), economic revitalization through attracting and retaining businesses and residents in an area, and increasing tourism.

Among all these economic benefits, as Kwak et al. (2003) indicated, amenity values of open spaces has gained a special attention in the recent years. That is, the benefits of proximity to an open space are capitalized into property prices since many people are willing to pay a larger amount for a property located close to parks and open spaces than for a home that is not

close to these amenities (Sherer 2003). Different studies show a positive and significant effect of the Size of urban parks. The Larger (smaller) the Size of the park, the Larger (smaller) the Sales Price of nearby houses. But Distance of a park has a significant Negative effect. There is a tangible link between property values and their proximity to green space and urban forested areas (Tyrvainen, 1997; Tyrvainen and Miettinen, 2000; Thorsnes, 2002).

For instance, Crompton (2000) reviewed 25 studies investigating whether parks and open space contributed to property values of nearby properties or not; and found that 20 of the results indicated a positive result (Correll, et al. 1978, Des Rosiers, et al. 2002, Irwin 2002, Kwak et al. 2003, Lindsey and Knaap 1999, Luttik 2000, McPherson 1992, Morancho 2003, More 1988, Nicholls 2002, Phillips 2003, Rogers 2003, Tyrvainen and Miettinen 2000). Increases in property values around parks may also lead to increases in the amount of property tax revenue; Central Park in New York is an early example (Nicholls 2002).

Another emphasized economic benefit is their influence on economic revitalization through attracting and retaining businesses and residents, and increasing tourism. According to Nicholls (2002), a well-designed and managed open space network may not only improve residents' quality of life, but also enhance outsider' perceptions. Finally, as Dunnett et al. (2002) stated they may play role in urban renewal.

To protect all these positive benefits of open spaces, they must be well maintained and designed. Within this context, it is necessary to assess and measure their benefits in planning studies (Morancho 2003, Kwak, et al. 2003, Tyrvainen and Miettinen 2000). Through the methods developed by economics science, it is possible to make quantitative valuations for open spaces (Freeman 1993, Haab and McConnell 2002). Nevertheless, unlike the vast literature on valuation of environmental assets in general, researches measuring the economic value of open space benefits are limited. Thus, this is an area where additional research is still needed.

2.4 Typologies of Urban Open Spaces

A typology of urban green spaces means developing a classification of categories within which sit definitions of types of urban green space. Hierarchical division has the benefit of allowing the different categories to be either aggregated at a higher level or broken down further in a consistent way, depending on the level of detail required and the purpose of the

classification. The typology needs to reflect the full range of different types of urban green space that occur and which together form the green fabric of the urban area (Dunnett et al., 2002). To understand what types of open spaces are important to daily urban life, the grouping of urban open spaces into types or categories has been undertaken from time to time as a planning tool. Such groupings have usually resulted in either a typology or a hierarchy of urban open spaces. All open spaces are classified according to the nature of the land and type of open space use. According to western standard all the open spaces in urban areas falls under four types:

01. Utility open spaces
02. Green open space
03. Corridor open spaces
04. Multi use classification

Each of these major types has a number of categories according to functional land use. (Koppelme and Chiara, 1975). Public open space is usually categorised into a hierarchy of neighbourhood, district and regional open space and can be used for either passive or active recreation (Thompson, 2008). According to Lynch (1981) open space can be identified as regional parks, squares, plazas, linear parks, adventure playgrounds, wastelands, playgrounds and playing fields. The main focuses of this typology perhaps more on spaces that are dominated by hard landscape. Other research about open spaces defined a hierarchy to include small park, local park, district park, metropolitan park, regional park and linear open space (Llewelyn-Davies Planning, 1992). Eckbo (1969) suggested a range of positive functions of open spaces, including provision for relaxation and recreation, conservation of wildlife, natural and agricultural resources, scenery and the shaping and control of urbanisation.

Dunnett et al. (2002) indicated, the term “open space” seems to be used loosely and interchangeably with the term “green space” which is a more recent term and particularly used to emphasize the green environment of urban areas. According to him Open space consists of green space and grey space. Green space is land that consists predominantly of unsealed, permeable, soft surfaces such as soil, grass, shrubs and trees. Grey space is land that consists predominantly of sealed, impermeable, hard surfaces such as concrete, paving. The emphasis is on ‘predominant’ character because of course green spaces may include buildings and hard surfaced areas and grey spaces may contain trees. Grey space can be further subdivided into functional spaces and civic spaces. Functional spaces serve a particular practical purpose, such as roads, pavements, car parks and other hard surfaced areas associated with different types of built development. Civic spaces are publicly accessible

areas designed primarily for public enjoyment including town squares, plazas, pedestrian ways and esplanades (Dunnett 2002, Carr, et al. 1992). Indeed, there are many other classifications for open space. Dunnett, N (2002), summarized typology of Urban Green Spaces in table 2.1;

Types of Urban Green Spaces		
Types	**Examples**	**Figure**
AMENITYGREEN SPACE All land which is designed primarily for amenity, both visual amenity and enjoyment for access and recreation. It consists mainly of publicly owned land but also includes private land, such as domestic gardens, which can contribute greatly to the green fabric of towns and cities.	**Parks and Gardens** Areas of green space specifically designed for public access and enjoyment and combining a variety of landscape and horticultural elements (sometimes including semi-natural habitats) and facilities for the	
	Informal Recreation Areas Areas of green space available for public access and enjoyment but with only low key provision of facilities. Usually consist mainly of grass areas for informal recreation, but may also have trees, a play area, paths and sometimes toilets and parking area.	
	Outdoor Sports Areas Green space designed to accommodate sports; including sports pitches, playing fields, golf courses, and other outdoor activities. Often occur within parks, but may also be separate, especially in the case of golf courses.	
	Play Areas Green space designed specifically for children's play, with various levels of provision of equipment and facilities. May occur separately but also often incorporated within parks, informal recreation areas and outdoor sports facilities.	
	Incidental Green Space Areas of green space that, although publicly owned and managed, and accessible for public enjoyment, have no clear recreation function and little significant value as habitat. Their function is usually as a 'green landscape' backdrop' but their landscape value can sometimes be minimal because of	

	poor design. They include the 'left over 'green spaces within housing and other forms of development.	
	Domestic Gardens Green space within the cartilage of individual dwellings, which is generally not publicly accessible, but which often makes a significant contribution to the green fabric of urban environments.	
FUNCTIONAL GREEN SPACE Green space which has a primary function other than amenity or recreation, although some of these areas may also be publicly accessible and available for people's enjoyment. The primary functions include farming, horticulture, burial grounds and educational and other institutional use. Access to these green spaces may go hand in hand with the primary function (for example cemeteries, churchyards and allotments) or be by public right of way, or by agreement, for example where school grounds are made available for public use.	**Farmland** Green space under agricultural management. Includes farms which also have a recreation and education function such as City Farms.	
	Allotments Green Space available for members of the public who occupy them to cultivate vegetable or fruit crops for their own use.	
	Burial Grounds Land used as burial grounds, including cemeteries and churchyards.	
	School Grounds Green space in the grounds of schools including sports pitches, other outdoor sports facilities, play areas, gardens, nature areas, school farms and growing areas and incidental green space.	

	Other Institutional Grounds Green space in the grounds of institutions such as universities and colleges, hospitals and nursing homes, and associated with commercial and industrial premises, including gardens, sports pitches, other outdoor sports facilities, play areas, semi-	
	Wetland Green space dominated by wet habitats, including water bodies, running water and fen, marsh, bog and wet flush vegetation.	
SEMI-NATURAL GREEN SPACE Green space that is made up of semi natural habitat. These habitats may be encapsulated areas of the countryside that existed before the urban area expanded. Alternatively they may have been formed by the natural processes of colonisation and succession on abandoned or disturbed ground or by deliberate creation of new habitats through initiatives such as urban forestry and reclamation of derelict land. All these habitats make a vital contribution to the urban landscape but may or may not be accessible for public enjoyment. In some cases where there is access it may be	**Woodland** All forms of urban woodland including deciduous woodland (both ancient semi-natural and woodlands of more recent origin) and mixed and coniferous woodland (including plantations and shelterbelts). Includes newly planted woodland.	
	Moor and Heath Areas of moorland and heath land vegetation consisting mainly of ericaceous species, and including moorland grass, shrub moor, shrub heath and bracken. Likely to include some Commons within urban areas.	
	Grassland Grassland which is not agriculturally improved and not formally part of an amenity green space, including calcareous grassland, acidic upland grassland and unimproved meadows. Could include established vegetation on reclaimed derelict land which	
	Disturbed Ground Land which has been disturbed by previous development or land use but is now abandoned, waste or derelict and is becoming re-colonised by processes of colonisation and natural succession.	

unofficial, but still extremely important to local people.	**River and Canal Banks** Green space occurring along the margins of canals or rivers and forming part of the river or canal corridor.	
LINEAR GREEN SPACE Green space that occurs in association with linear features, especially transport routes such as roads, railways and canals, but also rivers and streams. It is a matter for debate whether this category should be considered separately, since these spaces might also be defined as either semi natural habitat, or functional green spaces whose primary function is transport, or incidental green space with a visual amenity function. These spaces are, however, distinguished by their linear character and are often an important part of strategic green space designations such as green links and reason we suggest that they should be considered separately.	**Transport Corridors** The often substantial areas of green space associated with transport. Includes: the variety of habitats, associated with railways, which are often inaccessible but when they fall into disuse can become an important part of an open space network; green space associated with roads, and especially the large areas of grassland, scrub, trees and woodland found along major roads and motorways; and green space along cycle ways and walking routes.	
	Other Linear Features Cliffs and other natural areas of linear green space.	

Table 2.1: Based on Dunnett, N (2002), Typology of Urban Green Spaces

Woolley (2003) has been suggested a typology from the user's point of view which consists of three groupings of urban open spaces —domestic, neighbourhood and civic—based upon

the concept of home range. The typology developed in his research is shown above in Table 2.2

Open Space	Characteristics	Type	Figure	Function
Domestic urban open spaces	Physically closest to home, Spaces integral within a housing area	private gardens, community garden, allotments, courtyard, playground		Spaces for relaxation, recreation such as bird watching, gardening and socialization
Neighbourhood urban open spaces	Physically further from home, need a very specific decision to visit, requires journey of some sort	Park, playgrounds, playing fields, sports grounds, school playgrounds, streets, city farms and incidental spaces	 	Involve people from different network, organization, religious and culture. Provide opportunities for community and cultural
Civic urban open spaces	set within the urban context usually physically farthest from the home, places at strategic or specific locations, visiting a civic spaces cost, travel, accessibility, fear and safety may be an issue.	comprise commercial urban open spaces which include squares, plazas, water features and office grounds, hospital grounds and university campuses, Urban open spaces relating to the transport system and recreational urban	 	Provide a great opportunity for meeting a huge variety of people from other neighbourhoods, Improving physical and mental health

Table 2.2: Based on Woolley (2003), Open Space Typologies

None of the western slandered are comparable to the case of Dhaka. However considering the nature of the land and the type of open space use all the public open spaces within Dhaka can be ordered under the following four. Open spaces can be classified into three broad groups according to the spatial scales, extent of utility and services rendered by them [Islam, Kawsar and Ahmed, 2002]. The term ‘urban open spaces’ is used throughout this report as a short

hand term for Green Space that focuses on the parks and water bodies of different neighbourhoods of Dhaka city.

Significance	Characteristics	Figure
Regional or national open space	Regional green spaces or facilities often serve to define and separate urban areas, link the urban area within or outside the cities and often provide for recreational needs region wide or national wide. A high proportion of users are likely to travel to them by car or public transport.	
	Example: regional or national parks, zoological and botanical gardens.	
City open space	City green spaces provide facilities for city wide recreation. These facilities tend to attract a significant proportion of city people, several neighbourhoods can use those open spaces. They may attract the highest number of users, mainly from throughout the local authority area but possibly wider afield and	
	Example: city parks, park ways, green belts, stadium, sports centers, athletic fields, golf course, water bodies.	
	Example: play grounds, Play fields, medium sized parks, water bodies	
Local open space2	Local green spaces are often smaller in size, with fewer facilities, but are greater in number, spread throughout a local area and with well used footpaths linking key community facilities. These green spaces will tend to attract almost all of their users from a localized area. Many users of these facilities will walk to them.	
	Example: Small parks, small green pockets, play lots, incidental open space	

Table 2.3: Based on Islam, Kawsar and Ahmed (2002): Spatial Scale of facilities in green and grey spaces

2.5 Valuation of Open Space

While the open space benefits described above are clearly of importance to people, their value may be difficult to quantify. As a result, urban designers and planners may overlook such benefits in their planning. The benefits of open space and other environmental amenities, however, may be capitalized in the sales prices of homes in a community. If so, estimates of the monetary value of these benefits can be derived by careful analysis of home prices. Indeed, the effect of open space on residential property values has been the subject of much study in the last decade and numerous studies have found that increased proximity to open space increases home sale prices.

2.6 Valuation of Non Market Goods

Applying economic theory, demand curves for normal commodities like automobiles or milk can be estimated from market data, and the value of these goods to consumers can therefore be determined. However, consumers also receive benefits from objects and characteristics which are not typically bought and sold. For example, the current price of clean air cannot easily be calculated because it does not pass through a traditional market (Kristom 2000). Open space, wetlands, and farmlands provide a range of both public and private benefits. Some of the services provided by such open space can be relatively easily valued because they are traded in markets, such as the value of crops for land in agriculture, the value of fisheries protection or flood control through the preservation of wetlands, or the value of timber produced from forested lands (Swallow, 1994 and Acharya and Barbier, 2002). The benefits provided by open space give areas amenity value. But like other environmental amenities, there is no explicit market for the benefits provided by open space. There is a market for undeveloped land, and properties have market value as reflected in the real estate market. But this value does not necessarily reflect the value of undeveloped land as open space. In urban or urbanizing regions, however, where the highest and best use (as determined by the market) has usually been development, the open space value of land must be separated from its development value (Fausold & Lilieholm, 1996). In most cases, therefore, real estate market price will not accurately measure the value of undeveloped land as open space. The benefits of open space and other environmental amenities, however, may be capitalized in the sales prices of homes in a community. If so, estimates of the economic value of these benefits can be derived by careful analysis of home prices. Indeed, the effect of open space on residential property values has been the subject of much study in the last decade and

numerous studies have found that increased proximity to open space increases home sale prices. Like many other environmental amenities, there is no explicit market for these benefits. Some benefits, however (e.g. nice views or convenient opportunities for recreation), accrue mainly to home owners living near open areas. In a competitive housing market, we expect that prospective homebuyers will bid up the prices of homes near open space in order to gain these benefits, and so the externalities generated by proximity to open space will be reflected in nearby home values (Anderson, et al. 2003). Economists have used a variety of techniques for valuing nonmarket goods. For purposes of valuing open space, most studies rely on the hedonic property value approach and contingent choice or valuation techniques.

This paper, aims to reveal the monetary value of open space by using a hedonic pricing model of residential property values.

2.7 Economic Valuation of Open Space

In many cities, parks and other open spaces have traditionally been publicly provided facilities for which no price has been established in the market place (Nicholls 2002). But, as Luttik (2000) indicated it is conceivable that future residents and urban developers will finance the creation of new open spaces. Due to the increasing demand for green areas, the governments are looking for financing possibilities from private sources, as the demand is not met by an increase in public finance. In the case of private finance, a careful analysis of their economic value particularly property value-increasing effect has great importance.

A planning approach, which value open spaces also as an economic entity can solve these problems by helping governments in managing financial obstacles to generate open spaces. In this context, their economic value should be systematically measured in monetary terms in urban affairs (Tyrvainen and Vaananen 1998). Nevertheless, although having value, urban open spaces are public goods without a market price. Therefore, as noted by Tyrvainen and Miettinen (2000), the benefits are more difficult to estimate although the cost of supplying open spaces can be calculated in a relatively straightforward way. Because most of the values attached to open spaces are non-priced environmental and social benefits such as pleasant landscape and recreation opportunities. As a result, they are valued generally qualitatively but not quantitatively. However, qualitative valuations of open spaces are difficult to integrate into the assessment procedure. Their lack of value, expressed in monetary terms, prevents open spaces from being properly considered in the cost-benefit analyses of urban planning

and design policies (Morancho 2003). Consequently, these values are underestimated or not reflected in urban planning and design processes (Kwak, et al. 2003). Therefore, quantitative information concerning urban open space benefits is needed as a component in urban affairs (Tyrvainen and Miettinen 2000, Tyrvainen and Vaananen 1998).

Luttik (2000) mentioned, decision-makers compare economic factors like contribution to the tax base and employment or value added to local economy against the value of environmental factors. By expressing value of open spaces in monetary terms they become comparable to the former. This will put more weight on environmental factors in the decision making process.

In the direction of these considerations explained above, limited amount of researches have been carried to measure the economic value of open spaces out mostly in the form of measuring their property value increasing effect. For instance, Luttik (2000) in Netherlands, Tyrvainen (1997) in Finland, Irwin (2002) and Nicholls (2002) in USA, Morancho (2003) in Spain, and more recently, West and Anderson (2006) in USA investigated the value of open spaces. But, there is still a need for further researches on economic valuation of open spaces.

2.7.1 Basic concepts of economic valuation

The economic value of environmental resources, goods or the benefits they provide is defined by economists using the concept of Total Economic Value (TEV). The total economic value of environmental goods and resources has been exclusively based on the use value attributed to goods considering direct benefits enjoyed by consumers. The expression of total economic value bears as an attempt to overcome the traditional evaluation of environmental goods. The expression of “total economic value” appeared for the first time in an essay by Peterson and Sorg in 1987, “Toward the measurement of total economic value”. The concept of the “total economic value” (TEV) of a resource has been presented in a variety of sources (Pearce and Turner, 1990, Aylward and Barbier, 1992, Munasinghe, 1993). According to standard economics theory, TEV is determined by people's preferences. Preference can be measured by finding out individuals' maximum ***willingness*** to pay (WTP) to maintain an existing environmental amenity or their ***willingness*** to accept compensation for the loss of an amenity. Economic theory says that ***maximum willingness*** to pay is equal to ***minimum willingness*** to accept. The total value of a resource is the sum of component values across the entire population of individuals that receives benefit from the resource (Hearne.R, 1996).

Although there is nothing particularly original in the idea that the total value of a resource is the sum of component values across the entire population of individuals that receives benefit

from the resource, TEV does present a useful taxonomy of use and non-use benefits. Figure 02 shows the main framework of the Total Economic Value (TEV). The breakdown and terminology vary slightly from analyst to analyst, but Total Economic Value consists of two main elements: use value and non-use value. According to Pearce, 1993; Randall and Stoll, 1983 TEV is the sum of both use values and non-use values. Use value captures indirect use in addition to direct use.

There are two main categories of values used to determine the TEV:

- Use Value
- Non- use Value

The economic concept of value has been broadly defined as any net change in the welfare of society. This concept does not restrict environmental values to benefits from the direct use of a resource. To account for the fact that a given resource such as undeveloped land provides a variety of services to society (both internal and external to the market). The first three components (direct use, indirect use and option) of the equation are generally referred to together as 'use value. The non- use value includes, other components: the existence value, altruistic and bequest value.

TEV= direct use + indirect use + option + existence + altruistic + bequest values

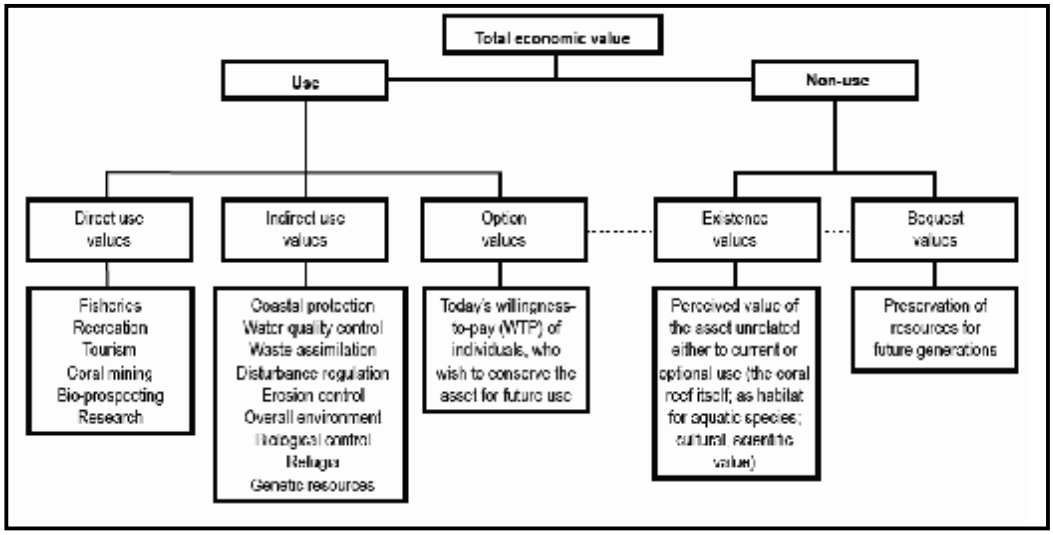

Figure 2.1: Components of Total Economic Value (taken from Cesar and Chong, 2004)

The **Use Value** derives from a concrete use of environmental goods and resources. Even the value attributed to goods to individuals is included in the use value, because they enjoy seeing

a landscape or can swim in a lake; even one uses environmental goods in an inappropriate and under-destructive manner can also be considered the user of those environmental goods. Thus every use, in any moment and by anyone are realize to create use values, which are more or less measurable since they derive from their current use.

But the total economic value is not only use value as mentioned before; it is given by the sum of use and non-use values referring to intrinsic benefits, those deriving from the mere existence of environmental goods.

- **Direct use values** refer to environmental goods and services that are used directly by human beings. They include the value of *consumptive uses* such as farming, harvesting of food products, timber for fuel or construction, and medicinal products and hunting of animals for consumption; and the value of *non-consumptive uses* such walking and bird watching; as the enjoyment of recreational and cultural activities that do not require harvesting of products..

- **Indirect use values**, which are unrelated to current use but are, linked to the site which often benefits people far downstream, for example, ecosystem functions such as watershed protection or carbon sequestration by the land and forests which benefits the entire global community by abating climate change

  .

Indirect use values refer to regulating ecological functions carried out by the system and converged in the general categories of functions supporting life and the pollution control. The indirect use comes from the implicit carried out in supporting or protecting economic activities. For example, accumulation functions of underground and artificially recharged water in some damp areas (flooded plays and beat bogs) are used indirectly, because water is used for domestic and agricultural purposes.

- **Option values,** the notion of option value introduced by Weisbrod (1964), where individuals are willing to pay for the option of using the site in the future, such as future visits for recreational purposes. The particularly innovative element is the explicit reference to economic subjects who, without using the goods, can be interested in its conservation. In this context it is the first time that the so-called “option value” has been delineated, i.e. the maximum amount that the non-users are willing to pay so that the park can stay open (Krutilla, 1967).

The final value component, known as non-use value was first proposed by John V. Krutilla in 1967 , captures those elements of value that are unrelated to a current, future, or potential use. John Kutrilla conducted an analysis, in which in contrast with the use value, he identifies a larger concept of non-use value.

Non-use values include where the benefit results from knowledge that goods and service exist and will continue to exist, independently of any actual or prospective use by the individual; and bequest value, where the benefit is in ensuring that future generations will be able to inherit the same goods and services of the present generation.

- **Existence value** reflects benefits from simply knowing that a certain good or service exists, which in the current context reflect the fact enjoyment that an individual gets from knowing that an environmental element will be preserved (a site, park, forest, animal species), even if they never expect to use or visit those resources in future directly themselves, but simply want the elements continue to exist (Krutilla 1967). Those individuals, may value the 'existence' of undeveloped land sites unrelated to their current or future use.

- **Altruistic values**, which might arise when the individuals are concerned that undeveloped land site should be available to others in the current generation.

- **Bequest values**, which measure individuals' willingness to pay to ensure that future generations will be able to enjoy the site in its undeveloped state. We can also define a bequest value bound to the satisfaction that individuals derive from knowing that a resource will be preserved for use by successive generations (Krutilla 1967). For example, many people are concerned with future damages from global warming and would be willing to pay to reduce them, despite knowing the act that the vast majority of the damages are expected to affect the Earth long after our generation is gone. Policies associated with either a long-term or irreversible impacts can lead to losses that consist primarily of bequest value.

2.7.2 Methods of Economic Valuation

In the literature, although there are different taxonomies for valuation methods, mostly the economic value of open spaces have been addressed by economists through the use of two broad methodological approaches that can assess the economic value of environmental amenities and disamenities in the absence of explicit markets:

1. Stated preference methods (direct).
2. Revealed preference methods (indirect), and

2.7.2.1 Stated Preference Methods

Stated preference methods can be applied to any context. These methods ask consumers how much they value environmental goods and services in carefully structured surveys. The approach has the appealing virtue that it can be used to value for non use value (Walsh et al. 1984; Brookshire et al., 1983), nonmarket use values (Choe et al., 1996; Loomis and duVair, 1993) or both (Niklitschek and Leon, 1996; Desvousges et al., 1993) of any environmental good or service as long as the good can be described. Non-use values have been shown to be a significant portion of total economic value in the context of many natural resources, especially where the resource concerned is unique or the impact is irreversible. There are two major variants of stated preference methods:

1. Contingent valuation, and
2. Choice modelling.

Contingent valuation is concerned with the resource as a bundle of different attributes or characteristics, while choice modelling is mainly concerned with the individual attributes of the resource (DTLR 2003, Brookshire and Coursey 1987, Loureiro, et al. 2003, Moons 2003, Smith 1993). Both variants use similarly structured questionnaires but differ in the way they define the environmental resource of concern. The best known and most commonly used stated preference method is the contingent valuation method (CVM). Specifically, these questions are designed to extract information regarding an individual's willingness to pay for the effects of a particular policy (Breffle, et al., 1998). For example, in order to determine the willingness to pay for open space in a particular neighbourhood one might ask, "How much would you be willing to pay for the development of lakeside green space at the Dhanmondi and Gulshan residential areas of Dhaka city? The CVM was originally proposed by Ciriacy-Wantrup (1947), according to him the prevention of soil erosion generates some extra market benefits" that are public goods in nature, and therefore, one possible way of estimating these benefits is to elicit the individuals' willingness to pay for these benefits through a survey method (Portney 1994, Hanemann 1994). However, Davis (1963) first used the CV method empirically when he estimated the benefits of goose hunting through a survey among the goose-hunters. Venkatachalam (2004) indicated that this method gained popularity after the two major non-use values, namely, option and existence values have been recognized as important components of the total economic values in environmental economics literature,

especially during the 1960s. Conventional revealed preference methods such as travel cost method are not capable of capturing these non-use values, the only method that is identified for estimating these values is the contingent valuation method.

Venkatachalam (2004) reviewed CVM extensively in terms of the developments and issues on the theoretical, methodological and empirical aspects. In his review, the contingent valuation method (CVM) is defined as a simple, flexible non-market valuation method that is widely used in cost-benefit analysis and environmental impact assessment (Mitchell and Carson 1989, Cummings, et al. 1986).

Though a popular nonmarket valuation method, a group of academicians criticise this method severely for not being a proper method of estimating the nonmarket values (Hausman, 1993). Some critics suggest that CVM is highly controversial and completely useless (Venkatachalam 2004, Carson et al. 2001, Diamond and Hausman 1994). The criticism revolves mainly around two aspects, namely, the validity and the reliability of the results, and the effects of various biases and errors (Venkatachalam 2004, Hausman 1993, Bateman and Langford 1997). Carson et al. (2001) reviewed this method in terms of controversies, and discussed key areas of the debate over CV and the validity of passive use value. They concluded that many of the alleged problems with CV can be resolved by careful study design and implementation. They also indicated that empirical CV findings are theoretically inconsistent are not generally supported by the literature. The debate over CV, however, has clarified several key issues related to nonmarket valuation and can provide useful guidance both to CV practitioners and the users of CV results. Hardarson and Hardarson (2000) stated that a more prevalent opinion is that CVM can be of some use although great care needs to be applied in the study design and in the interpretation of results. In practice, the contingent valuation method can be quite complicated, since results often depend on survey design.

An advantage of contingent valuation is that, it is able to capture the ***non-use*** value provided by a particular amenity by directly ***asking*** individuals about their willingness to pay. Contingent valuation can also be used to value environmental amenities when the data required for other techniques (These include home property value data or wage data), in the case of hedonic analysis are not available.

2.7.2.2 Revealed preference methods

Revealed preference approaches are based on the premise that individuals' WTP for a good or service is reflected in their actions. Non-market goods such as environmental quality or scenic views are not traded directly in markets. Revealed preference uses observed market choices from individuals to reveal their underlying preferences, as well as to estimate the values these individuals place on goods and services. These methods attempt to seek natural experiments to estimate the demand function for an environmental good. Revealed preference methods rely on data regarding individuals' preferences for or against a marketed good, which has an environmental attribute related to it in some way. These techniques depend on either actual market, for example, the property market where property prices reflect the various attributes of the property, including environmental attributes. The type of data and the absence of direct enquiry into individual preferences for environmental goods restrict revealed preference methods to estimates of use value only (DTLR 2003). Revealed preferences techniques include:

1. Hedonic price method
2. Travel cost method
3. Random utility modelling and
4. Averting behaviour

Among these various revealed preference methods the study focused on two major revealed preference methods which are travel cost and hedonic price methods are based on the premise that individuals' WTP for a good or service is reflected in their actions.

Travel Cost Method (TCM)

The travel cost method, emerged in the 1950s as the earliest form of revealed preference approach (Hanemann, 2005). Non-market goods such as environmental quality or scenic views are not traded directly in markets. This method has been used to estimate mostly the value of recreational sites. To visit a site people have to bear various costs. These include travel costs (petrol, train tickets, etc.), the opportunity cost of time and, possibly, an entry fee. For example, recreation in a National Park is not a good that is bought and sold as such in the market. Nevertheless, if an individual on a visit to a National Park spends a total of $100 on gasoline, lodging, entrance fees, time, etc., it seems reasonable to assume that the benefit the person receives from visiting the park is *at least* equivalent to $100. The traditional type travel cost analysis attempts to estimate the value people place on a particular environmental good by examining their expenditures on that good, commonly one particular recreation site. By contrast, hedonic travel cost analysis, a variant of the traditional travel cost analysis,

compares people's expenditures on sites with differing levels of environmental features in order to estimate the value people place on particular site characteristics such as scenic views, clean air, etc. (Englin and Mendelsohn, 1991).

The travel cost method is used by the National Park Service, the Forest Service, or the Fish and Wildlife Service to assess the total direct expenditures by recreationists on the use of National Parks, Forests, Wildlife Refuges, or all lands in a state or nationally (American Sport fishing Association, 2002, 2006; U.S. Fish and Wildlife Service and U.S. Census Bureau, 2002).

According to Hardarson and Hardarson (2000) the application of the TCM has some restrictions. One problem is related to the allocation of travel costs. Some studies only estimate the cost for purchasing petrol. Other studies also include costs relating to the maintenance of vehicles, such as insurance and depreciation. Secondly the appropriate measure for the opportunity cost of time is another issue. Most people cannot pick their working hours flexibly and recreational activity is mostly at the expense of other similar activity. Another issue is how one should make allowances for the fact that travellers differ (e.g., some visit only for a day, other stays for weeks). No clear consensus has emerged on how this issue or the other issues discussed above can be resolved. Researchers' preference relating to these issues can have a huge impact on welfare estimates. The choice of functional form has been shown to have a significant impact on consumer surplus estimates.

Another revealed preference method is **Hedonic Price Method**, since this is the method of this research thus reviewed specially in the next section.

2.8 Hedonic Price Method (HPM)

The most popular indirect approach for estimating the monetary value of an environmental asset is hedonic price method, which is usually termed as a revealed preference method. This method obtains the economic value through the influence exercised by the environment on the market price of another good (Freeman 1993, Morancho 2003, Tyrvainen and Miettinen 2000). The aim of the method is to reveal how much of the differences in property prices depend on the differences of environmental quality, that is, the implicit price that individuals are willing to pay to consume environmental characteristics associated with the house, and to infer what the social value of this difference is (Mantymaa 2003, DTLR 2003).

The following sections review the hedonic price method in terms of its emergence and historical development, assumptions, advantages and disadvantages, variables used in the hedonic models, types of functional forms, and previous studies.

2.8.1 Emergence and historical development of HPM

Griliches (1971) and Rosen (1974) provided the theoretical support for the development of the hedonic models. Nevertheless, Goodman (1998) indicated that although, popularized by Griliches in the early 1960s, the pioneering work, and using of the term 'hedonic', dated back to a 1939 article by Andrew Court who was an economist for the Automobile Manufacturers Association in Detroit. By including variables that contributed to the selling price of a car, the implicit values of various automobile attributes were estimated. However, according to Colwell and Dilmore (1999), the origins of the method may possibly be found in previous works.

Colwell and Dilmore (1999) claimed that they found an earlier researcher for the first application of hedonic models. According to them, the first application was more than 15 years prior to A. T. Court. In 1922, G. C. Haas conducted a hedonic study on agricultural land prices with a particular focus on distance to the city center and city size. Thus, Haas's work had much of the flavor of contemporary urban economics. Estimation of a new model showed that some of Haas's adjustments to price, especially his time adjustments, were amazingly accurate. According to them, Haas work was very sophisticated and stands up quite well to the standards of contemporary hedonic price studies. First, the data-gathering effort was substantial. Second, there were a number of statistical devices, other than regression analysis, that were used primarily to adjust the dependent variable. Third, the regression analysis had four explanatory variables. Nevertheless, Colwell and Dilmore also stated that they were not for sure that Haas was the exactly the first. But, the real competition with Haas for high impact on the field was probably Wallace (1926), and not Court (1939). They concluded their study indicating that who was the first matters somewhat, but it was especially interesting that Haas's very early hedonic analysis could be spun into the thread of urban land economics tradition.

On the other hand, Goodman (1998) indicated that also Court's work stand up quite well in terms of many standards of contemporary hedonic price analysis by addressing problems of nonlinearity and changes in underlying goods. Court was interested in automobile price indices. The term 'hedonic' was used to describe the relative importance of various

components, such as horsepower, braking capacity, and window area, among others in constructing an index of usefulness and desirability. Thus, hedonic price comparisons recognize the potential contribution of any commodity, a motor car in this instance, to the welfare and happiness of its purchasers and the community.

Nevertheless, there was little follow-up to Court's hedonic work from 1939 to 1960. Goodman (1998) explained why it took so long. First of all, the econometrics that took hold in the 1940s and 1950s was fundamentally and data collection concentrated. Hedonic price analysis, which is fundamentally a micro-econometric analysis, might have been of less professional interest to those conducting quantitative work. Second, the rudimentary nature of data collection and coding, as well as the time-consuming nature of regression analysis on office calculators and early electronic computers, made the contemporary types of calculation impossible. Calculating one regression with many observations and a large number of explanatory variables was a major undertaking. Detailed examination of which variables were important, or what functional form would fit best was beyond the machines of the early analysts.

In 1958, Griliches recalled using his first hedonic regression on the demand for fertilizer. Similar to Court, Griliches's work on automobile price indices used automobile models as units of analysis including the regressions reported in more modern terms (standard errors of the coefficients, R^2s). Like Court's work, the Griliches analysis was not published in conventional economics journals. Unlike Court, however, Goodman (1998) stated that there was considerable response, and hedonic prices moved swiftly into the micro-econometric tool kit.

In 1974, the method was first introduced to the housing sector by Rosen (1974). Later it was summarized by Freeman (1979, 1985) and recently by Palmquist (1991). Since initial formulation of the hedonic price model, an extensive literature has been developed on application of the model to value locality and environmental amenities associated with residential property. Milon et al. (1984) stated that the early research using the hedonic technique centered on statistical estimation of the relationship between amenities and land prices. However, it was not until the statement of the implicit market model by Rosen (1974) and the subsequent extensions to the problems of land markets by Polinsky and Rubinfeld (1977) and Witte et al. (1979) that the theoretical implications of the hedonic technique were clarified.

From its early emergence onwards, hedonic price method has been applied on diverse range of the impacts of environmental externalities on residential, commercial, and agricultural property markets. For instance, some application focused on the impact of air pollution, noise, underground water contamination, and the existence of high power electric networks and hazardous waste landfills. Some applications of the method focused on the analysis of the value of urban amenities and various land uses such as schools, open spaces (Luttik 2000, Morancho 2003), urban forests (Tyrvainen and Miettinen 2000, Tyrvainen 1997), urban wetlands (Mahan, et al. 2000), public housing projects (Rabiega, et al. 1984), shopping centers, and office buildings (Thibodeau 1990), and the neighborhood effects (Tse 2002).

2.8.2 Assumptions of HPM

Hedonic price method offers a means to estimate the marginal implicit prices of characteristics associated with a differentiated market good such as housing. The hedonic price function, which posits price as a function of the quantities of a good's attributes, arises through the interactions of many buyers and sellers in the market. As a result, it describes the focus of equilibrium points between buyers and sellers in the market. The marginal implicit price of any of the good's attributes is found by differentiating the hedonic price function with respect to the attribute. Evaluated at an individual's optimal choice, this implicit price represents the individual's marginal willingness-to-pay for the attribute (Irwin 2002). The method seeks to estimate an implicit price for environmental attributes by observing actual markets (DTLR 2003).

The starting hypothesis of HPM is that goods are formed by a heterogeneous set of attributes or characteristics. Thus, when acquiring a good, it can be considered the price buyers have paid for it to be the sum of price paid for each one of its characteristics, so that an implicit price exists for each one of attributes defining the good. Assuming that the housing as a multi-attribute good, its price will be determined by a set of attributes. Principally, there are three categories of attributes:

- One category of attributes reflects the structural characteristics of the house such as the plot and building size, type and age of the house, number of rooms, bathrooms, balconies, material quality, comfort level, and so on.

- The second category involves locality and local socio-economic or neighborhood characteristics such as population density, education, income status, poverty level etc.

§ Finally, the last category includes environmental or amenity characteristics such as proximity to city center, schools, hospitals, green areas, environmental quality, and so on. For instance, if a household wishes to have easy access to a recreation area will buy this type of house and pay a premium for it. Therefore, the selling price of the house reflects both structural and locality-environmental characteristics. When structural characteristics are shared, it is possible to estimate the value of locality and environmental characteristics (Palmquist 1991, Freeman 1993, Luttik 2000, Morancho 2003, Tyrvainen and Miettinen 2000). In the application of the method to the property market, five assumptions have to be considered;

1. Housing is a heterogeneous good; it is formed by a heterogeneous set of attributes or characteristics. Thus, it can be considered the price buyers have paid for it to be the sum of price paid for each one of its characteristics, so that an implicit price exists for each one of attributes defining the property.

2. Housing is a segmented market. Any large area has in it a wide variety of sizes and types of housing with different location and environmental characteristics. The entire urban area as a whole can be treated as a single market for housing services in which the individuals have information on all alternatives and are free to choose a house anywhere in the urban market.

3. The housing market is in or near equilibrium, that is, that all individuals have made their utility-maximizing residential choices given the prices of alternative housing locations, and that these prices just clear the market given the existing stock of housing and its characteristics.

4. Preferences are weakly separable in housing and its characteristics, that is, the demands for characteristics independent of prices of other goods.

5. In addition, hedonic theory suggests that large cross-sectional datasets should be used (Freeman 1985, Palmquist 1991, Freeman 1993, Tyrvainen 1997).

2.8.3 Advantage and disadvantages of HPM

The hedonic price method is theoretically promising in measuring non-priced goods since it has the advantage of being based on actual transaction data, choice and purchase price unlike

the contingent valuation method (Freeman 1993, Palmquist 1991, Tyrvainen 1997). Nevertheless, the hedonic property price method has also some limitations and disadvantages.

There are several strict requirements in conducting comprehensive empirical studies of the method. The method needs large datasets from restricted time periods which are time-consuming and difficult to collect. In addition, as Milon et al. (1984), Freeman (1993), Irwin (2002), Mantymaa (2003), Palmquist (1991), Tyrvainen and Miettinen (2000), Tyrvainen (1997), Abelson (1979), Butler (1982), Brown and Rosen (1982) and many others indicated, a variety of econometric issues and problems may occur in estimating hedonic models since as with most other applications of economic theory, the hedonic model does not provide a complete quantitative characterization of real land markets. These problems may include functional form and model specification, extent of the housing market, selection of appropriate variables, multi co- linearity and spatial correlation.

The hedonic model may take several types of functional forms such as linear, semi-logarithmic, double logarithmic or quadratic forms. Nevertheless, the functional form of the hedonic price equation cannot be specified purely on theoretical grounds since the hedonic theory does not give a basis to know the functional form to be used (Cropper, et al. 1988, Milon, et al. 1984, Morancho 2003). Also Mantymaa (2003) stated that according to economic theory it is impossible to say what form of the hedonic price method is the right one. Therefore, the form of the equation must be defined empirically. In general, a flexible functional form is suggested, but it may reduce the ability to obtain significant results (Freeman 1993, Freeman 1985, Palmquist 1991, Tyrvainen 1997, Tyrvainen and Miettinen 2000). The question of functional form has received considerable attention in the literature (Abelson 1979, Butler 1982, Diamond 1980, Freeman 1979, Brown and Rosen 1982, Huh and Kwak 1997, Milon, et al. 1984).

