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Name: Md. Sadat Khan

Supervisor: Dr Alberto Gianoli

Specialisation: Urban Environment, Sustainability & Climate Change

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Summary

Most studies on the "hedonic pricing model" focus on developing nations. In Bangladesh, several research studies shows the influence of socio economic, transportation and environmental factors on urban housing prices of Dhaka and Khulna city. Despite Chattogram being Bangladesh's second largest city and "Commercial Capital," no definitive study has been done yet. Furthermore, no study has examined the economic value of urban cultural ecosystem services and their relationship to housing rent in Bangladesh's metropolitan areas. There is a clear lack of research using HPM to assess the influence of "Cultural Ecosystem Services" on house rent in urban areas like Chattogram city. Therefore, the main objective of this study is to assess the influence of Cultural Ecosystem Services on housing rent in Halishahar Housing Estate of Chattogram City. This study was conducted within Block A & B of Halishahar Housing Estate in Chattogram city. To collect primary data for this study, a field survey was performed with the assistance of assigned interviewers, utilizing questionnaires. However, due to time and resource constraints, as well as household members' reluctance to share information in this post-COVID-19 pandemic situation, this study only has 136 samples. OLS regressions (LRM & SRM) were used to predict housing rent and measure independent variables. On different variables, LRM and SRM were compared to determine the best model for describing independent-dependent relationships. Backward regression analysis was used to determine the final HPM for this study. WILD bootstrapping was also used to explain the variation in results with a 1,000 samples. According to the findings of this research, CES has a significant influence on the determination of housing rent in the studied region. The factors that have the greatest influence on housing rent in the study area among the various CES indicators are "the distance to recreational facilities", "the amount of time spent at recreational sites", "the degree of satisfaction with recreational services", and "the quality of the scenic and attractive views from residences". In addition, there are also significant differences in house rents and the availability of CES facilities between the two study blocks. In this study, monthly housing rent was used as a proxy for housing price, but housing transaction price or land and property value could provide more evidence on the relationship between housing price and CES in an urban residential setting. Future studies can use these housing-price factors as a dependent variable in other neighbourhoods of Chattogram city. This study only covered two neighbourhood blocks due to time and resources. Therefore, it may be challenging to generalize the study's findings to the entire Chattogram region. Similar studies are recommended for Chattogram's entire city area to better understand the hedonic price model's conclusion of this study.

Keywords

Cultural Ecosystem Services, Recreational Services, Aesthetic Services, Housing Rent, Hedonic Price Model.

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Abbreviations

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
CAB	Consumers Association of Bangladesh
CBD	Central Business District
CCC	Chattogram City Corporation
CDA	Chattogram Development Authority
CES	Cultural Ecosystem Services
CI	Confidence Interval
CV	Control Variable
DOE	Department of Environment
DRM	Double-log Regression Models
DV	Dependent Variable
ES	Ecosystem Services
EUR	Erasmus University Rotterdam
HPM	Hedonic Price Model
HR	Housing Rent
IHS	Institute for Housing and Urban Development Studies
IV	Independent Variable
LRM	Linear Regression Models
NBS	Nature-Based Solutions
OLS	Ordinary Least Squares
SRM	Semi-log Regression Models
WHO	World Health Organization

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Chapter 1: Introduction

1.1 Background of the Research

The growth of physical structure, employment generation, basic service enhancement, and level of life are all benefits of planned urbanization. In contrary, uncontrolled urbanization causes urban poverty, unemployment, and pollution (Loton, 2004). In recent years, large cities like Dhaka and Chattogram have seen a fast expansion of both planned and uncontrolled urbanization (Haque et al., 2018). Rapid urbanization in Bangladesh's major cities is mostly owing to rural-to-urban migration, which accounts for the vast majority of the population growth (Hossain, 2013).

The urban population of Bangladesh was estimated at 23.1% in 2001 (Majumder et al., 2007), and at 29.38% in 2011. (BBS, 2015). Dhaka, Bangladesh's capital, is presently the earth's 17th most populated megacity, with 36,941 occupants per square kilometer (Islam et al., 2017; Akter et al., 2013; Demographia, 2021). A significant consequence of such urban expansion is a rise in demand for housing in city areas, which has a substantial influence on the housing market (Islam et al., 2020). In urban area, like Dhaka and Chattogram, the housing crisis is one of the most pressing issues. According to Consumers Association of Bangladesh (CAB) report, Dhaka's housing rent has risen by 350 percent in the previous 22 years (1990–2012) (Akter and. al., 2013). Moreover, In Dhaka, Seventy percent of the total housing stock is hired out, of which less than ten percent is provided by the public sector (Hossain, 2004).

Several factors, both directly and indirectly, can have a substantial influence on the prices of residential housing rents, including the condition of the building's structural elements, the availability of transportation and social services, the quality of the city's cultural ecosystem services, the state of the environment, and the availability of urban utility services. Many research papers have utilized the hedonic price model to illustrate the association between urban property price and variables that influence it. (Wen et al., 2005). This research intends to explore the nature and intensity of the influence of cultural ecosystem services on urban property prices such as house rent.

1.2 Problem Statement

The "hedonic price model" is often applied by researcher to analyse the influence of ecological, social, community, and transportation infrastructure on rental property values, however most studies concentrate on developed nations. In developing nations, like Bangladesh, policymakers may overlook the value of these facilities in the urban housing market, which is dominated by middle-class renters (Islam et al., 2020). Nonetheless, in Bangladesh, certain research projects have been carried out in order to demonstrate the outcome of different components on the housing price of urban areas in general.

Akter et al. (2013) explored the association of growing house rent with several important factors including structural attributes, landuse attributes, and road accessibility in Dhaka city. Moreover, Rahman et al. (2021) used the HPM technique to empirically examine the influence of transportation accessibility on house rent in Khulna city. While, Islam et al. (2020) used 04 environmental features like "ventilation", "open space", "waterlogging" & "landfill by waste" to illuminate the difference of property rents in Khulna. Aside from that, Islam (2006) utilized HPM to investigate the influence of accessibility in terms of "transportation network", "central business district", and "other significant activity centers", on the house rent of Dhaka city. Rahman (2014) also conducted a research in which he adopted HPM to evaluate the influence of various environmental amenities on the housing rent in the city of Dhaka, Bangladesh.

Furthermore, Sander & Haight (2012) argued that ecosystem services are evidently important, but the economic worth is undervalued and overlooked in developed country's planning and policy making. They further argued that by ignoring these challenges, wealthy countries like the USA also lose these services and amenities. However, Sander & Haight (2012) also use HPM to explore economic values related with "ecosystem services", particularly "cultural ecosystem services" in the form of "aesthetic quality (views)", "access to outdoor recreation" and "the benefits provided by tree cover" in USA.

In Bangladesh, the majority of studies on the application of HPM to determine economic values of different environmental and other amenities, those are only based on Dhaka and Khulna city. Despite the fact that Chattogram is Bangladesh's second biggest city and is regarded as the country's "Commercial Capital," no definitive study has been conducted in this domain as far. Moreover, no previous study has been conducted to investigate the economic values of urban cultural ecosystem services and their association with housing prices in Bangladesh's metropolitan areas. Therefore, there is a clear lack of research using Hedonic Price Model (HPM) to analyse the influence of "cultural ecosystem services" on the rent of houses in urban area like Chattogram city of Bangladesh.

1.3 Research Objective

The emphasis of this study primarily is about two intertwined issues: urban cultural ecosystem services and their influence on housing prices. The research both theoretically and experimentally has explained the influence of cultural ecosystem services on housing prices. This research looks at the association between cultural ecosystem services and house prices. To evaluate the economic value of housing rent, additional variables have been controlled, such as the house's structural features, transport accessibility attributes, environmental quality variables, and socio-economic attributes of the residents. A thorough understanding of economic value will support public policymakers make better decisions about why urban ecosystem services should be increased in the future. The research was carried out in two neighbourhood blocks of Chittagong's Halishahar Housing Estate, where cultural ecosystem services are available.

Therefore, the following is the research objective:

"To assess the influence of Cultural Ecosystem Services (CES) on housing price in Halishahar Housing Estate of Chattogram City".

1.4 Provisional Main Research Question

General research question

"To what degree does the cultural ecosystem services influence the house rent in Halishahar Housing Estate of Chattogram city?"

1.4.1 Research Sub-Questions

The research sub-questions primarily relate to the key research question. The study is conducted in two different blocks (Block A & B) of the study region, thus it is essential to examine the differences between these blocks in terms of housing rent and the current scenario of CES. Furthermore, there are a number of variables that may influence the relationship between housing rent and cultural ecosystem services in the research area. Consequently, it is also essential to consider these variables in order to explain the main research question of this study. Therefore, the sub-questions are:

1) Is there a difference in housing rent and cultural ecosystem services between Block-A and Block-B of the study area?

2) What is the association between the study area's cultural ecosystem services and house rent?
3) Do other factors (like structural elements of a property, transportation accessibility, environmental quality and socio-economic characteristics of respondents) have an influence on the house rent in the study area?

1.5 Scientific and Social Relevance of the Study

The scientific relevance of the study demonstrates the need for more studies into that specific research issue. The study should address a gap in the current scientific knowledge in order for it to be considered scientifically relevant (Vinz, 2021). Moreover, Vinz, 2021 also stated that the chosen study subjects should not have studied yet, and the topic looks to be interesting. This study has scientific relevance since it examines the relationship between cultural ecosystem services and housing prices, where the economic worth of ecosystem services has been devalued and disregarded in most developed and developing countries (Sander & Haight, 2012). Most nations are losing ecosystem services as a result of disregarding the issue. Moreover, in Bangladesh, the majority of research evaluating housing prices has been undertaken based on environmental and other features, and these studies have only been conducted in Dhaka and Khulna. Nonetheless, several scientific research has been undertaken on how environmental amenities and ecosystem services influence the price of urban real estate in industrialised nations (Sander & Haight, 2012; Crompton, 2001; Doss and Taff, 1996; Anderson and West, 2006). Moreover, no prior research has examined the economic worth of urban cultural ecosystem services and their association with house prices in Bangladesh's urban areas. However, a comprehensive knowledge of economic value can help public officials make better future judgments on why urban ecosystem services should be expanded.

It's likely that this research will help stakeholders and benefit society as a whole. In a general concept, it is known that ecosystem services in urban area offers wide range of environmental, social and health benefits (Elmqvist et al., 2015). Moreover, ecosystem services need to be considered an essential tool for spatial development and planning where interaction between local stakeholder, planners, and policy makers is inadequate (Helka, 2016). Furthermore, several scientific studies show that urban green areas have monetary benefits that may be evaluated using economic valuation methods (Elmqvist et al., 2015). This study has also demonstrated the monetary value of CES using HPM, which paints a clear picture of the benefits of having CES in the urban area for relevant stakeholders including the society.

Chapter 2: Literature Review

2.1 Introduction

This chapter covers the idea and theories of CES and HPM, as well as the relationship between CES and urban housing rents. This section also discusses other housing rent-related variables. In order to address the CES, two aspects, namely recreational and aesthetic services, have been taken into consideration. In addition to this, the correlation between CES and housing price has been explored in light of the findings from different empirical research studies. Environmental quality, transportation accessibility, structural components of the house, and the socio-economic structure of the neighbourhood also affect housing rent in any country's metropolitan area. Environmental quality, transportation accessibility, structural components of the house, and the socioeconomic structure of the neighbourhood also play a role in determining housing rent in any country's metropolitan area. This section of the article covers these topics also. In addition, a brief discussion has been made on the hedonic pricing model (HPM), which is a method that has been used in a significant number of empirical research to ascertain the value of non-market attributes in the housing market.

2.2 Concept of Urban Ecosystem Services

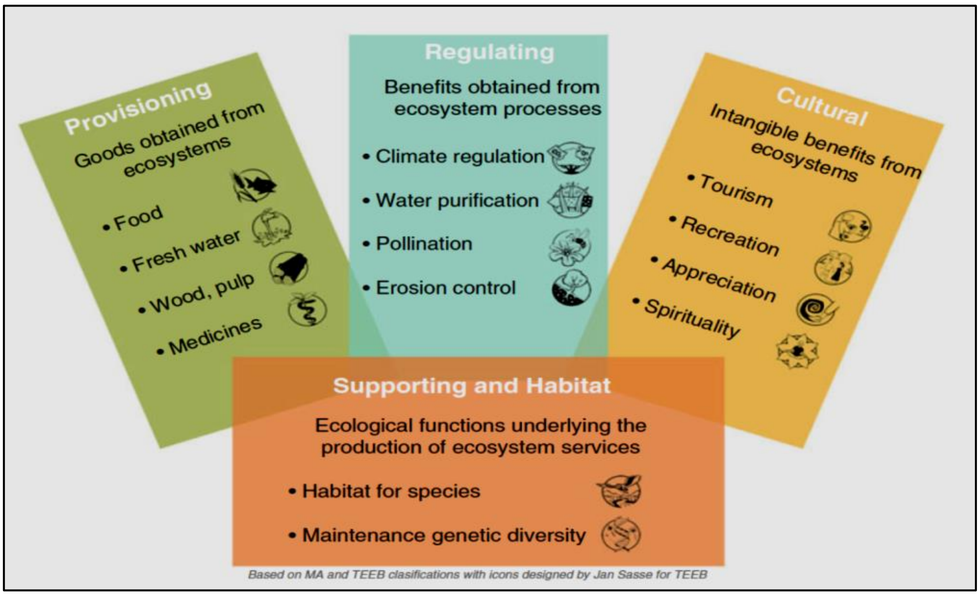
Many research have used the phrase "ecosystem services" implicitly since the 1970s, but a precise definition of ecosystem services in scientific literature was established only in the 1990s (Daily et al., 1997; De Groot, 1992). Therefore, Ecosystem services can be defined as the commodities and services that benefit human existence, both directly and indirectly as a result of the functioning of an ecosystem (Feng et al., 2012; Zhan, 2015). However, the term "urban ecosystem" refers to a specific location where people may enthusiastically live in the presence of man-made infrastructure and natural surroundings (Pickett et al., 2001). Moreover, the importance of urban ecosystems cannot be understated, since they improve air quality, reduce noise, reduce the effect of urban heat, and manage rainfall runoff. (Gómez-Baggethun et al., 2013). However, the degradation of urban ecosystem services has been occurring on a global scale as a result of excessive resource extraction, the introduction of exotic species, environmental degradation, and the impact of climate change. (Millennium Ecosystem Assessment, 2005). Hence, the idea of ecosystem services is increasingly being taken into consideration by planners and policy makers in order to promote them within the framework of urban development.

The classification of ecosystem services within an urban context has been the subject of various scientific research for many years. The *"Millennium Ecosystem Assessment"* (2005) classifies ecosystem services as,

- *Provisioning Services*- Nature may provide humans with food, fibre, genetic resources, fresh water, natural medicine, etc.
- *Regulating Services*- Benefits of ecosystem processes that regulate natural events. Services that regulate include pollination, decomposition, water purification, erosion and flood management, carbon storage, and climate regulation.
- *Cultural Services*- Nature's nonmaterial benefits. They include entertainment, aesthetic delight, health advantages, and spiritual experiences.
- *Support Services*- Ecosystem services essential for the functioning of other ecosystems, such as soil formation, water cycling, biomass generation, provision of atmospheric oxygen, and habitat provisioning, etc.