For instance, Huh and Kwak (1997) conducted a research on the choice of functional form of a hedonic price model in Seoul. Their study demonstrated that the important part of exploring the proper functional form of the hedonic price model included investigating a dissimilar and unique hedonic price structure when the hedonic price model was applied to different housing markets. Also, Milon et al. (1984) examined the problem of choosing a functional form for hedonic models and developed a flexible functional form for amenity valuation using a generalized Box-Cox transformation. According to them, the flexible form lead to amenity value estimates with no prior restrictions on the hedonic relationship and permits likelihood

ratio tests of more traditional functional forms. Cropper et al. (1988) examined how errors in measuring marginal attribute prices vary with the form of the hedonic price function.

They estimated various forms of hedonic function using equilibrium housing prices, and calculated errors in estimating marginal attribute prices by comparing each consumer's equilibrium marginal bid vector with the gradient of the hedonic function. They found out that, when all attributes are observed, linear and quadratic Box-Cox forms produce lowest mean percentage errors; however, when some attributes are unobserved or are replaced by proxies, linear and linear Box-Cox functions perform best.

Tyrvainen and Miettinen (2000) indicated that besides the functional form of the hedonic price equation, also other econometric problems require special attention. One of these issues is the choice of appropriate variables in the models. It was seen in the previous studies that, the number and quality of explanatory variables vary considerably between the different studies. Theoretically, the price equation should include all the housing characteristics included in the utility functions of households. Nevertheless, the choice of variables in empirical studies has restrictions such as the availability of data and multi co-linearity. In hedonic price models some explanatory variables are often multi co -linear. Therefore, multi co -linearity occurs when some environmental variables correlate with each other (Goodman 1989, Mantymaa, 2003). Consequently, estimating accurate and stable regression coefficients may be difficult. In this situation, as Tyrvainen and Miettinen (2000) suggested, restricting the number of variables may also make the interpretation of results easier. Also, it is possible to use some other multivariate statistical method than regression analysis.

There are some problems also associated with spatial autocorrelation. Tyrvainen and Miettinen (2000) stated that the error terms may be spatially correlated if some relevant variable, typically local externality is excluded from the regression model. The second form of spatial autocorrelation is more complicated. It may occur if positive error terms in the sale of houses at one location may noticeably influence sales prices at nearby locations, and less so at more distant locations (Goodman, 1988).

One limitation is related to the method's assumptions that, first, the entire urban area can be treated as a single market; and second, the housing market is in or near equilibrium (Freeman 1993, Palmquist 1991). Nevertheless, as Mantymaa (2003) and many others pointed out this is not always the case, there may be lack of houses or public policy restricts the function of a housing market. Further, the price structures of hedonic models are not stable. They may

differ significantly from market to market, or from year to year. However, this may be questionable if housing market has received significant shocks over the time period. Thus, it is suggested to consider the temporal stability of estimated parameters (Tyrvainen and Miettinen 2000, Goodman 1988).

Another difficulty in hedonic studies is to select the proper areas to analyze. Luttik (2000) stated that the essence of the hedonic price method is a comparison of situations with and situations without a specific attribute. Consequently, the value of a specific attribute can only be tested if suitable situations with and without can be found. For example, if a whole district is nice and green, the value-increasing effect of green in the residential area cannot be tested in this district. Another -otherwise comparable district, which is not nice and green, is needed. Since the house market is highly segmented, the two districts should be found within the same segment of the house market. This might cause difficulty in the selection of suitable research areas.

In addition, hedonic theory suggests that large datasets from restricted time periods should be used. Nevertheless, in many countries, data for the hedonic price studies is difficult to get (often manually) and its collection in general time consuming and labor intensive (Freeman 1985, Palmquist 1991, Tyrvainen 1997, Tyrvainen and Miettinen 2000). Nevertheless, as Tyrvainen and Miettinen (2000) stated in future data on house prices will be more readily available from price registers, and geographical information systems and numerical maps will simplify data collection (Bateman, et al. 2002, Paterson and Boyle 2002). Furthermore, Tyrvainen (1997) claimed that in the future city planning will be done numerically using GIS and therefore, the hedonic price models will become more usable for assessing the economic consequences of land-use changes in environmental impact assessment.

Another problem with hedonic price method is that the method does not reveal existence values (Mantymaa 2003). Further, hedonic price method is applicable only when people perceive the existence of the environmental issue sufficiently for it to feature in property values. Otherwise, no statistical association between the impact and the property price can be detected (DTLR 2003). Therefore, as Tyrvainen (1997) pointed out, it is necessary to choose environmental variables in the hedonic model so that they correspond to the ways people perceive the environment.

To conclude, despite its limitations and strict requirements, the hedonic price method is presently theoretically promising and accepted method in the valuation of different environmental benefits.

2.8.4 Variables used in HPM

The hedonic price method reveals the implicit prices of various attributes of properties. Therefore, selection of suitable variables describing the attributes of housing is essential. Theoretically, as mentioned above, the price equation should include all housing characteristics. Nevertheless, it may not be possible to include all attributes because of the availability of data and multi co-linearity. Hence, the choice of variables varies considerably between different studies. Regardless, variables used in the hedonic models consist of a dependent variable and a set of explanatory (independent) variables.

The dependent variable is rent or purchase price in most applications. The data on the price of the property may be obtained from real estate agents, government data registry, or through questionnaire surveys to be applied to households. For reliable estimations, the researcher should decide carefully about the source of data. The most reliable as well as practical data source should be used (Freeman 1993).

The independent (explanatory) variables can be divided into three categories. First category of variables comprises the structural characteristics of the house. The second category involves locality and local socio-economic characteristics. Finally, the last category includes the variables of environmental or amenity characteristics. The data on the explanatory variables may also be obtained from real estate agents, government data registry. Nevertheless, some kind of data may not be gathered from these sources. In this circumstances, although being time-consuming, conducting questionnaire surveys may be preferred. For reliable estimations, the researcher should decide carefully about the source of data (Freeman 1993, Palmquist 1991).

Unlike dependent variable, it is seen in the previous studies that the number and quality of independent variables vary considerably between the different studies. Through a very careful and extensive review of previous studies presented later, the following variables which have been used in previous applications of HPM were found. Below, these variables are listed within three categories of attributes;

1) Structural variables: Structural variables has been used in the previous hedonic price studies are

- size of the housing unit, size of the garden,
- size of the plot,
- age of the building,
- building type,
- Construction type,
- number of all floors,
- floor number of the housing unit,
- number of bedrooms,
- number of bathrooms,
- number of balconies,
- number of facades,
- facade orientation,
- material quality,
- overall building quality,
- type of heating,
- type of door and window material,
- type of main door material,
- availability of storage,
- availability of room looking light hole,
- availability of elevator,
- availability of shutter,
- availability of satellite,
- availability of cabled TV,
- availability of doorkeeper,
- availability of car parking, and so on.

In the previous applications, it is seen that these variables are very influential on the price of housing.

2) **Neighbourhood variables**: These variables include

- distance from housing unit to district center,
- distance from housing unit to bazaar,
- distance from housing unit to supermarket,
- distance from housing unit to primary health service area,
- distance from housing unit to hospital,

- distance from housing unit to nearest primary school,
- distance from housing unit to socio-cultural service area
- distance from housing unit to technical and administrative service areas,
- distance from housing unit to public transportation roads and stations,
- distance from housing unit to metro stations,
- distance from housing unit to railway and railway stations,
- distance from housing unit to energy lines and high power electric networks.
- people per square miles in the census block group,
- percentage of residents under poverty level,
- proportion of vacant houses,
- median age of the residents,
- median household income of the residents
- percentage of residents with college degree

3) Environmental variables: In the previous hedonic price studies, these environmental variables have been used:

- distance from housing unit to sport facilities and areas,
- distance from housing unit to parks and play grounds,
- distance from housing unit to greenways,
- distance from housing unit to golf courses,
- distance from housing unit to lakes and watersheds,
- distance from housing unit to view,
- distance from housing unit to urban forests,
- distance from housing unit to urban wetlands,
- distance from housing unit to waste disposal lands,
- distance from housing unit to hazardous waste landfills,
- size in square footage of the nearest urban recreation park

Apart from these locality variables, also various environmental quality variables such as air pollution, noise, underground water contamination, and natural hazards risks such as earthquake and flood have been used such as quality and quantity of urban amenities.

2.8.5 Functional forms of HPM

Since housing is a heterogeneous good, its price is determined by a set of attributes when identical characteristics are shared. The price function of housing is formulated as follows:

$P = f(Si, Ni, Ei)$

Si: a vector of the structural attributes such as age and type of building;
Ni: a vector of the locality and neighbourhood attributes such as accessibility to city center, parks and play grounds;
Ei: a vector of the amenity or environmental attributes such as view of open spaces, proximity to nearest park;

The essence of the method consists of finding what portion of the price is determined by hedonic variable (Freeman 1993, Tyrvainen 1997, Morancho 2003).

Application of the hedonic price method into the housing market theoretically consists of two stages. Tyrvainen and Miettinen (2000) stated that, at the first stage, implicit prices for different housing characteristics are estimated with formula given above. Here, variation in selling prices of dwellings is explained by the characteristics of housing. One can use these implicit prices directly to evaluate the benefits or losses arising from marginal changes in the supply of environmental goods. This procedure will apply when the environmental change affects only a restricted area and a small number of people. In contrast, the use of price estimates is more problematic if the change in question covers the whole urban area or a large part of it. Here, a second stage of analysis is required, where information about implicit prices and data concerning environmental quality are combined to identify the inverse demand functions of characteristics. Owing to the strict requirements of the data and the econometric problems connected with the second stage, most empirical valuation studies have used only the first-step hedonic model.

Regardless of the number of stages, one important issue in estimation of implicit prices is determination of the functional form of the price equation. The hedonic model may take several types of functional forms such as linear, semi-logarithmic (log-linear), double logarithmic (log-log), inverse semi-logarithmic, quadratic, or Box-Cox transformation forms presented with formulas below (Palmquist 1991, Tyrvainen 1997, Tyrvainen and Miettinen 2000, Morancho 2003).

Linear functional form:
$P = \beta 0 + \beta 1\ X1 + \beta 2\ X2 + \beta 3\ X3 + \ldots\ldots + \beta n\ Xn + \varepsilon;$
Semi-logarithmic (log-linear) functional form:
$LnP = \beta 0 + \beta 1\ X1 + \beta 2\ X2 + \beta 3\ X3 + \ldots\ldots + \beta n\ Xn + \varepsilon;$

Linear-log functional form:

$P = \beta 0\alpha + \beta 1\ lnX1 + \beta 2\ lnX2 + \beta 3\ lnX3 + \ldots\ldots\ldots\ldots\ldots\ldots + \beta n\ lnXn + \varepsilon;$

Double logarithmic (log-log) functional form:

$LnP = \beta 0 + \beta 1\ lnX1 + \beta 2\ lnX2 + \beta 3\ lnX3 + \ldots\ldots\ldots\ldots\ldots + \beta n\ lnXn + \varepsilon;$

Inverse semi-logarithmic functional form:

$LnY = \beta 0 - \beta 2\ 1/X1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + \varepsilon;$

Quadratic functional form:

$Y = \beta 0 + \beta 1 + \beta 2\ X1 + \beta 3\ X1\ 2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + \varepsilon;$

Selection of the best functional form is essential in finding correct results. Nevertheless, the hedonic theory does not give a basis to know the functional form of the price equation as stated in part 2.7.3 (Morancho 2003, Cropper, et al. 1988, Milon, et al. 1984, Mantymaa 2003). Thus, form of the equation must be defined empirically.

The question of functional form has received considerable attention in the literature as mentioned before. According to Rosen (1974), there are many reasons to suppose the relationship between the price and the environmental variable to be nonlinear.

Therefore, logarithmic specifications may fit better. Nevertheless, linear models are still in use because of ease of interpretation of the parameters (Morancho 2003). In general, a flexible functional form is suggested, but it may reduce the ability to obtain significant results. Milon et al. (1984) stated that the flexible form leads to amenity value estimates with no prior restrictions on the hedonic relationship and permits likelihood ratio tests of more traditional functional forms.

According to the results of Cropper et al.'s study (1988), when all attributes are observed, linear and quadratic Box-Cox forms produce lowest mean percentage errors; however, when some attributes are unobserved or are replaced by proxies, linear and linear Box-Cox functions perform best. On the other hand, Cropper et al. (1988) suggested linear form, semi-logarithmic and double logarithmic forms instead quadratic forms when some relevant explanatory variables are omitted (Freeman 1993, 1985, Palmquist 1991, Tyrvainen 1997, Tyrvainen and Miettinen 2000, Morancho 2003, Box and Cox 1964).

2.8.6 Applications of HPM

From Court (1939) onwards (especially in recent decades), the hedonic price method has been applied on diverse range of goods. Among them, the most common applications have focused

on the valuation of environmental externalities caused by such as air pollution (e.g., Smith and Huang 1995, Zabel and Kiel 2000), noise, underground water contamination, high power electric networks, and hazardous waste landfills (Mantymaa 2003, Palmquist 1991).

Some applications of the method have focused on the analysis of the value of urban amenities (see Bartik 1988) and various land uses such as schools, open spaces (e.g., Luttik 2000, Morancho 2003), urban forests (e.g., Tyrvainen and Miettinen 2000, Tyrvainen 1997), urban wetlands (e.g., Mahan, et al. 2000), public housing projects, (Rabiega, et al. 1984), shopping centers, office buildings (e.g., Thibodeau 1990), and the neighborhood effects (e.g., Tse 2002) on house prices.

Other applications have focused on the valuation of social-economic factors such as racial discrimination and urban revitalization (e.g., Ding, et al. 2000). Within the context of real estate sector, the method has been studied for housing, commercial (e.g., Bender, et al. 1999, Dunse and Jones 1998), and agricultural (e.g., McLeod, et al. 2002) property markets. Nevertheless, the most common application of the method is in housing market.

2.8.7 Evaluation

The hedonic price method is presently an accepted and reliable method in valuation of different environmental benefits. In the application of property market, Hedonic price method assumes that first, housing is a heterogeneous good, thus, an implicit price exists for each one of attributes defining the property; second, housing is a segmented market; third, the urban area as a whole can be treated as a single market for housing services; fourth, the housing market is in or near equilibrium; and finally, demands for characteristics of housing independent of prices of other goods.

As a revealed preference technique, from its early emergence onwards, it has been widely applied to measure the impact of diverse range of environmental externalities caused by such as air pollution, noise, underground water contamination, the existence of high power electric networks and hazardous waste landfills, and urban amenities and various land uses such as schools, open spaces, forests, wetlands, public housing projects, neighborhood effects, shopping centers and office buildings in property values. Nevertheless, in the case of urban open spaces, researches are limited. The method is theoretically promising in measuring the value of urban amenities and environmental externalities because of basing on actual data (rent/purchase price) unlike the stated preference methods. Therefore, this study employed hedonic price method as a research method. Nevertheless, the hedonic price method has some

disadvantages as well. These are because of several strict requirements such as selection of suitable area to analyze, and large data sets. There are also a variety of econometric issues and problems in estimating hedonic models such as questions of functional form, multi co-linearity and spatial correlation.

2.9 Studies on Economic Valuation

Previous valuation studies were reviewed first in a wider context: environmental, then, specifically, in the context of open spaces.

2.9.1. Studies in wider context: Environment

In general, there are many researches on the valuation of environmental assets in the world wide, particularly in USA and Europe. The vast literature on the valuation of environmental goods may be divided broadly into two general categories.

The first category involves valuation concepts, methods, and econometric issues (Abdalla, et al. 1992, Adamowicz, et al 1997, Blamey, et al. 1999, Blamey 1998, Boxall, et al. 1996, Boyle, et al. 1996, Cameron 1992, Carson, et al. 2001, Carson, et al. 1996, Champ, et al. 2002, Cropper, et al. 1988, Cummings and Taylor 1998, Earnhart 2001, Freeman 1993, Folmer, et al. 2001, Haab and McConnell 2002, McConnell, et al. 1988, Hanley, et al. 1998, Huang, et al. 1997, Kristom and Laitila 2002, Sterner, et al. 1998, Venkatachalam 2004).

The second literature category presents empirical studies on the economic value of environmental externalities, resources, and land uses in a very wide range (e.g. Bennett, et al. 2003, Breffle, et al. 1998, Boyle and Kiel 1999, Hadker, et al. 1997, Hanley, et al. 2003, Rosiers, et al. 1996, Thibodeau 1990, Tyrvainen and Vaananen 1998, Whitehead, et al. 1999, Arguea, et al. 2000, Asabere and Harvey 1985, Bond and Coulson 1990, Neelam C. Poudyal,et al. 2009, Morancho, 2003)

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2.9.1.1. Studies used Hedonic Price Method

Analyzing the literature, Nelson (1992) indicated that environmental features can increase land and house value if they are viewed as attractive or desirable, or they can reduce values if they are viewed as nuisances or undesirable (Bonnetain 2003, Rosen 1974). Therefore, these empirical studies can be categorized primarily as valuation of negative and positive environmental externalities and land uses depending upon the sign of their expected impact.

Nevertheless, it is also necessary to indicate that the result obtained from the analysis may sometimes not match the expected sign. For instance, the value of climate may be positive or negative depending on the characteristics. Berrens et al. (2004) proved the positive influence of the desirable climatic features on property values. Furthermore, the value of water may be positive or negative depending on the quality, the constraints on property rights, and on the environmental conscious level of people (Bockstael and Leggett 2000, Des Rosiers, et al. 1999, Faux and Perry 1999). Literature presents such studies having unexpected results sufficiently. However, it is useful to divide this huge literature on empirical studies on valuation into two basic groups since it ensures the easy comprehension of the big frame of that complex area.

2.9.1.1.1. Studies on Negative Externalities and Land Uses

There is an abundant valuation literature on a great number of subjects of negative environmental externalities caused by noise, traffic, air pollution, landfills, and so on. Some applications focused on the value of air pollution (e.g., Graves, et al. 1988, Phipps, et al. 2003, Ridker and Henning 1967). Phipps et al. (2003) measured the benefits of air quality improvement improving the methodology for estimating hedonic price functions when the data are inherently spatial.

Some others focused on the **acoustic contamination** (e.g., Becker and Lavee 2003, Kupke, et al. 2002, McMillen 2004, Theebe 2004, Tomkins, et al. 1998, Wilhelmsson 2000). For instance, McMillen (2004) added to the empirical literature by estimating the effect of airport noise on property values around one of the world's busiest airports, Chiacago O'Hare.

Most of the studies focused on the economic impact of **landfill areas** and **waste transport** (Gawande and Smith 2001, Hite, et al. 2001, Kiel 1995, Nelson, et al. 1992, Reichert, et al. 1992, Smolen, et al. 1992, Thayer, et al. 1992). Thayer et al. (1992) examined the benefits of reducing exposure to waste disposal sites by using hedonic price method. They used a large detailed data set to examine the relationship between housing prices and several environmental quality indicators representing air, water, and land influences.

Landfills and hazardous manufacturing facilities are expected to impose health or amenity risks on surrounding communities (Farber 1998). These risks are thus expected to be translated economically into negative effects on adjacent property values (Farber 1998, Haney 1992, Jackson 2001, McCluskey and Rausser 2001, Richards 1996).

Hedonic studies presented the negative values obtained also from **natural hazards** such as earthquake and flood (e.g., Beron, et al. 1997, Murdoch, et al. 1993, Onder, et al. 2004, Harrison, et al. 2001).
For instance, Onder at al. (2004) examined the impact of public perception of earthquake risk on Istanbul's housing market by investigating the spatial distribution of the average house values and the changes in average house prices in Istanbul.

Another subject of negative environmental externalities is the existence of **high voltage power lines**. For instance, Delaney and Timmons (1992) administered a survey in 1990 to estimate the impact of power lines on property values. The results suggested that proximity to high voltage power lines was capitalized into lower values for residential properties.

2.9.1.1.2. Studies on positive externalities and land uses

Positive environmental externalities are produced through various amenities such as roads, schools, parks, greenways, and golf courses. Positive environmental externalities and land uses are in general expected to improve the quality of life in the surrounding communities. Des Rosiers (2002) indicated that these benefits are thus expected to be translated economically into positive effects on adjacent property values. Like studies on valuation of negative externalities and land uses, there is a huge literature also on valuation of various subjects of positive externalities and land uses.

Most of the studies focused on the valuation of positive externality effects of **Transportation improvements and elements** such as rail lines, stations, roads and highways (Benjamin and Sirmans 1996, Bowes and Ihlanfeldt 2001, Coffman and Gregson 1998, Craig, et al. 1998,). For instance, Craig et al. (1998) investigated the relationship between transportation improvements and land values in the Antebellum United States by using hedonic approach

One application is on the valuation of **wetlands.** For instance, Mahan et al. (2000) measured the value of wetland amenities in the Portland, Oregon, metropolitan area using the hedonic property price model. They used residential housing and wetland data to relate the sales price of a property to structural characteristics neighbourhood attributes, and amenities of wetlands and other environmental characteristics.

Some applications were on valuation of **new urbanism features** (Eppli and Tu 1999, Song and Knaap 2003). Asking whether new urbanism offers a desirable place to live, and

consumers willing to pay a premium for it; Eppli and Tu (1999) investigated the impact of new urbanism on single-family home prices in Kentlands.

Some applications were on value of **school quality.** For instance, Brasington (1999), Downes and Zabel (2002), and Haurin and Brasington (1996) proved that the school quality and characteristics have an important influence on property in particularly housing values.

Haurin and Brasington (1996) investigated the relationship between school quality and house prices focusing on explaining variations in real constant-quality house prices in jurisdictions located in multiple MSAs. Using a hedonic house price framework, they tested competing theories of house price determination.

One specific subject of applications was to understand **the value of view**. Nevertheless, a relatively small number of studies examined the value of the view amenity, as pointed out by Benson et al. (1998) either as a primary or secondary focus of analysis (e.g., Brown and Pollakowski 1977, Correl, et al. 1978, Benson, et al. 1997, Benson, et al. 1998). These studies found that view adds significantly to the value of residential real estate.

For instance, Benson et al. (1998) investigated the value of the view amenity in single-family residential real estate markets. They indicated that views are not uniform, but vary by type (water, mountains, valleys, and so on) and by quality.

The economic value of planning decisions are not only resulted from the decisions on land use types, but also from other decisions related with such as conservation (Asabere and Huffman 1991, Leichenko, et al. 2001), plot size (Lin and Evans 2000, Thorsnes 2000, Thorsnes and McMillen 1998), and location (Archer, et al. 1996, Henneberry 1998). And, each of these decisions has some economic consequences. For instance Leichenko et al. (2001) analyzed the relationship between historic preservation and residential property values in the case of Texas Cities. Designation of historic districts is increasingly used as a tool to revive or halt the deterioration of central-city neighbourhoods.

Ding et al. (2000) investigated the effect of residential investment on **nearby property values** providing evidence from Cleveland, Ohio.

Zylicz et al. (2001) investigated the impact of **environmental amenities** on the housing market in Warsaw by using hedonic price method. They surveyed and analyzed four housing markets in Warsaw –house sales, apartment sales, house rentals and apartment rentals.

Thibodeau's (1990) research, estimated the effect of **high-rise office buildings** on residential property values. The hedonic specification employed in that study permitted the estimation of both negative and positive externalities potentially associated with this high-rise employment center.

One special hedonic price method study was conducted by Vandell and Lane (1989) as a preliminary attempt to evaluate empirically the contribution of **architectural quality** to the value of buildings.

2.9.1.2. Studies used other methods

Empirical studies used other methods can also be categorized as valuation studies on negative and positive environmental externalities and land uses. Nevertheless, as this study used HPM, the applications of other methods were not reviewed as extensive as it was done for HPM studies. The following presents only some examples.

Breffle et al. (1998) used contingent valuation method to estimate a neighbourhood's willingness to pay to preserve a 5.5 acre parcel of undeveloped land in Boulder, Colorado, that provides views, open space and wildlife habitat. Households were surveyed to determine bounds on their willingness to pay for preservation.

Hadker et al. (1997) conducted a study to survey the residents of Bombay and measured their willingness to pay for the maintenance and preservation of Borivli National Park using the contingent valuation method.

Choe et al. (1996) conducted both a contingent valuation study and a travel cost model in Davao, Philippines to estimate the economic benefits of surface water quality improvements in developing countries. They reported that the contingent valuation and travel cost estimates are very close to each other and are quite low, both in absolute terms and as a percentage of household income.

Chakraborty and Keith (2000) estimated the recreation demand and economic value of mountain biking in Moab, Utah applying Count Data Models. They reported the results of

both standard and truncated count data travel cost demand models for estimating demand for and the economic value to participants in mountain biking in the Moab, Utah area.

2.9.2. Studies in Open Space context

Within the context of environmental economics, also urban open spaces have a significant value (monetary or not) like other environmental externalities, and this value have been measured by several methods. Most of these studies have been made to analyze the value of green open spaces such as parks (Crompton 2000, Irwin 2002, Luttik 2000, McPherson 1992, Morancho 2003, More 1988, Nicholls 2002, Phillips 2003, Rogers 2003), lakes (Feather et al. 1992, Luttik 2000), greenways and greenbelts (Lindsey and Knaap 1999, Correll, et al. 1978), urban forests (Kwak, et al. 2003, Tyrvainen and Miettinen 2000, Tyrvainen and Vaananen 1998, Tyrvainen 1997), and individual or group trees and landscaping (Anderson and Cordell 1988, Des Rosiers, et al. 2002, Theriault, et al. 2003).

Most of the previous studies are empirical; nevertheless, there are some reviews as well. Correll (1978), More et al. (1988), Anderson and Cordell (1988), McPherson (1992), Tyrvainen (1997), Tyrvainen with Vaananen (1998), Lindsey and Knaap (1999), Tyrvainen and Miettinen (2000), Luttik (2000), Bates and Santerre (2001), Nicholls (2002), Des Rosiers et al. (2002), Irwin (2002), Morancho (2003), Kwak et al. (2003), Tajima (2003), Loomis et al. (2004), and, more recently, Anderson and West (2006) conducted empirical researches to value open spaces. Further, Crompton (2000), Phillips (2003), and Rogers (2003) provided reviews of previous studies on economic valuation of open spaces. In the following, a detail review of the previous empirical studies on economic valuation of open spaces in a chronological order is provided.

2.9.2.1. Studies used HPM

Correll (1978) researched the effect of greenbelts on residential property values. Correll indentified the effect of proximity to greenbelts in Boulder, Colorado, and showed that, there was a $4.20 decrease in the price of residential property for every foot one moved away from the greenbelt, and that the average value of homes next to the greenbelt was 32% higher than those 3,200 feet away. This study showed that the greenbelt added $5.4 million to the total property values of one neighbourhood. That generated $500,000 per year in additional potential property taxes, enough to cover the $1.5 million purchase price of the greenbelt in only three years.

More et al. (1988) investigated the value of urban parks. For this, they reviewed and applied three valuation techniques to urban parks since they consider that the reason why urban parks and open spaces are subject to development pressure is that planners and researchers have been unable to articulate their value in economic terms. Their results indicated that landscape planners need to be aware of the strengths and shortcomings of each method to properly evaluate research on valuation of urban parks.

Anderson and Cordell (1988) measured the influence of trees on residential property values by using HPM. They conducted a survey of the sales of 844 single family residential properties in Athens, Georgia, U.S.A. Their results indicated that landscaping with trees was associated with 3.5%–4.5% increase in sales prices. During the 1978–1980 study period, the average house sold for about $38 100 (in 1978 constant dollars) and had five trees in its front yard. The average sales price increase due to trees was between $1475 and $1750 ($2869 and $3073 in 1985 dollars) and was largely due to trees in the intermediate and large size classes, regardless of species. This increase in property value resulted in an estimated increase of $100 000 (1978 dollars) in the city's property tax revenues.

Feather (1992) describes the application of the hedonic pricing technique (property values) to the evaluation of lake resources. Hedonic models are developed to test the land value of lakefront property which is greater than non lake-front property, the effect of lake characteristics (size and water quality) and water resource related impact on land value that will diminish with distance from the water sources. Results confirmed all these hypotheses and illustrated the use of the hedonic technique for evaluating such environmental amenities as lake resources.

Tyrvainen (1997) conducted a hedonic price study to reveal whether and how urban forest benefits are capitalized in property prices and indentified variables suitable for describing the green space benefits in hedonic pricing models. For these purposes, auther collected apartment sales data (1006 apartments) in Joensuu a town of 48 000 inhabitants, where green spaces represent 34% of the town area, and designed the hedonic models to explain purchase prices using apartment' structural characteristics, and locality-environmental quality variables as explanatory variables. Tyrvainen's study results indicated that urban forests are an appreciated environmental characteristic and their benefits are reflected in the property prices. Proximity of water courses and wooded recreation areas as well as increasing proportion of total forested area in the housing district has a positive influence on apartment price. In contrast, forest parks have a negative effect on prices, this was not expected. This occurred

since the range of variable values remained small, that is, the criteria for capitalization (enough variation within the variable) were not fulfilled since most of the apartments (78%) were at a distance of 100m or closer from a forested area. Consequently, Tyrvainen suggested that the effect of urban forest on property prices is nonlinear rather than linear, and the increasing effect depends on their distance, size, quality, and quantity. Furthermore, attitudes towards urban forests depend on people's cultural background as well as on their ability to pay. Therefore, the valuations are expected to differ in different parts of the country, and also be substantially different from people's attitudes in central Europe. It is also expected that people's willingness to pay for the environment depends on their ability to pay.

Tyrvainen and Miettinen (2000) made a hedonic study in Salo, Finland to value implicitly non-priced urban forest amenities by comparing dwelling prices and specific amounts of amenities associated with dwelling units. The empirical study was based on data from the sales of terraced houses in the district of Salo. The hedonic price model included two variables measuring urban forest amenities: distance to a forest park and view onto forest.

Their results showed that residents pay for such environmental amenities as the forest view through property prices. On the housing market of Salo, buyers have to pay 4.9 percent more to obtain a dwelling with a forest view. In addition, proximity to the nearest forested park was found to have a significant positive effect on house prices. According to the semi logarithmic model, an increase of one kilometre in the distance reduced the price of a dwelling by 5.9 percent. However, when the relationship between the dwelling price and distance to the nearest forested area was log-linear, or the distance was established using dummy variables, the effect to selling prices was strongest up to a distance of 300 meters. The results suggested that distance to a forested park has a price effect if the area is within walking distance from home. Further, Tyrvainen and Miettinen indicated that in spite of local differences between the towns, the results of their study provided a good measure of valuations of urban forests in Finnish towns.

In the Netherlands, **Luttik (2000)** researched the value of trees, water and open space as reflected by house prices. Luttik stated that houses in attractive settings will have an added value over similar, less favourably located houses. Luttik studied nearly 3000 house transactions, in eight towns and regions in the Netherlands to estimate the effect of different environmental attributes on transaction prices.

Luttik performed the analysis in two stages. Firstly, author estimated the house price due to structural housing attributes in a linear regression analysis. Subsequently, she assumed that the difference between this value and the actual transaction price could be ascribed mainly to difference in locality. In her study, locality referred to not only to environmental amenities, but also to schools, traffic noise, view of apartment buildings, motorways, shops, public transport or other public facilities. The ratio of the estimated price and the actual transaction price was referred to as the location indicator – which was calculated as the difference between the two values expressed as a percentage of the estimated value. The location-indicator was linked to location variables in a second linear regression analysis. Further, the selection of research areas assured an analysis of the influence of a wide range of green area types, water bodies, open space and landscape types, which not only differ in age, function and type, but also occur on different scale levels: from small, decorative green and canals to large parks and lakes.

According to results, the largest increases in house prices due to environmental factors (up to 28%) for houses with a garden facing water. A pleasant view can lead to a considerable increase in house price, particularly if the house overlooks water (8-10%) or open space (6-12%). In addition, house price varies by landscape type. Attractive landscape types attract a premium of 5-12% over less attractive environmental settings. Clearly the most influential environmental attribute in her study is the presence of water features. She informed that current town developments in the Netherlands indicate that town developers are well aware of the value of water features, given the large number of plans that include water bodies. The Dutch government is searching for alternative sources of finance for creation / or maintenance of nature and landscape features. Given the immediate effect of water features, as opposed to green areas which need time to mature, and the high premium water features seem to attract, they seem to be the major candidate for private finance or joined public-private finance.

Also green in the residential area was shown to attract a premium in a number of cases. This advocates preservation of existing green areas in residential areas, and application of existing green areas in new urban developments. Nevertheless, it proved to be much more difficult to demonstrate the effect of a park or a recreational area bordering the residential area. Luttik tested this hypothesis in four cases. Only in one case (out of four) this variable was significant. This sheds some doubt on the current policy preference in the Netherlands for development of this type of green areas. Recreational lakes bordering the residential area were shown to attract a premium, also when they were of the same size as the investigated green areas bordering the residential area (circa 100 ha). This suggests the application of

sizeable water bodies in parks or recreational areas. At the same time, this leads the way to preserve openness in the landscape, another environmental factor that was reflected in a higher house price.

Further, larger green areas (1000 ha) and attractive landscape types were demonstrated to have a considerable impact on house price. Only in one case, the hypothesis that an attractive, wooded landscape attracts a premium on the house price had to be rejected. Luttik considered that in this particular case it seemed likely that poor accessibility crossed the willingness to pay for an attractive landscape. In this situation, improving accessibility is a clue for policy action. To sum, the results showed that the impact of green areas was ambiguous; in many cases, the hypothesis that a green structure attracts a premium had to be rejected. The effect of water bodies and open space could be demonstrated in almost every instance. Attractive landscape types were shown to attract a premium over less attractive landscape types (monotonous landscapes). Finally, she suggested that a promising option would be to preserve existing green areas in residential areas improving the accessibility to them, and develop larger green areas with water features in new urban developments.

In USA, **Nicholls (2002)** measured the impacts of green spaces on property values and the property tax base applying hedonic price model to a series of open spaces (greenbelts, neighbourhood parks, and a golf course). She found that the most substantial impacts on property prices were caused by adjacency to a golf course, the premium for such a location ranged from $61,000 to $73,500 (16% to 19% of value), depending upon model specification. Also, adjacency to a greenbelt had a significant, positive impact on property prices in two of three cases; premiums ranged from $13,000 to $48,000 (5% to 13% of total value).

Nicholls indicated that unsurprisingly, results of prior studies not provided conclusive evidence as to the relationship between proximity to an urban park and property value. Most analyses recorded mixed findings, suggesting positive impacts around some facilities and in some areas, but negligible effects around and in others. Nevertheless, results have indicated the potential for substantial premiums to be associated with properties located adjacent or close to parks. Premiums are most likely for properties adjacent to or within a short distance of large, well maintained, and attractive facilities, and whose use is predominantly passive. Smaller premiums or negligible effects appear more likely for properties close to smaller, less attractive, active-use amenities. Properties adjacent to heavily used, unattractive, or poorly maintained parks may, however, record reductions in value due to the inconveniences associated with their location, according to previous studies.

According to Nicholls, beyond problems of comparability, many of the methods used in earlier studies suffered from numerous deficiencies and beyond the lack of consistency between them. Many of the earlier studies (those in the 1930s through the mid 1970s) simply compared or correlated proximity with property value, concluding that any relationship discovered was due entirely to the effect of the park. All other characteristics that differentiate individual houses and their values from one another were ignored. Since the mid 1970s, multiple regression techniques have increasingly been used. However, though this approach does enable numerous potential influences on property values to be analyzed simultaneously, it also raises several other methodological concerns inherent to its usage that have rarely even been acknowledged in green space analyses of property value impacts. Furthermore, use of multiple regression procedures does not solve the questions either of which types of property value to use as the dependent variable, or how to define and measure the proximity relationship between sample properties and the green space under the analysis.

According to **Des Rosiers et al. (2002)** while the impact of trees on residential prices has already been the object of several studies, little attention has been devoted to landscaping as such. Thus, they investigated the relations between landscaping and house values by using the hedonic price approach. Their study based on a detailed field survey of 760 single-family homes sold between 1993 and 2000 in Quebec, Canada. They captured the environmental information from the front and side of houses and included thirty-one landscaping attributes of both houses and their immediate environment dealing with tree as well as ground cover, flower arrangements and rock plants, hedges, landscaped curbs, density of visible vegetation as well as roof, patio and balcony arrangements. They added landscaping features to an array of physical, census and access attributes.

They found that, a positive tree cover differential between the property and its immediate neighbourhood translates into a higher house value (roughly 0.2%). Findings also suggested that the positive price impact of a good tree cover is more enhanced by retired persons. Nevertheless, according to them, quite interestingly, an above-average density of the vegetation visible from the property impacts negatively on prices. Finally, they indicated that a high percentage of lawn cover as well as features such as flower arrangements, rock plants, etc. all command a substantial market premium (each percentage of ground cover adds some 0.2% to the price, and, the presence of a hedge or landscaped wall raises a property's value by nearly 4%).

Irwin (2002) conducted a research to reveal the effects of open space on residential property values in USA. According to her open space is a heterogeneous good, and thus it may be distinguished by land use, land cover, ownership type, development potential, and geographic location, each of which may be valued differentially. However, less evidence exists regarding the relative values of the various attributes associated with open space since studies have tended to focus on a particular type of open space.

Therefore, using residential sales data from an ex-urban region in central Maryland, Irwin employed a hedonic pricing model to test whether different types of open space generate significantly different spill over effects. Irwin distinguished open space first by whether the land is preserved or is developable, and second by land ownership (privately vs. publicly held preserved open space) and land use type (cropland, pasture, and forests that are developable) to explore whether preserved open space carries a premium with it and whether the various landscape amenities that are associated with different open space land uses have differing marginal values.

Results showed a premium associated with permanently preserved open space relative to developable agricultural and forested lands and support the hypothesis that open space is most valued for providing an absence of development, rather than for providing a particular bundle of open space amenities.

Alkay (2002) measured the economic value of green areas in Istanbul by using Hedonic Price Method. Alkay used double-logarithmic functional form for each model. The results showed that green areas in different size and types have varying impacts on nearby house values. In four districts, Alkay found that neighbourhood parks (with a premium changing between %10 and %14), district parks (with a premium changing between %14 and %17), and visual greens (with a premium changing %13) have a positive impact on house values.

Morancho (2003) analyzed the link between housing prices and urban green areas endowments using the hedonic technique as methodological approach. In that study, together with a set of the conventional explanatory variables used to explain housing prices, Morancho considered three environmental variables effecting housing prices: the existence of views of a park or a public garden, the distance from the dwelling to its nearest green area and the size of that open space. The sample was made up of 810 observations gathered in Castellon, Spain. Results showed that size of the houses is the most relevant variable on price. And, there is an inverse relationship between the selling price of the dwelling and its distance from a green

urban area (every 100m further away from a green area means a drop of €1800 in the housing price); however, neither the size of the nearest green area nor the views of a garden or a public park influences the price. Morancho suggested for urban planning studies, provision of numerous small green areas throughout the city is more appropriate than a few vast parks, and the creation of large park areas as complements to small landscaped areas.

Tajima (2003) focused on the benefits of parks in urban centers and provided new estimates of the demand for urban green space and implications for valuing the environmental benefits of Boston's Big Dig Project. Using Boston's land use and assessed property price data, Tajima determined that proximity to urban open space has positive impacts on property values, while proximity to highways has negative impacts on property prices. Based on this observation, Tajima expected that the spatial alteration will cause a significant increase in nearby property prices. Results showed that when distance to the nearest large park doubles, the coefficient of -.085 implies that property price is expected to decrease by 6%. For the highway, the effect is in the opposite direction. When distance to the nearest highway doubles, the coefficient of .064 means that property price will increase by 5%. Through the empirical analysis using the hedonic pricing method, Tajima indicated that people are willing to pay higher prices to live near a park. Demand for a property apparently increases with the creation of a new park nearby. Further, the data suggested that the increase in property price caused by the environmental quality improvement by the Big Dig may negatively impact low-income minority groups who live in rental housing units in the neighbourhood. However, it may benefit the owners of the properties in the form of capital gains and by attracting a wealthier population. Finally, Tajima stated that further investigation is needed in order to make proper assessments of the impacts of the Big Dig on community demography.

Loomis et al. (2004) estimated a hedonic model of public market transactions for open space protection illustrating how the price per acre of open space paid by public buyers such as counties or land trusts, is influenced by local demand and supply factors. They run empirical regression model using 133 public transactions of open space in the Front Range of Colorado. The model explains over half the variation in price per acre. The mean price per acre was $13,635. According to the results, if a property provides access to water bodies, this feature increases the price per acre by $937, while adjacency of the parcel to existing park or open space adds $11,039 an acre. 1% increase in county population results in a 0.27% increase in price per acre. Loomis suggested that the prediction capability of the hedonic price equation may be an alternative to traditional real estate appraisal techniques when agencies must

determine fair market values of prospective open space parcels that vary in attributes from existing ones.