Furthermore, Gómez-Baggethun et al. (2013) also used the *"Millennium Ecosystem Assessment"* as well as the *"TEEB project"* as key categorization frameworks to classify and describe significant ecosystem services offered in urban settings (figure 01).

Figure 1: Types of ecosystem services.



Source: Gómez-Baggethun et al., 2013.

2.3 Cultural Ecosystem Services within Urban Residential Setting

"Cultural Ecosystem Services (CES)" are the input of the "nonmaterial" welfares that people gain from the natural environmental setting, and also they are essential in maintaining the human-environment interaction. Urban green and open spaces may offer a wide range of cultural ecosystem services, including leisure, aesthetic beauty, cultural learning, spiritual necessities and tourism (Gómez-Baggethun & Barton, 2013; Millennium Ecosystem Assessment, 2005), which account for a considerable share of the ecosystem services in an urban residential setting (Wu, 2013).

2.3.1 Significance of CES

The human civilization benefits from an abundance of functions and services provided by ecosystems, including ones that satisfy both material and spiritual need (De Groot, 1992). Nevertheless, perceptions of CES' importance may vary depending on where we live and the surrounding socio-economic milieu. Elwell et al. (2020) found that people with varied degrees of dependency on coastal, marine, and terrestrial provisioning ecosystem services evaluate cultural ecosystem services, notably aesthetic attractiveness, bio-diversity, and place for recreation. Furthermore, CES are held in very high esteem in civilised nations because of the psychological and recreational services they provide (Tielbörger et al., 2010). On the other hand, more importance is placed on CES in the societies of the developing world because of the significance they play in maintaining cultural identity and in safeguarding livelihood (Millennium Ecosystem Assessment, 2005). CES are not the same as the other sorts of urban ecosystem services. Therefore, for complex urban systems, CES is an absolute need. It is also essential that CES be included into the planning and development of metropolitan areas. When it comes to the design and construction of sustainable, eco-friendly and climate resilient cities, more developed economies put a larger priority on CES than less developed ones do. Moreover, in today's world, city planning absolutely must be done using the CES method. Moreover, the primary driver of CES, as opposed to other types of ecosystem services, is human experience

(Dickinson & Hobbs, 2017). This is what differentiates cultural ecosystem services from other types of ecosystem services. Furthermore, the strong connection between residents and CES increases awareness of the multi-functionality and interconnection of ecosystem elements and its importance for urban wellbeing (Sen & Guchhait, 2021).

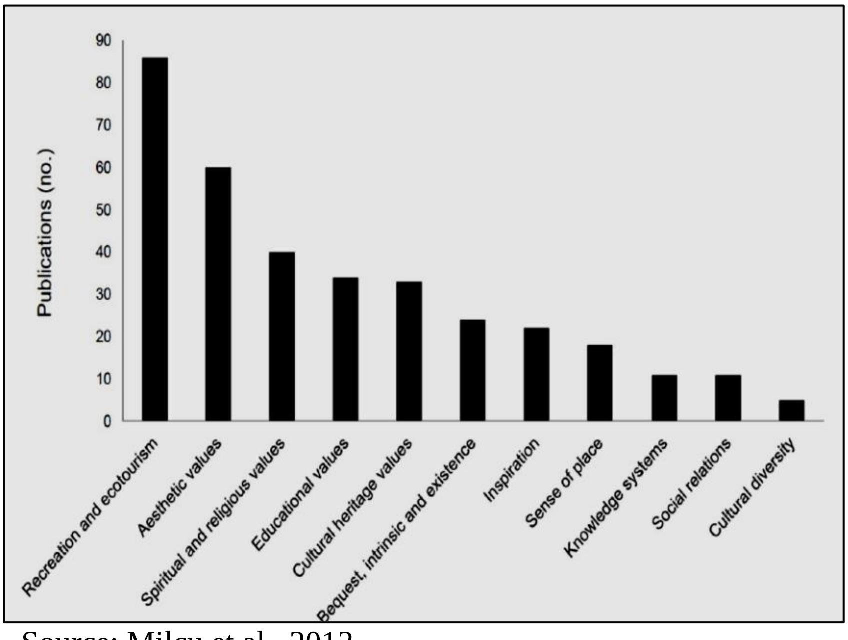
2.3.2 CES and Urban Sustainability

The concept of CES, could be an effective access point for dealing and controlling the presence of nature in urban areas (Andersson et al., 2015). Furthermore, Andersson et al. (2015) argued that CES could help introduce multipurpose ecosystems and the services they provide into urban landscapes and the thinking of urban residents and planners, thereby resolving the issue of urban sustainability. When it comes to the process of urban planning and development, CES should be given a high degree of priority consideration. Despite this, the availability of CES received a relatively low priority throughout the planning and development of the city, particularly when considering the associated advantages (Gómez-baggethun & Barton, 2013; Haase et al., 2014; Hernández-Morcillo et al., 2013). Furthermore, La Rosa et al., (2016) admitted that CES could offer great insight for urban planning and design, particularly in urban environments where culture, history, geography, and other elements play a major role for communal identity, local tradition, and cohesiveness. However, incorporating nature-based solutions (NBS) into urban planning and neighbourhood design could be a sustainable choice for enabling ecosystem services in urban residential contexts. According to Semeraro et al., (2022), including nature-based solutions (NBS) and decreasing brown development in the urban planning may increase the amount of ecosystem services in the city region, remarkably cultural ecosystem services. Since NBS promotes both climate change adaptation and mitigation, it is an innovative notion for urban planners and policy makers to support sustainable development (Semeraro et al., 2021).

2.3.3 Subcategories of Cultural Ecosystem Services (CES)

As mention before, CES are the intangible advantages that humans get from their interactions with natural environments, as described in a number of research papers. Nevertheless, Gómez-Baggethun et al. (2013) classified CES using the "Millennium Ecosystem Assessment" in addition to the "TEEB project" as essential classification frameworks (figure 01). Moreover, in a review paper on cultural ecosystem services (CES), Milcu et al. (2013) found 11 distinct subcategories of cultural ecosystem services that were reported in different scientific research papers (figure 2). In this study, however, only two forms of CES are considered, "Recreational Services" and "Aesthetic Services". The following section provides more explanation on these.

Figure 2: Subcategories of CES in different research papers.



Source: Milcu et al., 2013.

2.3.3.1 Recreational Services

The recreational features of urban ecosystems are one of the most highly valued ecosystem services in urban areas since the surroundings of the cities could be stressful for the people residing there (Gómez-Baggethun et al., 2013). Therefore, the provision of recreation services in an urban area implies the opportunity of getting benefits from a range of environmental amenities, physical infrastructures, and activities that take place outside (Biswas, 2021). Considering the environmental amenities within an urban context, different green infrastructures (neighbourhood parks, playfield, urban forest, community garden, greenery, etc.) and blue infrastructures (lakes, rivers, canals, water bodies etc.) offer a variety of recreational opportunities, ultimately promoting human happiness and wellness. Therefore, it is widely accepted that recreational ecosystem services refer to the provision of services that are influenced by recreational usage. (Kulczyk et al., 2018). In addition to this, Barton et al. (2019) asserted, “recreation services are the biotic and abiotic characteristics of open space that enable health, recuperation and enjoyment through outdoor activities”. In this way, the size, shape and functions of urban cultural ecosystems reduce mental stress, create a more pleasant living environment, and increase opportunities for outdoor activities.