And, more recently, **Anderson and West (2006)** applied hedonic price method to home transaction data from the Minneapolis-St. Paul metropolitan area to estimate the effects of proximity to open spaces -neighbourhood Park, special park, golf course, cemetery, and lake- on sales price. Allowing the effects of proximity to vary with demographic and location-specific characteristics and the analysis included fixed effects to control for observed and unobserved neighbourhood characteristics. The results showed that the value of proximity to open space is higher in neighbourhoods that are dense, near the central business district, high-income, high-crime, or home to many children. They suggested that using the metropolitan area's average value may substantially overestimate or underestimate the value of open space in particular neighbourhoods. While there is a considerable interest, particularly in Northern America and Europe, for economic valuation of open spaces, there is little concern in Turkey.

Neelam, et al. (2009) estimated the amenity value of and demands for urban recreation park acres in Roanoke, Virginia by using a two-stage hedonic model. Their Findings suggest that both the proximity to and size of the urban recreation parks have a small but significant positive effect on property values. Further, the hedonic price of an urban park acre was negatively related to the park size. A fairly inelastic demand curve was derived with a price elasticity of−0.84. The demand was inelastic for income as well, but income was still the most important predictor after hedonic prices of park size itself and its close substitute. The study also confirmed that the price of the living space and proximity to the nearest park were substitutes for the acres of nearby urban parks. The demand for urban park size increases as the cost of living space increases. This might be a useful implication in land use planning and urban sprawl management because preserving public open spaces could encourage high-density development and help discourage sprawl. Similarly, residents prefer the residential locations by trading the size of the urban recreation parks with the proximity of those parks.

This study also suggests that increasing the current mean size of urban forest acres by 20% in Roanoke will increase the per household consumer surplus by $160. Properties located within an immediate neighbourhood of these parks will have an increased total consumer surplus of $6.5 million from this policy in the city. This estimated welfare impact might be helpful in justifying investment on open space preservation and park management, and may provide guidance in designing citizen-financed open space preservation or park management for Roanoke in particular and hundreds of cities.

They also confirmed that the second stage demand estimation could yield theoretically consistent results, provided the submarkets are identified systematically. As a result, the method offers a useful approach to estimate the demand for other environmental amenities for which data from multiple cities are not available. This study can assist in understanding how residents respond to different levels of open space; and to ensure that any proposed investments in new acquisitions can be justified by the anticipated welfare gains.

2.9.2.2. Studies Used Other Methods

McPherson (1992) accounted the benefits and costs of urban green space. McPherson described a green space accounting approach to partially address this deficiency by using cost benefit analysis for a proposed tree-planting project in Tucson. The approach directly connected vegetation structure with the spatial-temporal flow of functional benefits and costs. Prices were assigned to each cost (i.e. planting, pruning, removal, irrigation) and benefit (i.e. cooling energy savings, interception of particulates, storm water runoff reduction) through direct estimation and implied valuation of benefits as environmental externalities. The results suggested that the approach can be used to evaluate net economic benefits associated with capital investments in urban forests vs. other investments in the urban infrastructure or traditional environmental control technologies.

In **1998, Tyrvainen with Vaananen** conducted a contingent valuation study again in Joensuu in which green spaces represent 34% of the town area to measure the use-values of urban wooded recreation areas, and the residents' willingness to pay for small forest parks contributing to the quality of housing environment, and to evaluate the suitability of the contingent valuation method in assessing urban forest amenities in Nordic conditions, where most green spaces are formed from preserved forest vegetation and the use of forests is based on free access to all forest areas. They found that most visitors were willing to pay for the use of wooded recreation areas. Furthermore, approximately half of the respondents were willing to pay to prevent the conversion of forested parks to another land-use. They indicated that the results can be used to assess the profitability of the management of urban forests. In addition, the results are useful in assessing value of green space benefits in different land use options.

With a consideration of the substantive debate over the public value of private landscapes, the debate over contingent valuation (CV), and the processes of greenway planning and implementation, **Lindsey and Knaap (1999)** searched for the willingness to pay for urban greenway projects. Their article reported the results of an experiment to estimate the value of

an urban greenway and to test the validity of contingent valuation (CV), and discussed the implications of the results for greenway planning. They experiment concerned people's willingness to pay (WTP) for greenway projects in a publicly designated greenway in Indianapolis, Indiana, that is mostly in private ownership. The response rate for the mailed survey of Greenway property owners was 47%, somewhat low for mail surveys with high salience. As expected, response rates were lower for County residents and were very low for Greenway renters. They found that the proportion of respondents willing to pay was much higher in response to the survey than the actual solicitation. Most property owners in the corridor had located there because of its amenities, and had lived there during the greenways planning process, but still were unaware that the corridor had been designated a greenway and believed that designation will have positive or at least neutral effects.

Lindsey and Knaap reported their findings summarizing as follows. First, general awareness that the Crooked Creek corridor had been designated a greenway was low, but most respondents believed that such a designation will increase their quality of life and thus property values in the corridor. Second, support for greenway projects, measured as willingness to pay and as willingness to donate to the White River Greenways Foundation, was greater among property owners than renters and greater among those who lived in the corridor than among those who did not. Third, although most respondents valued the greenway designation and reported participation in outdoor recreation and other behavior consistent with environmental appreciation, most thought other public objectives were more important, and most considered a basic public health issue -reduction of sewage in the water- as the most important greenway improvement. Finally, for both property owners and renters in the Greenway, and for residents throughout the County, stated WTP was greater than stated willingness to contribute, which was greater than actual willingness to contribute.

To conclude, their findings suggested that there are indeed public benefits to private landscapes, but that in any particular place, their value depends on salience and proximity to individuals as well as other site-specific characteristics. They indicated that CV surveys can inform debates over the public value of private landscapes. In particular, planners can use the results of CV surveys to design and carry out more effective strategies for greenway and open space planning.

Bates and Santerre (2001) analyzed the public demand for open space in the case of Connecticut Communities. They stated that in USA at both the state and national levels, public policies are being designed to stimulate the demand for locally owned open space.

And, yet very little is known about the factors that influence the demand for open space and the sensitivity of demand to price and income. To fill the void, they used data for Connecticut cities and towns to estimate the public demand for open space. Their empirical study results suggested that the demand for open space is relatively insensitive to changes in price but highly responsive to changes in income. Their findings also showed that federal and state open space may tend to crowd out locally owned open space, which is highly congestible good. Finally, they indicated that privately owned open space is not a good substitute for locally owned public open space.

Kwak et al. (2003) estimated the value attached by the public to Kwanggyo Mountain in the Seoul Metropolitan Area of Korea using a contingent valuation survey, aimed at providing policy-makers with useful information to make an informed public decision in urban development planning. They carefully designed and implemented the survey to meet a number of recommendation rules suggested in the literature. The overall results showed that the respondents received the hypothetical scenario well and would be willing to pay a significant amount for the proposed program of conserving the mountain. The total value stated by the public amounted to approximately US$2.9 million per year. They indicated that this quantitative information can be used in policymaking process for urban development plans.

Fukahori and Kubota (2003) searched for the role of design elements on the cost-effectiveness of streetscape improvement discussing the effectiveness of contingent valuation methods in evaluating the visual quality of streets. Research on conventional contingent valuation methods concentrates on estimating the total value of landscape resources such as forests, wetlands, and parks. In contrast, they assess street design plans from both economic and psychological points of view and analyze by factor and relative importance of design elements such as vegetation, lighting columns, and pavements on the economic and perception-based values. They estimated the economic value of streetscape by the contingent valuation method in order to quantify landscape quality; clarified the meaning of economic valuation by respondents by analyzing the relationship between psychological rating scales and the economic scale; analyzed the contributions of design elements to economic valuation by respondents; and discussed streetscape quality from the point of view of cost efficiency based on several cost-related indices.

Fukahori and Kubota conducted the experiments by using computer-simulated photomontage images as virtual alternatives for two street design projects in Saitama City. Visual elements

of a streetscape usually include the road structure (road surface, vegetation, street hardware, and furniture), elements along the street (surrounding buildings, signboards, and so on), the background, human activities, and underground structures and utilities. Consequently, they organized elements as various types of design with a varying cost of materials for street furniture. Then, they asked the respondents participating in the experiment to evaluate the alternatives by a bidding game method, which is one of the elicitation methods used in contingent valuation. According to the results, Fukahori and Kubota pointed out that an acceptable cost had a strong correlation to the amenity score for each of the two street design projects.

2.10 Evaluation

From a detailed review of this open space valuation literature on above, it is seen that open spaces have a relative measurable economic value, and this value is positive in general. Nevertheless, it is necessary to indicate some important findings and needs:

- The previous studies shows that hedonic price method is the most commonly employed method which aims to value open green space by measuring their impacts on property values. The other methods of valuation of open space benefits are contingent valuation and travel cost. However, applications of these methods are very rare. Therefore, there is still a need for further research to understand the value of open spaces, however, not only in the form of property value increasing impact by employing hedonic price method, but also in other forms by using other methods.

- Brookshire et al. (1982) estimate the willingness to pay for improvements in air quality using both hedonic and contingent valuation approaches. They find that contingent valuation survey estimates are bounded ***above*** by hedonic estimates and ***below*** by zero. Thus, although contingent valuation methods have the ***potential*** to capture both the use and non-use values of open space, prior research indicates that contingent valuation survey estimates may actually ***understate*** value as compared to hedonic estimate.

- Most of the previous hedonic price analysis of open spaces was carried out in Northern America and in Europe. These studies indicated that open spaces in general have a positive impact on property values. Nevertheless, an open space may not have positive impact and the amount of this impact is not same in all markets and

circumstances. Therefore, there is a need for further research to investigate the impact of open spaces on property values at different countries and in different property markets like Dhaka.

- Previous studies on open space valuation principally focused on the amount and sign of the value of the open space, since most of these studies have been carried out within the limits of economics or environmental economics disciplines. However, to reveal merely the amount or sign of value is not fully enough for properly assessment in decision-making process. Understanding not only their value but also the factors determining this value might set important conclusions in terms of policy implications and urban design works. Thus, there is a need for studies to search causalities for better understanding the relationship between open space attributes and their values. Nevertheless, such studies will require urban designer outlook since open space attributes can be properly evaluated only by a designer.

Analyzing these results and the availability of the required data, the study will use hedonic regression analysis to estimate the value of open space amenities.

2.11 Summary

Open spaces in a neighborhood provide or has the potential to provide physical, environmental, social and economic benefits to communities whether direct or indirect. The open space benefits are clearly of importance to people but their value may be difficult to quantify. While it is a nonmarket good and it does not pass through a traditional market. Previous studies show that the benefits of open space and other environmental amenities, however, may be capitalized in the sales prices of homes in a community. For the purposes of valuing open space economically, this study relies on the Hedonic Price Method as it is the most popular indirect approach for estimating the monetary value of an environmental asset. Nevertheless, the hedonic price method has some disadvantages as well. Besides this, there are some other methods to measure benefits of open spaces economically.

Estimates of the economic values or amenity benefits of urban parks and public open spaces have emerged recently (Tyrvainen, 1997; More et al., 1998; Tyrvainen and Miettinen, 2000; Nicholls, 2002; Alkay, 2002; Morancho, 2003; Anderson and West, 2006) and Neelam, et al., 2009. Previous research revealed that the price of a house increases with its proximity to

nearby parks (Tyrvainen, 1997; Tyrvainen and Miettinen, 2000; Monarcho, 2003, Tajima, 2003). Similarly, other studies indicated that increasing the size of urban parks increases the housing values nearby (Tyrvainen, 1997). On the contrary Anderson and West (2006) and Morancho (2003) reported that the size of urban parks or green areas did not have a significant amenity effect. Nicholls (2002) measured the impacts of different categories of open spaces such as; green belt, neighborhood park and golf course on property values and property tax base applying hedonic price model. Feather (1992) developed a hedonic model to test the land value of lakefront property which is greater than non-lake front property. Anderson and West (2006) applied hedonic price method to estimate the effect of proximity to different types of open spaces on home sales price. In a recent hedonic study, Neelam (2009) analyzed the amenity value of and demands for urban recreation park acre by using a two- stage hedonic model. Most of the hedonic studies discussed above had been analyzed the effect of open space on land value of European real estate market. From the light of the previous hedonic studies, the approach has developed in this study, will advance the knowledge about the impact of open space on the residential property values, which will provide the first evidence in Dhaka.

CHAPTER 03: RESEARCH DESIGN

In this research an empirical analysis is carried out through conducting a questionnaire survey and employing HPM to test the hypotheses of the study. Different residential neighborhoods of Dhaka have been chosen as the case area of the study. This part is composed of determination of research design, results of data analysis, and hedonic price models.

3.1 Research Design

The research design is composed of a five stepped process. These steps are explained in detail under the following sub-headings.

1. Determination of the case area
2. Determination of the variables,
3. Determination of the statistics submarket,
4. Determination of the statistics hypotheses,
5. Determination of the sampling design and data collection techniques, and
6. Determination of data analysis and preparation techniques used in the study.

3.1.1 Determination of the Case Area

This study solely aimed to look in depth house price transactions at two different private housing markets, to explore and understand the effects of open spaces on home sales transaction. If public housing market were considered, the effect of open spaces on property prices could have different results.

The enormous population growth in the past decades due to normal population growth and migration of people from rural areas made the housing demand high and on the other hand, the merge supply created an acute shortage of housing in Dhaka city (Toufiq, 2012). Phenomenal growth of the Dhaka city population is dominantly contributing to the dynamic changes in residential areas. The contribution of public sector to cope with housing demand is not adequate to provide a suitable housing environment with all the facilities and services. In this circumstances private sector is playing a vital role by providing a new type of residential development broadly termed as apartment development. The increasing housing demands are being fulfilled essentially by multi-storied apartments with approximately 2-7 floors, each

containing number of dwelling units. Thus multi-storied apartments are steadily transforming the landscape and lifestyle of huge urban dwellers in Dhaka. A typical household of multistoried apartments occupies a self contained apartments and shares the elevators, stairs and for some developments indoor and outdoor amenity facilities. Most of the multi-storied housing developments have failed to provide internal communal green spaces as an additional landscape amenity. The sprawling and compact high density developments in this area conform with the purpose of this study because significant variation in relative values households place on different characteristics of limited amount of open space is expected between these extremes. However, the amount of formal green spaces in the neighborhoods is very limited (Chau et al., 2006). Such views are enjoyed mainly by a limited number of units. For most residential properties, the typical view out of the windows is the built-up landscape composed of adjacent buildings and roads. The limited availability of natural views could command a premium reflected in the transaction price.

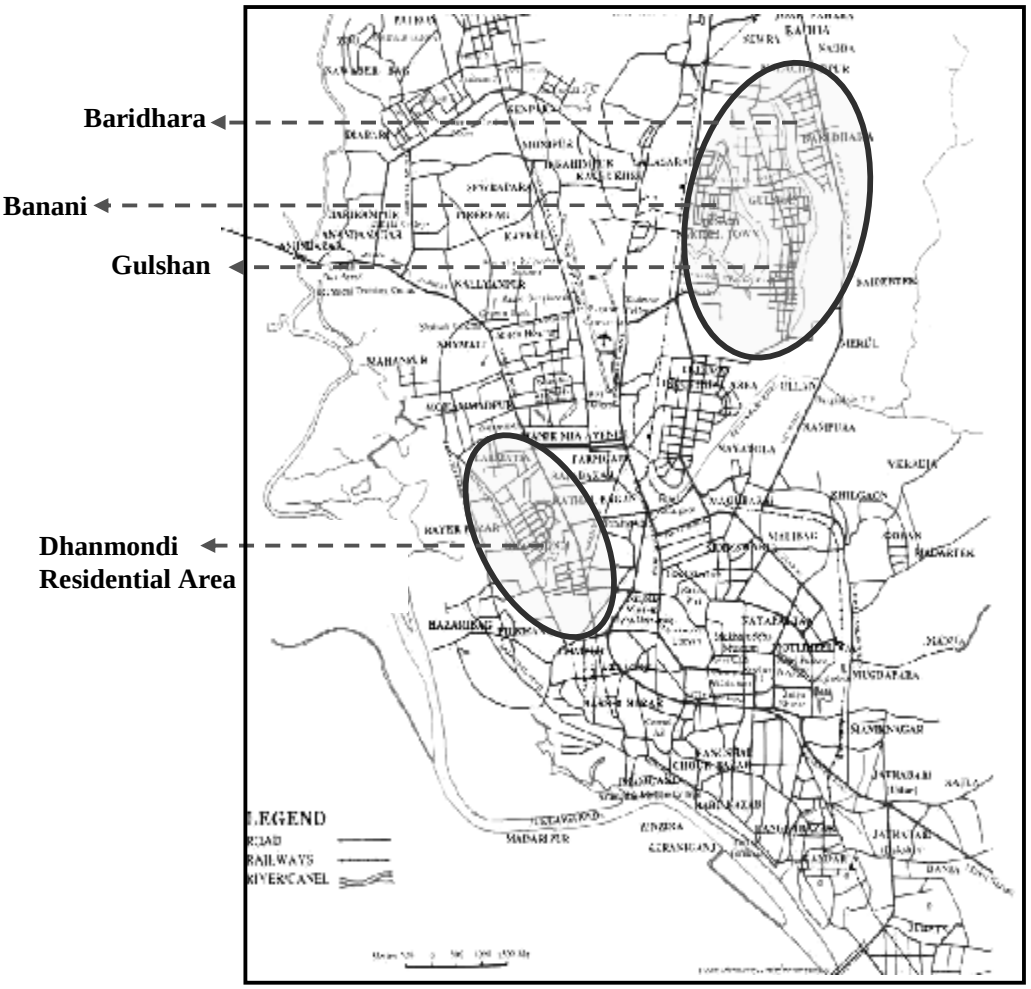

Fig 3.1: Selected Residential Neighborhoods of Dhaka

The selection of the research area assured including different segments of the housing market, which offer houses in different prices with different scale, neighborhood and characteristics of open spaces. In selection of the research area, another important consideration was the familiarity in both the physical and functional characteristics of areas, there transformations and scenario of urban life and existing situation. The study is conducted with data from Dhaka cities two different neighborhoods, named Dhanmondi and Gulshan, including Banani and Baridhara.

Dhanmondi and Gulshan are the prime planned residential areas of Dhaka City. Sense of pride of ownership, sense of security, prestige and status, external amenities induce people to live in these high-class residential areas. Both areas have their own characteristics; hence there are some common features in these areas. These planned areas are implemented following the method of sites and services schemes (Hasan and Kabir, 2002). These neighborhoods are chosen because: (1) these two are one of the largest and fastest growing urban areas in Dhaka and consist of compact high density urban-core (2) these have been mostly chosen by high class residents for improved facilities and its amenity attractions including urban parks and water bodies. The effect of these amenities has been clearly reflected in their home transaction and (3) both of these contain urban recreation parks and lakes of varying size, distributed throughout the neighborhoods and hence provides an ideal place for the study of urban park benefits. In addition to green open space and urban trees, water bodies these parks are supplemented with additional man-made attractions such as greenways and sitting areas, bridges, walking tracts, food shops etc. In the direction of these considerations, neighborhoods at Dhanmondi, Gulshan, Banani and Baridhara residential areas are selected as the case area (Figure 3.1).

3.1.1.1 Case area 01: Dhanmondi Residential Area (DRA)

Dhanmondi is located 5 km away from the city center (Figure 3.2) The administrative boundary of Dhanmondi area is commonly referred as Dhanmondi thana, consists of 3 wards (49, 50, 51) and has an area of about 6.23 sq. km (BBS, 2011). Dhanmondi thana is bounded by Tejgoan and Mohammadpur thanas on the north, Lalbag thana on the south, Ramna thana on the east, Hazaribagh and Mohammadpur thanas on the west (Figure 3.3).

Figure 3.2: Location Map of Dhanmondi Residential area

Dhanmondi is an extreme example of such an urban sprawl. The population size in Dhanmondi Thana was 1, 47,643 in 2001 and increased to 2, 52,519 in 2011 with different income groups which eventually shape a gross density of 40533 persons per sq. km (BBS, 2011). Population density in 2001 was 23698 per sq. km (BBS, 2001), which become almost double in 2011. Thus, Dhanmondi is now set to become one of the most densely populated up-market residential areas in Dhaka city. DRA, which belongs to ward number 49, initially was designed as a low-density residential area for high and higher-middle income groups in early 1950s by the Public Works Department. By the next decade it had become the prime and typical residential area in the capital. Figure 3.4 shows the extent of DRA with 50 and 51 no. wards in Dhanmondi Thana.

Dhanmondi is basically laid out on a gridiron pattern and consists of rectangular plots. Pre dominant house form was individual private homes with a front lawn and /or a back garden. Since 1990s', an uncontrolled growth of shopping complexes, educational institutions, clinics and hospitals, banks and other commercial activities ruthlessly changed the residential character of the area into a mixed land use pattern. The most emphasized feature is

Dhanmondi Lake, which had been started to revitalize in1998 to provide a place of recreation for the urban community ofDhaka city (Nasreen, 2009).

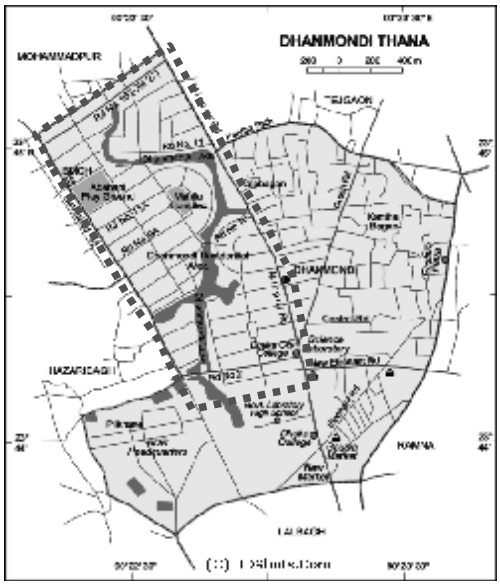

Figure 3.3: Dhanmondi Area in Dhaka City **Figure 3.4:** DRA in Dhanmondi Thana

Now Dhanmondi is one of the high-class residential areas of Dhaka City. The total area of the site including different amenities (Figure 3.5) such as; open spaces (park, play field. Eidgah), water body (Dhanmondi Lake), roads, etc. is about 472.62 acres and divided into about 1000 plots.

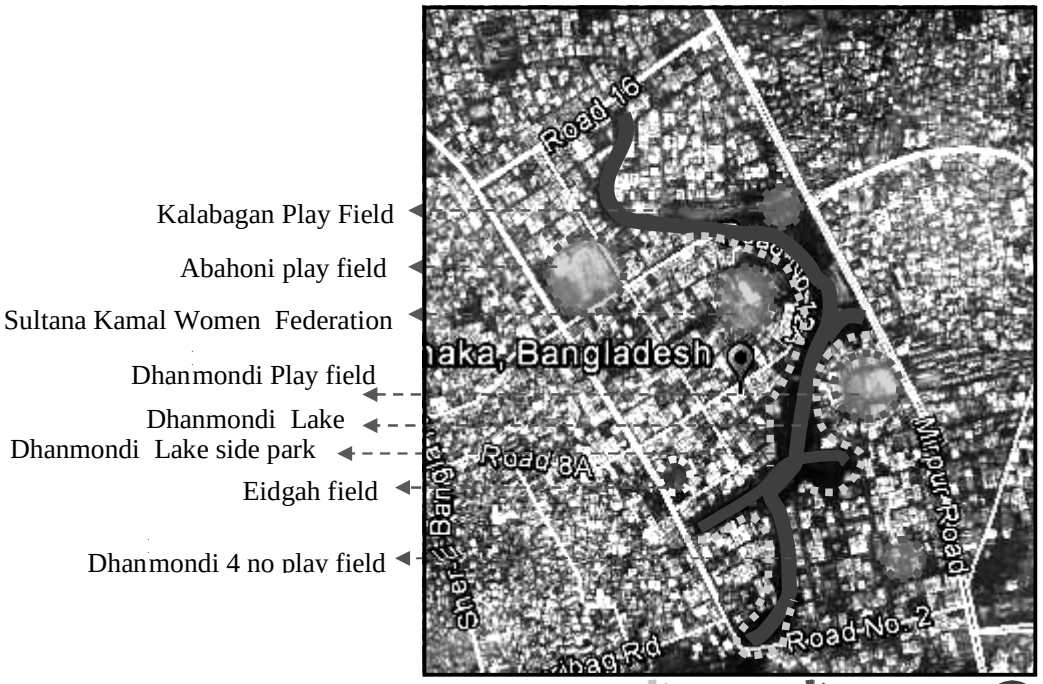

Figure 3.5: Open spaces distribution at dhanmondi; Park Play Field Water Body

Figure 3.6: Location Map of Gulshan Thana

3.1.1.2 Case area 02: Gulshan Area

Gulshan Thana is located at northern part of dhaka ciity (Figure 3.7). The administrative boundary of Gulshan area is commonly referred as Gulshan thana, consists of 3 wards 18, 19and 20 including Gulshan Model Town (consisting of Gulshan circle 1 and circle 2), Banani Model Town, Baridhara Diplomatic Zone, and Mohakhali and has an area of about 10.28 sq. km. 50% of the area is residential, 20% commercial, and 12% is diplomatic area. It has an area of about 53.59 sq. km. The population size in Gulshan Thana was 1, 90,590 in 2001 and increased to 2, 53,050 in 2011. Popolation density was 18522 per sq. km in 2001 and become 24599 per sq. km in 2011. Gulshan thana is bounded on north by Uttara Thana, on east by Badda Thana, on south by Demra and Tejgoan Thanas and on the west by Cantonment Thana (BBS, 2011) (Figure 3.8).

The residents who can afford to live in this area have a diverse socio–economic background**.** As price and rent of houses are relatively high only the high-income people can afford these houses. A new diplomatic zone was established at Baridhara under Gulshan Thana in the late eighties by Rajdhani Unnoyan Kartripakkha (RAJUK). Most of the Foreign Embassies in Bangladesh are located here. Though there is similarity of physical features in Baridhara and Gulshan, Baridhara possess its own special identity as a diplomatic zone. In case of Baridhara, intensity of non-residential use is relatively low within the residential area.

Gulshan Thana also consists Banani Model Town, which have similarities with Gulshan Model Town.

Figure 3.7: Gulshan Thana in Dhaka

Figure 3.8: Selected Areas in Gulshan Thana

In Gulshan Thana water bodies cover 205.42 acres or 11.47 percent of land. The Gulshan-Banani, Gulshan-Baridhara, Gulshan-Badda and Gulshan-Mohakhali lakes lie in the planning area (Dap, 95). These lakes are important artificial features of Dhaka Metropolitan city, which are still under development process. Some part of these lakes is not well developed or maintained as Dhanmondi Lake.

However these areas are situated in posh area of Dhaka but at the same time slum people are frequently using part of this lake or sometimes lake side plot owners encroach it within their boundaries. This area also consists number of parks and play fields, some of them are well planned and managed. Number of residential units has been developed beside these parks and water bodies and some are under process. The water bodies and parks of this area have been identified in Figure 3.9.

Figure 3.9: Open spaces distribution at Gulshan area; Park Play Field Water Body

The surveyed apartments both in Dhanmondi and Gulshan have different price ranges depending on some factors like the location of the area, services and facilities provided by the authority, design and size of the flats, orientation, accessibility to school, workplace or nearest open spaces mainly lakes and parks etc, which are discussed in the next section.

3.1.2 Determination of the Variables

According to theoretical analysis, variables' set is composed of dependent variable and sets of independent variables. **Dependent variable** is the implicit price of Housing unit. **Independent variables** include three sets of attributes: Structural and Housing variables, Neighbourhood variables, Urban Amenity or Environmental variables. Home sale transactions are defined with the interview carried with residents and local real estate brokers. The independent variables are come from literature review of open space, study of location map, site visit, and interview with the real estate brokers, questionnaire survey of home buyers and also from some software. When defining these variables, the study benefits from economic valuation, urban design and landscape design literatures.

3.1.2.1 Home Transaction Data and Housing unit's Structural Variables (See Table B.40 and Table B.43 at Appendix B, for structural characteristics data of houses)

Home sale transactions and structural characteristic data are obtained from local real estate brokers. These data represent multi-storied (mostly 2-7 storied) residential property transactions in the Dhanmondi residential area, Gulshan, Baridhara and Banani of Dhaka. All the housing prices were adjusted to year from 2005 to 2008 to control for real estate market fluctuations in the city and to make them compatible with the neighbourhood data. This time period has been chosen because there was a linear growth of apartments from 1997 to 2007. In 2008 the growth of apartments was higher than any period of the past (Toufiq, 2012). Since these data come from an entire 12-month period of each year, it is possible that they are biased by fluctuations in housing market supply and demand due to extraordinary political condition, housing demand and financial policy of Dhaka. Three-year is not a very long period. However, with the high responding rate of the market, changes of price level occur from time to time. Data adjustment is important to make the data more accurately reflecting the real price of the apartment.

Table 3.1 below presents the explanatory variables used in this study, their definitions, and expected relationship to the dependent variable.

Variables	Definition	Expected sign
Living Area	Square feet of living area	Positive
Exterior	Exterior Facade treatment with brick/RCC	Positive
Bedrooms	Number of bedrooms in house	Positive
Garage	Availability of garages in the house	Positive
Land area	Square footage of the plot	Positive
Stories	Number of stories in the house	Positive
Age	Age of the building	Negative
Orientation	Building orientation	Positive

Table 3.1: Definitions and expected values of Housing unit's Structural Variables

In Appendix B Table B.40 and Table B.43, represents structural variables of all randomly selected housing units of Dhanmondi and Gulshan area for both owner occupied and rental houses. These data include home sales price, the address of each home, and a variety of structural characteristics for 107 (79 owned and 28 rental houses) observations. All transactions represent "arms-length" market transactions (That is, a transaction between utility-maximizing consumers and profit-maximizing sellers, where the buyer seeks the lowest possible price and the seller seeks the highest possible price. Multiple listing services collect data primarily for homes transacted through

real-estate brokers. Since it is unlikely that individuals *not* engaged in arms-length transactions would employ the use of a real-estate agent, it is unlikely that MLS data would include such a transaction) and home value data are given by sales price.

3.1.2.2 Housing unit's Location and Neighbourhood Variables (See Table B.41 and Table B.44 at Appendix B for housing units' neighborhood characteristics data)

The neighbourhood data on socioeconomic information are obtained from the census block group 1 level data of Bangladesh Census Bureau (BBS, 2001). These data may fail to represent the actual characteristics of particular neighbourhoods as aggregated by census tract block group. Furthermore, these data are from 2001, while home transaction data are from 2005 and 2008. Block groups are relatively small in size, however, and census demographic data are fairly constant over time. Thus, it is likely that these data adequately reflect the relative characteristics of particular neighbourhoods in between 2005 to 2008.

Table B.41 and Table B.44 at appendix B presents the detail information of all neighborhood characteristics for 107 (79 owned and 28 rental houses) observations for both owned and rental houses. These tables represents variables capturing the neighbourhood characteristics include population density, percentage of population below poverty level, and vacancy rate of houses, median age and median household income, percentage of school attendance, tenancy status etc. Population density captured the relative congestion and level of development in the neighbourhood. Percentage of population below poverty level reflected the economic condition and prosperity of the neighbourhood. The vacancy rate captured the housing occupancy and residential consumption rate in the neighbourhood. Goodman and Thibodeau (1998) mentioned that the quality of public education is the major predictor of neighbourhood quality and can explain the housing segmentation.

Since location is important in defining neighbourhood quality, some distance variables are used to capture the houses proximity to different distance amenities. These include distances from the house to nearest school, to main road etc. Distance from each variable to those features is computed by using Arc View GIS 3.2.

Definitions of each neighbourhood variable of these two areas are reported in **table 3.2**, which includes variable names, their definitions and expected relationship to the dependent variable.

Variables	Definition	Expected sign
Population density	People per square miles in the census block	Ambiguous
Poverty	Percentage of residents under poverty level in the census block group	Negative
Median age	Median age of the residents in the census block group	Positive
Vacancy rate	Proportions of vacant houses in the census block group	Negative
Median. H. I	Median household income of the residents	Positive
School attendance	% of residents with attending school (5-24 years in the census block group	positive
School Proximity	Distance in feet from the house to the nearest school	Negative
Tenancy status	% of population living in owner-occupied and rental houses	Positive

Table 3.2: Definitions and Expected values of Housing unit's Neighbourhood Variables

3.1.2.3. Housing unit's Urban Amenity or Environmental Variables (See Table B. 42 and Table B.45 at Appendix B for amenity or environmental characteristics of houses)

The amenity or environmental variables are the focus variable of the study. All the proximity measures of Urban Amenity variables such as distance of parks and lakes from houses are generated using Arc View GIS 3.2. The size of open spaces is ensured from various sources. Size of Gulshan-Mahakhali, Gulshan-Baridhara and Gulshan-Banani lakes are determined from DMDP structure plan of RAJUK (DAP, 95). Dhanmondi lake size is confirmed from a research paper (Nasreen, et al. 2009). The size of other open spaces (parks and play fields) is defined from a thesis paper (Afroza, 2010). It is possible that these data do not include other important open space amenity areas—like open areas provided by colleges and universities, public schools, cemeteries, and golf courses etc. Nevertheless, these data do include parks and lakes of the selected neighborhoods of Dhnmondi and Gulshan, which all may provide open space benefits. Table B.42 and Table B.45 at appendix B presents the detail information of amenity variables for 107 (79 owned and 28 rental houses) observations. The locations of these amenities can be seen in Figures 3.10, 3.11 and 3.12 below.

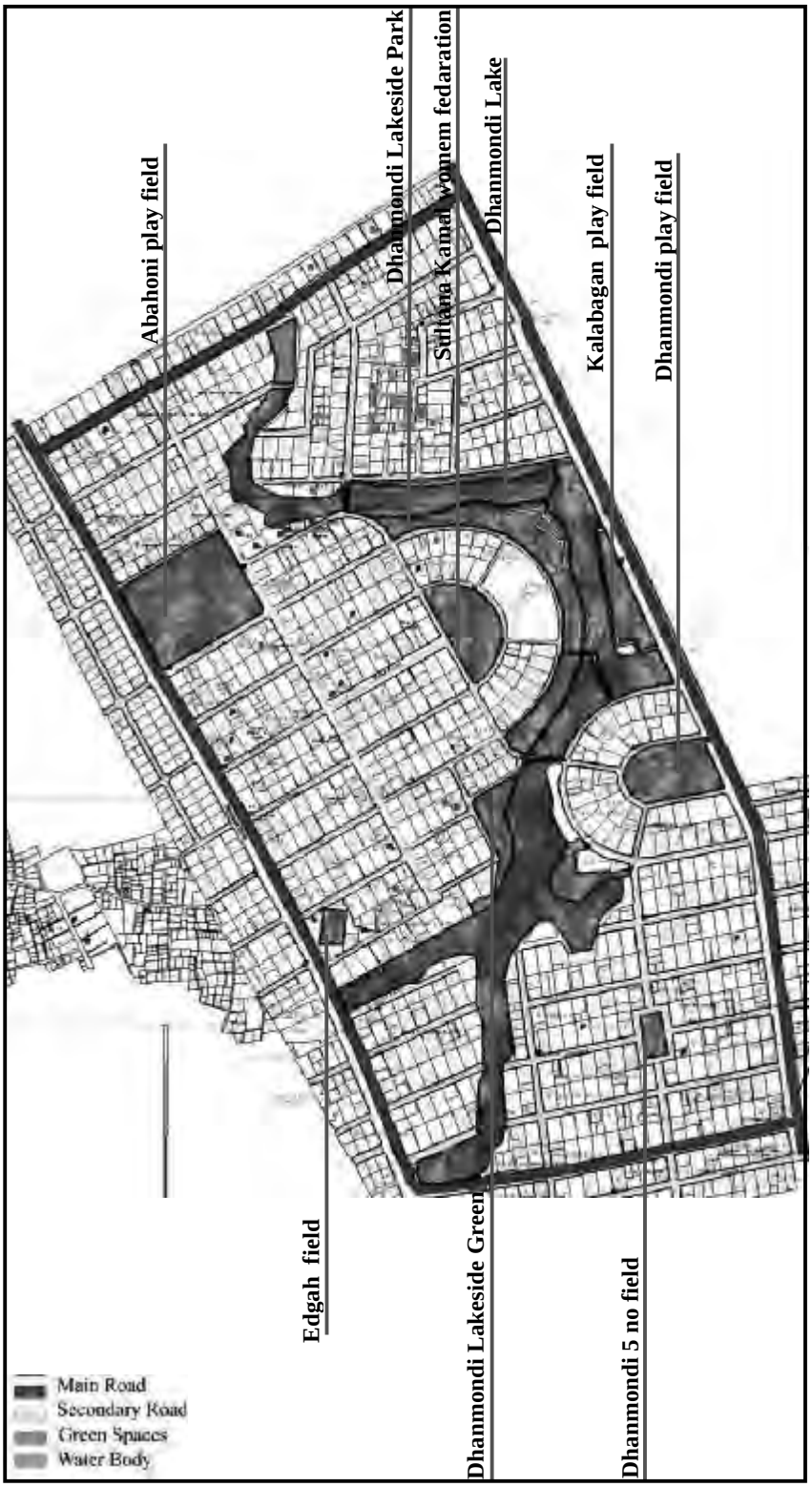

Figure 3.10: Distribution of amenity variables at Dhanmondi Residential area

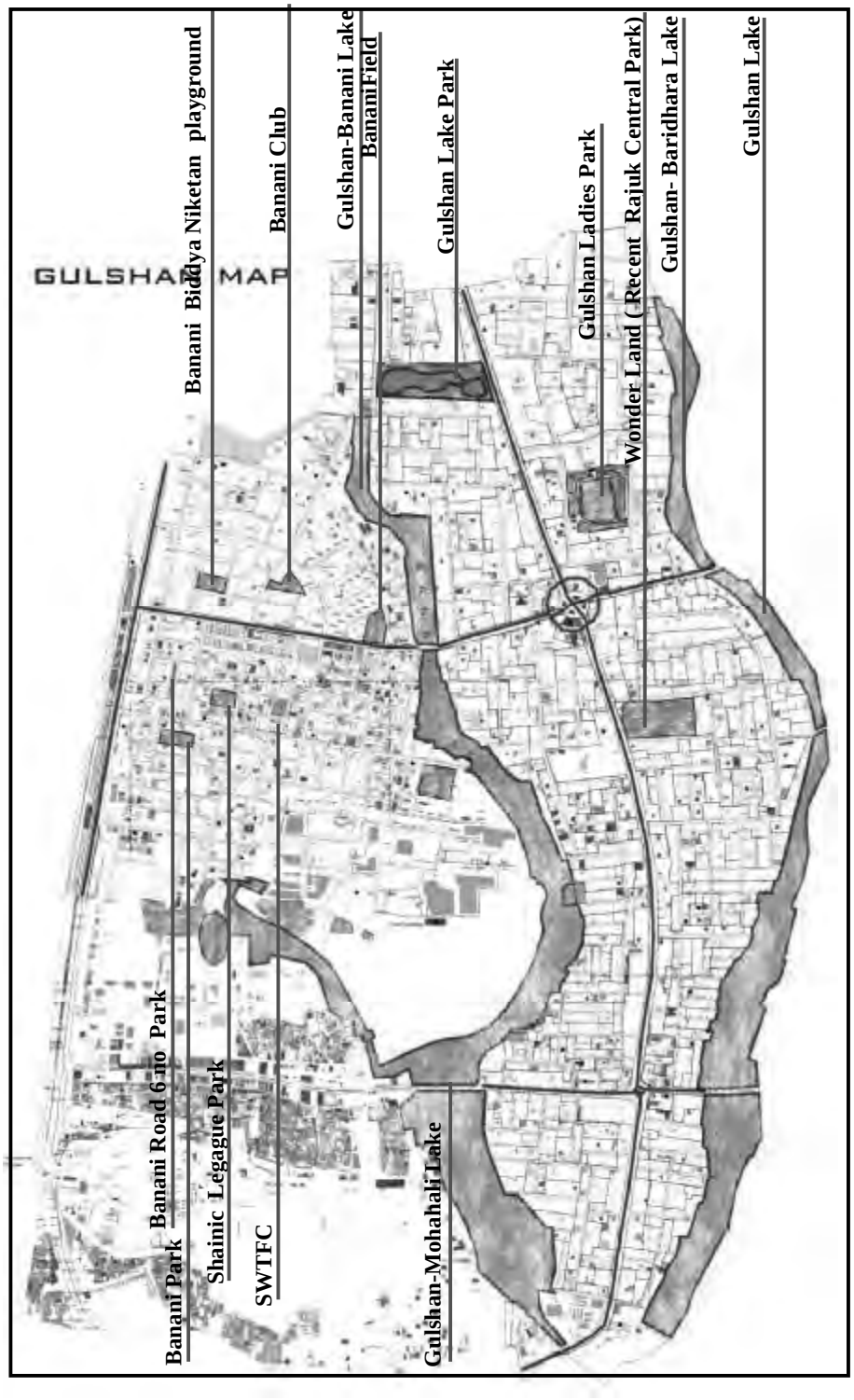

Figure 3.11: Distribution of Amenities at Gulshan and Banani model town

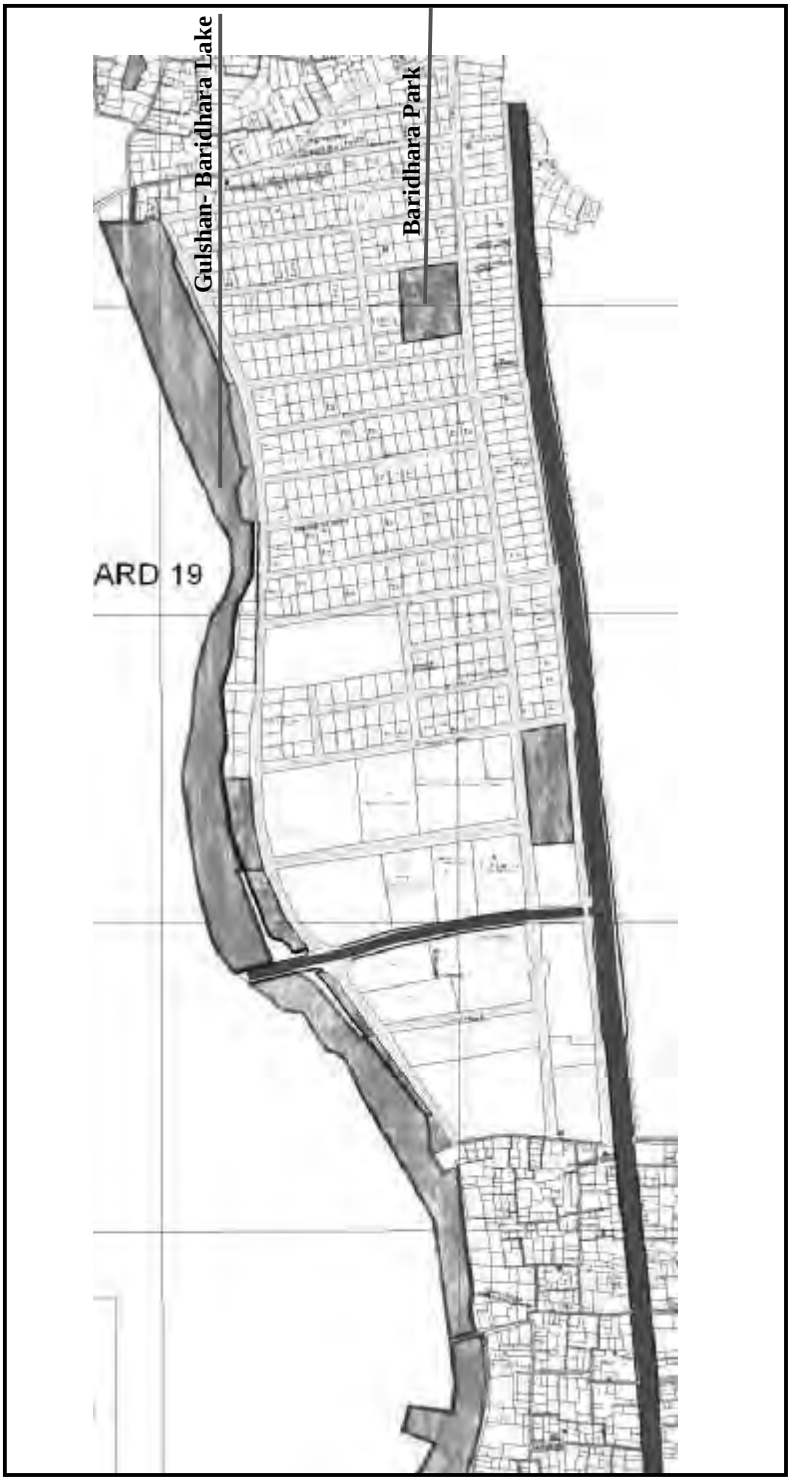

Figure 3.12: Distribution of Amenities at Baridhara Diplomatic Zone

It should be noted that walking or driving distance to these amenities might be more appropriate in cases gaining access for recreation (e.g., walking, playing). Whereas straight line distance would be more appropriate in cases such as enjoying the view of open spaces or consuming its environmental benefits. While one of these measures could possibly better capture the value of open spaces than other, we used straight-line distances for computational simplicity. Straight-line distances have also been used consistently in recent hedonic literature (Geoghegan et al., 1997; Tyrvainen and Miettinen, 2000; Cho et al., 2008).

Table 3.3 below includes the view of open space, distance from the house to the nearest urban park and size of that park. All these are the focus variables of the study. The definitions of each variable and their expected sign are also reported here.

Variables	Definition	Expected sign
view	Housing units having the view of open spaces (park, lake or field)	Positive
proximity	Distance in feet from the house to the nearest open space(park, lake or field)	Negative
size	Size in square footage of the nearest urban open space	Positive

Table3.3: Definitions and expected values of Housing unit's Amenity Variables

3.1.2.4. Explanation of Expected Signs

Expected signs are assumed from reviewing previous literatures. Intuitively, the expected signs for most of the structural variables (ACRE, LIVING AREA, BED, GARAGE, and STORIES, ORIENTATION) all follow the logic that "more is better." That is, additional units of these characteristics will increase the value of a home. With time, a home will deteriorate structurally, so the expected sign on AGE is negative. The justification for the expected signs on the neighbourhood variables is slightly less intuitive. Previous studies indicate that by measuring the relationship between home values and percentage of residents under poverty level in the neighbourhood is negatively related to home value (Palmquist, 1984; Gillard, 1981; Brookshire et al., 1982). Since higher median income might proxy for neighborhood quality factors like better schools and lower crime rates, the expected sign on INCOME is positive. A higher percent composition of neighborhood residents living in owner-occupied housing may reflect a more stable neighborhood community, so the expected sign on OWN is positive. There are both benefits (i.e. close-knit community) and costs (i.e. more congestion) to higher population density, so the expected sign on DENSITY is ambiguous.

The expected signs on the accessibility variables are all fairly straightforward. Since proximity to the SCHOOL represents increased accessibility to important geographic locations, the expected signs on these variables are negative. That is, as distance *from* these locations increases, we expect home values to decrease. Equivalently, *proximity* to these areas will have a *positive* effect on home value. These types of locations may also generate negative effects, however. Major highways, for example, create traffic, noise, and smog. For homes close to major highways, the net effect of *proximity* may be negative. Summary statistics for the dependent and independent variables are presented in Table3.4 below;

Variables		Code	Measure	
Price of the house unit		VA1	Ratio	**Dependent Variable**
Housing unit's Structural Variables				**Independent Variables**
Living Area		VAS1	Ratio	
Exterior		VAS2	Ordinal	
Bedrooms		VAS3	Ratio	
Garage		VAS4	Ratio	
Land area		VAS5	Ratio	
Stories		VAS6	Ratio	
Age		VAS7	Ratio	
Orientation		VAS8	Ordinal	
Housing unit's Neighborhood Variables				
Population density		VBN1	Ratio	
Poverty		VBN2	Ratio	
Median age		VBN3	Ratio	
Vacancy rate		VBN4	Ratio	
Median. H. I		VBN5	Ratio	
School Attendance		VBN6	Ratio	
Literacy rate		VBN7	Ratio	
School Proximity		VBN8	Ratio	
Housing tenancy status	Owned	VBN9	Ratio	
	Rental			
Housing unit's Environmental and amenity Variables				
view		VCA1	Ordinal	
size		VCA2	Ratio	
proximity		VCA3	Ratio	

Table 3.4: Descriptive Statistics of the Variables

Like the accessibility variables, the expected signs on the amenity variables are all negative. That is, as distance from these amenities increases, we expect home values to decrease. Equivalently, proximity to these areas will have a positive effect on home value. Again, however, particular open space areas may generate negative externalities. Parks, for instance, may generate noise and congestion. For homes nearer to a park, the net effect of proximity may actually be negative. These issues must be examined empirically.

The distance from the house to the nearest urban park, which is one of the focus variable of the study, is included as well to account for the accessibility of the park from the house. Distance to the park is expected to have a significant and negative effect. In addition the size of the nearest urban recreation park, is also included to account for the accessibility of the park from the house. A positive and significant effect of the size of urban park is expected. That means the larger (smaller) the size of the park, the larger (smaller) the sales price of nearby houses. Furthermore expected sign of having view of open space is positive following the logic “more is better”.

In addition the variables along with their code and measures use in the model are presented in Table 3.4. While developing a robust hedonic model to yield theoretically consistent results, we include as many structural and neighborhood variables as possible in the hedonic model in order to properly tease out the effect of our focus variable (i.e. open space size, view and proximity) on property price.

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3.1.3. Determination of Submarkets

The typical approach of analyzing housing market segmentation involves estimating hedonic equations for various assumed or defined submarkets and then testing for structural stability across those equations (Rothenberg et al., 1991).Thus in addition to issues of specification and functional form, it is also important that hedonic specifications accurately model the structure of the housing submarket itself. Traditionally, most hedonic studies have assumed that housing attributes will have the same marginal implicit price across the entire study area, implying a single, homogenous housing market. In some cases, however, the complexity of housing market dynamics may actually lead to the formation of quasi-independent sub-markets. In such cases, implicit prices may vary by sub-market (Oxford, 1999). Specifically, this occurs when ***exogenous*** factors constrain individual buyers and sellers to participation in certain segments of a larger market (Michaels & Smith, 1990). Examples of such exogenous factors may include geographic barriers or political boundaries, discrimination, or a lack of information (Palmquist, 1991).

In the case of the latter, Michaels & Smith (1990) argue that real or perceived sub-markets may develop as a consequence of the amount and type of information available to participants in the housing market. In large housing markets, for instance, individuals may rely on housing market experts (realtors, developers, etc.) for housing market information, which may result in market segmentation.

After identifying sub-markets, researchers must model segmentation by estimating separate hedonic equations for each sub-market or by applying more advanced econometric techniques (Orford, 2000). However, it is necessary to exercise caution. As Palmquist notes:

"If economists assume that there is a single market when it is actually segmented, their coefficients will be biased. On the other hand, if they assume that the markets are segmented when they are not, their estimates will be imprecise and they may have insufficient data in the segments (p. 89, 1990)."

In empirical studies, researchers have defined submarkets in different ways such as by demand and supply factors, geographical characteristics, spatial characteristics, structural characteristics and neighborhood characteristics. Household income and race also defined submarkets in some studies. Watkins (2001) reviewed and summarized submarket definitions in four groups based on structural dimensions, spatial dimensions, demander characteristics and the joint influence of structural and spatial characteristics of dwellings. Brourassa et al. (2003) summarized those definitions under two main groups as geographical areas and statistical techniques.

This paper first identified the submarkets and then estimated a separate hedonic price function for each submarket, following Lipscomb and Farmer (2005), Lipscomb (2006), Day et al. (2007), Cho et al. (2008). A recently developed clustering technique called Two Step Clustering (McGarigal et al., 2000) is capable of identifying the optimal number of clusters based on the housing and neighborhood characteristics entering the hedonic function. The first step of the Two Step Cluster method begins with pre-clustering observations for individual houses by constructing a likelihood distance measure function. A matrix containing distances between all pairs of pre-clustered observations is created. In the second step, these pre-clustered groups of original observations are treated as individual observations and re-grouped by selecting the optimal number of clusters. Because the first step groups a large number of original observations into a much smaller number of pre-clusters, the second step

uses an agglomerative hierarchical clustering to re-group the pre-clusters (Green and Salkind, 2003).

Following McGarigal et al. (2000), and Strong and Jacobson (2005), the study is employed Two Step Clustering techniques for market segmentation. This research considers three factors in identifying submarkets. First, houses within a submarket are close substitutes for one another, but poor substitutes for houses in other submarkets (Bourassa et al., 1999; Grisby et al., 1987). So it is important that the houses classified as members of a submarket be similar in their properties. Second, the distribution of household's tastes and preferences should be stable or the same across markets but price functions should be different (Ekeland et al., 2002). Therefore, it is important to control for the socio- economic characteristics of the households. Third, the 'location' has been argued to be the most important factor in existence of submarkets (Bourassa et al., 2003). So neighborhood characteristics and locational references (e.g., distances to various amenities) should be considered when delineating submarkets. Schnare and Struyk (1976,) viewed market segmentation as a function of structural attributes, neighborhood attributes, or a combination of both. This study follows prior studies (Bourassa et al., 1999; Bourassa et al., 2003; Day, 2003; Chen et al., 2009; Cho et al., 2008) in using the variables of a typical hedonic model in clustering and defining submarkets. All structural properties, neighborhood characteristics, and amenity variables are used in defining the three submarkets to classify the houses in such a way that the resulting submarkets are homogenous in as many attributes as possible.

Considering those factors specially distance from open space variables, the sample houses of both areas; Dhanmondi and Gulshan including Banani, Baridhara are classified into three submarkets. The sample houses which are located adjacent to and have direct view of open spaces are classified as **Submarket 1**. **The Submarket 2** is identified by the houses those do not have direct view or access but are located at next layer or closest proximity of Submarket 1. The sample houses those are located at next to the next layer of submarket 1 and onward are grouped as **Submarket 3**. The tables B.40, B.41, B.42, B.43, B.44, B.45 at Appendix B, present the detail information of all the variables which are considered to differentiate the submarkets for both owner occupied and rental houses. Identified three different submarkets are segmented by using different color coding. The green labeled houses are defined as Submarket1, the yellow labeled houses are defined as Submarket 2 and Submarket 3 is identified by orange labeling. Figures 3.13, 3.14, 3.15, 3.16, and 3.17 below, show the sample houses near to open spaces within the three identified submarkets at the study areas;

Figure 3.13: Identification of submarkets (Sample plots) at Dhanmondi Residential Area

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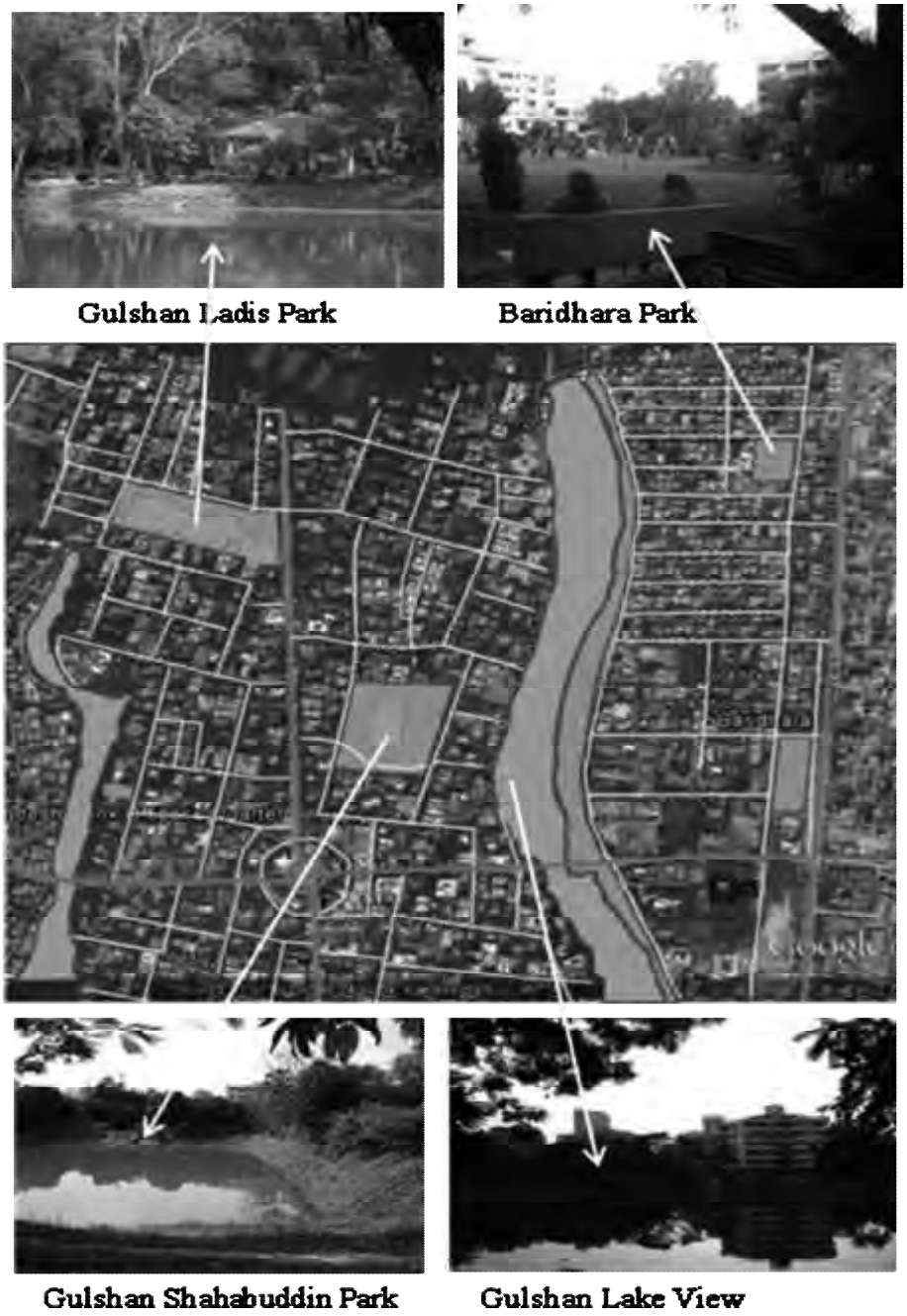

Figure 3.14: Identification of Submarkets (sample plots) at Gulshan North zone

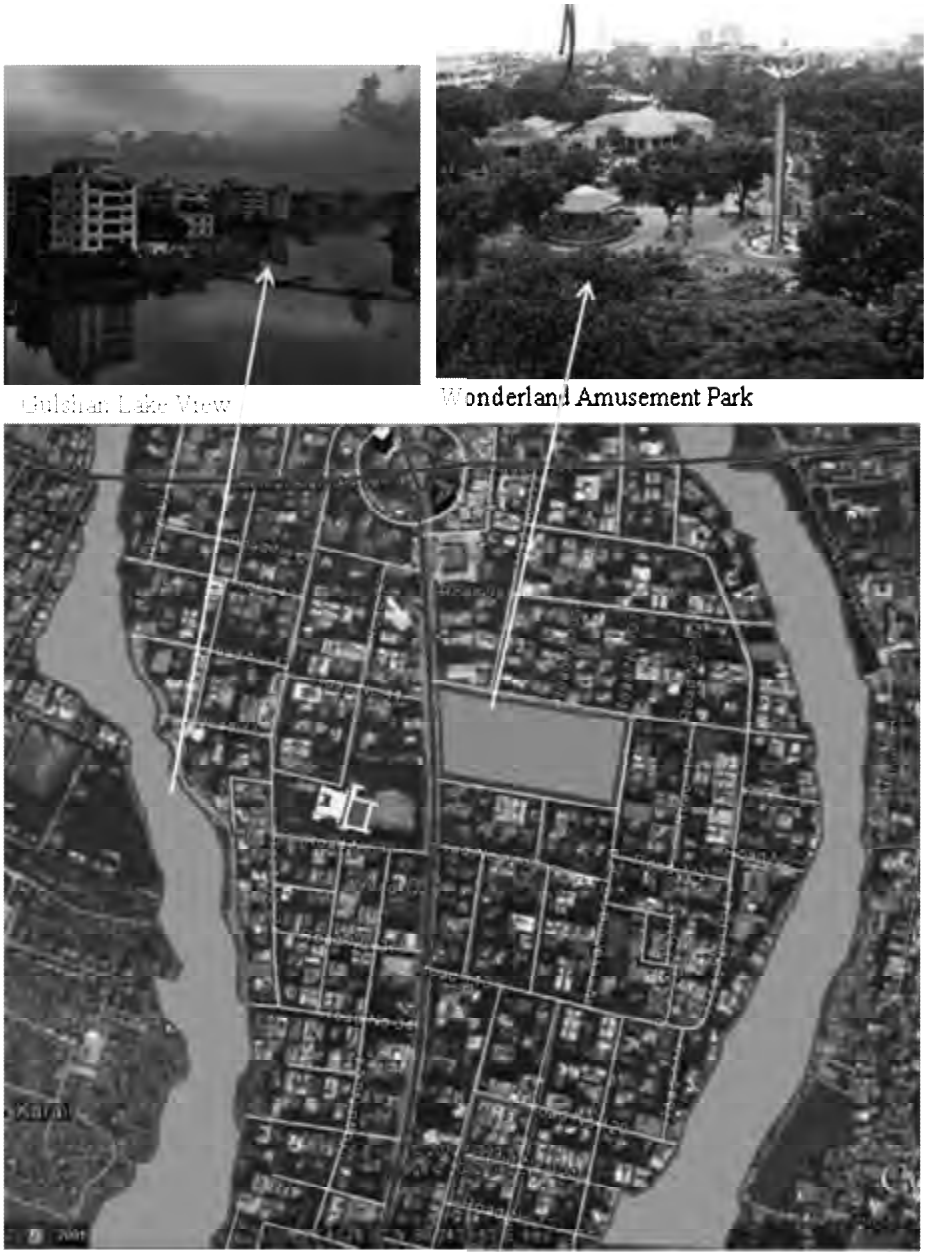

Figure 3.15: Identification of submarkets (sample plots) at Gulshan Middle zone

Figure 3.16: Identification of submarkets (sample plots) at Gulshan South zone

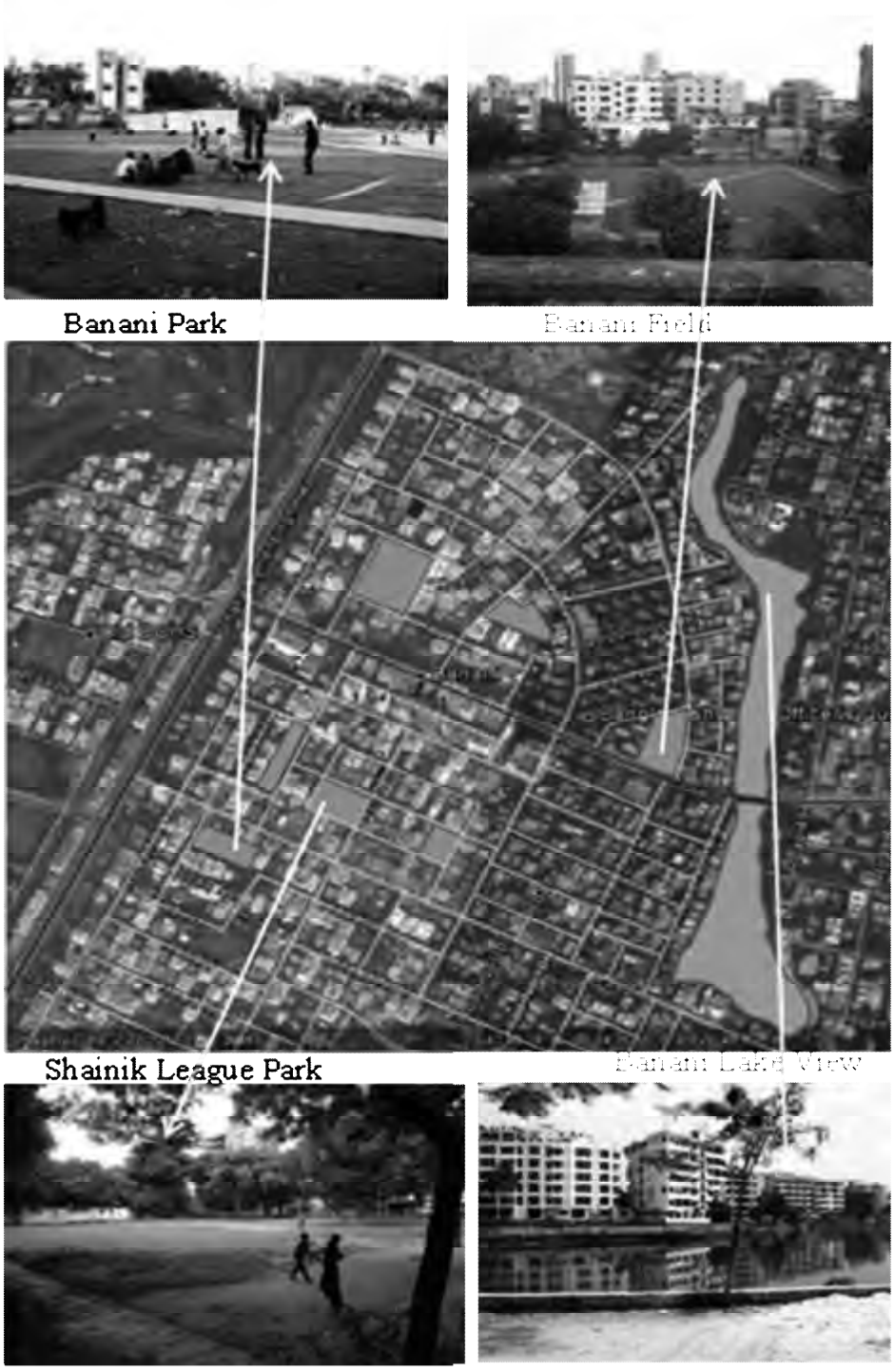

Figure 3.17: Identification of submarkets (sample plots) at Banani Model Town

Even though the clustering technique groups the properties of similar characteristics into clusters, it is important to understand whether those clusters represent the submarkets in an economic sense. Therefore, ANOVA tests are performed to compare the statistical difference among the submarket properties, based on sample means and variances (Moore and McCabe, 2003).

3.1.4 Determination of the Statistics Hypotheses

The study examined statistics hypotheses within eight sets:

1. Correlation between implicit price of housing unit and its structural characteristics.
2. Correlation between implicit price of housing unit and its neighborhood and locational characteristics.
3. Correlation between implicit price of housing unit and its amenity or environmental characteristics.
4. Price differences depending on housing units structural characteristics (t test).
5. Price differences depending on housing units structural, neighborhood and environmental characteristics (F test)
6. Difference of zones in terms of the price and housing unit's structural, location or neighborhood, user' socio-economic characteristics and environmental characteristics (ANOVA test).
7. Relation between zones and structural, location or neighborhood, user' socio-economic and environmental characteristics of the housing unit (Chi-Square test).
8. Regression analysis between implicit prices of housing unit and its structural, location or neighborhood, users' socio-economic characteristics and environmental characteristics (First stage Hedonic Model).

Below, all statistics hypotheses within these sets are listed.

Hypothesis 1: Correlation between implicit price of housing unit and its structural characteristics

Within the context of the first set of the statistics hypotheses (correlation between price of housing unit and its structural characteristics); the following statistics hypotheses are formulated to be tested by using correlation technique. If the null hypothesis is true;

- There is no correlation between the implicit price of housing unit and size of the housing unit's living area.
- There is no correlation between the implicit price of housing unit and size of the plot.
- There is no correlation between the implicit price of housing unit and number of floors of the housing unit.
- There is no correlation between the implicit price of housing unit and age of the building.
- There is no correlation between the implicit price of housing unit and orientation of the building.

Hypothesis 2: Correlation between implicit price of housing unit and its neighborhood and locational characteristics

Within the context of the second set of the statistics hypotheses (correlation between price of housing unit and its neighborhood characteristics); the following statistics hypotheses are formulated to be tested by using correlation technique; If the null hypothesis is true;

- There is no correlation between implicit price of the housing unit and population density of the area.
- There is no correlation between implicit price of the housing and percentage of residents under poverty level.
- There is no correlation between implicit price of the housing unit and proportions of vacant houses.
- There is no correlation between implicit price of the housing unit and median age of the residents in the census block group
- There is no correlation between implicit price of the housing unit and percentage of residents attending school (5-24years) in the census block group.
- There is no correlation between implicit price of the housing unit and median household income of the residents.
- There is no correlation between implicit price of the housing and distance in feet from the house to the nearest school.
- The There is no correlation between implicit price of the housing and percentage of population living in owner-occupied housing.
- The There is no correlation between implicit price of the housing and percentage of population living in rented houses.

Hypothesis 3: Correlation between implicit price of housing unit and its amenity or environmental characteristics

Within the context of the third set of the statistics hypotheses (correlation between price of housing unit and its amenity variables); the following statistics hypotheses are formulated to be tested by using correlation technique. As amenity characteristics of housing unit are the focus variables of this study, the relation between price and amenity variables for both owners occupied and rental houses are considered here; If the null hypothesis is true;

- There is no correlation between implicit price of the owner occupied and rental houses and view from these houses to the nearest park or lake.
- There is no correlation between implicit price of the owner occupied and rental houses and size in square footage of the nearest urban recreation park from these houses.
- There is no correlation between implicit price of the owner occupied and rental houses and distance in feet from these houses to the nearest park or lake.

The first three sets of statistics hypotheses as stated above are designed to understand the relation between the price of housing unit and its structural, location or neighborhood and amenity or environmental characteristics. For amenity characteristics of housing both owner occupied and rental houses are considered. All these variables are chosen because they are commonly applied by many researchers and they contribute significantly to the property prices. These three statistics hypotheses are formulated to be tested by using correlation technique. In these hypotheses correlation analysis are operated to analyze whether the linear relationship between implicit price, which is a dependent variable and any other independent variable of housing units structural, neighborhood or amenity characteristics. The sign of correlation coefficient (positive or negative) describes the price of relationship between the variables being correlated.

Hypothesis 4: Price differences depending on housing units structural characteristics (T-test)

Within the context of the fourth set of the statistics hypotheses (price differences depending on structural characteristics); the following statistics hypotheses are formulated to be tested by using t-test technique; if the null hypothesis is true;

- The implicit price of housing unit is not differentiated depending on the façade treatment (Brick/ RCC finish) of the housing unit.
- The implicit price of housing unit is not differentiated depending on the number of bedrooms.

The fourth set of statistics hypotheses as stated above is also designed to test the difference between the price of housing unit and its structural, and amenity or environmental characteristics. The fourth set of statistics hypotheses is formulated to be tested by using t-test technique as there is one quantitative variable (price) and other predictor variables (façade treatment and number of bedrooms), which are categorical and each variable contains two or less than two sub categories. T-statistics is used to test the significance of the impact of each independent variable on the dependent variable (price). The t-value is relating to the regression coefficient of the independent variable and the standard error of that coefficient. It should be noted that the magnitude of the effect of the independent variable on price can be highly significant but the effect of the independent variable on price may not be very high.

Hypothesis 5: Price differences depending on housing units structural and environmental characteristics (F test)

Within the context of the fifth set of the statistics hypotheses (price differences depending on structural and environmental characteristics); the following statistics hypotheses are formulated to be tested by using F test technique (one way ANOVA); If the null hypothesis is true;

- The implicit price of housing unit is not differentiated depending on number of stories of the housing unit.
- The implicit price of housing unit is not differentiated depending on age of the building.
- The implicit price of housing unit is not differentiated depending on the facade orientation.
- The implicit sales price of housing unit is not differentiated depending on the view of open spaces (lake, park or field) from the house to the nearest park/lake/field.

The fifth set of statistics hypotheses as stated above is designed to test the difference between the price of housing unit and its structural (number of stories, age of the building, facade orientation) and amenity or environmental characteristics (view of open spaces). The fifth set

of statistics hypotheses is formulated to be tested by using F test technique or ANOVA test, as there is one quantitative variable (price) and other predictor variables (stories, age, orientation or view), which are categorical and each variable contains more than two sub categories. The ANOVA test results describe the overall variance accounted for in the regression model.

Hypothesis 6: Difference of zones in terms of the price, and housing units' structural, location or neighborhood and environmental characteristics (ANOVA test)

Within the context of the sixth set of the statistics hypotheses (difference of zones in terms of the price, structural, location or neighborhood and environmental characteristics of the housing unit); the following statistics hypotheses are formulated to be tested by using F test technique (one way ANOVA) for both owner occupied and rental houses.

ANOVA test for Owner Occupied houses

ANOVA test for owner occupied houses all housing characteristics (structural, location or neighborhood and environmental) are considered. If the null hypothesis is true;

- The zones as representatives of market segments are not differentiated in terms of the implicit price.
- The zones as representatives of market segments are not differentiated in terms of the size of the housing unit.
- The zones as representatives of market segments are not differentiated in terms of the plot size.
- The zones as representatives of market segments are not differentiated in terms of the number of floors of the housing unit.
- The zones as representatives of market segments are not differentiated in terms of the age of the building.
- The zones as representatives of market segments are not differentiated in terms of the population density of the area.
- The zones as representatives of market segments are not differentiated in terms of the percentage of residents under poverty level.
- The zones as representatives of market segments are not differentiated in terms of the median age of the residents in the census block group
- The zones as representatives of market segments are not differentiated in terms of the proportions of vacant houses.
- The zones as representatives of market segments are not differentiated in terms of the median household income of the residents.

- The zones as representatives of market segments are not differentiated in terms of the percentage of residents with college degree in the census block group.
- The zones as representatives of market segments are not differentiated in terms of the distance in feet from the house to the nearest school.
- The zones as representatives of market segments are not differentiated in terms of the percentage of population living in owner-occupied housing.
- The zones as representatives of market segments are not differentiated in terms of the distance in feet from the house to the nearest lake, park or field.
- The zones as representatives of market segments are not differentiated in terms of the size in square footage of the nearest urban recreation park.

ANOVA test for Rental houses

For rental houses only environmental or amenity variables are taken into account, as these are the focus variables of the study. If the null hypothesis is true;

- The zones as representatives of market segments are not differentiated in terms of the rent price.
- The zones as representatives of market segments are not differentiated in terms of the distance in feet from the house to the nearest lake, park or field.
- The zones as representatives of market segments are not differentiated in terms of the size in square footage of the nearest urban recreation park.

The sixth set of statistics hypotheses as stated above is developed to test whether the zones represents or not the different segments of housing market or different submarkets, which offer houses in different prices with different structural, location and environmental characteristics. In terms of amenity variables both owner occupied and rental houses are considered. This set of statistics hypotheses is formulated to be tested by using F test technique or ANOVA test. ANOVA test are performed to compare the statistical difference among the submarket properties, based on sample means and variances.

Hypothesis 7: Relation between zones and structural, location or neighborhood, users' socio-economic and environmental characteristics of the housing unit (Chi-Square test)

Within the context of the seventh set of the statistics hypotheses (relation between zones and structural, location and environmental characteristics of the housing unit, and users' socio-economic characteristics); the following statistics hypotheses are formulated to be tested by using Chi-Square ($\chi 2$) test technique for both owned and rental houses.

Chi-Square ($\chi 2$) test for Owner occupied houses

The following statistics hypotheses are formulated to be tested by using Chi-Square ($\chi 2$) test technique for owner occupied houses to determine the relation between zones and structural, location and environmental characteristics of the housing unit, and users' socio-economic characteristics. If the null hypothesis is true;

- There is no relation between the zones as representatives of market segments and facade treatment (Brick/ RCC finish) of the housing unit.
- There is no relation between the zones as representatives of market segments and number of bedrooms.
- There is no relation between the zones as representatives of market segments and number of floors of the housing unit.
- There is no relation between the zones as representatives of market segments and age of the building.
- There is not a relation between the zones as representatives of market segments and facade orientation.
- There is no relation between the zones as representatives of market segments and having view from the housing unit.

Chi- Square ($\chi 2$) test for Rental houses

The following statistics hypotheses are formulated to be tested by using Chi-Square ($\chi 2$) test technique for rental houses to determine the relation between zones and its structural, location and environmental or amenity characteristics of the housing unit. If the null hypothesis is true;

- There is no relation between the zones as representatives of market segments and view of open space (lake, park of field) from both rental and owner occupied houses.

The seventh set of statistics hypotheses as stated above is formulated to be tested by using Chi-Square ($\chi 2$) test technique. This test gives information about the relationship between submarkets, where all the variables are categorical. This study analyzed structural and neighborhood variables for owner occupied houses. But in terms amenity variables both owner occupied and rental houses are considered. $\chi 2$ test are performed to understand the statistical relationship among the submarket properties.

Hypothesis 8: Regression analysis between implicit prices of housing unit and its structural, location or neighborhood, users' socio-economic and environmental characteristics (First stage Hedonic Model)

In the Final stage, within the the context of the eighth set of the statistics hypotheses a **Hedonic Price Model** is developed by using least square method. In this model variables related to housing structural, location and socio-economic and environmental attributes are tested. The following statistics hypotheses are formulated to be tested by using regression analysis for both owned and rental houses.

Regression analysis for Owner occupied houses

The following statistics hypotheses are formulated to be tested for regression analysis by using Least Square Method for owner occupied houses to determine the relation between price of housing unit and its structural, location, users' socio-economic and environmental characteristics. If the null hypotheses is true;

- There is no relationship between the implicit price of housing unit and size of the housing unit's living area.
- There is no relationship between the implicit price of housing unit and exterior façade treatment
- There is no relationship between the implicit price of housing unit and size of number of bedroom
- There is no relationship between the implicit price of housing unit and size of the plot.
- There is no relationship between the implicit price of housing unit and number of floors of the housing unit.
- There is no relationship between the implicit price of housing unit and age of the building.
- There is no relationship between the implicit price of housing unit and façade orientation.
- There is no relationship between implicit price of the housing unit and population density of the area.
- There is no relationship between implicit price of the housing and percentage of residents under poverty level.
- There is no relationship between implicit price of the housing unit and proportions of vacant houses.

- There is no relationship between implicit price of the housing unit and median age of the residents in the census block group
- There is no relationship between implicit price of the housing unit and percentage of residents attending school (5-24years) in the census block group.
- There is no relationship between implicit price of the housing unit and median household income of the residents.
- There is no relationship between implicit price of the housing and distance in feet from the house to the nearest school.
- The There is no relationship between implicit price of the housing and percentage of population living in owner-occupied housing.
- The There is no relationship between implicit price of the housing and percentage of population living in rented houses.
- There is no relationship between implicit price of the housing and view from the house to the nearest park or lake.
- There is no relationship between implicit price of the housing and size in square footage of the nearest urban recreation park.
- There is no relationship between implicit price of the housing and distance in feet from the house to the nearest park or lake.

Regression analysis for Rental houses

The following statistics hypotheses are formulated to be tested for regression analysis by using Least Square Method for owner occupied houses to determine the relation between price of housing unit and its environmental characteristics. If the null hypotheses is true;

- There is no relationship between rent price of the housing and view from the house to the nearest park or lake.
- There is no relationship between rent price of the housing and size in square footage of the nearest urban recreation park.
- There is no relationship between rent price of the housing and distance in feet from the house to the nearest park or lake.

The last hypothesis analyzes linear regression analysis for the variables related to housing units' structural, locality or neighborhood and amenity or environmental attributes. This research considers structural and neighborhood characteristics of houses for only owner occupied houses and environmental or amenity variables for both owner occupied and rental houses; as these are the focus variable of the study. These sets of statistics hypotheses are formulated to be tested by using Least Square Method to investigate the effect of housing

units' structural, neighborhood and amenity or environmental characteristics on the implicit price of housing unit. Regression analysis is allowed to make statements about how well the independent variable (i.e. structural, locality and amenity) would predict the value of dependent variable (i.e. price). Within the context of regression analysis a coefficient table is generated, which provides information about the effects of individual predictor variables and results of significance level as well. The statistical tests to be used in analyzing these hypotheses are explained under the sub-heading of 3.1.6.

3.1.5. Determination of Data Collection Technique-Sampling Design

The hedonic model outlined in the previous section 2, requires data observations of the dependent variable, selling price, and its corresponding independent variables. Since the hedonic method relies on real market data, information from actual transactions is necessary for model estimation. This study uses data from three submarkets of homes; those were sold in Dhanmondi and Gulshan residential area including Baridhara and Banani in between the year of 2005 to 2008, as mentioned before.

The study determines principally two sources and techniques to gather required information. Households and Private developers are the main sources of information. Questionnaire survey is used as the main method to collect the data set featuring the price and structural characteristics of housing, and some neighborhoods and environmental attributes. Further, some information about the open spaces and locality factors is drawn from maps provided by the Dhaka City Corporation and GIS and from literature review of some research papers. Neighbourhood data was collected from Bangladesh Bureau and Statistics (BBS, 2001).

As a sampling technique for the questionnaire survey, the simple random sampling techniques are used within three submarkets of Dhanmondi, Gulshan, Banani and Baridhara. Sample sizes for each submarket and for the entire area have been seen before in figure 3.13, 3.14, 3.15, 3.16, 3.17. Nevertheless, on site, a great reaction against participation to the survey was observed; therefore, it was needed to talk much more people (approximately 150 to persuade for participation to the survey. Although 50 people were persuaded at the beginning, later some of them said that they changed their decision. Also, some of them could not be reached or not able to give past data. Consequently, the questionnaire survey was applied to the 70 respondents (including Owner of the houses and developers) and to 20 respondents, who use these houses on a rental basis within the entire sample area. Most of the surveys were carried out face to face. Nevertheless, some respondents said that they did not have enough time at

that moment, therefore asked for time. In these situations, questionnaire form was left, and few days later it was received by hand.