2.3.3.2 Aesthetic Services

With the form, diversity, and colour, we feel that nature is attractive, a place to relax, and a place of amazing. There is no doubt that individuals' feelings influence this judgment about nature's aesthetic. Since nature's aesthetic is a non-material aspect, these ecosystem services are also classified as cultural ecosystem service (Alfaro, 2015). However, a significant number of scientific research has shown that the presence of aesthetic ecosystem services within a living environment has a significant influence on the mental and physical health of humans. Gómez-Baggethun et al., (2013) argued, “aesthetic benefits from urban green spaces have been associated with reduced stress and with increased physical and mental health”. Furthermore, Ulrich (1984) observed that a view of greenery from home could speed up the healing process after surgery. According to van den Berg et al. (2010), living near open spaces improves general health and reduces chronic anxiety. However, the aesthetic appeal and scenic quality of a natural place could suffer if its landuse is transformed in an undesirable way (Biswas, 2021).

2.3.4 Indicators to Measure CES

A variety of indicators can be applied to quantify the CES in an urban residential setting. Many scholars utilised indicators identified by Hernández-Morcillo et al. (2013) in their empirical review paper to measure the impact of CES. They also claimed that "quality of open spaces," "stress reduction by green environment," and "nature watching" are all important indicators for assessing recreational services. On the other hand, the "visual quality" of nature, the "number of scenic viewpoint" and the "views use for photos" are all essential indicators for assessing an area's aesthetic services. Therefore, Mao et al., (2020) specified several indicators to assess the CES in urban environment (Figure 03).

Figure 3: Indicators to measure the cultural ecosystem services.

CES	Indicators
Recreation	Visiting types, visiting frequency, residence time, and satisfactory recreation
Aesthetic value	Satisfactory aesthetic of the green space landscapes and plant collocation
Social relationship	Chat frequency, satisfactory neighborhood relation
Sense of belonging	Satisfactory sense of belonging
Spiritual value	Stress relieving features, Quietness of the environment

Source: Mao et al., 2020.

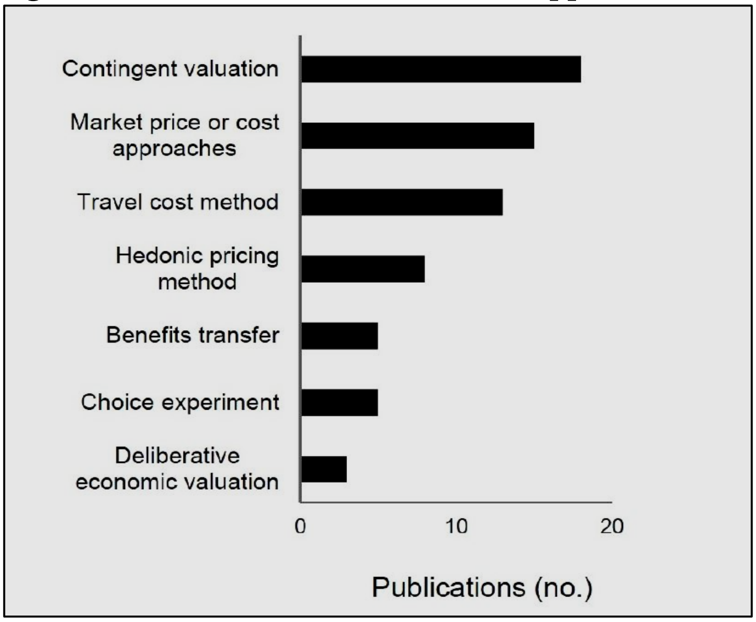
Furthermore, La Rosa et al. (2016) also found that "park visitation," "area of greenery," "proximity to open space," "number of visits," "time spent on recreational site," "public accessibility," "physical accessibility," and "number of recreation infrastructure" also were used in many scientific articles for evaluating recreational services in an urban setting. Several researchers have also utilised "scenic quality," "density of photographs," and "home's view shed" to assess recreational services within an urban neighbourhood (La Rosa et al., 2016). In addition to that, there are also several essential indications that might be used to measure the quality of aesthetic services provided within urban setting, for instance, the distance from house, the views that are utilised in photography, and so on (La Rosa et al., 2016).

2.4 Economic Valuation of Cultural Ecosystem Services

The method of determining the value of ecosystem services is challenging, and there are presently no single standard valuation guidelines in place to follow (Kaval, 2010). Furthermore, the worth given to CES is based on personal and societal estimates of their relevance to wellbeing (Kosanic & Petzold, 2020). However, CES are sometimes represented by economic indices (for instance, changes in property prices), and they are much less likely to be merchantable (Carpenter et al., 2009; Martn-López et al., 2009). The price of the goods or the cost of tickets to enter in a theatre could be used to determine a product's market value. Non-market values, on the other hand, are more difficult to track down (Kaval, 2010). Therefore, the economic value of urban ecosystem services refers to direct or indirect monetary benefits. For instance, cost reduced cost by technological intervention for pollution, cost associated with climate-related property damage, increased housing prices near environmental amenities etc. (Sutton & Anderson, 2016).

However, "the contingent valuation approach," "the trip cost method," "choice experiments," "hedonic pricing," and "the benefit transfer method" are some of the methods often employed by researchers to evaluate non-market value of ecosystem services, including CES (Kaval & Baskaran, 2013; Markantonis et al., 2012; Zhang & Fogarty, 2015). Moreover, in the review paper on cultural ecosystem services, Milcu et al. (2013) found that several scientific research articles have used or addressed economic methods to evaluate cultural ecosystem services, with some using one or several techniques (figure 4).

Figure 4: Economic valuation methods applied to CES.



Source: Milcu et al., 2013.

The ***"contingent valuation method"*** is also known as the "willingness-to-pay" or "willingness-to-accept" method (Kaval, 2010). To be more explicit, contingent valuation requires an individual to indicate the amount of money that he is prepared to pay (prepared to accept) in exchange for a change in a certain item or service (Hussen, 2012; Kahn & Kahn, 2005; Hackett, 2010).

The ***"travel expense approach"*** is an example of a stated preference method since it requires the responder to reveal more about themselves that they have really done (Kaval, 2010). In this context, individuals place a value on the amount of money that must be spent to take a certain vacation, money that they ordinarily might not have paid (Kaval, 2010; Hackett, 2010; Kahn & Kahn, 2005).

The ***"choice experiments"*** is also a stated preference method, which involve asking a responder about their preferences for different managing tactics, in each question, responders are often given three or four comparable options (Kaval, 2010; Rose et al., 2009).

The ***"hedonic pricing model (HPM)"*** is an approach of estimating an environmental resources based on the prices individuals pay for certain items (Kaval, 2010). In HPM, commonly examined prices are house/property prices, For instance, a researcher may associate the price of properties facing a neighbourhood park versus those few blocks faraway (Kaval, 2010).

The ***"benefit transfer method"*** employs secondary data due to time and/or money restrictions. In this strategy, a researcher takes existing economic appraisal evidence from one location and transfers it to a different area (Kaval, 2010; Kahn & Kahn, 2005).

In this research, the hedonic pricing model (HPM) is used to assess the influence of the CES on the price of housing in a metropolitan area. Thus, the following section describes this method in details.