3.1.6. Determination of Data Analysis and Preparation Techniques

Statistical analyzes which are carried out for data analysis in this study, done by advanced inferential statistics, such as analysis of variance, frequency analysis, correlation, and regression models. This part gives a brief on inferential statistical techniques use in the study. Further and detailed information about these statistical tests can easily be found from the literature of statistics and econometrics disciplines (e.g., see Christensen and Stoup 1986, Gnandesikan 1990, Jacques 1997, Sharma 1996, Stevens 1996, Tabachnick and Fidel 1996).

In the study, as a software package SPSS is used for conducting statistical analyses and generating tables that summarize data (for information about SPSS package, see SPSS Survival Manuel by Pallant, 2003).

3.1.6.1. Descriptive Statistical Tests

The first step in the data analysis is to describe and summarize information about variables in the dataset in a clear and understandable way. For this, descriptives, frequencies, and cross tabs are done by using both numerical and graphical methods. All the descriptive statistical tests are briefly described in the next chapter at section 4.1.1.

3.1.6.2. Inferential Statistical Tests

In the direction of the statistics hypotheses, inferential statistical tests are carried out to inspect the picture that will appear after operating the hedonic price models. Within the context of the inferential statistics, chi-square test, *t* test, F test, correlation and regression analysis are carried out. The selection of the inferential statistical technique is determined depending on the measuring scale of the variables and the structure of the statistics hypotheses. All the inferential techniques are briefly described in the next chapter at section 4.1.2.

3.2 Summary

In this section Dhaka cities different neighborhoods, named Dhanmondi and Gulshan, Banani and Baridhara has been selected as case area considering their physical, functional and socio-economic characteristics. Study uses data from the 107 (79 owned and 28 rental) apartments

those were sold in the years between 2005 to 2008. As a sampling technique for questionnaire survey, the simple random sampling techniques are used within the entire selected areas. The data from these sample houses include home sales price, as Dependent variable, and a variety of structural, neighborhood and amenity or neighborhood characteristics of housing unit as Independent variables. The amenity characteristics (view, size and distance of nearest open spaces from the houses) of houses are identified as focus variables of the study as the study is aimed to determine the monetary value of open spaces. Considering those factors specially distance from open space variables, the sample houses are classified into three submarkets to compare the statistical differences among the submarket properties. Finally this study examines in the direction of the hedonic price method's assumptions and research question eight sets of statistics hypotheses to understand the relation between the price of housing unit and its structural, neighborhood and environmental characteristics. Finally, statistical analyzes is carried out for data analysis in this study, done by both advanced Inferential and Descriptive Statistics. For conducting these statistical analyses a software package SPSS is used.

CHAPTER 04: DATA ANALYSIS AND DISCUSSION

This chapter discusses the results of data analysis within the context of eight sets of statistics hypotheses. All these sets of hypotheses are tested by using correlation analysis, *t*-test, ANOVA test, chi-square test to support the results of research method Hedonic Regression Model.

4.1 Results of Data Analysis

Results of the data analysis are summarized in two groups: descriptive statistics results and inferential statistics results.

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4.1.1. Descriptive Statistics Results

This part briefly summarized the mean, minimum, maximum values for metric scale variables, variance, standard deviation values and maximum frequency values for nominal scale and ordinal scale variables. This numerical information is also demonstrated graphically by using histogram, stem and leaf displays, and box plots. The descriptive statistics were summarized within each variable set.

4.1.1.1 Descriptive Statistics Results of Entire Sample Area

For the entire area, descriptive statistics (mean, minimum, maximum values for metric scale variables and maximum frequency values for nominal and ordinal scale variables) for variables are summarized within the variable sets of;

- Descriptive Statistics results for housing unit's dependent variable (Price)
- Descriptive Statistics results within the variable set of housing unit's structural attributes
- Descriptive Statistics results within the variable set of housing unit's location and neighborhood attributes
- Descriptive Statistics results within the variable set of housing unit's environmental or amenity attribute

Descriptive Statistics results for housing unit's dependent variable (Price)

Descriptive statistics (mean, minimum, maximum values for metric scale variables and standard deviation values) for dependent variable (price) of both owners' occupied and rental houses for entire sample areas are summarized below at table 4.1. The numerical information is also demonstrated graphically by using histogram.

The mean value for the dependent variable; Implicit Price of the owner occupied housing units **(VA1- Actual Price**) is 109283405.00 BDT; the value of the variable ranges from 4650000.00 BDT to 41280000.00 BDT. The mean value for the dependent variable Rent Price of the rental housing units (**VA1'**- Rent Price) is 29074.0741 BDT. The value of the variable ranges from 14000.00 BDT to 55000.00 BDT (from table 4.1). The descriptive statistics results for both have been shown at Figure 4.1 and Figure 4.2.

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Owner occupied houses					
PRICE	79	4650000.00	41280000.00	10928340.5063	6374932.70568
Valid N (listwise)	79				
Rental Houses					
PRICE	27	14000.00	55000.00	29074.0741	9840.75484
Valid N (listwise)	27				

Table 4.1: Descriptive Statistics results for the Dependent Variable

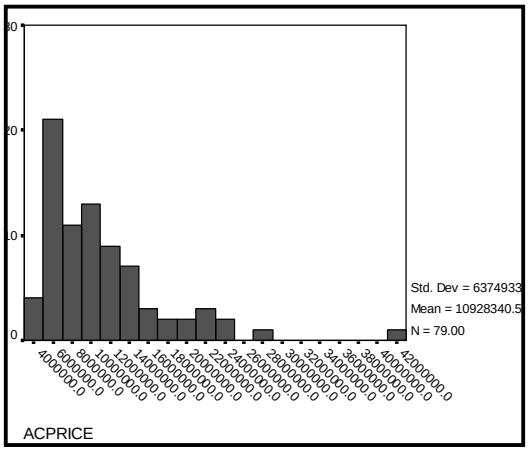

Figure 4.1: Descriptive Statistics results for implicit Price of owned Houses

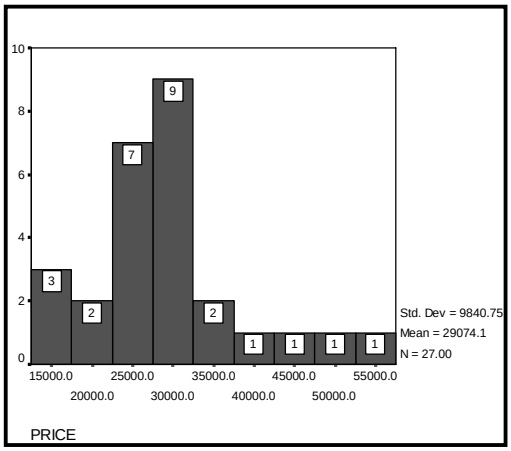

Figure 4.2: Descriptive Statistics results for the Price of rental Houses

Descriptive Statistics results within the variable set of housing unit's structural attributes:

While the descriptive statistics procedure described above is useful for summarizing continues data, it doesn't helpful for interpreting categorical data. Therefore, the frequencies are measured for categorical data. This allowed obtaining the number of cases within each category in the dataset. This study considered for housing units' structural and neighborhood variables for only owner occupied houses. But for amenity variables this study includes data for both owner occupied and rental houses.

Variables	Category	Frequency	Percentage	Cumulative percentage
Exterior	**Brick**	76	96.2	96.2
	RCC	3	3.8	100
Bedroom	**4**	46	58.2	58.2
	3	32	40.5	98.7
	5	1	1.3	100
Garage		79	100	100
Age	**0**	15	19.0	19.0
	1	13	16.5	37.4
	2	17	21.5	54.0
	3	34	43.0	100
Stories	**5**	1	1.3	1.3
	6	76	96.2	97.5
	7	2	2.5	100
Facing	**E**	7	8.9	8.9
	W	11	13.9	22.8
	NW,N,NE	29	36.7	59.5
	SE, S, SW	32	40.5	100

Table 4.2: Frequency Analyses of Categorical Variables for structural characteristics of Owned houses

The table 4.2 above represents, the frequency results, which includes all categorical variables. Table shows that, 96.2% (frequency 76) of sample houses are Brick constructed (**VAS2- exterior**); only 3.8% (frequency 3) of housing units have Reinforced Concrete on Exterior Facade [Figure 4.3]. 58.2% (frequency 46) of housing units have 4 Bedrooms (**VAS3- no of bedroom**), 40.5 % (frequency 32) of houses have 3 Bedrooms [Figure 4.4]. The graphical representations of these variables are shown below;

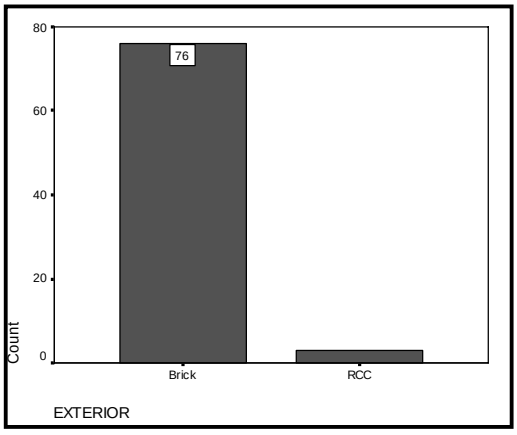

Figure 4.3: Frequency values of Exterior façade

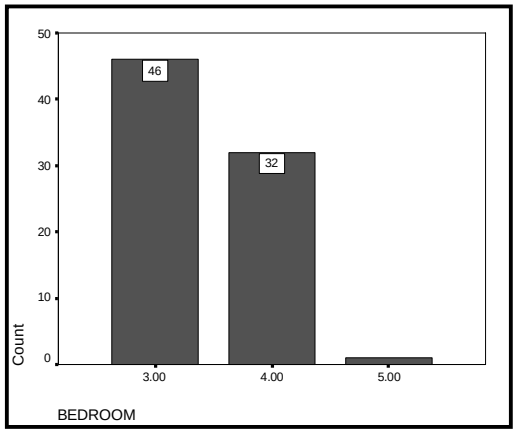

Figure 4.4: Frequency values of Bedroom numbers

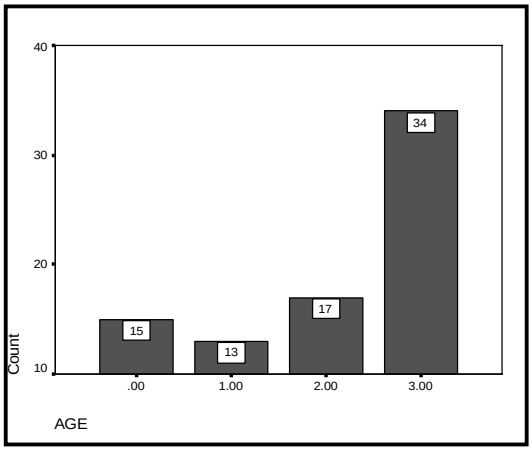

Figure 4.5: Frequency values of Age of houses

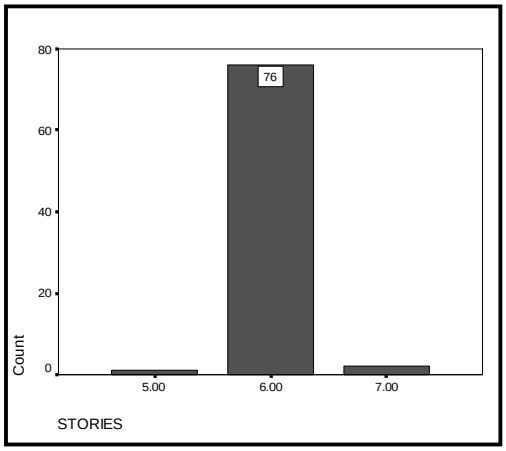

Figure 4.6: Frequency values numbers of Stories

100% of buildings have Garage (**VAS4 – garage**). However all the houses have garages, it has been excluded from inferential statistics analysis. From table 4.2 above, in the year 2008 43% (frequency 43) of buildings are Aged 3 years (**VAS7-age)**, 21.5% (frequency 17) of buildings are 2 years old, 16.5% (frequency 13) of buildings are 1 years old and 19% (frequency 15) of buildings are less than 1 years old (Figure 4.5). 96.2% (frequency 76) of buildings are 6 Storied (**VAS6- no of stories**), 2.5% (frequency 2) are 7 storied and 1.3% (frequency 1) of buildings are 5 storied (Figure 4.6). In terms of orientation (**VAS8-orientation**), 40.5% (frequency 32) of houses are south-east, south or south-west facing, 36.7% (frequency 29) houses are north-west, north or north-east facing, 13.9% (frequency 11) houses are west oriented and only 8.9% (frequency 7) houses have east orientation (Figure 4.7). All these structural variables are considered for owned houses.

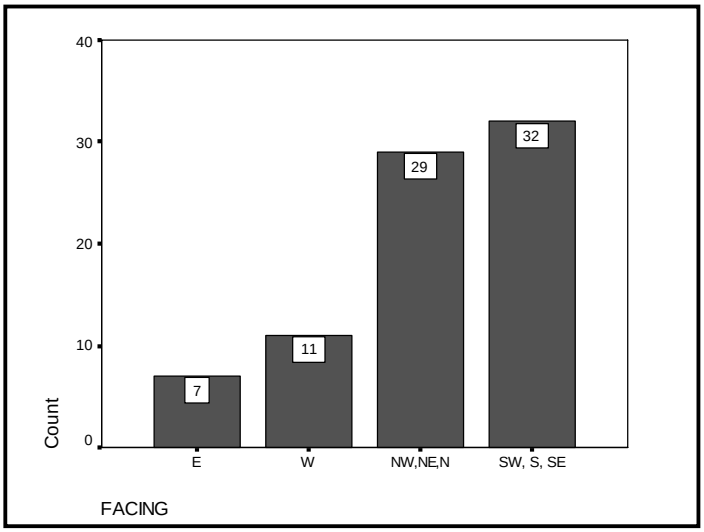

Figure 4.7: Frequency values of different Orientations of houses

Variables	N	Minimum	Maximum	Mean	Std. Deviation
L.AREA	79	1145.00	5300.00	2174.9494	774.85656
LANDAREA	79	4.00	23.00	11.3033	5.41081
DENSITY	79	10240.00	162296.00	39766.8987	26380.46920
POVERTY	79	2.5	8.6	5.589	3.0692
VACANCY	79	9.00	26.70	17.8405	8.80020
M.AGE	79	28.20	53.40	31.7392	6.67272
S.ATTEND	79	32.20	45.30	38.6671	6.59133
LITERACY	79	76.90	86.40	81.4025	2.21371
OWNED	79	14.40	65.40	50.8582	11.54960
RENTED	79	24.00	54.20	37.3519	8.35872
INCOME	79	20000.00	150000.00	53354.4304	20410.55407
SCHOOL	79	30.00	2789.53	910.7024	761.91996
Valid N (listwise)	79				

Table 4.3: Descriptive Statistics results for the variables of owner occupied houses

Table 4.3 above represents the descriptive statistics results for all structural and neighborhood characteristics of owner occupied houses of entire sample areas. The mean value for the variable; size of the housing unit's living area (**VAS1- size of living area**) is 2199.0 sq ft; the value ranges from 1145 sq ft to 5300 sq ft(Figure 4.8). The mean value for the variable; land area (**VAS5 -plot size**) is 11.3033 katha. The value of this variable ranges from 4 katha to 23 katha (Figure 4.9).

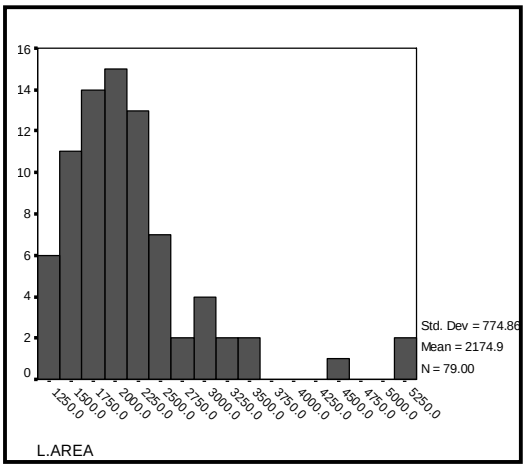

Figure 4.8: Descriptive Statistics result for Living area of owned houses

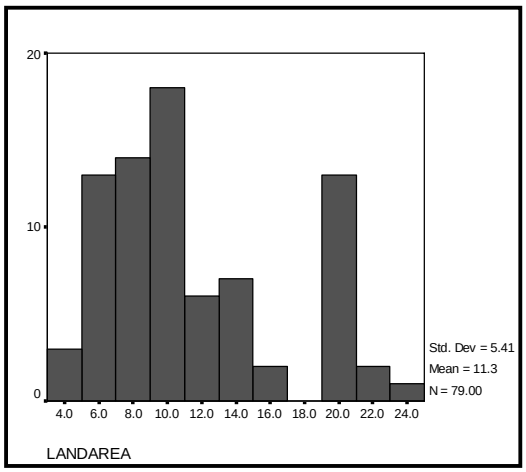

Figure 4.9: Descriptive Statistics result for Land area of owned houses

Descriptive Statistics results within the variable set of housing unit's neighborhood attributes:

From table 4.3 above, it is found that the mean value of the people per sq mile in the census block group (**VBN1- density**) is 39766.8987. The value of the variable ranges from 10240.00

people to 162296.00 people per square mile (Figure 4.10). The mean value of the percentage of residents under poverty level (**VBN2 -poverty**) is 5.589. The minimum number of people under poverty level is 2.5% and the maximum number is 8.6% (Figure 4.11). The mean value of the percentage of the median age of the residents in the census block group (**VBN3 - median age**) is 31.7392. The value ranges from 28.2% to 53.4% (Figure 4.12). The mean value of the percentage of the vacant houses in the census block group (**VBN4 -vacancy rate**) is 17.8405. The value of the variable ranges from 9.00% to 26.7% (Figure 4.13).

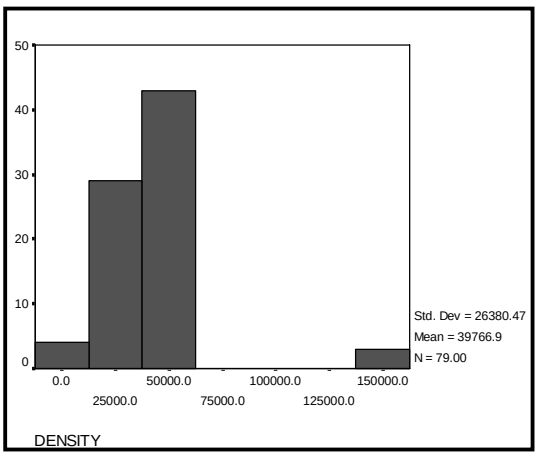

Figure 4.10: Descriptive Statistics result for Population Density

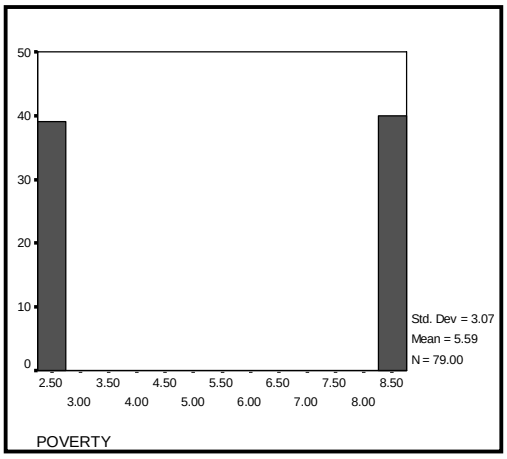

Figure 4.11: Descriptive Statistics result for % of people under Poverty level

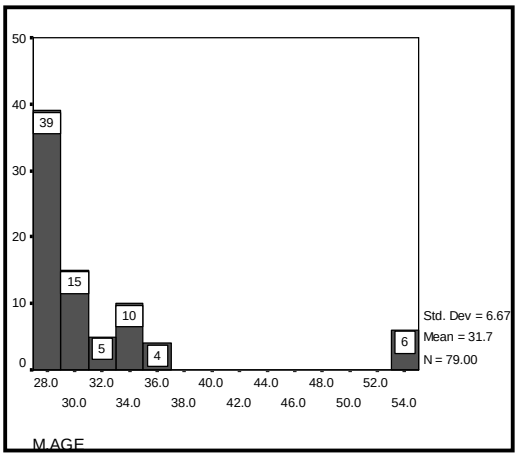

Figure 4.12: Descriptive Statistics result for Median Age of residents'

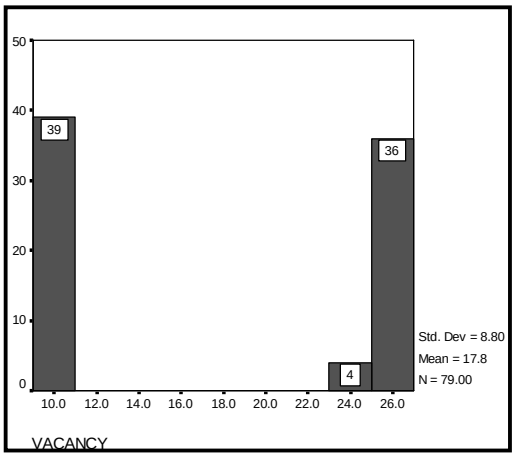

Figure 4.13: Descriptive Statistics result for % of Vacant houses

Table 4.3 indicates, the mean value of the household monthly income (**VBN5- monthly income**) is 53354.4304 BDT. Household's monthly income ranges from 20000 BDT to 1500000 BDT (Figure 4.14). The mean value of the percentage of residents attending school, aged 5-24 years (**VBN6 school attendant**) is 38.6671. The value range from 32.20% to 45.30% (Figure 4.15).

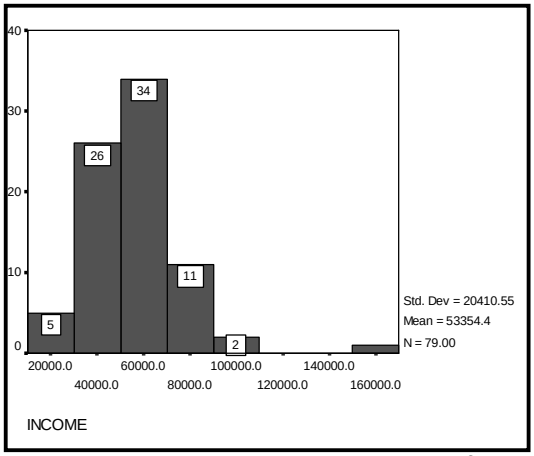

Figure 4.14: Descriptive Statistics result for for Income of residents'

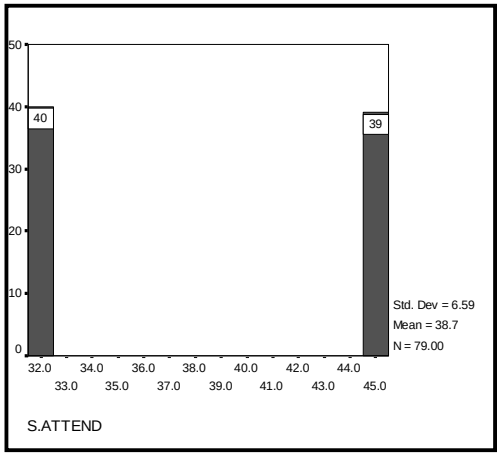

Figure 4.15: Descriptive Statistics result % of school attendance

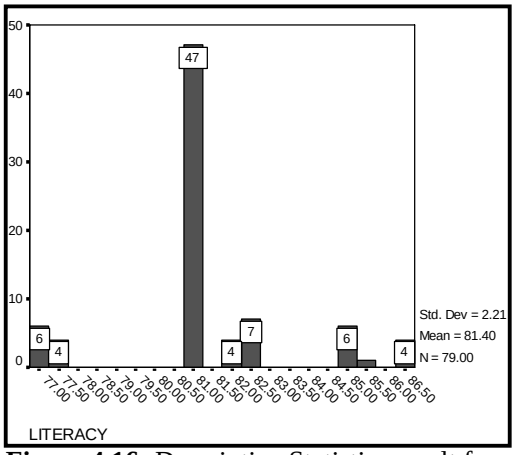

Figure 4.16: Descriptive Statistics result for Literacy rate of residents'

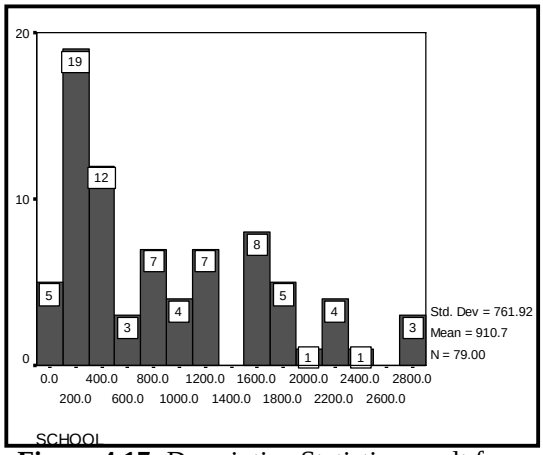

Figure 4.17: Descriptive Statistics result for Distance of nearest school

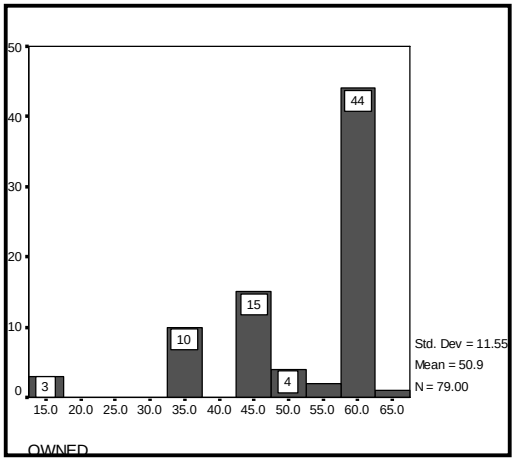

Figure 4.18: Descriptive Statistics result for Tenancy status (Owned houses)

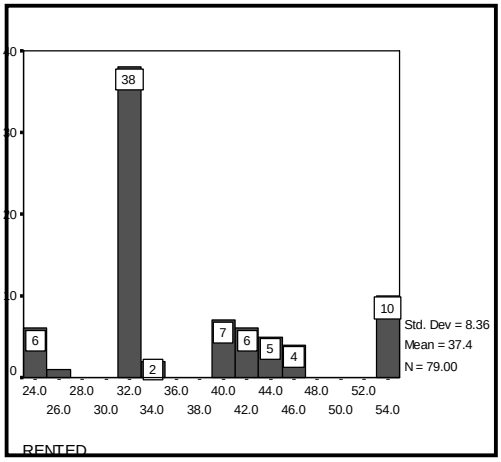

Figure 4.19: Descriptive Statistics result for Tenancy status (Rented houses)

The mean value of the percentage of literate person (VBN7 -literacy rate) is 81.4025. The value ranges from 86.4% to 76.9% (Figure 4.16). The mean value for the variable Distance in feet from the housing unit to the nearest school (VBN8- distance) is 910.7024 ft. the value of the variable ranges from 30ft to 2789.53ft (Figure 4.17). The mean value of the percentage of respondents having own house (VBN9-tenancy status) is 50.8582. The value ranges from 14.40% to 65.40% (Figure 4.18). The mean value of the percentage of respondents living in the rental house (VBN8- tenancy status) is 37.3519. The value ranges from 24.00% to 54.20% (Figure 4.19).

Descriptive Statistics results within the variable set of housing unit's Amenity or Environmental attributes:

For analyzing descriptive statistics results for amenity characteristics of housing units, this study is concerned with both owner occupied and rental houses, as amenity characteristics is the focus variable of the study.

Variables	Category	Frequency	Percentage	Cumulative percentage
View (owned house)	**No**	40	50.6	50.6
	Field	5	6.3	57.0
	Park	7	8.9	65.8
	Lake	27	34.2	100.0
View (rental houses)	**No**	14	51.9	51.9
	Field	3	11.0	63.0
	Lake	10	37.0	100

Table 4.4: Frequency Analyses of Categorical Variables for Amenity characteristics

Table 4.4 above presents the frequency analysis results for view of amenity characteristics, considering both owned and rental houses .From sets of data at appendix III, view is the only categorical amenity variable in this study.

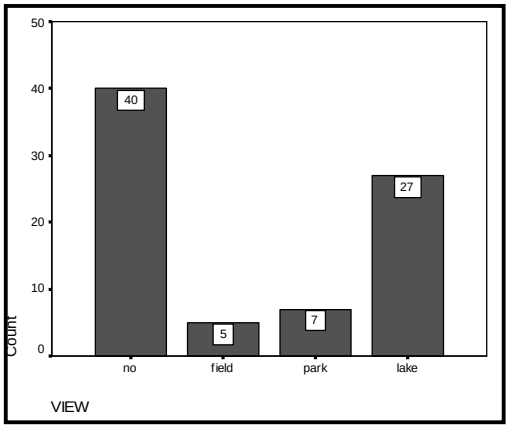

Figure 4.20: Frequency analyses of View of nearest open spaces form owned houses

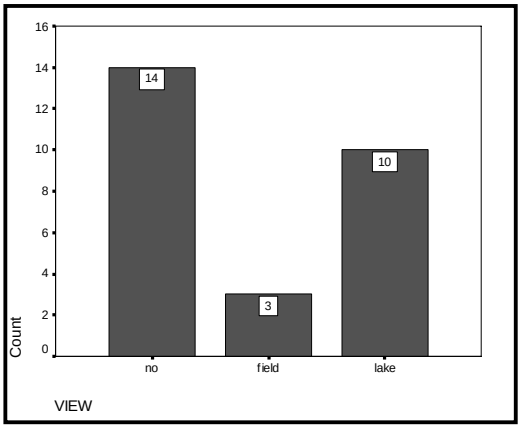

Figure 4.21: Frequency Analyses of View of nearest open spaces from rental houses

From table 4.4 above it is observed that, 49.4% houses have open space view (**VCA2 - view**); among them 34.2% of the housing units are viewing towards the lake, 8.9% of housing units have the view of park and. only 6.3% of buildings have play field view. And 50.6% of housing units do not have any open space like park or lake view (Figure 4.20). This is the case for owner occupied houses. For rental houses, it is found that 37% of the houses have lake view and 11% of the housing units have field view. The frequency analysis result has been shown in (Figure 4.21).

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Owner Occupied Houses					
Size	79	38794.000	6337108.80	2707074.6000	2396614
Distance	79	00	1240.40	226.7906	282.64
Valid N (listwise)	79				
Rental Houses					
Size	27	16734.00	3728736.00	3178809.7778	1343796.66567
Distance	27	.00	836.00	270.5185	361.83925
Valid N (listwise)	27				

Table 4.5: Descriptive Statistics results for Amenity variables used in the first- stage Hedonic model

Table 4.5 above represents the descriptive statistics results for amenity variables used to determine the price of housing unit. For owned houses the mean value of size in square footage of the nearest urban park/lake/field (**VCA1-size**) is 2707074.6000. The value of the variable ranges from 38794.000 sq ft to 6337108.80 sq ft. For rental houses the mean value of size of the nearest open space 3178809.7778 sq ft. The value of the variable ranges from 16734.00 sq ft to 3728736.00 sq ft. The results have been shown at Figure 4.22 and Figure 4.23 respectively.

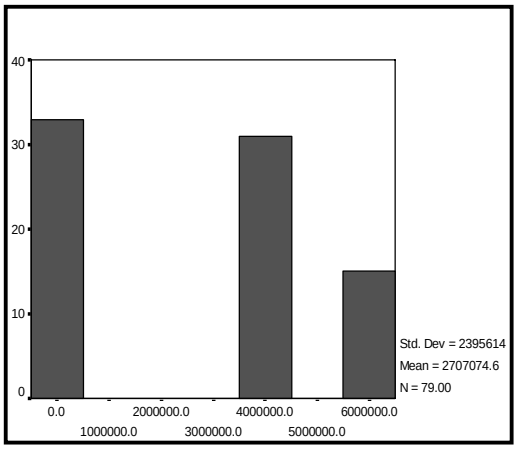

Figure 4.22: Size of nearest open spaces from owned houses

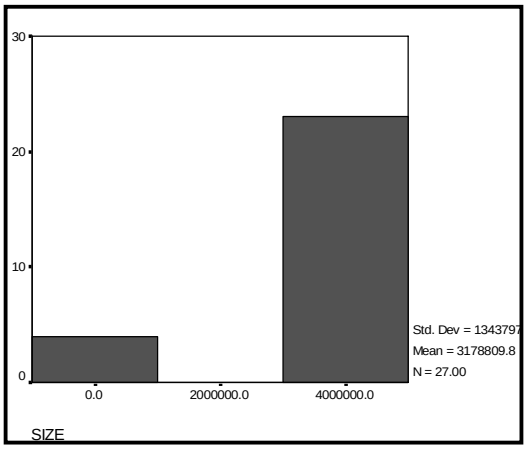

Figure 4.23: Size of nearest open spaces from rental houses

From table 11 above, in case of owner occupied houses the mean value for the variable distance in feet from the housing unit to the nearest lake/park/field (VCA2- distance) is 226.7906 ft. The value of the variable ranges from 00 ft to 1240.40 ft (Figure 4.24). For rental houses the mean value is 270.5185 ft. The value of the variable ranges from 00 ft to 836.00 ft (Figure 4.25).

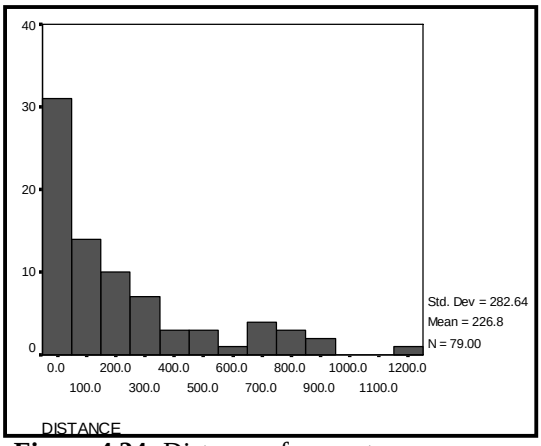

Figure 4.24: Distance of nearest open spaces from owned houses

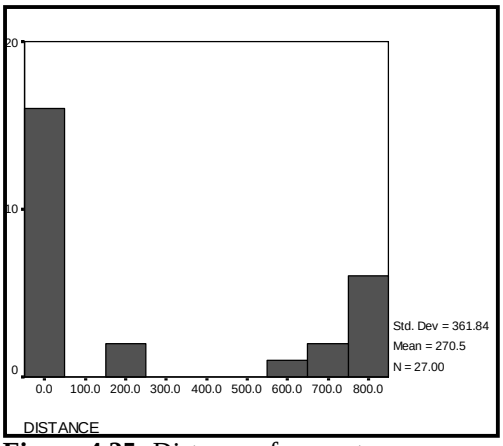

Figure 4.25: Distance of nearest open spaces from rental houses

4.1.2. Inferential Statistics Results

In the direction of the statistics hypotheses, inferential statistical tests are carried out to inspect the picture that will appear after operating the hedonic price models. Within the context of the inferential statistics, chi-square test, *t* test, F test, correlation and regression analysis are carried out. The selection of the inferential statistical technique is determined depending on the measuring scale of the variables and the structure of the statistics hypotheses.

For the entire area, inferential statistical tests for variables are summarized within the eight sets of statistics hypotheses; the graphical presentations and table of results for the structural and neighborhood variables are illustrated at appendix A and appendix B respectively, because the size of this research becomes too immense. The numerical information of the amenity variables is demonstrated here graphically, as this is considered as the focus variables.

Correlation analysis within the context of the first set of the statistics hypotheses:

Correlation is one of the most common forms of data analysis because it underlies many other analyses. In correlation analysis a coefficient is used, which has a value ranging from -1 to 1. Value closer to the absolute value of 1 indicates that there is a strong relationship between the

variables being correlated, whereas value closer to 0 indicates that there is little or no linear relationship. The sign of a correlation coefficient describes the type of relationship between the variables being correlated. A positive correlation coefficient indicates that there is a positive linear relationship between the variables: as one variable increases in value, so does the other. A negative value indicates a negative linear relationship between variables: as one variable increases in value, the other variable decreases in value. In this study, correlation analyses are operated between price of housing unit and is structural, neighborhood or amenity characteristics of housing units to analyze whether the linear relationship between two variables.

This statistics hypothesis is tested by using correlation analysis technique to understand the relation between the implicit price of housing unit and its structural characteristics. According to the tests results;

- Figure A.01 at appendix A, shows that, there is a statistically significant positive correlation coefficient [r= 0.727(0.000)] between the implicit price and size of the housing unit's living area, indicating that the linear relationship between these variables is one in which the values of one variable increase as the other increases, that is the bigger the housing unit is, the larger implicit price is. This relation can be considered as the result of the more benefits provided by larger area.

- There is a fairly weak negative correlation coefficient [r= -.120(0.291)] between the implicit price of housing unit and size of the plot (Figure A.02; at appendix A), it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- Although there is a fairly weak positive correlation coefficient [r= 0.097(0.396)] between the implicit price of housing unit and number of floors of the housing unit (Figure A.03; at appendix A), it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

From previous analysis it is found that correlation results for structural attributes of housing units indicates that the implicit price of the owner occupied houses have a strong positive and significant correlation with the size of living area. That means, the bigger the size of the house, the larger the price of the houses. Other structural variables do not indicate a statistically significant linear relationship with price.

Correlation analysis within the context of the second set of the statistics hypotheses:
This statistics hypothesis is tested by using correlation analysis technique to understand the relation between the price of housing unit and its neighborhood characteristics. According to the tests results;

- From figure A.04 at appendix A, it is found that there is a statistically significant positive correlation coefficient [r= 0.321(0.004)] between the implicit price of housing unit and the population density per square mile, indicating that the rent price of housing unit located at densely built area is bigger than the price of the houses located at the area having lower population density. This can be considered as the result of greater cultural diversity and greater variety and quantity of human resource. All these can be advantageous in the fields of socio-economics, understanding of various nature-human interactions.

- There is a fairly weak positive correlation coefficient [r= 0.190(0.430)] between the implicit price of housing unit and percentage of poverty level of the area (Figure A.05 at appendix A); it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- There is a fairly weak positive correlation coefficient [r= 0.079(0.487)] between the implicit price of housing unit and percentage of vacant house with in the area (Figure A.06 at appendix A), it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- There is a fairly weak negative correlation coefficient [r= -0.090(0.429)] between the implicit price of housing unit and percentage of median aged people living in the house (Figure A.07 at appendix A); it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- There is a fairly weak negative correlation coefficient [r= -0.090(0.430)] between the implicit price of housing unit and percentage of people attending school aged between 5-24 years ; living in the house (Figure A.08 at appendix A); it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- Although there is a fairly weak negative correlation coefficient [r= -0.152(0.180)] between the implicit price of housing unit and percentage of literate people in the census block group (Figure A.09 at appendix A); it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- Although there is a fairly weak negative correlation coefficient [r= -0.204(0.071)] between the implicit price of housing unit and percentage of people having their own houses (Figure A.10 at appendix A); it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- Although there is a fairly weak negative correlation coefficient [r= -0.070(0.537)] between the implicit price of housing unit and percentage of people living in the rental houses (Figure A.11 at appendix A); it does not indicate a statistically significant linear relationship. This can be considered as the result of unobserved factor.

- From figure A.12 at appendix A; indicates that, there is a statistically significant positive correlation coefficient [r= 0.515(0.000)] between the implicit price of housing unit and income of people living in the housing unit; indicating that the linear relationship between these two variables is one in which the value of one variable increase as the other increases, that is, the higher the income of people of housing unit is, the larger house price is. This can be considered as the result of more opportunity for more facilities for houses provided by developers.

- There is a statistically significant (at 1% level) positive correlation coefficient [r= 0.315(0.005)] between the implicit price of housing unit and distance from housing unit to the nearest school, indicating that the linear relationship between these two variables is one in which the value of one variable increase, as the other increases; that is, the more distant from housing unit from nearest school, the more price of housing unit is. The correlation results have been shown (Figure A.13 at appendix A). This result is inconsistent with previous studies; the reason might be that, most of the schools in the study areas are within the residential zone which creates huge traffic jam, noise, crowd and other problems. Thus people in this country prefer to live farther away from school. Because the houses farther away from the school might

have a higher demand for residential purposes due to sound and quality of life. This result can be considered as the natural tendency to avoid chaos.

The correlation analysis results for neighborhood characteristics of housing units indicates that implicit price of owner occupied houses increases as the population density per square mile, income of the residents and distance from nearest school increases. All these neighborhood and socio-economic attributes have a positive and significant impact on house price. The other neighborhood variables do not indicate a statistically significant linear relationship with price.