2.4.1 Hedonic Price Model (HPM)

Hedonic Price Model was used in many scientific studies to determine how much ecosystem services affect housing prices. Moreover, while assessing the value of a house, HPM looks at both the internal and external aspects of that (Qiao et al., 2021). In most cases, the housing market is the focal area in which HPM is used. Since, the price of physical property (i.e., residential building or apartment) is dependent not only on the attributes of the property itself, but also on the community or the environment in which it is located (Liu & Strobl, 2022). Therefore, HPM describes *"the market price of a real estate property as a function of each tangible & intangible characteristics of that and other outside influencing factors"*, according to Monson (2009). Thus, Monson (2009) used the following equation to show this relationship:

"Market Price = f (tangible & building characteristics, other influencing factors)"

However, Chapter 3 (Section *3.6.1 Hedonic Price Model and OLS*) of this research paper provides a comprehensive discussion of the functional shape of HPM.

2.4.1.1 Benefits and Drawbacks of HPM

The capacity to predict prices based on specific options is one of the numerous benefits of the HPM, especially when applied to housing prices with easily accessible and precise data (Hargrave, 2021). Simultaneously, the strategy is adaptable enough to take into account linkages between other market components and external circumstances. (Qiao et al., 2021)

Among the limitations of HPM, is its inability to incorporate consumers' willingness-to-pay for apparent environmental variations and their consequences (Hargrave, 2021). For example, if purchasers are unaware of a polluted water supply or if they have a landfill site nearby, the property's price will not alter. A further drawback of HPM is that, it does not always take into account external variables or restrictions like "taxes", "inflation rates" and "interest rates", all of these have the potential to have a considerable influence on housing prices (Garrod & Willis, 1992).

2.5 Housing Price and Cultural Ecosystem Services

In urban residential areas, green and blue infrastructures offer diverse CES, which enhance the quality of life by encouraging more frequent visits (Aranda, 2016; Mao et al., 2020; Biswas, 2022). Additionally, the provision of cultural ecosystem services in an urban neighbourhood context is closely related to the area's housing price (Sander & Haight, 2012). According to an analysis of 30 research investigations on the influence of parks on housing prices, parks usually have a beneficial impact (Crompton, 2001). However, these influences varied approximately 10-20% of total housing prices and ranged 500-2000 feet (150-610 m) from parks, depending on park features (Sander & Haight, 2012).

Jim & Chen (2006) identified the value of ecosystem services provided by urban green spaces & water bodies, as well as the value of good environmental quality in Guangzhou, China. However, investors and authorities in China had not convincingly incorporated these characteristics into housing pricing and associated decisions (Jim & Chen, 2006). They found that “window orientation”, “green-space view”, “floor height”, “closeness to urban forest areas and water bodies”, and “traffic noise” affect residential house price in Guangzhou (Jim & Chen, 2006). They reported, *“A view of green spaces and proximity to water bodies significantly increased the housing price by 7.1% and 13.2%, respectively”*. Whereas, *“windows with a southern orientation with or without complementary eastern or northern views added 1% to the price”*. Additionally, “proximity to nearby wooded area without public access was not significant, conveying the rational attitude in hedonic behaviour” (Jim & Chen, 2006).

Doss and Taff (1996) also explored the influence of wetland type and locality on housing prices in Ramsey County, Minnesota, USA. Their studies show that living near a marsh or lake adds from $99 and $145 (1990 US$) to a home's estimated worth, while a lake view adds about $45,950. Hence, the selection of a housing site within an urban area is significantly influenced by the characteristics of the natural landscapes of the surrounding area (Tyrväinen and Miettinen, 2000). Moreover, Tyrvainen and Miettinen (2000) did an empirical study to determine the influence of urban forests on Salo, Finland's property prices. According to their findings, *“a one kilometer increase in the distance to the nearest forested area leads to an average 5.9 percent decrease in the market price of the dwelling; furthermore, dwellings with a view onto forests are on average 4.9 percent more expensive than dwellings with otherwise similar characteristics”*.

Anderson and West (2006) as well looked at the influence of closeness, nature, and extent of public space on housing prices in the United States. According to their research, access to neighbourhood and parks, wetland, and canals enhances a house's price by 0.0035 percent to 0.0342 percent for every one percent reduction in distance.

Cho et al., (2008) also utilised the HPM framework to investigate the influence of urban green space on the housing market of United States. They found that the "size, closeness, spatial layout, and species composition of open space" in an urban region has a considerable influence on the research area's housing price. Therefore, housing prices in core urban regions are greater than those in locations with less green space due to the availability of ecosystem services supplied by seasonal and mixed trees, larger forest chunks, and well-maintained urban forest patches (Cho et al., 2008). Additionally, Troy and Grove (2008) reported that the housing market in the United States places a positive value on the vicinity to parks.

2.6 Other Factors Influencing the Housing Price

Despite the fact that there is a substantial correlation between CES and house rent, various studies have also demonstrated that there are a number of additional variables, that have also significant influence on the price of a property in urban areas (refer to Appendix 2). These variable includes, the presence of urban utility facilities, accessibility to different urban facilities (i.e. CBD, hospital, commercial activities, educational facilities etc.), house’s structural property, transport accessibility (distance from main road, connecting road, public transport station), socio-economic dimension of neighbourhood and environmental quality (air and sound quality, water logging, landfill by waste) (Akter et al., 2013; Aranda, 2016; Rahman et al., 2021; Kolbe & Wüstemann, 2014; Hussain et al., 2019; Islam et al., 2020; Sharmin, 2013; Islam, 2006; Rahman, 2014).

2.6.1 House's Structural Features

In the urban housing market, one of the most significant elements that influences the price of a house is its structural features. These factors include the total floor area, number of rooms, construction type or materials of the buildings, age of the structures, and so on. In general, housing rent is the expense incurred by a tenant who requires a specific amount of room or space for a specified period of time (Ojetunde et al., 2012). However, the tenant-landlord interaction shapes the market's rental rate trends and occupancy levels (Keogh, 1994; Geltner et al., 2007).

Zoppi et al. (2015) used several indicators under structural features (e.g. "unit size, distance from the shoreline, the building age, the apartment level and the maintenance level") of housing units to determine the housing price in their paper. Along with other market-driven factors, these structural features are seen as the most important factors in figuring out how much a housing lot is worth.

Moreover, several researchers also used HPM to assess the effect of non-market elements in influencing housing price; where, in the most of scientific research studies, the house's structural characteristics have been considered as control variables in order to determine the best regression model that explains the most (Akter et al., 2013; Rahman et al., 2021; Kolbe & Wüstemann, 2014; 18. Hussain et al., 2019; Islam et al., 2020; Sharmin, 2013; Yasmin, 2017; Hussain et al., 2021; Bashar, 2012; Nazir et al., 2015; Selim, 2008).

2.6.2 Transport Accessibility Attributes

Transportation and landuse are interlinked components of the urban planning and development process. Therefore, transportation planning choices influence the landuse growth trend, and landuse influence the mobility pattern of the city (Rahman et al., 2021). Moreover, numerous studies over the last several years indicate that the city transportation infrastructure has a greater influence on social views and the socioeconomic development of the city (Acheampong and Silva 2015).

Rahman et al. (2021) revealed that transport accessibility is a major rent determinant for housing market. In their location of research study, Khulna, Bangladesh, "distance to the CBD" and "main roads" have a significant impact on the rental of the house. Therefore, residences near the CBD spent more monthly house rent than others are. Major highways raise the home rent by improving access to city sites (Rahman et al., 2021).

In addition, Brécard et al. (2018) found in their empirical study that closeness to the town center in Nantes Métropole, France also raises housing prices. Nevertheless, the public transportation network had no substantial impact on housing prices in the same research location. In Wuhan, China, however, a one-unit rise in proximity between highways reduces housing prices by 8.8 percent to 25.4%, indicating that residents of this city consider avoiding traffic noise by residing in distant from major highways (Tang & Wang, 2017).