Correlation analysis within the context of the third set of the statistics hypotheses:

This statistics hypothesis is tested by using correlation analysis technique to understand the relation between the implicit price of housing unit and its environmental or amenity characteristics; which are the focus variables of the study. Both owner occupied and rental houses are considered here. According to the tests results;

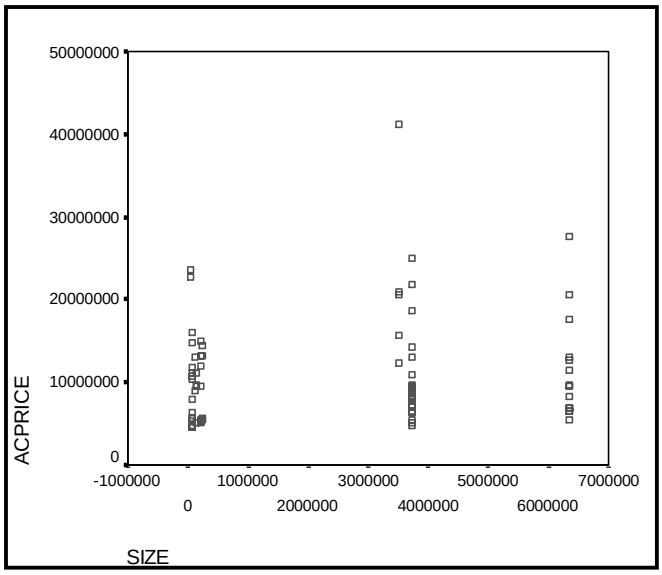

Figure 4.26: Correlation (not significant) between price and size of nearest open spaces for owner occupied houses

§ For **Owner Occupied Houses**, there is a fairly weak positive correlation coefficient [r= 0.092(0.420)] between the implicit price of housing unit and size the nearest of open spaces (park, lake or field) from the house (Figure 4.26); it does not indicate a statistically significant linear relationship. Findings from the previous studies (e.g., Tyrvainen, 1997; Bolitzer and Netusil, 2000; Lutzenhiser and Netusil, 2001), show that size of the nearest open space was significant and positively related to house

price. It reveals that increase in square footage of the nearest urban open spaces in the neighborhood increase the real sales price of housing unit. But this finding confirms that the size of the nearest open space (park, lake or field) does not have a significant impact on housing sales price, only view of open space does matter for house price.

§ For **Rental Houses** there is a weak positive correlation [r= 0.036(0.860)] between the rent price of housing unit and size the nearest of open spaces (park, lake or field) from the house (Figure 4.27); it does not indicate a statistically significant linear relationship like owned houses.

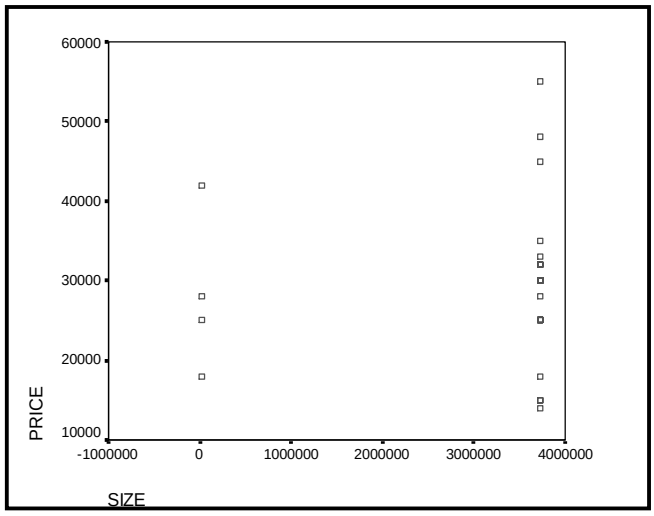

Figure 4.27: Correlation (not significant) between price and size of nearest open spaces for rented houses

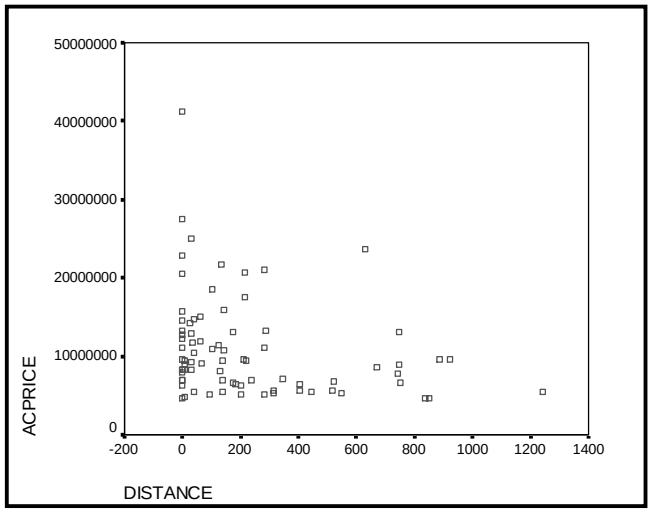

Figure 4.28: Correlation between price and distance from nearest open spaces For owned houses

- Figure 4.28 below represents that, there is a statistically significant (at 5% level) negative correlation [r= -250(0.026)] between implicit price of housing unit and distance from housing unit to nearest open space. The result indicates linear relationship between these two variables is one in which the values of one variable increases as the other decreases, that is, the more distant of housing unit from nearest open space, the less rent price is. This relation can be considered as the result of the positive externalities of the open space of various social, physical, environmental and economic benefits.

- There is also a weak negative correlation [r= -202(0.313)] between **Rent Price** of housing unit and distance from housing unit to nearest open space (Figure 4.29); it does not indicate a statistically significant linear relationship.

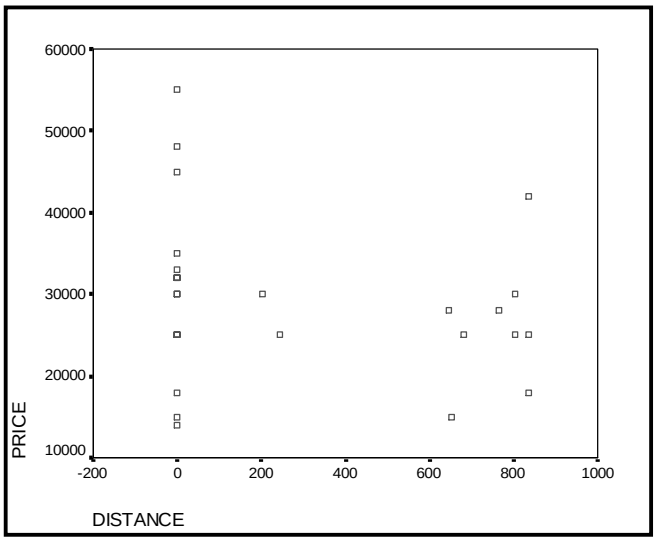

Figure 4.29: Correlation (not significant) between price and distance from nearest open spaces for rental houses

The correlation analysis results of environmental or amenity characteristics for both owners' occupied and rental housing units indicates that, there is a weak positive correlation between price and size of the nearest open space from the housing unit for both cases. Thus it does not indicate a statistically significant linear relationship. In terms of distance of the nearest open spaces from owner occupied houses represents a statistically significant negative correlation. That is, the more distant of housing unit from nearest open space, the less rent price is. But for the houses those are rented corresponds to a weak negative correlation between the price and distance from nearest open spaces; it does not indicate a statistically significant linear relationship. thus for rental houses residents only prefer for having open space views; but the size and proximity to nearby open spaces do not have significant amenity effect.

T- Test results within the context of the fourth set of the statistics hypotheses:

T-statistics is used to test the significance of the impact of each independent variable on the dependent variable (price). The t-value is relating to the regression coefficient of the independent variable and the standard error of that coefficient. It should be noted that the magnitude of the effect of the independent variable on price can be highly significant but the effect of the independent variable on price may not be very high.

This statistics hypothesis is tested by using *t*-test technique to understand the price differences depending on structural characteristics. According to the test result;

- The price of housing unit differs depending on the façade treatment (Brick/ RCC finish) [-2.8(0.006), df=77] and significant at 1% level (Table B.01 at appendix B). The price of Reinforced Concrete (RCC) façade of the housing unit is bigger than Brick façade, as RCC façade treatment are newer than brick facade treatment. This can be considered as the result of the increase in satisfaction level because reinforced concrete is newer and manufacturing cost is expansive than brick.

- The price of housing differs depending on the number of bedrooms [-5.574(000), df=76] and significant at 1% level (Table B.02 at appendix B). The price of houses having four bedrooms is bigger than the houses having three bedrooms; this can be considered as the result of more benefits provided by more rooms.

The t- test results shows that there is a difference in price of owner occupied houses depending on exterior façade treatment and number of bedrooms. The price housing units are bigger those having RCC façade treatment instead of brick or having four bedrooms instead of three bedrooms.

F- Test results within the context of the fifth set of the statistics hypotheses:

ANOVA test results describe the overall variance accounted for in the model. The *F* statistic represents a test of the null hypothesis that the expected values of the regression coefficients are equal to each other and that they equal zero. This *F* statistic tests whether the R square proportion of variance in the dependent variable accounted for by the predictors is zero. If the null hypothesis is true, then that will indicate that there is not a regression relationship between the dependent variable and the predictor variables.

This statistics hypotheses is formulated by using F test technique (one way ANOVA) to understand the price differences depending on housing units structural, location and environmental or amenity characteristics, and users' socio-economic characteristics. For structural, location and socio-economic characteristics of housing units only owned houses are considered. But for amenity characteristics of houses this study focuses on both owned and rental houses. According to the test result;

- The price of **Owner Occupied Houses** do not differs depending on number of stories of the housing unit [F-stat= 1.063(0.350); df=2; 76] (Table B.03 at appendix B). Because most of the sample housing units are six storied. This can be considered as the result of unobserved factor.

- The price of **Owner Occupied Houses** differs depending on age of the building [F-stat= 4.821(004); df=3;75]; According to the test result (p_i <0.05), in terms of the house price, 0 year old housing units differ from houses in other age groups(1-3years) [Table B.04 at appendix B]. This relation can be considered as the result of the decrease in satisfaction level because of oldness in terms of the comfort, convenience, durability and functionality qualities.

- The price of **Owner Occupied Houses** differs depending on facade orientation of the building [F-stat= 3.106(0.031); df=3;75]; According to the test result (p_i <0.05), the price of housing unit having south-east, south or south-west orientation is bigger than the housing units having other orientation like east, west and north-east. This can be considered as the result of the more opportunity for climatic benefits provided by south or south east facing buildings (Table B.05 at appendix B).

- For **Owner Occupied Houses** table 4.6 shows, The price differs depending on having different views of open spaces (park, lake or field) from the house [F-stat= 3.181(0.029); df=3;75]; and significant at 5% level. According to the test result (p_i <0.05), in terms of the house price, the price of housing units do not having any views differ from housing units having lake park or field views. And the price of housing units having lake or park views significantly differs from housing units having only field views. This price difference can be considered as a result of the more opportunity for having view of open spaces.

ACPRICE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	357798988430629.600	3	119266329476876.500	3.181	.029
Within Groups	2812102837719750.000	75	37494704502930.000		
Total	3169901826150379.000	78			

Table 4.6: One way ANOVA results of owned houses for different Open Space Views

- For **Rental Houses,** price also significantly differs depending on having view of open spaces (park, lake or field) from the house [F-stat= 3.970(0.032); df=2; 24]; from table 4.7, according to the test result (p_i <0.05). This can be considered as a result of the more opportunity for having view of open spaces.

PRICE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	625870899.471	2	312935449.735	3.970	.032
Within Groups	1891980952.381	24	78832539.683		
Total	2517851851.852	26			

Table 4.7: One way ANOVA results of rental houses for different Open Space Views

The F-test results for the variables those have more than two categories indicate that, the price differs in terms of age, façade orientation for owner occupied houses and price also differs depending on view of open spaces from both owner occupied and rental houses. According to the test results, the price of 0 years old housing units differs than other age groups. The price of houses having south-east, south or south-west facing is bigger than the housing units having other orientations. The price of both rental and owner occupied housing units having lake or park views significantly differ from the houses having only field views or no scenic views.

F- Test results within the context of the sixth set of the statistics hypotheses:

The following statistics hypotheses is formulated to be tested by using F test technique (one way ANOVA) for three different identified sub markets of entire study area.

The Table 4.8 below represents the ANOVA test results to understand difference of zones in terms of the price, structural, location and environmental characteristics of the housing unit, and users' socio-economic characteristics. The values of the variables at blue labeled rows are significantly differed among the three submarkets. And the variables values labeled orange do not significantly differ among the three submarkets. The test result shows that, the three submarkets significantly differ in terms of price, view and distance of nearest open spaces for both rental and owner occupied houses. The three submarkets also significantly differ for tenancy status and size of open spaces for the owner occupied houses. The three submarkets

of owner occupied houses do not significantly differ for the variables size of living area, facade treatment, number of bedrooms, plot size, number of floors, age of the building, orientation of housing units, population density, poverty, median age of the residents, proportions of vacant houses, median household income, school attendance, literacy rate, distance from nearest school. The submarkets of rental houses do not differ in terms of size of nearest open spaces.

Variables	**Significance**	**Submarket 1**	**Submarket 2**	**Submarket 3**
For Owner Occupied Houses				
Implicit Price	0.018	13000000	8345816	9664382
Living area	0.396	2298.8421	2089.6316	2043.2727
Plot size	0.313	11.0653	12.8737	10.3582
Stories	0.599	6.000	6.0526	6.0000
Age	0.237	1.6579	2.1579	2.0455
Population density	0.412	43889.34	35529.63	36304.91
poverty	0.697	5.711	5.068	5.827
Median age	0.327	32.8974	30.9263	30.4409
Vacancy rate	0.734	18.1895	16.4526	18.4364
Household income	0.347	535552.63	48157.89	57500.00
School attendants	0.697	38.4053	39.7842	38. 2543
Literacy rate	0.151	81.4316	80.6526	82.0000
School distance	0.620	898.7645	796.3067	1029.8623
Owner occupied	0.038	48.1474	56.3895	50.7636
Rented	0.042	38.7079	33.1789	38.6136
Open space proximity	0.000	71.3747	224.1563	497.5114
Open space size	0.038	3144703	3103075	1609170
Variables	**Significance**	**Submarket 1**	**Submarket 2**	**Submarket 3**
For Rental Houses				
Rent price	0.039	35200	25200	25857.14
Open space proximity	0.000	000	275	650.4286
Open space size	0.183	3728736	2615135	3298450

Table 4.8: Means for property characteristics by submarket and ANOVA results of different among submarket means

According to table 4.8 above and ANOVA test results, Zones as representatives of market segments differs significantly depending on;

- The **Implicit Price** of owner occupied housing units [F-stat=4.228(0.018); df=2; 76]; significant at 5% level (Table 4.9). According to the test result (p_i <0.05), in terms of

the house price from Table 4.8, the 1st zone name as submarket1 in which houses take place adjacent to the open space and consisting the houses with highest price (mean value 13000000 BDT), differs from the next two zones as submarket 2 (mean value, 8345816 BDT') and submarket 3 (mean value, 9664382 BDT). And the submarket 2 which is situated to the next layer of sub market 1 differs from the submarket 3.

ACPRICE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	317386652650283.900	2	158693326325141.900	4.228	.018
Within Groups	2852515173500096.000	76	37533094388159.160		
Total	3169901826150380.000	78			

Table 4.9: ANOVA test results of Zones as representatives of market segments differ significantly depending on price for owned houses

§ The **Rent Price**; in case of rental houses test result is [F-stat=3.736(0.039); df=2; 24] and significant at 5% level (Table 4.10). According to the test result (p_i <0.05), in terms of the house price, from Table 4.8 rent price is highest at submarket 1(mean value, 35200 BDT) significantly differ from submarket 2 (mean value, 1.1579) and submarket 3 (mean value, 25857.14 BDT). Result shows that the submarket 2 and submarket 3 are not different in terms of rent price.

PRICE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	597794708.995	2	298897354.497	3.736	.039
Within Groups	1920057142.857	24	80002380.952		
Total	2517851851.852	26			

Table 4.10: ANOVA test results of Zones as representatives of market segments differ significantly depending on price for rental houses

§ The **Owner Occupied Houses** [F-stat=3.427(0.038); df=2; 76]. According to the test result (p_i <0.05), in terms of the tenancy status, the sub market 2 (mean value 56.3895%), in which the proportion of owned houses is maximum differs from submarket 1 (mean value 48.1474) and submarket 3 (mean value 50.7636) (Table B.06 at appendix B).

§ The **Rented Houses** [F-stat=3.302(0.042); df=2; 76]. According to the test result (p_i <0.05), in terms of tenancy status, the submarket 1(mean value 38.7079) and sub market 3 (mean value 38.6136), in which the proportion of rented houses is maximum differs from submarket 2 (mean value 33.1789) (Table B.07 at appendix B).

§ The distance of the nearest open spaces from the **Owner Occupied** housing units [F-stat=25.982(0.000); df=2; 76]; strongly significant 1% level (Table 4.11). According to the test result (p_i <0.05) from Table 4.8, in terms of the open space proximity the submarket 1(mean value 71.3747 ft) appears to be located at the closest proximity to the open space than submarket 2(mean value 224.1563 ft) and submarket 3 (mean value 497.5114 ft). The submarket 3 which is located at a greater distance from open space differs from the submarket 2. This relation can be considered as a result of the decrease in benefits resulted from distance.

DISTANCE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	2530361.390	2	1265180.695	25.982	.000
Within Groups	3700738.886	76	48693.933		
Total	6231100.276	78			

Table 4.11: ANOVA test results of Zones as representatives of market segments differ significantly depending on the distance of open space from owned houses

§ The distance of the nearest open spaces from the **Rental Houses** [F-stat=12.582(0.000); df=2; 24]; strongly significant 1% level (Table 4.12). According to the test result (p_i <0.05) from table 4.8, in terms of the open space proximity, the submarket 1 (mean value 000 ft) appears to be located at the closest proximity to the open space than submarket 2 (mean value 275 ft) and submarket (mean value 650.4286 ft). But the submarket 3 which is located at a greater distance from open space do not significantly differs from the submarket 2.

DISTANCE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	1742334.126	2	871167.063	12.582	.000
Within Groups	1661784.614	24	69241.026		
Total	3404118.741	26			

Table 4.12: ANOVA test results of Zones as representatives of market segments differ significantly depending on the distance of open space from rented houses

§ The size of the nearest open spaces from the **Owner Occupied** housing units [F-stat=3.401(0.038); df=2; 76; significant 5% level (Table 4.13). According to the test result (p_i <0.05) from Table 4.8, in terms of the size of open space the submarket 1(mean value 3144703 sq ft) and submarket 2(mean value 3103075 sq ft) significantly differ from submarket 3 (mean value 1609170 sq ft). The submarket 1 and the submarket 2 do not differ in terms of size of open spaces nearest to the house. This can be considered as a result of the more opportunity to benefit from the large size open space visually and environmentally.

SIZE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	36775876283821.300	2	18387938141910.650	3.401	.038
Within Groups	410863428830556.300	76	5406097747770.470		
Total	447639305114377.600	78			

Table 4.13: ANOVA test results of Zones as representatives of market segments differ significantly depending on the size of nearest open spaces from owned houses

The zones as representatives of market segments do not differ significantly depending on

- The size of living area [F-stat=0.949(0.396); df=2; 76]; (Table B.08 at Appendix B);
- The plot size [F-stat=1.178(0.313); df=2; 76]; (Table B.09 at Appendix B),
- The number of floors [F-stat=0.515(0.599); df=2; 76]; (Table B.10 at Appendix B) ,
- The age of the building [F-stat=1.468(0.237); df=2; 76]; (Table B.11 at Appendix B),
- The population density [F-stat=0.896(0.412); df=2; 76]; (Table B.12 at Appendix B),
- The poverty level [F-stat=0.363(0.697); df=2; 76]; (Table B13 at Appendix B) ,
- The median age of the residents [F-stat=1.134(0.327); df=2; 76]; (Table B.14 at Appendix B) ,
- The proportions of vacant houses [F-stat=0.311(0.734); df=2; 76]; (Table B.15 at Appendix B),
- The median household income [F-stat=1.073(0.347); df=2; 76]; (Table B.16 at Appendix B),
- The residents attending school [F-stat=0.363(0.697); df=2; 76]; (Table B.17 at Appendix B),
- The literacy rate [F-stat=1.940(0.151); df=2; 76]; (Table B.18 at Appendix B),
- The distance in feet from the houses to the nearest schools [F-stat=0,480(0.620); df=2; 76]; (Table B.19 at Appendix B),
- The size of the nearest open spaces from the **Rental houses** [F-stat=1.827(0.183); df=2; 24]; (Table B.20 at Appendix B). This case shows a different test result from owned houses.

ANOVA tests above are performed to compare the statistical difference among the three submarket properties, based on sample means and variances. The results indicate that some property characteristics varied significantly among submarkets, suggesting a clear distinction among submarkets in terms of price, tenancy status and size of nearest open space for owner occupied houses. And in terms of amenity or environmental characteristics for both rental and owner occupied houses, view and distance of nearest open space from houses differ among the submarkets.

Chi- Square ($\chi 2$) test results within the context of the sixth set of the statistics hypotheses

The following statistics hypotheses is formulated to be tested by using $\chi 2$ test technique to understand relation between zones and structural, location and environmental characteristics of the housing unit, and users' socio-economic characteristics; According to test results;

The zones as representatives of market segments; There is no significant relationship between zones and

- exterior facade treatment (Brick/ RCC finish) of the housing unit [$\chi 2=2.579^{a}$ (0.275); df=2]; (Table B.21 at Appendix B),
- number of bedrooms [$\chi 2=1.797^{a}$ (0.773); df=4]; (Table B.22 at Appendix B),
- number of floors of the housing unit [$\chi 2=2.243^{a}$ (0.691); df=4]; (Table B.22 at Appendix B).

The zones as representatives of market segments; There is a relationship between zones and

- age of the building [$\chi 2=17.934^{a}$ (0.006); df=6]; significant at 1% level. As this study is not concern with the amenity characteristics, thus structural attributes of houses thus cross tabulation for this variable is not discussed in details (Figure A. 14 at Appendix A).

- facade orientation [$\chi 2=15.664^{a}$ (0.16); df=6]; significant at 5% level. As this study is not concern with the structural attributes of houses thus cross tabulation for this variable is not discussed in details (Figure A. 15 at Appendix A).

- view of open space (lake, park of field) from the **Owner Occupied Houses** housing unit [$\chi 2=75.281^{a}$ (0.000); df=6]; strongly significant at 1% level. Graphical representation of Cross tabulations are presented above at figure 4.30.

Figure 4.30 shows that almost all the houses at submarket 1 have open space views. Among them 26 houses have lake views, 7 houses have park views and 5 houses have play field views. Thus the house price at submarket 1 is higher than other two submarkets. Only one apartment at submarket 2 has the lake view, and no housing unit at submarket 3 can enjoy any open space view.

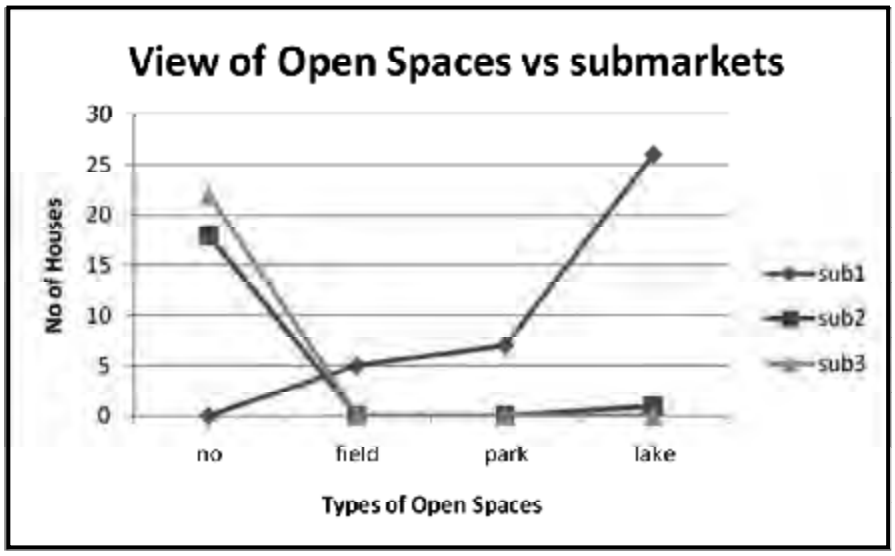

Figure 4.30: Cross Tabulation of Zones and View of open spaces for owned houses

§ view of open space (lake, park of field) from the **Rental Houses** [$\chi 2=31.050^{a}$ (0.000); df=4]. Graphical representation of Cross tabulations result are presented below at Figure 4.31;

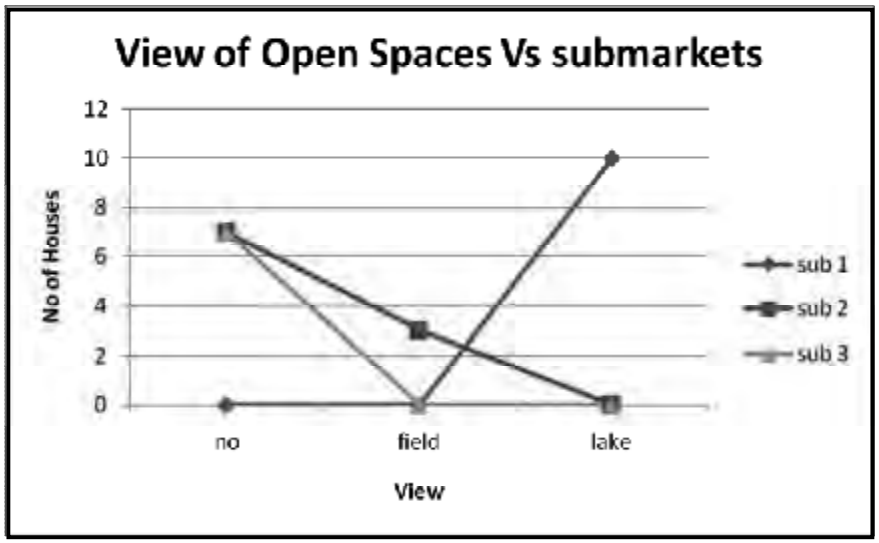

Figure 4.31: Cross Tabulation of Zones (submarkets) and View of open spaces for rental houses

The Figure 4.31 represents between three zones of rental houses, 10 housing units of submarket 1 have lake view and only 1 unit at submarket 2 has play field view. And there is no view from the houses of submarket 3.

Chi-square test results above indicates that the Differences between zones in terms of housing units structural, neighborhoods and environmental attributes. Considering all the variables there is a relationship between zones and age of the buildings and facade orientation of structural attributes of owner occupied houses. Differences between zones for environmental attributes of the houses are mostly related with the attributes affected from open space. Zones as a representatives of market segments; there is a relationship between zones and view of open spaces and distance from the both rental and owner occupied houses to the nearest open spaces.

5.2 Within the context of the eighth set of the statistics hypotheses (Hedonic Price Model):

Finally, the Hedonic Price Models are developed. First, step by step regression analysis is carried out through least squares method with 107 observations. Later, the hypotheses of the study are tested in the direction of the parameters of the estimated hedonic price functions (see section 5.2).

Regression is a technique that is used to investigate the effect of one or more predictor variables on an outcome variable. Regression analysis in the study allowed to make statements about how well one or more independent variables would predict the value of a dependent variable. Within the context of regression analysis, an output table is generated. This table includes information about the quantity of variance that is explained by predictor variables. The first statistic, *R*, is the multiple correlation coefficients between all of the predictor variables and the dependent variable. The next value, *R* Square, is simply the squared value of *R*. This is frequently used to describe the goodness-of-fit or amount of variance explained by a given set of predictor variables. The table also gives ANOVA test results that describes the overall variance accounted for in the model. The *F* statistic represents a test of the null hypothesis that the expected values of the regression coefficients are equal to each other and that they equal zero. This *F* statistic tests whether the R square proportion of variance in the dependent variable accounted for by the predictors is zero. If the null hypothesis is true, then that will indicate that there is not a regression relationship between the dependent variable and the predictor variables. Further, the table provides information about the effects of individual predictor variables. There are two types of information in the coefficients table: coefficients and significance tests. In addition to the coefficients, the table also provides a significance test for each of the independent variables in the model. The significance test evaluates the null hypothesis that the regression coefficient

for the predictor is zero when all other predictors' coefficients are fixed to zero. This test is presented as a *t* statistic.

To formulate a Hedonic Price Model, with the sample of 107 observations (79 owned houses and 28 rental houses) and by using least square method, linear regression analysis are operated through E-views statistics package, SPSS. This study uses a typical hedonic equation of housing price in a semi logarithmic form as shown in Eq. (1)

$$P_i = \beta_0 + \sum \beta_j S_{ij} + \sum \beta_k N_{ik} + \sum \beta_j A_{il} + €_i \quad \text{.....(1)}$$

where ***Pi*** is the implicit price of the ***i***th house, S***ij*** represents ***j***th structural variable, ***N***ik is the measure of the ***k***th neighborhood characteristics, and A***il*** represents the ***l***th attribute of Amenity or environmental attributes. Similarly $\beta_{0,}$ $\beta_{j,}$ $\beta_{k,}$ $\beta_{l,}$ represent the corresponding parameters to be estimated, whereas $€_i$ captures the error term.

As expressed in the hedonic function above. Three sets of explanatory variables are used. These include a set of structural variables of the house, a set of neighborhood characteristics and a set of amenity or environmental variables explaining the attributes o the nearest urban park. In this study dependent variable is housing unit's implicit price. However, housing characteristics model include independent variables related to housing unit's structural, locality and socio- economic and amenity or environmental attributes. In this regression model focus variable is VCA1 which means view of open spaces from housing unit. The Amenity variables are tested both for owned houses and rental houses. In addition, VCA3 which means Proximity to the nearest urban open space from housing unit is also included to account for the accessibility of the park from the house Table 4.14 represents R^2 , F- statistics and coefficient values for each variable entered the model.

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Variables	**Coefficients**	**Standard errors**	**t-statistic**	**P- value**
Housing unit's Structural Variables (owned houses)				
VAS1 (Living area)	5757.734	669.716	8.579	0.000
VAS2 (Exterior)	10000000	3596750	2.811	0.006
VAS3(Bedroom)	6908865	1143144	6.044	0.000
VAS5 (Land area)	-160601	133013.2	-1.207	0.231
VAS6(Stories)	2610903	3700288	0.706	0.483
VAS7 (Age)	-1831205	587195.9	-3.188	0.003

Variables		Coefficients	Standard errors	t-statistic	P- value
VAS8 (Orientation)		1228212	549352.6	2.236	0.028
Housing unit's Neighbourhood Variables (owned houses)					
VBN1 (Population density)		87.236	25.682	3.397	0.001
VBN2 (Poverty)		163427.6	235966.5	0.693	0.491
VBN3(Median Age)		-0.006	0.009	-0.654	0.515
VBN4 (Vacancy rate)		48167.976	82371.248	0.585	0.560
VBN5 (Household income)		151.719	31.112	0.4.876	0.000
VBN6 (School Attendance)		148242.3	78687.398	1.884	0.064
VBN7 (Literacy)		-631167	320198.8	-1.971	0.052
VBN8 (School distance)		2766.355	899.876	3.074	0.003
VBN9(Housing tenancy status)	Owned	98759.707	47330.86	2.087	0.040
	Rented	-110073	55288.328	-1.991	0.050
Housing unit's Amenity Variables (owned houses)					
VCA1(Park /Lake/ Field view)		1545181	494481.9	3.125	0.000
VCA2(Park or Lake size)		0.069	0.030	0.892	0.375
VCA3(Park /Lake/ Field proximity)		-5811.852	2483.569	-2.340	0.022
R- squared		0.744			
Adjusted R- squared		0.678			
F- statistics		11.247			
Number of observations		78			
Housing unit's Amenity Variables (rental houses)					
VCA4(Park /Lake/ Field view)		3447.257	1198.728	2.876	0.008
VCA5(Park or Lake size)		0.000	0.001	0.178	0.860
VCA6(Park /Lake/ Field proximity)		-5.481	5.328	-1.029	0.313
R- squared		0.25			
Adjusted R- squared		0.153			
F- statistics		2.5			
Number of observations		29			

Table 4.14: Results of Regression Analysis model, significance of parameters at 1% and 5% level (marked as yellow)

The Hedonic regression analysis for owner occupied housing units **Structural Variables** (for owned houses) is discussed below:

- **Size of living area- VAS1** has a strong positive and significant impact on implicit house price at 1% level. One unit (sq ft) increase in living area of the houses leads to 5757.734 BDT increase in house price (Table B.23 at Appendix B).

- **Exterior façade treatment of the house- VAS2** is positively related to the implicit price of housing and significant at 1% level. Means, housing units with RCC façade having bigger sales price than brick exterior (Table B.24 at Appendix B).

- **Number of Bedrooms – VAS3** has a positive and significant impact on implicit price and significant in the model at 1%. One unit (number of bedrooms) increase in number of bedrooms lead to 6908865 BDT increase in house price (Table B.25 at Appendix B) .

- **Size of plot - VAS5** has a negative impact on price. One unit increase in land area reduces the price 160601 BDT; but it does not indicate a statistical significant linear relationship. Thus this can be considered as an unobserved factor (Table B.26 at Appendix B).

- **Number of Stories- VAS6** is positively related to implicit price. But it does not indicate a statistical significant linear relationship. Thus this can be considered as an unobserved factor (Table B.27 at Appendix B).
  .

- **Age – VAS7** is found as negatively related and significant in the model at the 1% level. One unit (year) increase in age leads to 1831205 BDT decrease in rent price (Table B.28 at Appendix B).

- **Orientation – VAS8** has a positive impact on implicit price and significant at 5% level; indicating the price of south-east or south facing buildings is bigger than the houses having other orientations (north, east and west). The house price increases 1228212 BDT for the houses having south-east, south facing (Table B.29 at Appendix B).

The Hedonic regression analysis for housing unit's **Neighborhood Variables** (for owned houses) is tested below:

- **Population density** –**VBN1** has a strong positive impact on the implicit price of houses and significant at 1% level. It means increase of one people per sq mile increase house price 87.236 BDT. Price of housing unit is higher at densely populated areas.

- **Poverty – VBN2** is found weakly positive relationship with implicit price. But it does not indicate a statistical significant linear relationship.

- **Median age- VBN3** of the residence is negatively related to implicit price of houses. It does not indicate a statistical significant linear relationship.

- **Vacancy rate – VBN4** means vacant houses in the neighborhoods are positively related to implicit house price; but it does not indicate a statistical significant linear relationship.

- **Household's monthly income – VBN5,** is strongly positive and found one of the most significant in the regression analysis model at 1% level. This relationship indicates one unit increase (BDT) in income increases the house price 151.719 BDT.

- **Percentage of school attendance (5-24years) –VBN6** in the neighborhood, is positively related to implicit house price at 10% level; indicating that 1% increase of school attending people (5-24 years) increase the house price 148242.3 BDT.

- **Literacy rate- VBN7** has a negative relationship with implicit house price and significant at 10% level. The areas having lower literacy rate have higher rent price. This result is on the contrary to the expectation based on the previous hedonic price studies.

- **Distance from the house to the nearest school- VBN8** is positively related to implicit house price at 1% level; it means one unit (ft) increase in distance to the nearest school results with 2766.355 BDT increase in house price. This result is on the contrary to the expectation based on the previous hedonic price studies.

- **Housing tenancy status within the neighborhood – VBN9**, the owned house is found positively related to the implicit house price at1% level. Increase in the number of owned house in an area increase the house price 98759.707 BDT. And in case of rented houses there is a negative relationship with house prices and significant 5% level. This relationship indicates 1% increase of rental houses decrease the house price 110073 BDT.

The focus variables capturing the **Amenity or Environmental** characteristics (for both owned and rented houses) are tested below through hedonic regression model. Results for owned houses are discussed first,

- Houses having the **view of nearest park, lake or field – VAN1** have a positive and significant impact on implicit house price at 1% level. The coefficient value for view is 1545181; Indicates that existence of view of open spaces for a particular house increases that house price by 1545181 BDT. That means houses with open space views specially lake or park views are sold by 1545181 BDT or 14% higher price than the houses without open space views (Table 4.15). From analysis it is also found that houses with lake view or park view have the higher price than the field view. In most of the cases playing field does not have any significant impact on price.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	7427233.811	1310639.669		5.667	.000
	VIEW	1545181.167	494481.858	.335	3.125	.003

Table 4.15: Regression analysis results between price and view of nearest open spaces from owner occupied houses

- **Size of the open space (park or lake) - VAN2** is positively related to house price. It means increase in size of open spaces nearest to the house increase the implicit price; but it does not indicate a statistical significant linear relationship (Table 4.16).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	10199513.388	1087577.640		9.378	.000
	SIZE	.269	.302	.101	.892	.375

Table 4.16: Regression analysis results between price and size of nearest open spaces from owner occupied houses

- **Distance from the house to nearest open space (park, lake or field) –VAN3** has a negative impact on implicit house price and significant at the 5% level. The elasticity indicates that one unit (ft) decrease in distance from house to the open space increases the implicit price of the house by 5811.852 BDT on an average (Table 4.17). Or 1% increases in the distance of open space increase the price by 0.053%.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	12246414.046	896526.186		13.660	.000
	DISTANCE	-5811.852	2483.569	-.258	-2.340	.022

Table 4.17: Regression analysis results between price and distance of nearest open spaces from owner occupied houses

Results of regression model for rental houses; from table 18 above:

- **View of nearest park, lake or field – VAN1** have a positive and significant impact on implicit house price at 1% level. Result shows that existence of open space view increase the rent price by 3447.257 BDT on an average (figure 4.18). Indicating that houses with open space view have 12% higher house rent price than the houses without open space view. From results it is also found that houses with lake view or park view have the higher price than the field view. In most of the cases playing field does not have any significant impact on price.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Significance
	B	Std. Error	Beta		
1 (Constant)	21413.502	3146.265		6.806	.000
VIEW	3447.257	1198.728	.499	2.876	.008

Table 4.18: Regression analysis results between price and view of nearest open spaces from rental houses

- **Size of the open space (park or lake) - VAN2** is positively related to implicit house price. It means one unit increase in size of open spaces nearest to the house increase the house; but it does not indicate a statistical significant linear relationship (Figure 4.19).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	28245.639	5037.257		5.607	.000
	SIZE	.000	.001	.036	.178	.860

Table 4.19: Regression analysis results between price and size of nearest open spaces from rental houses

§ **Distance from the house to nearest open space (park, lake or field) –VAN3** has a negative impact on implicit house price. It means one unit increase in distance to the open space from houses results with the decrease the house price; but it does not indicate a statistical significant linear relationship (Figure 4.20).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	30556.791	2378.196		12.849	.000
	DISTANCE	-5.481	5.328	-.202	-1.029	.313

Table 4.20: Regression analysis results between price and distance of nearest open spaces from rental houses

By using Least Square Method a linear regression analysis are operated with the sample of 107 observations (79 owned houses and 28 rental houses). In consequence, a price model are developed while dependent variable to be determined the price of housing units and independent variables include housing units structural, location or neighborhoods and environmental or amenity attributes. In this model the environmental or amenity characteristics (view, size and distance of nearest open spaces) are considered as the focus variables of the study and these variables are analyses for both owner occupied and rental houses. Parallel to the expectation with previous hedonic studies, size of living area, exterior façade treatment, number of bedrooms, age and orientation of houses, population density, households income, percentage of school attendance and tenancy status of owner occupied houses are found significant attributes affecting housing units price positively. Age of the houses and percentage of rented houses are negatively related to house price. School distance is positively and literacy rate is negatively related to house price. But these results are on the contrary to the expectation. Because most of the schools in the study areas are within the residential zone which creates huge traffic jam, noise, crowd and other problems. Thus people in this country prefer to live farther away from school due to sound and quality of life. From data it is found that the house price is comparatively higher at Gulshan area than Dhanmondi. But literacy rate is comparatively lower at Gulshan, because its peripheral zone is occupied by low income people with lower percentage of literacy rate. Thus regression results in this show that decrease in literacy rate, increase the house price of house units.

In terms of environmental attributes existence of **view** of open spaces for both owned and rental houses has a positive and significant impact on house price as expected**. Distance** of nearest open space from both rental and owner occupied houses is found negatively related to house price, but this relation is significant only for owner occupied houses. In other words,

increase in distance to the open space results with a decrease in house price of owned houses. **Size** of nearest open space from both rental and owner-occupied houses, does not have a significant impact on house price

5.3 Summary

This part briefly reviews the results of data analysis into two categories; **Descriptive Statistics Results**, which analyze mean, minimum, maximum values for metric scale variables and maximum frequency values for nominal scale and ordinal scale variables and **Inferential Statistics Results**, are presented within the context of eight sets of the statistics hypothesis. All these sets of hypotheses are tested by using correlation analysis, *t*-test, ANOVA test, chi-square test to support the results of research method Hedonic Regression Model. In hedonic regression analysis by using 107 observations a price model has been developed where price of housing units is determined as dependent variable and housing units' structural, neighborhood and amenity variables are determined as independent variables. This study focuses on the amenity or environmental characteristics of housing units, since it aims to determine the economic value of open spaces. The amenity attributes of house include **view** and **size** of nearest open spaces and **distance** of those open spaces from houses. From all the test results it is found that **view** of open spaces for both owned and rental houses have a positive and significant impact on house price. This indicates that existence of the view of open spaces increase the house price by 14% for owner occupied houses and 12% for rental houses. In terms of **size** of nearest open spaces for both owned and rental houses, the results show a positive impact. But it does not indicate a statistical significant linear relationship. As the supply of open spaces far short of demand, less choice make it difficult to clearly determine the value of residential properties for size of open spaces. The **distance** of nearest open spaces from both rental and owner occupied houses has a negative but have a significant impact only at owner occupied house price. This means increase of distance of nearest open spaces from houses by 1 ft, decrease the house price by 0.053% for owned houses. These test results summarize the findings of the study; which would provide suggestions for policy implications and further researches.

CHAPTER 05: CONCLUSION AND RECOMENDATION

In this final section, the findings of the study are summarized first. Where these findings have been evaluated in terms of the general framework of the study, results of the case study and application of Hedonic method to open space variables. Finally, suggestions for policy implications are given and scope of further research is identified.

5.1. Summary of Findings

Within the context of Open Space valuation, to analyze the impact of open spaces on residential property's sales prices and to determine the factors affecting those impacts, this study employed Hedonic Price Method in the case of Dhaka's residential neighborhoods - Dhanmondi and Gulshan, Banani, Baridhara. The study asked three major research questions - **Do Open Spaces Have a Relative Measurable Economic Value? Do Open Spaces Have an Impact on the Price of Residential Properties or Houses?** If yes, how this value varies with the presence and absence of Open Spaces? And **Which Attributes of Open Spaces Affect its Impact on the Price of Houses?** As a response to these questions, hypotheses are developed: first, open space have a relative measurable economic value; second, open spaces are one of the effective attributes which impact the price of the property, that is, it has an impact on property prices; and third, the impact of open spaces on property values differs depending on their different quantitative and qualitative characteristics.

To justify those hypotheses, prominent statistical methodology has been used. With a sample of 107 observations (79 owned houses and 28 rental houses) and by using least squares method, Linear Regression analyses were operated. That model was turned into **Hedonic Pricing Model** with housing characteristics attributes. Where the dependent variable was determined to be the price of the housing unit for both owned and rental houses. The housing characteristics model included independent variables related to housing unit's structural, locality, socio-economic, and amenity or environmental attributes. In this model, the focus variable was amenity attributes which included "**View**" - means existence of open space views (park, lake or field) from selected housing units; "**Proximity**" indicating distance in feet from the house to the nearest open space (park, lake or field); and "**Size**" indicating size in square footage of the nearest urban open space.

In the Hedonic Regression model, initially all the variables of housing units related to structural, neighborhood and amenity or environmental attribute were tested. Not all the variables, but most of the variables in this model has shown the results which is as expected from previous Hedonic studies. Housing units' Structural variables include; **Size** of living area, **Exterior** façade treatment of the house, number of **Bedrooms** is found positive and strongly significant in the model, these are parallel to the expectation. **Age** of the house is negative and strongly significant in the model, which is also as expected. **Orientation** is positively related and significant in the model; indicating that in most of the cases the price of south-east and south facing buildings is higher than the other orientations. This relation is significant; but not strong, because from data it is found that the price of some non-south facing building is higher as those having direct open space view. View is more preferable here to the residents than orientation because from survey it is observed that the residents ignore the problem of façade orientation for view as the houses consist air conditioner.

In terms of housing unit's Neighborhood variables population **Density and** Household **Income** of the residents is positively related to the model and significant. Similarly, as expected proportion of **Owner occupied** and **Rented** houses are negatively related with house price and strongly significant. But from the previous Hedonic studies it is found that some neighborhood variables are on the contrary to the expectation like, **Distance** from nearest school is positively related to the model and highly significant. **Literacy** rate and **Median Age** of households are found negatively related and not significant. Poverty, proportion of Vacant Houses and percentage of **School Attending** people are found positive and not significant in the model which are on the contrary to the expectation.

Most importantly, amenity or environmental variables associated with the urban open space, which also is the focus variables of the study, were tested both for rental and owned houses with this Hedonic model to understand the economic valuation of Open Spaces.

In this model, **View** of open space VAN1 for both owned and rental houses is found to be positively related to price of housing unit and is strongly significant at 1% level; which is found to be parallel to the expectation from previous Hedonic studies. It revealed that the houses with open space views have increased house price by 1545181 BDT or 14% than the houses without any scenic views. These findings largely correspond to those in the literature in assigning a value to housing with scenic view (lake, park, and field) has attracted positive responses (Tyrvainen, 1997; Tyrvainen and Miettinen, 2000; Bolitzer and Netusil, 2000; Lutzenhiser and Netusil, 2001; Geoghegan, 2002; Hobden et al., 2004; Salazar and

Menendez, 2007). This study has provided important preliminary evidence regarding the value *of* and preferences *for* open space amenities in these two residential neighbourhoohs of Dhaka city. The research also indicates that the values of lake view apartments are higher than park views. Most of the play fields does not have any significant impact on sales price; the exceptions are houses adjacent to Dhanmondi 4 number field and Banani 13/a and 14 number field; apartments price here is similar to lake or park view apartments.

Test result which is on the contrary to the expectation, **Size** of the nearest open space from the both owned and rented houses. This variable is positively related to house price, corroborating the findings of previous studies (e.g., Tyrvainen, 1997; Bolitzer and Netusil, 2000; Lutzenhiser and Netusil, 2001). However, it does not indicate a statistical significant linear relationship. This indicates size of open spaces does not have any significant impact on residential property values. This is because, in Dhaka, in terms of demand, supply of open space is far short; therefore less choice makes it difficult to clearly determine the value of property due to the size of nearest open spaces. Thus whatever the size is, property buyers only prefer having scenic views of open spaces from their houses.

Distance from the house to the nearest open space is negatively related to house price and indicates a significant relationship; which is Parallel to the expectation based on previous hedonic studies, This is consistent with the findings of Bolitzer and Netusil (2000), Tyrvainen and Miettinen (2000), Morancho (2003), Tajima (2003), Anderson and West (2006), etc. The elasticity indicates that a 1 feet decrease in distance from the house to these parks or lakes increases the implicit price of the house by 5811.852 BDT or 0.053%. This is quite consistent with the economic theory because the houses closest to open spaces have higher demand or more preferable for residential purpose than their counterparts. In such cases people would be willing to pay for better views, air quality and quiet ambience. This is the case for only **Owned** houses. The result for **Rental** houses in terms of distance from the house to the nearest open space is also negatively related to house price; but it does not indicate a statistically significant linear relationship.

As a response to the first research question, the findings of the research put forward that open space has a relative measurable economic values. The empirical evidence concludes that open spaces within the residential neighborhoods have a positive effect on the property price. Homebuyers are willing to pay a premium for the open spaces when they purchase the properties. As a response to the second research question, the results prove that presence of open space has a significant impact on property prices of the two selected residential

neighborhoods of Dhaka. Existence of open space views specially lake or park views increase the house price for both owner occupied houses and rental houses than the houses having no views within the same neighborhoods. Finally, as a response to the third research question, which aimed to understand the factors affecting the impact of open spaces on housing unit's prices, the study revealed that the impact of open space on price differs depending principally on having views of open spaces and its proximity to the housing unit.

Besides, the results of inferential analysis (correlation analysis, *t* test, one way ANOVA, $\chi 2$ tests) to test statistics hypotheses, which are formulated in the direction of the research questions and main hypotheses, supported the results of Hedonic Regression models:

According to **Correlation** analysis results, there is a statistically significant negative correlation [r= -250(0.026)] between real price of housing unit and distance from housing unit to nearest open space, which is parallel to the expectation. The result indicates linear relationship between these two variables is one in which the values of one variable increases as the other decreases, that is, the more distant of housing unit from nearest open space, the less rent price is. This relation can be considered as the result of the positive externalities of the open space of various social, physical, environmental and economic benefits. Interestingly, rental houses also show a negative relationship between rent price and distance from housing unit to nearest open space; it does not indicate a statistically significant linear relationship.

One Way ANOVA analysis results which are parallel to the expectation, the price for both owned and rental houses differs depending on having view of open spaces (park, lake or field) from the house. According to the test result, in terms of the house price, the price of housing units do not having any views differ from those housing units enjoying lake, park or field views. And the price of housing units having lake or park views significantly differs from housing units with only field views. This price difference can be considered as a result of the more opportunity for enjoying view of open spaces.

Zones as representatives of market segments, differs depending on price for both owned and rental houses. According to the test result, in terms of the house price, the 1st zone named as submarket1 which is adjacent to the open space and consisting the houses with highest price differs from the next two zones indicating submarket 2 and submarket 3, indicates result parallel to the expectation from previous studies. The test result indicates people only have willingness to pay for houses those having view but not concern with ease of accessibility to

open spaces. They do not differ submarket 2 from submarket 3, as submarket 2 is closest to submarket 1 and more easily accessible to open spaces in terms of distance than submarket 3.

Test result which is parallel to the expectation, Zones as representatives of market segments differ depending on view of open spaces, the submarket 1 in which houses take place adjacent to the open space and having maximum view differs from the other zones. The submarket 2 and submarket 3 do not differ depending on the view of open spaces, as almost all the houses within these zones do not have direct open space views. This can be considered as a result of the more opportunity to benefit from open space visually. This is the case for both owned and rental houses.

Test result which is parallel to the expectation, Zones as representatives of market segments differs depending on the open space proximity for owned houses; the submarket 1 appears to be located at the closest proximity to the open space than submarket 2 and submarket 3. The submarket 3 which is located at a greater distance from open space significantly differs from the submarket 2. This relation can be considered as a result of the decrease in benefits resulted from distance. The scenario of rental houses is quite similar for submarket 1. But in case of other zones, the submarket 2 and submarket 3 do not differ in terms of distance.

Test result which is parallel to the expectation, Zones as representatives of market segments differs depending on the size of the nearest open spaces from the owned housing unit. According to the test result, in terms of the size of open space the submarket 1 and submarket 2 significantly differ from submarket 3. The submarket 1 and the submarket 2 do not differ in terms of size of open spaces nearest to the house. This can be considered as a result of the more opportunity to benefit from the large size open space visually and environmentally. The rental houses shows a result, which is on the contrary to the expectation.

Chi-Square ($\chi 2$) Test results represents difference between zones are mostly related with the attributes affected from open space. Test result which is parallel to the expectation, there is a relationship between zones and view of nearest open space from the house. There is also a relationship between zones and distance in feet from the house to the nearest lake, park or field. This is the case for both owned and rental houses.

Test result which is on the contrary to the expectation, there is no relationship between zones and size in square footage of the nearest urban recreation open space from both owned and rental houses. It does not indicate a statistically significant linear relationship.

Further, the results of descriptive statistics analysis revealed categories of open spaces which have its impact on house price. 49.4% of respondents prefer having view and ease of accessibility to the nearest open spaces from their houses. Among them 34.2% of respondents prefer living in lake view apartments. 8.9% of respondents prefer their houses adjacent to park and only 6.8% of respondents are satisfied with a view of small field. This can be considered as a result of the more opportunity for enjoying different views of open spaces, better environment for recreational purpose, physical benefits and social interaction.

However, this research only focuses on open space attributes; there are other factors which have significant impact on house price. These includes housing units' structural variables like living area, number of bedrooms, no of stories, orientation and neighborhood variables as population density, household income, distance from nearest school, literacy rate etc. The impact of these variables has been discussed in data analysis part.

As Dhaka city continues to grow, an increasing number of residents are placing unprecedented demand on the existing open spaces. This means urban open spaces will become more and more congested, possibly to a point which exceeds the potential of these open spaces to offer recreational and amenity benefits. In order to estimates the benefits of urban open spaces this study employed a Hedonic Model to estimate the amenity value of urban open spaces in Dhaka.

This research analyzes all the above discussed empirical studies to establish that open space is desirable and valuable from a housing-market perspective. In this study, it has not been claimed that this is the best approach to access the impacts of open space attributes on residential property values. Nevertheless, it has been argued that, the approach developed in this study has advanced the knowledge about open space valuation and provided the first evidence in Dhaka- of the impact of open spaces on the values of residential properties by using Hedonic Price Method and tracing the factors shaping this impact.

Results show that, indeed open spaces have an economic value and they can be measured by analyzing the transaction price of the nearby residential properties. Open spaces are one of the prime attractions for property buyers. Some of this attraction is attributed to the accessibility to open spaces. The presence of open spaces does increase the property prices depending on its proximity to residences. The market value of properties located near an open space frequently is higher than those of comparable properties located else-where.

Finding 01: Open spaces have a relative measurable economic value. The monetary value of open spaces can be compared by the transaction price of the residential properties based on relative distances with open spaces.

i.e. Price α 1/ distance of open spaces.

The Hedonic Price Method assumes people's valuation of open spaces can be inferred from the amount they are willing to pay for these open spaces through the housing market. This research also suggests that open space have a strong positive correlation with adjacent homeowners' property values; that is, properties in the vicinity of open space can have higher property values than those not in the vicinity. This evidence has supported previous researches reporting that open space provides a premium for residential property prices. The results of this study can help the policy makers to understand how open spaces and recreational opportunities relate to the strength of the country's economy.

Finding 02: Open spaces within the residential neighborhoods have a positive effect on the property prices. Property buyers are willing to pay a premium for the open spaces when they purchase the properties.

The Hedonic Regression and other supporting test results proves that, the variables associated with urban open spaces, which also are the focus of this study, only **View** and **Proximity** to open spaces are significant and have expected signs. This finding confirms that existence of view of open spaces from houses have a significant and positive relationship to the property values both for owner occupied and rental houses and strongly significant. This indicates property located within an immediate neighborhood of open spaces will have an increased total consumer surplus of on an average 1545181 BDT or 14% of actual price for owner occupied houses and 3447.257 BDT or 12% higher rent price for rental houses. The data analysis results suggest that among the three identified submarkets the implicit price of lake view apartments are highest than other types of open spaces for most of the cases. Open space views have attracted positive responses because view is usually accompanied by a bundle of collateral benefits, such as less obstructed perspective, fresh air, better ventilation, sunshine access, brightness, opportunity for social interactions and in general better and prestigious residential location.

Finding 03 (a): A good scenic Open Space view could attract a premium of 14% above than less attractive environmental settings in urban residential neighborhoods of Dhaka. This is the case for owner occupied houses. In terms of rental houses the residents willing to pay 12% more for rent price. Thus presence of Open space does make a difference in rental or property price.

In the same way, results show **Distance** from the house to the nearest open spaces is negatively related to the house price and significant at 1% level. This result is consistent with previous findings. The elasticity indicates that a 1% decrease in distance from the house to nearest open spaces (lake, park or field) increase the real price of the house by 5811.852 BDT on an average or 0.053%, suggesting 581185 BDT increase in house price by moving the house 100 feet closer to an urban neighborhood open space. Houses located near both lakes and parks have significantly increased sale values than play fields in both study areas. On the other hand in terms of rental houses results show that distance of nearest open spaces do not have a significant impact on rent price. Indicating that proximity to open spaces influence house rent values to a lesser degree.

Finding 03 (b): The marginal implicit price for owner occupied houses increase 5.3%, by reducing the distance between a house and the closest open space by 100ft.

This research is also concerned with the **Size** of nearest urban open spaces from houses. The finding confirms that the size of nearby urban open spaces have a positive impact on sales price. The result indicates that 1% increase in square footage of urban open space in the neighborhood, increase the implicit price of nearest houses by 0.069 BDT. But the results do not indicate a significant relationship between house price and size of nearest open space. Since supply of open space is far short than demand, people do not have enough choice to consider the different sizes of open space during home purchase. For rental houses the empirical analysis also show the negative result and does not have a significant relationship with price as owned houses. Thus the result confirms that **Size** of nearest open space from houses does not have significant amenity effect on house price.

Finding 03 (c): Size of open spaces does not have a significant impact on implicit price of houses at the residential neighborhoods of Dhaka. 1 feet increase in size of nearby open space increases the house price by only 0.069 BDT and significant at 37.5% level. Since the supply of open space is far short of demand therefore less choice make it difficult to clearly determine the value of property due to the size of nearby open space.

Urban home owners are willing to pay or value open spaces only for scenic views and living in the closest proximity to the nearest open spaces for more opportunity of better environment for recreational purpose, social interaction, physical and mental benefits. This estimated welfare impact might be helpful in justifying investment on open space preservation, park management program of Dhaka city. These results might have important implications for real estate design and land use planning. In the light of this research results the urban planners and designers might consider in their planning, the **View** and **Proximity Measures** of open spaces not only from the adjacent plots but also from every possible distance of the houses. The estimated welfare impact of these houses might be helpful in justifying investment on open space preservation and park management. And this impact may also provide guidance in designing citizen-financed open space preservation or park management for Dhaka in particular and other cities nationwide.

5.2 Policy implications and suggestion for further research

The result of the first-stage Hedonic analysis suggests that, the impact of open spaces can be used not only to measure the economic value but also as a useful and strong mean to demonstrate

- The demand for open space in urban neighborhoods by using a two-stage hedonic framework. Second stage demand estimation is challenging because it involves additional data and estimation requirements beyond the first stage hedonic regression. This might be a useful implication in land use planning and urban sprawl management because preserving open spaces could encourage high-density development and help discourage sprawl.

- The knowledge of this estimated welfare of open space provided the urban homeowners are willing to pay for this amenity and land use planners in conjunction with neighborhood association can establish cooperative funds to develop new parks or expand existing one.

- This estimated welfare impact also might be helpful in justifying investment on open space preservation and park management program, and may provide guidance in designing citizen financed open space preservation and park management.

Nevertheless, although there is a body of knowledge, there is still a need for further valuation studies for open spaces. For further researches, the following suggestion might be useful.

- First, since the most common method employed in the previous studies is Hedonic price method and the use of other methods are very rare, further researches on economic valuation of open spaces should be carried out also by using other methods such as contingent valuation method and travel cost method.

- Second, since revealing merely the amount or sign of value is not fully enough for properly assessment in decision-making process, further studies should investigate causalities for better understanding the relationship between open space attributes and their values.

- Third, this dissertation focuses on the residential property values. This leaves a room for future research to study whether the result is valid for other properties such as offices, retail shops or mixed use buildings.

- Finally this study would be effective to analyze in future, the impact of open spaces on the high-rise buildings those have been built by following FAR (Floor Area Ratio) rules.

5.3 Concluding Remarks

Open spaces may contribute to quality of life in urban areas through their various benefits - social, environmental, physical, and economic. Effective urban land use planning and supplying additional acreage of such open spaces will require a clear understanding of their

amenity values and demand in the society. Within the context of the economic valuation of open space, the aim of this study was to understand the impact of public open space on price of residential properties. The real estate is one of the vital catalysts for a country's economy as urban land value is determinative in both urban planning and real estate activities in economies of today's world. To analyze the impact of open space attributes on price of residential properties, an empirical analysis is carried out by employing Hedonic Price Method (HPM) which is estimating the effect of each relevant variable on the price of properties. In Dhaka no research has been carrying out so far on valuation of open spaces in econometric terms by Hedonic Price Method, therefore, overseas studies are tested in Dhaka's urban neighborhood open space context.

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Hedonic regression analysis results confirm that open spaces within the residential neighborhoods have a positive effect on the property price. Homebuyers are willing to pay a premium for the open spaces when they purchase the properties. The results indicate that **View** and **Proximity Measure** of open spaces are one of the effective attributes which impact on property prices. Findings reveal that houses with scenic views (lake, park, and field) have attracted positive responses. People are willing to pay 14% more for the existence of open space views for owner occupied houses and 12% for rental houses. Open space views have attracted positive responses because view is usually accompanied by a bundle of collateral benefits, such as less obstructed perspective, fresh air, better ventilation, sunshine access, brightness, opportunity for social interactions and in general better and prestigious residential location.

The empirical results also show that, another open space attributes **Distance** is negatively related to open spaces for both rental and owner occupied houses. The elasticity indicates that 1% decrease in distance from the house to the open spaces increase the house price by 0.053%. Suggesting, 5.3% increase in house price by moving the house 100 feet closer to an urban neighborhood open space. This is the case for owner occupied houses. On the other hand in terms of rental houses results show that distance of nearest open spaces do not have a significant impact on rent price.

For both owned and rental houses **Size** of nearest open space do not have a significant impact on house sales price. Results for owned houses reveal that 1 feet increase in size of nearby open space increases the house price by only 0.069 BDT and significant at 37.5% level. Data shows that size of open space is weakly correlated with house price, and significance level is very poor. Experts suggested, an ideal city needs to keep its 40%-50% of land open or free.

However Dhaka structure plan urges to have 20% of open spaces for its future generation [Mowla, 2005]. Since the supply of open space is far short of demand therefore less choice make it difficult to clearly determine the value of property due to the size of nearby open space.

Other test results (*t*- test, ANOVA, $\chi 2$ test) are also conducted to support the results of Hedonic Regression Analysis. The estimated value and amenity benefits of urban open spaces will be useful in urban design, urban planning and open space preservation decision making process and this research suggests that there is a huge scope for future research. Its in implications for urban design, real estate design and land use planning, to determine urban design, urban planning and real estate activities, to establish cooperative funds to develop new parks or to expand existing one are evident. The justification of investment on open space preservation and park management program and to provide guidance in designing citizen-financed open space preservation or park management is also proved by this study.

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APPENDIX A: Graph Chart of Results

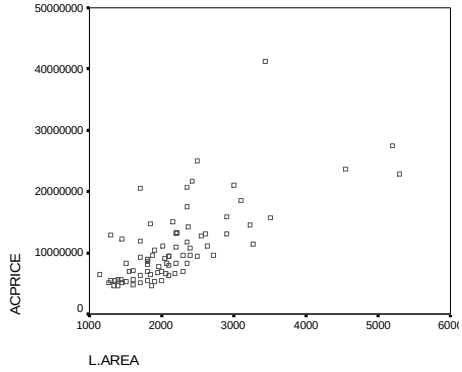

Figure A.01: Correlation between implicit price and size of living areas

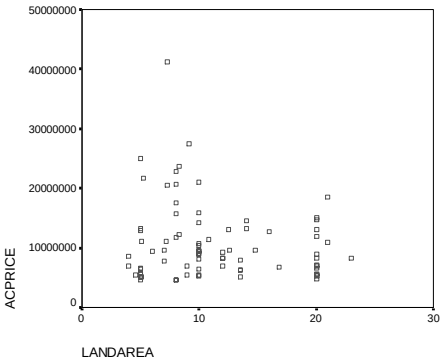

Figure A.02: Correlation between implicit price and size of plots

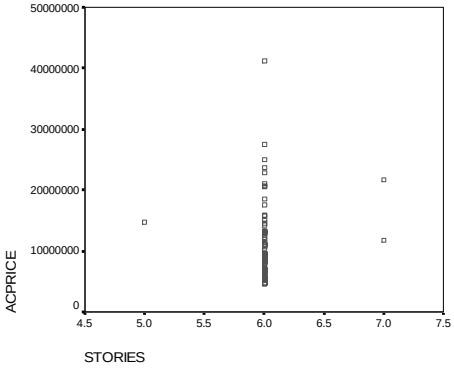

Figure A.03: Correlation between implicit price and number of stories

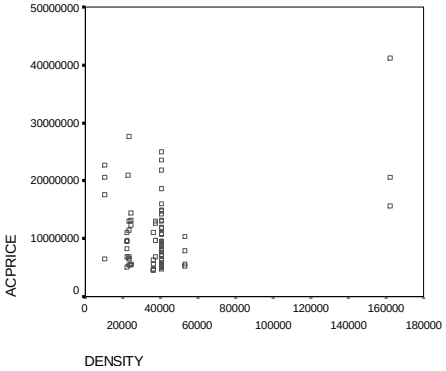

Figure A.04: Correlation between real price and population density

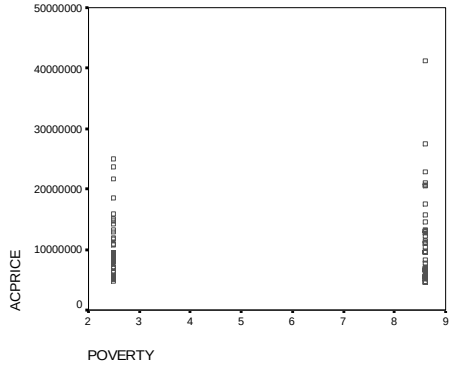

Figure A.05: Correlation between implicit price and poverty

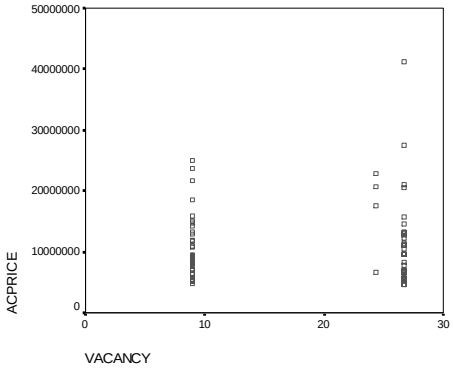

Figure A.06: Correlation between real price and percentage of vacant house

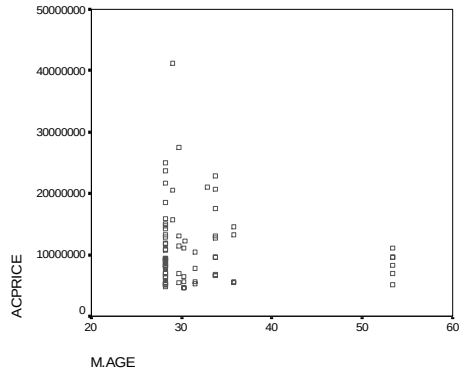

Figure A.07: Correlation between implicit price and median age

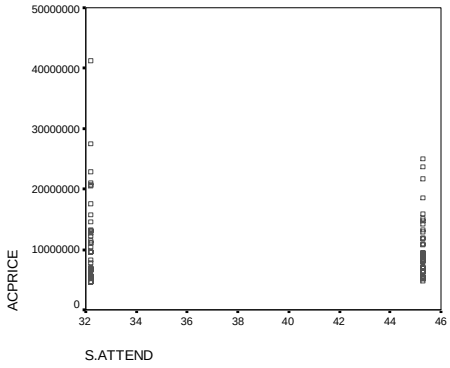

Figure A.08: Correlation between real price and percentage of school attendant

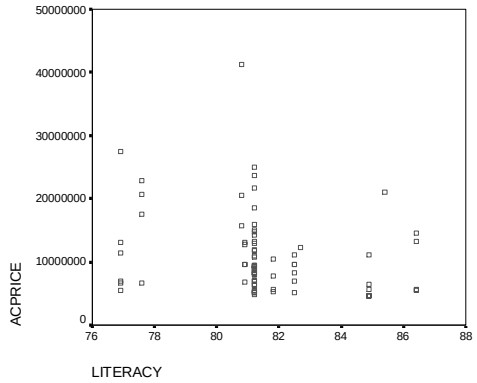

Figure A.09: Correlation between implicit price and literacy rate

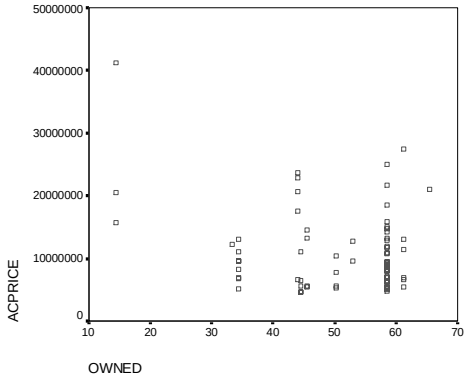

Figure A.10: Correlation between real price and percentage of owned house

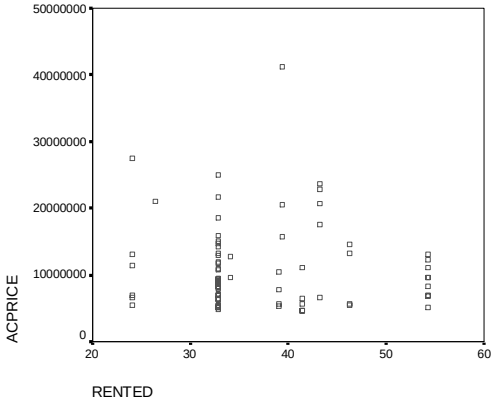

Figure A.11: Correlation between implicit price and percentage of rented house

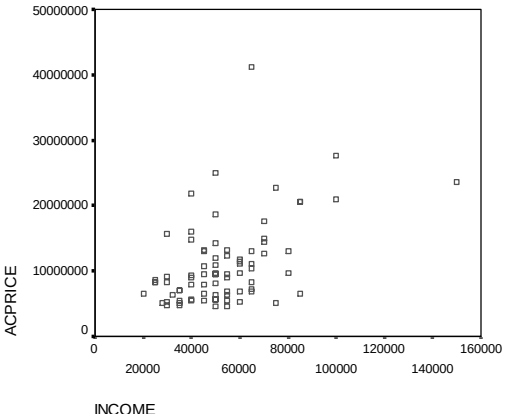

Figure A.12: Correlation between real price and household income

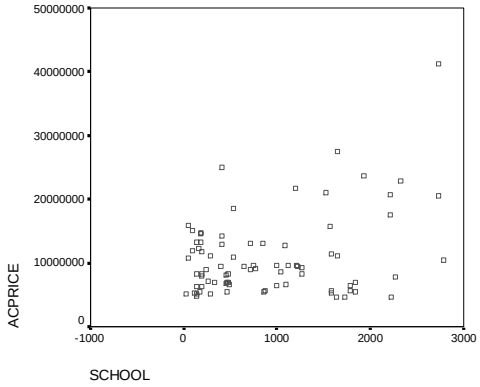

Figure A.13: Correlation between real price and Distance from nearest school

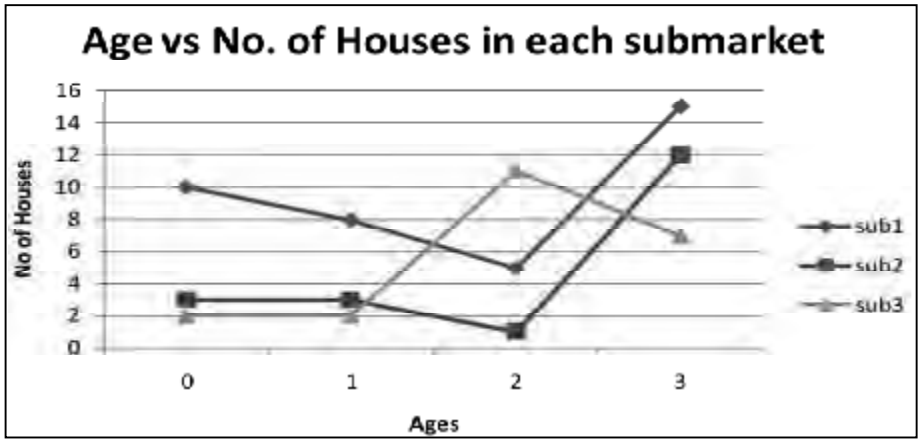

Figure A.14: Cross Tabulation of Zones and age of owned houses

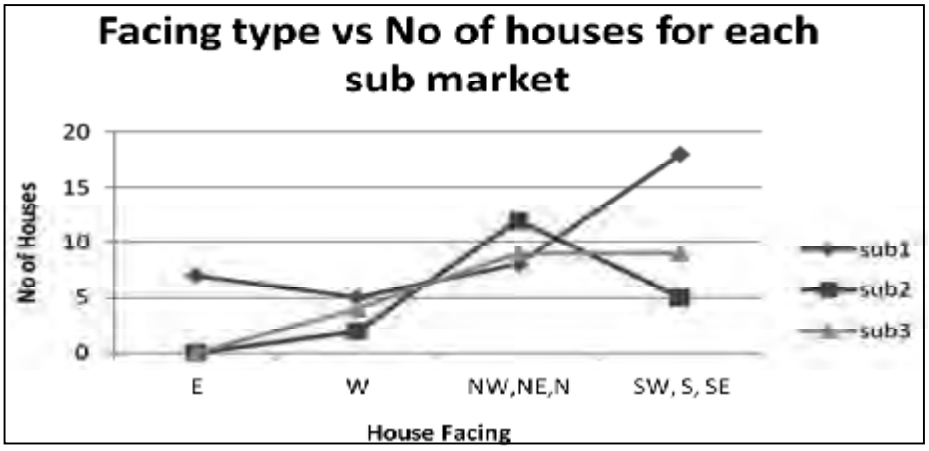

Figure A.15: Cross Tabulation of Zones and orientation of owned houses

APPENDIX B: Table of Results

		Levene Test ...		t-test for Equality...						
		F	Significance	t	df	Sig (2-tailed)...	Mean Difference	Std. Error Diff...	95% Confidence Interval of the Difference	
									Lower	Upper
ACPRICE	Equal variances ...	.782	.379	-2.811	77	.006	-10110606.5789	3596749.63513	-17272650.09901	-2948563.05889
	Not Equal variances ...			-5.376	2.713	.016	-10110606.5789	1880539.09281	-16469897.68151	-3751315.47638

Table B.01: T- test result for Façade treatment of owned houses

		Levene Test ...		t-test for Equality...						
		F	Significance	t	df	Sig(2-tailed)...	Mean Difference	Std. Error Diff...	95% Confidence Interval of the Difference	
									Lower	Upper
ACPRICE	Equal variances ...	13.368	.000	-5.574	76	.000	-6823162.6359	1224012.45683	-9260994.72001	-4385330.55173
	Not Equal variances ...			-4.921	39.250	.000	-6823162.6359	1386573.82791	-9627201.17677	-4019124.09497

Table B.02: T- test result for number of Bedrooms of owned houses

ACPRICE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	86278329898406.100	2	43139164949203.050	1.063	.350
Within Groups	3083623496251973.000	76	40573993371736.490		
Total	3169901826150379.000	78			

Table B.03: One way ANOVA result for number of Stories of owned houses

ACPRICE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	512468228507815.000	3	170822742835938.500	4.821	.004
Within Groups	2657433597642564.000	75	35432447968567.520		
Total	3169901826150379.000	78			

Table B.04: One way ANOVA result for the Age of owned houses

ACPRICE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	350309624629039.700	3	116769874876346.500	3.106	.031
Within Groups	2819592201521340.000	75	37594562686951.200		
Total	3169901826150380.000	78			

Table B.05: One way ANOVA result for the Orientation of owned houses

OWNED

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	860.749	2	430.374	3.427	.038
Within Groups	9543.924	76	125.578		
Total	10404.672	78			

Table B.06: ANOVA test results of Zones as representatives of market segments differ significantly depending on tenancy status for owned houses

RENTED

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	435.752	2	217.876	3.302	.042
Within Groups	5013.965	76	65.973		
Total	5449.717	78			

Table B.07: ANOVA test results of Zones as representatives of market segments differ significantly depending on tenancy status for rented houses

L.AREA

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	1137353.960	2	568676.980	.946	.393
Within Groups	45694055.837	76	601237.577		
Total	46831409.797	78			

Table B.08: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on size of living area of owned houses

LANDAREA

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	68.661	2	34.330	1.178	.313
Within Groups	2214.938	76	29.144		
Total	2283.598	78			

Table B.09: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on size of plots of owned houses

STORIES

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	.040	2	.020	.515	.599
Within Groups	2.947	76	.039		
Total	2.987	78			

Table B.10: ANOVA test results of Zones as representatives of market segments do no differ significantly depending on no. of stories of owned houses

AGE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	3.941	2	1.971	1.468	.237
Within Groups	102.033	76	1.343		
Total	105.975	78			

Table B.11: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on age of owned houses

DENSITY

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	1250761573.898	2	625380786.949	.896	.412
Within Groups	53031712523.292	76	697785691.096		
Total	54282474097.190	78			

Table B.12: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on population density of the areas of owned houses

POVERTY

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	6.959	2	3.480	.363	.697
Within Groups	727.820	76	9.577		
Total	734.780	78			

Table B.13: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on poverty of the areas of owned houses

M.AGE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	100.609	2	50.304	1.134	.327
Within Groups	3372.360	76	44.373		
Total	3472.968	78			

Table B.14: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on median age of the people of owned houses

VACANCY

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	49.036	2	24.518	.311	.734
Within Groups	5991.554	76	78.836		
Total	6040.590	78			

Table B.15: ANOVA test results of Zones as representatives of market segments do not differ significantly depending percentage of vacant houses

INCOME

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	892654896.736	2	446327448.368	1.073	.347
Within Groups	31601421052.632	76	415808171.745		
Total	32494075949.367	78			

Table B.16: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on median household income

S.ATTEND

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	32.096	2	16.048	.363	.697
Within Groups	3356.659	76	44.167		
Total	3388.754	78			

Table B.17: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on percentage of school attending people

LITERACY

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	18.570	2	9.285	1.940	.151
Within Groups	363.669	76	4.785		
Total	382.239	78			

Table B.18: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on literacy rate

SCHOOL

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	565147.013	2	282573.507	.480	.620
Within Groups	44715571.364	76	588362.781		
Total	45280718.377	78			

Table B.19: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on distance from nearest school

SIZE

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	6204176708810.260	2	3102088354405.134	1.827	.183
Within Groups	40746349736240.400	24	1697764572343.350		
Total	46950526445050.600	26			

Table B.20: ANOVA test results of Zones as representatives of market segments do not differ significantly depending on size from nearest open spaces from rental houses

	Value	df	Asymptotic Significance
Pearson Chi-Square	2.579(a)	2	.275
Likelihood Ratio	2.857	2	.240
Linear-by-Linear Association	1.231	1	.267
N of Valid Cases	79		

Table B.21: chi-square test results of the zones as representatives of market segments; there is no significant relationship between zones and exterior facade treatment

	Value	df	Asymptotic Significance
Pearson Chi-Square	1.797(a)	4	.773
Likelihood Ratio	2.183	4	.702
Linear-by-Linear Association	1.088	1	.297
N of Valid Cases	79		

Table B.21: chi-square test results of the zones as representatives of market segments; there is no significant relationship between zones and number of bedrooms

	Value	df	Asymptotic Significance
Pearson Chi-Square	2.243(a)	4	.691
Likelihood Ratio	3.050	4	.549
Linear-by-Linear Association	.019	1	.891
N of Valid Cases	79		

Table B.22: chi-square test results of the zones as representatives of market segments; there is no significant relationship between zones and number of stories

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	-1594439.399	1545174.202		-1.032	.305
	L.AREA	5757.734	669.716	.700	8.597	.000

Table B.23: Regression analysis results between price and size of housing units living area

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	433786.842	3796103.096		.114	.909
	EXTERIOR	10110606.579	3596749.635	.305	2.811	.006

Table B.24: Regression analysis results between price and exterior façade treatment of housing units

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	-12771688.803	3966229.332		-3.220	.002
	BEDROOM	6908864.633	1143144.442	.567	6.044	.000

Table B.25: Regression analysis results between price and number of bedrooms of housing units

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	12743663.638	1664902.392		7.654	.000
	LANDAREA	-160601.289	133013.245	-.136	-1.207	.231

Table B.26: Regression analysis results between price and land area of housing units

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	-4770126.695	22260202.834		-.214	.831
	STORIES	2610902.966	3700288.494	.080	.706	.483

Table B.27: Regression analysis results between price and number of stories of housing units

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	14382131.593	1299866.942		11.064	.000
	AGE	-1831204.670	587295.891	-.335	-3.118	.003

Table B.28: Regression analysis results between price and age of housing units

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	-17780414.860	3881204.378		-4.581	.000
	FACING	1228211.895	549352.589	.183	2.236	.028

Table B.29: Regression analysis results between price and orientation of housing units

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	7459232.485	1223206.393		6.098	.000
	DENSITY	87.236	25.682	.361	3.397	.001

Table B.30: Regression analysis results between price and population density in the census block group

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	10015008.039	1502303.588		6.666	.000
	POVERTY	163427.554	235966.534	.079	.693	.491

Table B.31: Regression analysis results between price and percentage of people under poverty level in the census block group

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	13913320.042	3513050.669		3.960	.000
	M.AGE	-94046.974	108345.932	-.098	-.868	.388

Table B.32: Regression analysis results between price and percentage of median aged people in the census block group

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	10068999.432	1636571.470		6.152	.000
	VACANCY	48167.976	82371.248	.066	.585	.560

Table B.33: Regression analysis results between price and percentage of vacant houses in the census block group

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	2833451.380	1775864.199		1.596	.115
	INCOME	151.719	31.112	.486	4.876	.000