Famuyiwa and Babawale (2014) used HPM to assess the value of various types of physical infrastructure involved in rental properties (i.e. Residential house). In their regression model, they also employed other transport accessibility features (such as "Distance to CBD, shopping centre, and recreation centre") as independent variables to predict the value of the dependent variable (house rent). They observed that these transport accessibility features influence the rental rates of residential houses, so those who live in houses with greater transport accessibility usually pay a premium.

2.6.3 Environmental Quality Variables

There have been a number of HPM studies conducted to estimate the implicit costs for the influence of environmental pollution on housing price, such as water, air, and sound pollution (Michael et al., 2000). In addition, Michael et al. (2000) reported that the rent for houses with clearer water is considerably higher than the rent for other dwellings.

Shinozaki et al. (2019) argued that environmental variables have an influence in the choosing of housing and the setting of rental rates in urban areas. They also discovered that the cost of housing in areas of Japan with greater air quality is higher than the cost of housing in other parts of the country (Shinozaki et al., 2019). In addition, Murdoch & Thayer (1988) conducted an empirical research to determine the impact of metropolitan air quality on property prices. The "visibility in miles" was used to describe the environmental quality of the research region, and visibility data were collected at airports inside the study area for one year. The research indicated that houses in areas with greater visibility are more costly than those in other areas, indicating that improved air quality results in a higher rental price in the study location (Murdoch & Thayer, 1988).

However, in another study, it is found that proximity to noise exposure did not influence “willingness-to-pay” for house price in Guangzhou, China, which implies acceptance of the persistent environment annoyance in the compact metropolis (Jim & Chen, 2006). Moreover, Rahman et al. (2021) also observed in their research that the magnitude of the effects of air and noise pollutions is less significant than other elements of the neighbourhoods, such as transportation attributes and home structure characteristics.

2.6.4 Socio-Economic Structure

When it comes to deciding where people choose to live, one of the most significant considerations to take into account is the socio-economic structure of the society. The results of a large number of empirical research analysed by HPM reveal that the various socio-economic attributes (i.e. *“demographic structure, age, gender, household income level, employment status etc.”*) have a substantial influence in shaping housing rent in the urban area (Wen et al., 2005; YAN & ZHANG, 2006; Rahman et al., 2021; Hussain et al., 2019; Sharmin, 2013). Moreover, People often pick their housing rent range depending on their income level, despite the fact that there are several additional factors to consider when selecting housing alternatives among various rent levels. For instance, residents are often compelled to exceed their budget for housing due to locational, environmental, and other factors. This is especially prevalent in metropolitan regions. However, in this study, the influence of socioeconomic structure on housing rent, as well as other associated characteristics, is examined within the study region to identify the level of influence on housing rent.

Following the end of the literature review, the research concluded that cultural ecosystem services (CES) are one of the most significant factors that are not determined by the market when determining housing rent in an urban residential context. Furthermore, previous empirical research reveals that the use of HPM to quantify the value of CES might vary according to the preferences and perspectives of urban residents. However, the valuation of non-market features or external factors and dynamics of the housing market is always crucial, despite the fact that a single study outcome cannot be generalised to all geographic regions. Since, CES may appear on a variety of forms and arrangements, its availability and quality might change depending on the particular geographical region. Furthermore, rather than assessing CES, many researches in this area focuses on estimating the value of different environmental amenities within an urban neighbourhood. In addition, other variables such as transportation accessibility, environmental quality, home structural characteristics, and the socio-economic dimension of the neighbourhood are shown to be key predictors of housing rent in the urban region, found in the literature review. Consequently, the relevance of this research topic, the scarcity of prior research on the subject of CES and its influence on housing rent all emphasise the need for this study.

2.7 Conceptual Framework

The preceding sections provide a summary of the primary concepts contained in the conceptual framework of this study in order to clarify their connections.

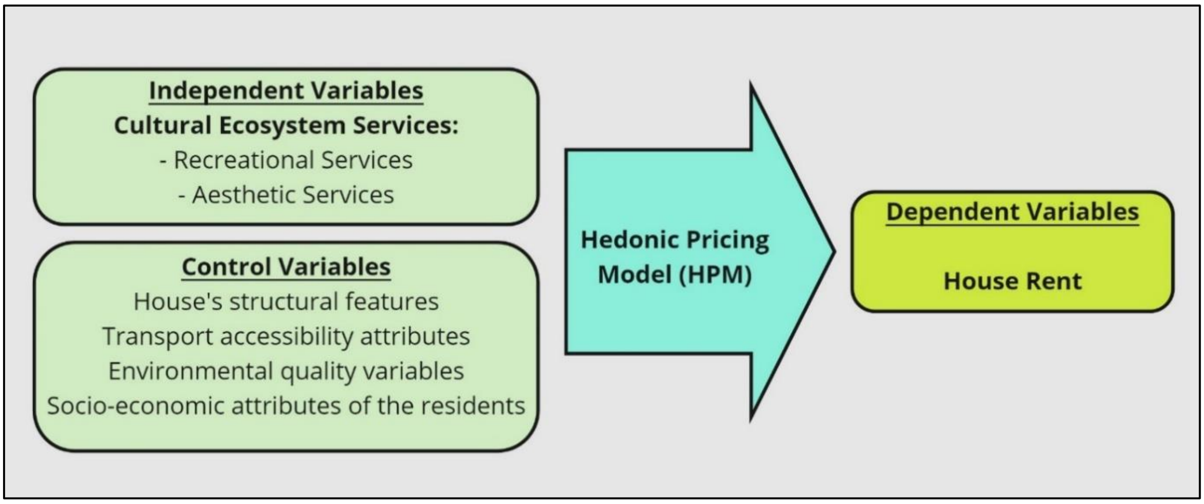
Cultural Ecosystem Services (CES) is one of the two major ideas under consideration, and it serves as the independent variable that has definite influence on the second notion and dependent variable, House Rent (HR).

In addition to that, the research is carried out in two distinct neighbourhood blocks within the area of the study (Block A & B). The difference between these two neighbourhoods could be observed in terms of the cultural ecosystem services (IV) provided as well as the house rent (DV).

Another type of independent variable referred as control variables (CV) (house's structural features, transport accessibility attributes, environmental quality variables, and socio-economic attributes of the residents) have been also used to measure the house rent in urban areas.

The influence of independent variables on dependent variable has been be evaluated and measured by the Hedonic Pricing Model (HPM), which works as a method. It is shown in the conceptual framework (refer to figure 03). Notably, its inclusion in major conceptual frameworks informs how their interaction are researched and reported.

Figure 5: Conceptual Framework.



Source: Author, 2022

Chapter 3: Research Design and Methodology

3.1 Introduction

This chapter discusses the operationalization and research design, utilised to answer the research questions and achieve the study's research objectives. To begin, the research question was amended at the beginning of the chapter after an extensive literature review in Chapter 2. The operationalization table was used to construct the variables and indicators. After then, the research strategy for this study was explained in this chapter. Following that, this section also discussed data collecting tools and methods, the study's sample size, sampling method, data processing, data analysis approach and limitation of the study. The reliability and validity of this study were also addressed in the last section of this chapter.