Table B.34: Regression analysis results between price and percentage of household income of people

Model		Unstandardized Coefficients		Standardized Coefficients	t	Significance
		B	Std. Error	Beta		
1	(Constant)	-24475741.785	4894908.937		-5.000	.000
	S.ATTEND	148242.273	78687.398	.153	1.884	.064

Table B.35: Regression analysis results between price and percentage of people attending school(5-24 years)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	62306971.297	26074508.615		2.390	.019
	LITERACY	-631167.480	320198.816	-.219	-1.971	.052

Table B.36: Regression analysis results between price and percentage of literate people in the census block group

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	8409014.390	1065718.015		7.890	.000
	SCHOOL	2766.355	899.876	.331	3.074	.003

Table B.37: Regression analysis results between price and distance from nearest school from the house

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	17937988.414	3175623.507		5.649	.000
	OWNED	-137827.215	60909.241	-.250	-2.263	.026

Table B.38: Regression analysis results between price percentages of owner occupied houses in the census block group

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	12295651.566	3321866.933		3.701	.000
	RENTED	-36606.200	86813.992	-.048	-.422	.674

Table B.39: Regression analysis results between price percentages of rented houses in the census block group

APPENDIX C: Questionnaire

Interview no				
Housing unit's information				
Apartment information	Name of owner Occupation	Apartment Name	Address	Developers Name

Housing units Structural Attributes				
Square feet of house				
Exterior façade material	[ ]Brick	[ ]RCC		
No of Bedrooms	[ ] 2	[ ] 3	[ ] 4	[ ] 5
Availability of Garage				
Square feet of Parcel/Plot size				
No of Stories				
Price of the apartment per sq ft				
Year of construction				
Year of sold				
Year of finished				
Age of the house at 2008				
Orientation of the house	[ ] North/north east	[ ] South/ south-east	[ ] East	[ ] West

Housing units Neighborhood Attributes				
Population density of the area per square mile				
Percentage of people under poverty level				
Proportion of Vacant Houses				
Age of the residents	[ ]15-24	[ ]25-39	[ ]40-55	[ ]55 +
Median Household Income of the Residents	[ ] 25000-45000	[ ] 45000-75000	[ ] 75000-100000	[ ] 100000-150000+
Percentage of residents attending				

school (5-24 years)				
Name of nearest school			Distance	ft
Housing units Amenity Attributes				
Do the house have open space view	[ ]Yes	[ ]No		
If, yes which open space view does the house have	[ ]Park	[ ]Lake	[ ]Field	[ ]other
If no, would you prefer open and green space near to your home?	[ ]Yes	[ ]No		
How far do you live from this open and green space?	[ ]Very far	[ ]Far	[ ] Relatively close	[ ] Close
How long does your normal journey take?	[ ] less than 1 minutes	[ ] 1-2 minutes	[ ] 2-3 minutes	[ ] more than 5 or 10 minutes
Distance in feet from the house to the open spaces				
Is distance affects your visit to existing open and green space?	[ ] yes		[ ] No	
Size in square footage of the nearest urban recreation park				
Which size of open space do you prefer near to your home	[ ]Small neighborhood park	[ ]Urban recreation park	[ ] Communit y park	[ ] Lake side green

Name	Address	Population density sq m	% under upper poverty level	Vacant house (%)	Median age (%)	% School attendence(5-24 years)	Literacy (%)	owner occupied house	Rented house	monthly Income	Distance frm nearest school (ft)
Owner Occupiedd Houses											
Submarket 1											
Keari Mohan	Road 7A, House 58, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	238
Keari Manor	Road 12/A, House 45, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	140
Keari Manor	Road 12/A, House 45, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	140
Keari Nirjhor	Road 6/A,House 45, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	25000	190
ADDL Mianjee	Road 8, Plot 2/B Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	75000	2318.74
Urban Cove	Road 6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	195
Urban Cove	Road 6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	195
Urban Nahar	Road 4/A, Plot 38, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	470
Urban Chitronir	Road 15, Plot 18, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	25000	1044.85
Assurance	Road 9, Plot 8, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	642
Rupayan Lake Side	Road 28, Plot 32, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	532
Rupayan Lake Side	Road 28, Plot 32, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	532
Rupayan Ferdouse	Road 28, Plot 20, K block. Banani	162296	8.6	26.7	29	32.2	80.8	14.4	39.4	30000	1563.93
Mega Moonmahina	Road 05, Plot 22, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	186.36
Bay's Water Ford	Road 128, house 10, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	100000	1645.89
Bay's Naseefa	Road 10, Plot 9, Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	85000	2210.03
Green Eden	Road 13/A, House 60, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	413.51
Green Island	Road 104, House 38,Gulshan 2	37184	8.6	26.7	33.8	32.2	80.9	52.9	34.1	70000	1086.16
Green Havan	Road 13,House 115, C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	65000	1642.4
Ever Green Siraj	Road 8/A, House 48, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	770.06
Green Essence	Road 50, plot 8b, Gulshan 2	24585	8.6	26.7	30.4	32.2	82.7	33.4	54.2	55000	160.21
Green Basilica	Road 120, House 19, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	80000	850.17
Green Leaf	Road 107, House 27,Gulshan 2	37184	8.6	26.7	33.8	32.2	80.9	34.4	54.2	60000	448.49
Navana Mozibunnessa De Lake	Road 22,Plot 15,Block K, Banani	162296	8.6	26.7	29	32.2	80.8	14.4	39.4	85000	2734.11
Navana Mozibunnessa De Lake	Road 22,Plot 15,Block K, Banani	162296	8.6	26.7	29	32.2	80.8	14.4	39.4	65000	2734.11
Navana Siraj Lake Star	Road 6, Plot 32, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	1195.44
Navana Water Edge	Road 11, Plot 22, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	65000	409.85
Navana Water Edge	Road 11, Plot 22, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	409.85
Mega LakeMorage	Road 8/A, House 47, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	25000	1264.01
Mega LakeMorage	Road 8/A, House 47, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	1264.01
Rupayan Signature	Road 84, House 5B, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	80000	746.5
Rupayan Gulshan Palace	Road 86, House 6, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	75000	283.34
Rupayan Gulshan Palace	Road 86, House 6, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	60000	283.34
Aziza Green	Road 88, House 4, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	55000	477.55
Aziza Green	Road 88, House 4, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	65000	477.55
Rupayan Nilufer	Road 62, House 3, Gulshan 2	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	45000	184.68
Rupayan Nilufer	Road 62, House 3, Gulshan 2	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	70000	184.68
Rupayan Jusna Villa	Road 13, House 117,C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	35000	1631.7
Rupayan Unilodge	Road 14, House 55, B block, Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	65000	2789.53
Submarket 2											
ADDL Lake Manson	Road 105, House 19/1 Gulshan 2	37184	8.6	26.7	33.8	32.2	80.9	52.9	34.1	60000	1113.19
ADDL Raquib Aurora	Road 3/A, Plot 49, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	450
Urban Cove (W/v)	6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	28000	140
Urban Cove (W/v)	6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	32000	140
Urban Nahar (w/v)	Plot 38, Road 4/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	470
Urban Raphael	plot no 69, Road no 11/A, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	90
Urban Raphael	plot no 69, Road no 11/A, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	70000	90
Assurance	Road 5, House 25/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	60000	190
Assurance Freesia	Road 11/A, House 52/1, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	30
Assurance	Road 15, Plot 21, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	45000	402
Rupayan Casabela	Road 128, Plot 17, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	55000	1837.51
Rupayan Casabela	Road 128, Plot 17, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	65000	1837.51
Rupayan Pearl	Road 120, Plot 19, Gulshan 1	23142	8.6	26.7	33.8	32.2	76.9	61.2	24	45000	1100
Green Retreat	Road 123, House 34, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	60000	1582.86
Ever Green Meena	Road 8/A, House 48, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	20000	994.01
Green Villa	Road 83, House 1B, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	55000	998.34
Green Palace	Road 62, House 20, Gulshan 1	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	50000	867.98
Halima Green	Road 23, House 7/B, B block Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	45000	2270.07
Submarket 3											
Keari Panshi	House 43, Road 9/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	110
ADDL Asghari	Rod 13, Plot 14, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	1225.25
ADDL South Namaiyra	Plot 34/1, Road 9/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	55000	142
ADDL Marium Palace	Plot 76, Road 8/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	176
Urban Chitronir (w/v)	Plot 18, Road 15, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	330
Urban Blessing	Plot 17, Road 15, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	65000	265
Rupayan Crown Emperial	Road 5, Plot 34, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	45000	50
Rupayan Crown Emperial	Road 5, Plot 34, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	50
Rupayan Teasel	Road 108, Plot 16, Gulshan 1	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	55000	712.84
Rupayan Teasel	Road 108, Plot 16, Gulshan 1	37184	8.6	26.7	33.8	32.2	80.9	34.4	54.2	45000	712.84
Renu Lake Reviera	Road 01, House 49, Dhanmondi R/A	37184	8.6	26.7	33.8	32.2	80.9	34.4	54.2	50000	1206.68
Bay's Park Road	Road 7, House no 48, Park Road, Baridhara	40533	2.5	9	28.2	45.3	81.2	44	43.2	150000	1928.41
Bay's Arjumand	Road32 , Plot 23, Gulshan 1	22645	8.6	26.7	32.9	32.2	85.4	65.4	26.4	100000	1526.63
Green Nonee Hamid	Road 3, House 1, Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	85000	484.23
Sofia Green House	Road 6, House 49,Block C, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	55000	1726.4
Green View	Road 56, House 5, Gulshan 1	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	45000	853.61
Firoza Green	Road 17, House 67,C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	50000	2223.57
Rupayan Oak Vale	Road 08, House 60 C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	55000	1786.28
Rupayan Oak Vale	Road 08, House 60 C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	40000	1786.28
Rupayan Chandralekha	Road 23, House 23, B block, Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	50000	1575.46
Rupayan Chandralekha	Road 23, House 23, B block, Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	60000	1575.46
Bay's Naseefa	Road 10, Plot 9, Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	70000	2210.03

Legend Submarket 1 | Submarket 2 | Submarket 3

Table B.41: Housing unit's Location and Neighbourhood Variables for Owner Occupied houses

Name	Address	Population density sq ...	% under upper poverty level	Vacant house (%)	Median age (%)	% School attendence(5-24 years)	Literacy (%)	owner occupied house	Rented house	monthly income	Distance frm nearest school (ft)
Owner Occupiedd Houses											
Submarket 1											
Keari Mohan	Road 7A, House 58, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	238
Keari Manor	Road 12/A, House 45, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	140
Keari Manor	Road 12/A, House 45, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	140
Keari Nirjhor	Road 6/A,House 45, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	25000	190
ADDL Mianjee	Road 8, Plot 2/B Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	75000	2318.74
Urban Cove	Road 6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	195
Urban Cove	Road 6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	195
Urban Nahar	Road 4/A, Plot 38, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	470
Urban Chitronir	Road 15, Plot 18, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	25000	1044.85
Assurance	Road 9, Plot 8, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	642
Rupayan Lake Side	Road 28, Plot 32, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	532
Rupayan Lake Side	Road 28, Plot 32, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	532
Rupayan Ferdouse	Road 28, Plot 20, K block, Banani	162296	8.6	26.7	29	32.2	80.8	14.4	39.4	30000	1563.93
Mega Moonmahina	Road 05, Plot 22, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	186.36
Bay's Water Ford	Road 128, house 10, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	100000	1645.89
Bay's Naseefa	Road 10, Plot 9, Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	85000	2210.03
Green Eden	Road 13/A, House 60, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	413.51
Green Island	Road 104, House 38,Gulshan 2	37184	8.6	26.7	33.8	32.2	80.9	52.9	34.1	70000	1086.16
Green Havan	Road 13,House 115, C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	65000	1642.4
Ever Green Siraj	Road 8/A, House 48, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	770.06
Green Essence	Road 50, plot 8b, Gulshan 2	24585	8.6	26.7	30.4	32.2	82.7	33.4	54.2	55000	160.21
Green Basilica	Road 120, House 19, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	80000	850.17
Green Leaf	Road 107, House 27,Gulshan 2	37184	8.6	26.7	33.8	32.2	80.9	34.4	54.2	60000	448.49
Navana Mozibunnessa De Lake	Road 22,Plot 15,Block K, Banani	162296	8.6	26.7	29	32.2	80.8	14.4	39.4	85000	2734.11
Navana Mozibunnessa De Lake	Road 22,Plot 15,Block K, Banani	162296	8.6	26.7	29	32.2	80.8	14.4	39.4	65000	2734.11
Navana Siraj Lake Star	Road 6, Plot 32, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	1195.44
Navana Water Edge	Road 11, Plot 22, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	65000	409.85
Navana Water Edge	Road 11, Plot 22, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	409.85
Mega LakeMorage	Road 8/A, House 47, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	25000	1264.01
Mega LakeMorage	Road 8/A, House 47, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	1264.01
Rupayan Signature	Road 84, House 5B, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	80000	746.5
Rupayan Gulshan Palace	Road 86, House 6, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	75000	283.34
Rupayan Gulshan Palace	Road 86, House 6, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	60000	283.34
Aziza Green	Road 88, House 4, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	55000	477.55
Aziza Green	Road 88, House 4, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	65000	477.55
Rupayan Nilufer	Road 62, House 3, Gulshan 2	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	45000	184.68
Rupayan Nilufer	Road 62, House 3, Gulshan 2	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	70000	184.68
Rupayan Jusna Villa	Road 13, House 117,C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	35000	1631.7
Rupayan Unilodge	Road 14, House 55, B block, Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	65000	2789.53
Submarket 2											
ADDL Lake Manson	Road 105, House 19/1 Gulshan 2	37184	8.6	26.7	33.8	32.2	80.9	52.9	34.1	60000	1113.19
ADDL Raquib Aurora	Road 3/A, Plot 49, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	450
Urban Cove (W/v)	6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	28000	140
Urban Cove (W/v)	6/A, Plot 47, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	32000	140
Urban Nahar (w/v)	Plot 38, Road 4/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	470
Urban Raphael	plot no 69, Road no 11/A, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	90
Urban Raphael	plot no 69, Road no 11/A, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	70000	90
Assurance	Road 5, House 25/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	60000	190
Assurance Freesia	Road 11/A, House 52/1, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	30
Assurance	Road 15, Plot 21, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	45000	402
Rupayan Casabela	Road 128, Plot 17, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	55000	1837.51
Rupayan Casabela	Road 128, Plot 17, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	65000	1837.51
Rupayan Pearl	Road 120, Plot 19, Gulshan 1	23142	8.6	26.7	33.8	32.2	76.9	61.2	24	45000	1100
Green Retreat	Road 123, House 34, Gulshan 1	23142	8.6	26.7	29.7	32.2	76.9	61.2	24	60000	1582.86
Ever Green Meena	Road 8/A, House 48, Dhanmondi	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	20000	994.01
Green Villa	Road 83, House 1B, Gulshan 2	22159	8.6	26.7	53.4	32.2	82.5	34.4	54.2	55000	998.34
Green Palace	Road 62, House 20, Gulshan 1	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	50000	867.98
Halima Green	Road 23, House 7/B, B block Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	45000	2270.07
Submarket 3											
Keari Panshi	House 43, Road 9/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	30000	110
ADDL Asghari	Rod 13, Plot 14, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	50000	1225.25
ADDL South Namaiyra	Plot 34/1, Road 9/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	55000	142
ADDL Marium Palace	Plot 76, Road 8/A, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	176
Urban Chitronir (w/v)	Plot 18, Road 15, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	35000	330
Urban Blessing	Plot 17, Road 15, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	65000	265
Rupayan Crown Emperial	Road 5, Plot 34, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	45000	50
Rupayan Crown Emperial	Road 5, Plot 34, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	40000	50
Rupayan Teasel	Road 108, Plot 16, Gulshan 1	40533	2.5	9	28.2	45.3	81.2	58.5	32.8	55000	712.84
Rupayan Teasel	Road 108, Plot 16, Gulshan 1	37184	8.6	26.7	33.8	32.2	80.9	34.4	54.2	45000	712.84
Renu Lake Reviera	Road 01, House 49, Dhanmondi R/A	37184	8.6	26.7	33.8	32.2	80.9	34.4	54.2	50000	1206.68
Bay's Park Road	Road 7, House no 48, Park Road, Baridhara	40533	2.5	9	28.2	45.3	81.2	44	43.2	150000	1928.41
Bay's Arjumand	Road32 , Plot 23, Gulshan 1	22645	8.6	26.7	32.9	32.2	85.4	65.4	26.4	100000	1526.63
Green Nonee Hamid	Road 3, House 1, Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	85000	484.23
Sofia Green House	Road 6, House 49,Block C, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	55000	1726.4
Green View	Road 56, House 5, Gulshan 1	24585	8.6	26.7	35.8	32.2	86.4	45.5	46.3	45000	853.61
Firoza Green	Road 17, House 67,C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	50000	2223.57
Rupayan Oak Vale	Road 08, House 60 C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	55000	1786.28
Rupayan Oak Vale	Road 08, House 60 C block, Banani	36473	8.6	26.7	30.2	32.2	84.9	44.5	41.4	40000	1786.28
Rupayan Chandralekha	Road 23, House 23, B block, Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	50000	1575.46
Rupayan Chandralekha	Road 23, House 23, B block, Banani	52704	8.6	26.7	31.5	32.2	81.8	50.3	39	60000	1575.46
Bay's Naseefa	Road 10, Plot 9, Baridhara	10240	8.6	24.3	33.8	32.2	77.6	44	43.2	70000	2210.03

Legend	Submarket 1	Submarket 2	Submarket 3

Table B.41: Housing unit's Location and Neighbourhood Variables for Owner Occupied houses

Name	Address	Lake/Park View	Extra Cost	Nearest Park/Lake	Size of nearest Park / Lake(sqft)	Distance frm nearest Park/Lake(ft)
Owner Occupiedd Houses						
Submarket 1						
Keari Mohan	Road 7A, House 58, Dhanmondi R/A	Lake	500	Dhanmondi lake	3728736	7.73
Keari Manor	Road 12/A, House 45, Dhanmondi R/A	Lake	200	Dhanmondi lake	3728736	7.47
Keari Manor	Road 12/A, House 45, Dhanmondi R/A	Lake	200	Dhanmondi lake	3728736	7.47
Keari Nirjhor	Road 6/A,House 45, Dhanmondi R/A	Lake	250	Dhanmondi lake	3728736	0
ADDL Mianjee	Road 8, Plot 2/B Baridhara	Park	0	Baridhara Park	38794	0
Urban Cove	Road 6/A, Plot 47, Dhanmondi R/A	Lake	700	Dhanmondi lake	3728736	0
Urban Cove	Road 6/A, Plot 47, Dhanmondi R/A	Lake	800	Dhanmondi lake	3728736	0
Urban Nahar	Road 4/A, Plot 38, Dhanmondi R/A	Lake	800	Dhanmondi lake	3728736	0
Urban Chitronir	Road 15, Plot 18, Dhanmondi R/A	Park	700	Dhanmondi lake	3728736	671.4
Assurance	Road 9, Plot 8, Dhanmondi R/A	playground	500	Dhanmondi Club Playground	218976	7
Rupayan Lake Side	Road 28, Plot 32, Dhanmondi R/A	Lake	1000	Dhanmondi lake	3728736	104
Rupayan Lake Side	Road 28, Plot 32, Dhanmondi R/A	Lake	1000	Dhanmondi lake	3728736	104
Rupayan Ferdouse	Road 28, Plot 20, K block. Banani	Lake	700	Gulshan-Banani Lake	3520083	0
Mega Moonmahina	Road 05, Plot 22, Dhanmondi R/A	field	200	Dhanmondi 4 no field	62379	40
Bay's Water Ford	Road 128, house 10, Gulshan 1	Lake	1000	Gulshan-Baridhara Lake	6337108.8	0
Bay's Naseefa	Road 10, Plot 9, Baridhara	Partly,lake	1500	Gulshan-Baridhara Lake	6337108.8	216.6
Green Eden	Road 13/A, House 60, Dhanmondi	Lake	900	Dhanmondi lake	3728736	27.57
Green Island	Road 104, House 38,Gulshan 2	Lake	750	Gulshan-Baridhara Lake	6337108	0
Green Havan	Road 13,House 115, C block, Banani	Yes(field, south)	630	13/a, Hawa Bhaban Ground	61713	0
Ever Green Siraj	Road 8/A, House 48, Dhanmondi	Lake	900	Dhanmondi lake	3728736	66.75
Green Essence	Road 50, plot 8b, Gulshan 2	Lake	400	Gulshan-Banani Lake	3520083	0
Green Basilica	Road 120, House 19, Gulshan 1	Lake	900	Gulshan-Baridhara Lake	6337108	173.23
Green Leaf	Road 107, House 27,Gulshan 2	Lake	700	Gulshan-Baridhara Lake	6337108	519.23
Navana Mozibunnessa De Lake	Road 22,Plot 15,Block K, Banani	Lake	1200	Gulshan-Banani Lake	3520083	0
Navana Mozibunnessa De Lake	Road 22,Plot 15,Block K, Banani	Lake	1200	Gulshan-Banani Lake	3520083	0
Navana Siraj Lake Star	Road 6, Plot 32, Dhanmondi	Lake	900	Dhanmondi lake	3728736	133.81
Navana Water Edge	Road 11, Plot 22, Dhanmondi R/A	Lake	1000	Dhanmondi lake	3728736	30
Navana Water Edge	Road 11, Plot 22, Dhanmondi R/A	Lake	1000	Dhanmondi lake	3728736	30
Mega LakeMorage	Road 8/A, House 47, Dhanmondi	Lake	200	Dhanmondi lake	3728736	31.86
Mega LakeMorage	Road 8/A, House 47, Dhanmondi	Lake	200	Dhanmondi lake	3728736	31.86
Rupayan Signature	Road 84, House 5B, Gulshan 2	park	850	Gulshan Ladies Park	138113	0
Rupayan Gulshan Palace	Road 86, House 6, Gulshan 2	park	900	Gulshan Ladies Park	138113	283.13
Rupayan Gulshan Palace	Road 86, House 6, Gulshan 2	park	900	Gulshan Ladies Park	138113	283.13
Aziza Green	Road 88, House 4, Gulshan 2	Lake	800	Gulshan-Baridhara Lake	6337108	0
Aziza Green	Road 88, House 4, Gulshan 2	Lake	800	Gulshan-Baridhara Lake	6337108	0
Rupayan Nilufer	Road 62, House 3, Gulshan 2	park	700	Gulshan Lake Park	241002	0
Rupayan Nilufer	Road 62, House 3, Gulshan 2	park	700	Gulshan Lake Park	241002	0
Rupayan Jusna Villa	Road 13, House 117,C block, Banani	field	750	banani 6 no field	61713	0
Rupayan Unilodge	Road 14, House 55, B block, Banani	field	825	Banani 14 no field	58936	40
Submarket 2						
ADDL Lake Manson	Road 105, House 19/1 Gulshan 2	No	0	Gulshan-Baridhara Lake	6337108	211.5
ADDL Raquib Aurora	Road 3/A, Plot 49, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	130
Urban Cove (W/v)	6/A, Plot 47, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	203
Urban Cove (W/v)	6/A, Plot 47, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	203
Urban Nahar (w/v)	Plot 38, Road 4/A, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	38
Urban Raphael	plot no 69, Road no 11/A, Dhanmondi	No	0	Bangladesh Women's Sports Feder	223767	62
Urban Raphael	plot no 69, Road no 11/A, Dhanmondi	No	0	Bangladesh Women's Sports Feder	223767	62
Assurance	Road 5, House 25/A, Dhanmondi R/A	No	0	Dhanmondi 4 no field	62379	33.15
Assurance Freesia	Road 11/A, House 52/1, Dhanmondi R/A	No	0	Bangladesh Women's Sports Feder	223767	94.73
Assurance	Road 15, Plot 21, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	217
Rupayan Casabela	Road 128, Plot 17, Gulshan 1	No	0	Gulshan-Baridhara Lake	6337108	136.75
Rupayan Casabela	Road 128, Plot 17, Gulshan 1	No	0	Gulshan-Baridhara Lake	6337108	136.75
Rupayan Pearl	Road 120, Plot 19, Gulshan 1	No	0	Gulshan-Baridhara Lake	6337108	172.15
Green Retreat	Road 123, House 34, Gulshan 1	No	0	Gulshan-Baridhara Lake	6337108	125.33
Ever Green Meena	Road 8/A, House 48, Dhanmondi	no	0	Dhanmondi lake	3728736	185.31
Green Villa	Road 83, House 1B, Gulshan 2	No	0	Gulshan Ladies Park	138113	884.71
Green Palace	Road 62, House 20, Gulshan 1	No	0	Gulshan Lake Park	241002	517.59
Halima Green	Road 23, House 7/B, B block Banani	No	0	Banani Bidya Nekaton platy field	58936	742
Submarket 3						
Keari Panshi	House 43, Road 9/A, Dhanmondi R/A	No	0	Bangladesh Women's Sports Feder	223767	549
ADDL Asghari	Rod 13, Plot 14, Dhanmondi R/A	No	0	Gulshan-Baridhara Lake	6337108	139.67
ADDL South Namaiyra	Plot 34/1, Road 9/A, Dhanmondi R/A	No	0	Bangladesh Women's Sports Feder	223767	285
ADDL Marium Palace	Plot 76, Road 8/A, Dhanmondi R/A	No	0	Bangladesh Women's Sports Feder	223767	443
Urban Chitronir (w/v)	Plot 18, Road 15, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	235
Urban Blessing	Plot 17, Road 15, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	345
Rupayan Crown Emperial	Road 5, Plot 34, Dhanmondi R/A	No	0	Dhanmondi 4 no field	62379	143
Rupayan Crown Emperial	Road 5, Plot 34, Dhanmondi R/A	No	0	Dhanmondi 4 no field	62379	143
Rupayan Teasel	Road 108, Plot 16, Gulshan 1	No	0	Wonder Land Amusement Park	121778	748.29
Rupayan Teasel	Road 108, Plot 16, Gulshan 1	No	0	Wonder Land Amusement Park	121778	748.29
Renu Lake Reviera	Road 01, House 49, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	922.27
Bay's Park Road	Road 7, House no 48, Park Road, Baridhara	No	0	Baridhara Park	38794	627.37
Bay's Arjumand	Road32 , Plot 23, Gulshan 1	No	0	Gulshan-Banani Lake	3520083	282.76
Green Nonee Hamid	Road 3, House 1, Baridhara	No	0	Gulshan Lake	6337108	750.58
Sofia Green House	Road 6, House 49,Block C, Banani	No	0	6no field	61713	838.62
Green View	Road 56, House 5, Gulshan 1	No	0	Gulshan Lake Park	241002	1240.4
Firoza Green	Road 17, House 67,C block, Banani	No	0	Sainik League, plat field	61713	848.78
Rupayan Oak Vale	Road 08, House 60 C block, Banani	No	0	Banani Bidya Nekaton platy field	61713	406.08
Rupayan Oak Vale	Road 08, House 60 C block, Banani	No	0	banani 13/a field	61713	406.08
Rupayan Chandralekha	Road 23, House 23, B block, Banani	No	0	Banani club	58936	313.23
Rupayan Chandralekha	Road 23, House 23, B block, Banani	No	0	Banani club	58936	313.23
Bay's Naseefa	Road 10, Plot 9, Baridhara	No	0	Gulshan-Baridhara Lake	6337108.8	216.6

Legend Submarkert 1 | Submarket 2 | Submarket 3

Table B.42: Housing unit's Urban Amenity or Environmental Variables for Owner Occupied houses

Name	Address	Developer's Name	Living Area sqft	Exterior	Bedrooms	Garage	Land Area	Age of the House	No of Stories	Orientation	Year of Construction	Year of Finished	Year of Sold	Rent Price
Rental Houses														
Submarket 1														
Chirontoni (Lake view)	Road 12/A, House 39, Dhanmondi R/A	KSE Engineering and Technolo	2256	Brick	3	yes	25		1	6 east- lake, corner	2007	2009	2007	45000
Sun Cloud	Road 12/A, House 27/B, Dhanmondi R/A	Asset Developers	1650	Brick	3	yes	10		3	6 south-east, corner	2005	2007	2005	25000
La Casita (Lake view)	Road 12/A, House 35, Dhanmondi R/A	Asset Developers	2600	Brick	4	yes	20		2	6 east- south	2006	2008	2006	55000
Winter Lake, Fortuna(Lake view)	Road 12/A, House 31, Dhanmondi R/A	Asset Developers	1600	Brick	3	yes	20		0	6 east- south	2008	2010	2008	25000
Urban Lagon(Lake view)	Road 7/A, House 56, Dhanmondi R/A	UDDL	2400	Brick	4	yes	15		0	6 south-east	2008	2010	2008	30000
Malobika	Road 7/A, House 59, Dhanmondi R/A		1700	Brick	3	yes	10		1	6 east- south	2006	2009	2007	25000
Ahsan Apartment (Lake view)	Road 7/A, House 54, Dhanmondi R/A	Housing Design	1850	Brick	3	yes	23		1	6 south-west	2007	2009	2007	32000
Oriental Lake Resort	Road 7/A, House 50, Dhanmondi R/A	Oriental Developers	1850	Brick	3	yes	15		2	6 south-east, east-lake,corner	2006	2009	2006	32000
Silver Lake Romance Cindrella	Road 12/A, House 33/ Ka,Dhanmondi R/A	Asset Developers Ltd	1800	Brick	3	yes	15		0	6 east-south	2008	2010	2008	35000
Bashati (Lake view)	Road 12/A, House 37,Dhanmondi R/A	Sand Dome Developers	2200	Brick	4	yes	22		2	6 east-north	2006	2009	2006	48000
Submarket 2														
Chirontoni (without Lake)	Road 12/A, House 39, Dhanmondi R/A	KSE Engineering and Technolo	2040	Brick	3	yes	25		1	6 north-east	2007	2009	2007	33000
La Casita (without Lake)	Road 12/A, House 35, Dhanmondi R/A	Asset Developers	1400	Brick	3	yes	20		2	6 north-east	2006	2008	2006	30000
Winter Lake, Fortuna(without Lake)	Road 12/A, House 31, Dhanmondi R/A	Asset Developers	1200	Brick	3	yes	20		0	6 north-east	2008	2010	2008	15000
Urban Lagon(without lake)	Road 7/A, House 56, Dhanmondi R/A	UDDL	1400	Brick	3	yes	15		0	6 south-west	2008	2010	2008	14000
Ahsan Apartment (without Lake)	Road 7/A, House 54, Dhanmondi R/A	Housing Design	1545	Brick	3	yes	23		1	6 south-west	2007	2009	2007	18000
Bashati (without Lake view)	Road 12/A, House 37,Dhanmondi R/A	Sand Dome Developers	1600	Brick	4	yes	22		2	6 south-west	2006	2009	2006	32000
Adora	Road 7/A, House 62/B, Dhanmondi R/A	ANZ Properties	1500	Brick	3	Yes	15		3	6 south-west	2005	2008	2005	25000
Resottessa (A1-A5)	Road 8/A, House 54,Dhanmondi R/A	Advanced Development Ltd	3000	Brick	3	Yes	15		0	6 south-east	2007	2010	2008	42000
Resottessa (S1-S5)	Road 8/A, House 54,Dhanmondi R/A	Advanced Development Ltd	1800	Brick	3	Yes	15		0	6 south-east	2007	2010	2008	25000
Resottessa (D1-D5)	Road 8/A, House 54,Dhanmondi R/A	Advanced Development Ltd	1500	Brick	3	Yes	15		0	6 south-east	2007	2010	2008	18000
Submarket 3														
Nirjona	Road 8/A, House 52,Dhanmondi R/A	City Axis Ltd	1850	Brick	3	Yes	20		0	6 south-west	2008	2010	2008	28000
Urban Home	Road 8/A, House 48/a,Dhanmondi R/A	UDDL	1800	Brick	3	Yes	15		2	6 north-east	2006	2008	2006	25000
Nirob Nibas	Road 7/A, House 69/2,Dhanmondi R/A	Syeed Haider	1100	Brick	3	Yes	11		3	6 north-east	2005	2008	2005	15000
Cordial Homes	Road 7/A, House 69, Dhanmondi R/A	Design & Development Ltd	1850	Brick	3	Yes	15		2	6 north-west	2006	2009	2006	28000
Sunflower	Road 8/A, House 55/1, Dhanmondi R/A	The Structural Engineers Ltd	1465	Brick	3	Yes	15		2	7 west-south	2006	2008	2006	30000
Urban Tesott	Road 8/A, House 48, Dhanmondi R/A	UDDL	1600	Brick	3	Yes	20		1	6 north-east	2007	2010	2007	25000
Urban Tesott(front)	Road 8/A, House 48, Dhanmondi R/A	UDDL	2100	Brick	3	Yes	20		1	6 north-east	2007	2010	2007	30000

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Table B.40: Housing unit's Structural Variables for Rental Houses

Name	Address	Population density sq.m	% under upper poverty level	Vacant house (%)	Median age (%)	% School attendence(5-24 years)	Literacy (%)	Distance frm nearest school (ft)
Rental Houses								
Submarket 1								
Chirontoni (Lake view)	Road 12/A, House 39, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	502
Sun Cloud	Road 12/A, House 27/B, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1150
La Casita (Lake view)	Road 12/A, House 35, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	665
Winter Lake, Fortuna(Lake view)	Road 12/A, House 31, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	957
Urban Lagon(Lake view)	Road 7/A, House 56, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1704
Malobika	Road 7/A, House 59, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	197
Ahsan Apartment (Lake view)	Road 7/A, House 54, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	207
Oriental Lake Resort	Road 7/A, House 50, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	472
Silver Lake Romance Cindrella	Road 12/A, House 33/ Ka,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	807
Bashati (Lake view)	Road 12/A, House 37,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	596
Submarket 2								
Chirontoni (without Lake)	Road 12/A, House 39, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	502
La Casita (without Lake)	Road 12/A, House 35, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	665
Winter Lake, Fortuna(without Lake)	Road 12/A, House 31, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	957
Urban Lagon(without lake)	Road 7/A, House 56, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1704
Ahsan Apartment (without Lake)	Road 7/A, House 54, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	207
Bashati (without Lake view)	Road 12/A, House 37,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	596
Adora	Road 7/A, House 62/B, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	716
Resottessa (A1-A5)	Road 6/A, House 54,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	202
Resottessa (S1-S5)	Road 6/A, House 54,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	202
Resottessa (D1-D5)	Road 6/A, House 54,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	202
Submarket 3								
Nirjona	Road 6/A, House 52,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	281
Urban Home	Road 6/A, House 48/a,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	688
Nirob Nibas	Road 7/A, House 69/2,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	757
Cordial Homes	Road 7/A, House 69, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	725
Sunflower	Road 8/A, House 55/1, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	644
Urban Tesott	Road 6/A, House 48, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1279
Urban Tesott	Road 6/A, House 48, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1279
Winter Lake Fortuna	Road 12/A, House 31, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1062
Resottessa (A1-A5)	Road 6/A, House 54,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	202
Resottessa (S1-S5)	Road 6/A, House 54,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	202
Resottessa (D1-D5)	Road 6/A, House 54,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	202
Submarket 3								
Nirjona	Road 6/A, House 52,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	281
Urban Home	Road 6/A, House 48/a,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	688
Nirob Nibas	Road 7/A, House 69/2,Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	757
Cordial Homes	Road 7/A, House 69, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	725
Sunflower	Road 8/A, House 55/1, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	644
Urban Tesott	Road 6/A, House 48, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1279
Urban Tesott	Road 6/A, House 48, Dhanmondi R/A	40533	2.5	9	28.2	45.3	81	1279

Submarket 3

Table B.41: Housing unit's Location and Neighbourhood Variables for Rental houses.

Name	Address	Lake/Park View	Extra Cost	Nearest Park/Lake	Size of nearest Park / Lake(sqft)	Distance frm nearest Park/Lake(ft)
Rental Houses						
Submarket 1						
Chirontoni (Lake view)	Road 12/A, House 39, Dhanmondi R/A	lake	12000	Dhanmondi lake	3728736	0
Sun Cloud	Road 12/A, House 27/B, Dhanmondi R/A	lake	10000	Dhanmondi lake	3728736	0
La Casita (Lake view)	Road 12/A, House 35, Dhanmondi R/A	lake	25000	Dhanmondi lake	3728736	0
Winter Lake, Fortuna(Lake view)	Road 12/A, House 31, Dhanmondi R/A	lake	10000	Dhanmondi lake	3728736	0
Urban Lagon(Lake view)	Road 7/A, House 56, Dhanmondi R/A	lake	16000	Dhanmondi lake	3728736	0
Malobika	Road 7/A, House 59, Dhanmondi R/A	lake	8000	Dhanmondi lake	3728736	0
Ahsan Apartment (Lake view)	Road 7/A, House 54, Dhanmondi R/A	lake	14000	Dhanmondi lake	3728736	0
Oriental Lake Resort	Road 7/A, House 50, Dhanmondi R/A	lake	10000	Dhanmondi lake	3728736	0
Silver Lake Romance Cindrella	Road 12/A, House 33/ Ka,Dhanmondi R/A	lake	10000	Dhanmondi lake	3728736	0
Bashati (Lake view)	Road 12/A, House 37,Dhanmondi R/A	lake	16000	Dhanmondi lake	3728736	0
Submarket 2						
Chirontoni (without Lake)	Road 12/A, House 39, Dhanmondi R/A	No	0	Dhanmondi lake	3728736	0
La Casita (without Lake)	Road 12/A, House 35, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	0
Winter Lake, Fortuna(without Lake)	Road 12/A, House 31, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	0
Urban Lagon(without lake)	Road 7/A, House 56, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	0
Ahsan Apartment (without Lake)	Road 7/A, House 54, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	0
Bashati (without Lake view)	Road 12/A, House 37,Dhanmondi R/A	no	0	Dhanmondi lake	3728736	0
Adora	Road 7/A, House 62/B, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	243
Winter Lake Fortuna	Road 12/A, House 31, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	163
Resottessa (A1-A5)	Road 6/A, House 54,Dhanmondi R/A	field	0	Eidgah	16734	836
Resottessa (S1-S5)	Road 6/A, House 54,Dhanmondi R/A	field	0	Eidgah	16734	836
Resottessa (D1-D5)	Road 6/A, House 54,Dhanmondi R/A	field	0	Eidgah	16734	836
Submarket 3						
Nirjona	Road 6/A, House 52,Dhanmondi R/A	no	0	Eidgah	16734	766
Urban Home	Road 6/A, House 48/a,Dhanmondi R/A	no	0	Dhanmondi lake	3728736	681
Nirob Nibas	Road 7/A, House 69/2,Dhanmondi R/A	no	0	Dhanmondi lake	3728736	652
Cordial Homes	Road 7/A, House 69, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	647
Sunflower	Road 8/A, House 55/1, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	201
Urban Tesott	Road 6/A, House 48, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	803
Urban Tesott	Road 6/A, House 48, Dhanmondi R/A	no	0	Dhanmondi lake	3728736	803

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Table B.43: Housing unit's Urban Amenities or Environmental Variables for Rental houses

APPENDIX C: Questionnaire

Interview no				
Housing unit's information				
Apartment information	Name of owner Occupation	Apartment Name	Address	Developers Name

Housing units Structural Attributes				
Square feet of house				
Exterior façade material	[ ]Brick	[ ]RCC		
No of Bedrooms	[ ] 2	[ ] 3	[ ] 4	[ ] 5
Availability of Garage				
Square feet of Parcel/Plot size				
No of Stories				
Price of the apartment per sq ft				
Year of construction				
Year of sold				
Year of finished				
Age of the house at 2008				
Orientation of the house	[ ] North/north east	[ ] South/ south-east	[ ] East	[ ] West

Housing units Neighborhood Attributes				
Population density of the area per square mile				
Percentage of people under poverty level				
Proportion of Vacant Houses				
Age of the residents	[ ]15-24	[ ]25-39	[ ]40-55	[ ]55 +
Median Household Income of the Residents	[ ] 25000-45000	[ ] 45000-75000	[ ] 75000-100000	[ ] 100000-150000+
Percentage of residents attending				

school (5-24 years)				
Name of nearest school			Distance	ft
Housing units Amenity Attributes				
Do the house have open space view	[ ]Yes	[ ]No		
If, yes which open space view does the house have	[ ]Park	[ ]Lake	[ ]Field	[ ]other
If no, would you prefer open and green space near to your home?	[ ]Yes	[ ]No		
How far do you live from this open and green space?	[ ]Very far	[ ]Far	[ ] Relatively close	[ ] Close
How long does your normal journey take?	[ ] less than 1 minutes	[ ] 1-2 minutes	[ ] 2-3 minutes	[ ] more than 5 or 10 minutes
Distance in feet from the house to the open spaces				
Is distance affects your visit to existing open and green space?	[ ] yes		[ ] No	
Size in square footage of the nearest urban recreation park				
Which size of open space do you prefer near to your home	[ ]Small neighborhood park	[ ]Urban recreation park	[ ] Communit y park	[ ] Lake side green