3.2 Operationalization: Variables and Indicators

In this research, there are two primary ideas that have been described in the conceptual framework section: "Cultural Ecosystem Services" and "Housing Rent." Both of these concepts have been covered in the conceptual framework section. Based on the indicators, it is feasible to operationalize each individual notion in turn. The variables and indicators used in this study were derived from the literature research (Sander & Haight, 2012; Doss and Taff, 1996; Anderson and West, 2006; Akter et al., 2013; Aranda, 2016; Rahman et al., 2021; Kolbe & Wüstemann, 2014; Hussain et al., 2019; Islam et al., 2020; Sharmin, 2013; Islam, 2006; Rahman, 2014). In order to get a specific outcome from any type of social study, indicators are necessary. As defined by Menon & Wignaraja (2009) in the UNDP's *"Handbook on planning, monitoring and evaluating for development results"*, that indicators need to be "specific," "measurable," "achievable," "relevant," and "time-bound," or, in other words, "SMART" indicators.

To measure the CES (independent variables), several indicators has been considered under "recreational services" and "aesthetic service". In contrast, the "monthly house rent" has been used as an indicator to estimate the "housing rent" (dependent variable). Furthermore, based on the literature review, control variables seem to be equally important in determining the influence on housing prices in urban areas. Therefore, related other related variables has been used in this research as control variables. The table 01 shows the detail indications for each control variable.

Table 1: Operationalization table.

Types of Variable	Variables	Indicators	Unit of Measurement	Data Type	Expected Relationship to Dependent Variables	Literature Source
Dependent Variable (Housing Price)	**House Rent**	Monthly House Rent	BDT	Continuous	N/A	Akter et al. 2013; Rahman et al., 2021; Hussain et al., 2019; Islam et al., 2020; Sharmin, 2013; Islam, 2006; Rahman, 2014; Bashar, 2012
Independent Variable (Cultural Ecosystem Services)	**Recreational Services**	Availability of Recreational Facilities	0 or 1	Binary	Positive	Casalegno et al., 2013; La Rosa et al., 2016; Brandt et al., 2014; Sander & Haight, 2012; Gómez-Baggethun & Barton, 2013; Mao et al., 2020
		No. of Recreational Facilities	Frequency	Continuous	Positive	
		Distance to Nearest Park/ Playground/ Water Bodies from Home	Meter	Continuous	Negative	
		The Visit's Purpose	Category	Categories	Indeterminate	
		Frequency of Visit	Likert (1 to 5)	Categories	Positive	
		Residence time per Visit	Hours	Continuous	Positive	
		Satisfaction Level with Recreational Facilities	Likert (1 to 5)	Categories	Positive	
	Aesthetic Services	Level of greenery within neighbourhood (to offer scenic view or beauty)	Likert (1 to 5)	Categories	Positive	
		Level of scenic and aesthetic view from home/ residence.	Likert (1 to 5)	Categories	Positive	
		Level of satisfaction with aesthetic services (scenic and aesthetic view) from home/ residence.	Likert (1 to 5)	Categories	Positive	

Types of Variable	Variables	Indicators	Unit of Measurement	Data Type	Expected Relationship to Dependent Variables	Literature Source
		Frequency of Using Camera to take photographs	Frequency	Continuous	Positive	
Control Variable (Other Factors)	**House's Structural Features**	Total Floor Space	Square Meter	Continuous	Positive	Akter et al., 2013; Rahman et al., 2021; Kolbe & Wüstemann, 2014; 18. Hussain et al., 2019; Islam et al., 2020; Sharmin, 2013; Yasmin, 2017; Hussain et al., 2021; Bashar, 2012; Nazir et al., 2015
		No. of Bedroom	Frequency	Continuous	Positive	
		No. of Bathroom/Toilet	Frequency	Continuous	Positive	
		Type of House/ Building	Category	Categories	Indeterminate	
		Age of the building	Category	Categories	Negative	
		No. of Balconies	Frequency	Continuous	Positive	
	Transport accessibility attributes	Distance to CBD (Agrabad Commercial Area)	Meter	Continuous	Negative	Akter et al., 2013; Aranda, 2016; Rahman et al., 2021; Hussain et al., 2019; Islam et al., 2020; Sharmin, 2013; Islam, 2006; Rahman, 2014; Yasmin, 2017; Hussain et al., 2021; Bashar, 2012; Nazir et al., 2015; Łaszkiewicz et al., 2022
		Distance to Kitchen Market	Meter	Continuous	Negative	
		Distance to Religious Facilities (Mosque/Temple/Church)	Meter	Continuous	Negative	
		Distance to Educational Facilities (Primary School)	Meter	Continuous	Negative	
		Distance to Health Care Facilities (Clinic/ Hospital)	Meter	Continuous	Negative	
		Distance to Main Road	Meter	Continuous	Negative	
		Width of the Connecting Road	Meter/ Feet	Continuous	Positive	
	Environmental quality variables	Indoor Air Quality	CO_2 (ppm)	Continuous	Negative	Rahman et al., 2021; Islam at al., 2020; Aranda, 2016; Rahman, 2014;
			PM2.5 (ug/m3)	Continuous	Negative	
			PM10 (ug/m3)	Continuous	Negative	
		Indoor Sound Level	dB	Continuous	Negative	

Types of Variable	Variables	Indicators	Unit of Measurement	Data Type	Expected Relationship to Dependent Variables	Literature Source
		Level of Water Logging	Likert (1 to 5)	Categories	Negative	Sharmin, 2013; Łaszkiewicz et al., 2022
	Socio-Economic structure	Monthly Household Income	BDT	Continuous	Positive	Rahman et al., 2021; Hussain et al., 2019; Sharmin, 2013
		Gender the Respondent	Gender Type	Categories	Indeterminate	
		Educational Level	Degree	Categories	Indeterminate	
		Employment type	Category	Categories	Indeterminate	
		Duration of living in house	Year	Categories	Indeterminate	
		Duration of living in Neighbourhood	Year	Categories	Indeterminate	

Source: Author, 2022

3.3 Research Strategy

Residents of the Halishahar Housing Estate in Chattogram, who live in rented housing, are the target population for this research study. The target group is comprised of people who are 18 years and above. There are seven blocks inside the Halishahar Housing Estate in Chattogram, and two of these blocks (A and B block) was selected to be the focus of the research investigation. The differences between these blocks (A and B block) in terms of CES and housing rent have been analysed, and the results of these comparisons have been used to provide an answer to the sub-research question of the study.

Moreover, Halishahar Housing Estate is one of the planned residential areas of the Chattogram city, covering an area of 51.24 square kilometers (12,662 acres) and having a population of 222,697 people (Muhammadi, 2017).

In this study, survey methods has been employed, since they are more ideal for exploring the broad scope of this particular research and are beneficial for data collection, analysis, and interpretation. To collect primary data for this research study, a field survey was performed with the assistance of assigned interviewers, utilizing questionnaires.

3.4 Data Collection, Sampling and Sample Size

3.4.1 Data Collection Techniques

To collect primary data from the household-based questionnaire survey, a predefined set of questions has been developed by incorporating various related data, such as housing rent patterns, recreational service availability, aesthetic service availability, transportation accessibility attributes, structural features of the home, environmental quality variables, and the socioeconomic structure of the study area. A pilot field survey was conducted to examine the questionnaire with a small number of respondents before the final survey. A web-based and android-based application called "KoBoToolbox" and "KoboCollect" were used in the trial and final survey to monitor the entire survey process and ensure data collecting quality. To construct the research area map, some secondary databases like GIS database and other related information has been collected from CDA (Chattogram Development Authority). As secondary sources, relevant newspaper and online databases was explored to comprehend the study area's current situation.

3.4.2 Sampling Technique and Sample Size

Probability sampling method has been used for this study. Furthermore, simple random sampling technique was used to collect primary data in the Questionnaire Survey. As mentioned before, the survey was conducted within the two blocks (A and B block) of Halishahar Housing Estate of Chattogram. Despite the fact that the total population of Halishahar Housing Estate is 222,697 persons (Muhammadi, 2017), no information on the population of any block in the research area has been found so far. Moreover, the general thump rule for sampling is that it should represent 20% of the total population (Van Thiel, 2014). The Cochran formula has typically been used to estimate the ideal sample size for minimizing error while also maximizing externality. Naing et al. (2006), on the other hand, pointed out that the Cochran formula is as follows:

$$n = \frac{z^2(pq)}{e^2}$$

Where, n = sample size; z= standard error of the confidence level (1.962); p= expected percent of the population (0.5), here p is unknown, hence the maximum proportion of p is assumed as 0.5; q= 1.00-p (0.5) and e= error term (0.05). However, the acceptable margin of error in social research is 5%. (Kotrlik & Higgins, 2001).

$$n = \frac{1.962^2(0.5 * 0.5)}{0.05^2} = 384.16$$

Therefore, the sample size is 384.16 or 384 people, according to the beforehand given calculation. However, this study has only 136 samples due to time and resource constraint, and household members' reluctance to share information in this post-COVID-19 pandemic situation.

3.5 Data Analysis Method

3.5.1 Hedonic Price Model and OLS

Following Rosen's (1974) introduction of this novel method of estimating asset value, HPMs have been commonly applied by different scholar. According to HPM's fundamental principle, most people pick their housing locations depending on home and community features which have a substantial impact on houses value (Jin & Rafferty, 2018). To examine how urban features, particularly CES, influence housing prices in the study area, the statistical analysis model (HPM) was performed utilising the primary data. The influence of a particular factor on the price of a product or service can be determined using the HPM method. Methodologically, HPM is applied to evaluate each independent and control variable's influence (i.e., cultural ecosystem services, house's structural features, transport accessibility attributes, environmental quality variables, or socio-economic attributes of the residents) in calculating the dependent variable (i.e., house rent) (Rahman et al., 2021). In this instance, HPM can be used to investigate the influence of each independent variable on the dependent variable (home rent) by controlling other related variables. Therefore, HPM was used in this study in order to determine the influence of cultural ecosystem services and other related factors on housing rent. Successively, using the results of the OLS regression, β coefficients would be determined to indicate the level to which an independent variables contributes to the overall explanation of housing rent in the study area. Here, the OLS model was developed utilising the operationalization table variables (see Table 1), which comprise four sets of control variables validated by the literature as having an influence on housing rent (refer to table 1 & appendix 2).

Hence, an HPM can be written in a variety of ways as Eq. (i) or (ii) to indicate the association between independent (X) and dependent variables (H) (Rahman et al., 2021). Furthermore, Eq. (i) or (ii) can also be defined as a “Linear Regression Model (LRM)” of HPM.

$$Y = f(X_1, X_2, X_3, X_4, X_5) + \varepsilon \qquad (i)$$

or

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5\ \varepsilon \qquad (ii)$$

Where, Y= House Rent; X_1= Cultural ecosystem services; X_2= House's structural features; X_3= Transport accessibility attributes; X_4= Environmental quality variables; X_5= Socio-economic attributes of the residents; β_0= Constant/ Intercept; $\beta_1, \beta_2, \beta_3, \beta_4$ & β_5= Coefficient of independents variables consider in the model, which indicate their influence on house rent; ε= Error term, this refers to other variables are not included in the equation but may influence the house rent.

Aside from that, there are two further forms of HPM that are often applied by many researchers in their studies to examine the association between housing price and other independent variables (refer to Appendix 2), these are “Semi-log Regression Model (SRM)” and “Double-log Regression Model (DRM)” as Eq. (iii) and (iv). However, it is not obvious from the literature review that which HPM form is the optimal one for examining the association between variables. Therefore, both linear and semi-log regression has been employed in this study to determine the best-fitting model for examining the associations between housing rent and independent variables.

$$log\ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5\ \varepsilon \qquad (iii)$$

$$log\ Y = \beta_0 + \beta_1 logX_1 + \beta_2 logX_2 + \beta_3 logX_3 + \beta_4 logX_4 + \beta_5 logX_5\ \varepsilon \qquad (iv)$$

In this research, OLS regressions (LRM & SRM) were used to predict dependent variable (housing rent) and measure the influence of independent variables (β coefficient). Moreover, on different variables, HPM "linear regression" and "semi-log regression" were compared to determine the optimum model for describing the influences of independent variables on dependent variables (housing rent). To identify the model's functional form, R-square was used to evaluate its ability to explain the link between dependent and independent variables. "Stepwise regression model" was utilised to identify the best housing rent regression model. Multicollinearity tests were also performed to determine regression model errors. It is important to note that different types of software, such as SPSS and Microsoft Excel, were utilised in order to carry out the statistical analysis.

3.5.2 Backward and Bootstrapping Regression Model

To find out the final HPM (regression model) for this research, backward regression analysis was used, which can explain the strongest association of independent variables (CES, house structural features, transport accessibility attributes, environmental quality, socioeconomic state) with the dependent variable (house rent). Backward regression removes insignificant variables while regressing multiple variables. Backward regression is a kind of multiple regression in which the least significant variable is excluded at each step of the procedure, leaving only the most significant variables to explain the distribution; In contrast, this regression requires simply normally distributed data (or residuals) and no association between independent variables (multicollinearity) (School of Geography, University of Leeds, 2022). In addition, WILD bootstrapping was applied in the final HPM model, using SPSS, in order to explain the variation in results with a sample size of 1,000. In the context of regression models, the wild bootstrap is the suitable bootstrap approach for interpretations that is resilient to heteroscedasticity of an unknown type (Flachaire, 2005).

3.6 Reliability and Validity of the Study

The principles of reliability and validity are used to assess the quality of research. They represent the precision of a research method or a test. Validity refers to the precision of a measure, whereas reliability refers to the consistency of a measure (Heale & Twycross, 2015). In quantitative research, Heale & Twycross (2015) also argued that reliability and validity should be taken into account when selecting a research design, data analysis tools, and interpretation of the analysed data. In survey-based research, the development of questionnaires is crucial for achieving validity and reliability. Van Thiel (2014) argued that questionnaires can be affected by the operationalization of variables, non-response of research units, and respondent response preferences. In this study, validity and reliability has been achieved by developing the questionnaire in light of operationalization of variables, includes all key research aspects for decent findings. Therefore, questionnaires were constructed by including control elements (i.e., the use of the multiple-choice & Likert scale) and preserving the integrity of the replies. In addition, the questionnaires can be considered reliable as it might generate comparable results when employed under similar conditions in a different investigation. Moreover, Van Thiel (2014) believes that if variables are analysed more precisely and regularly, the findings will be more consistent.

3.7 Challenges and Limitations of the Study

The most significant challenges of this study is that its findings cannot be generalized since they may differ throughout cities in Bangladesh, as each city has its unique characteristics based on its functioning and contribution to the national economy. For instance, Dhaka is the capital city of Bangladesh, but Chattogram is renowned as the country's port city and economic hub. Khulna, on the other hand, is an industrial city, while Rajshahi is known as the country's educational city. Furthermore, owing to time and budget constraints, field data collection was also a significant challenge. It was difficult to get access to the household to perform the survey because of the social stress that had resulted from the COVID-19 pandemic. It is generally accepted that increasing the number of samples in a survey provides more credible statistical results and helps in establishing the representativeness of the study's findings. In addition, it has already been mentioned that there is no ideal HPM model that provides the greatest representation of analysis, but this study provides substantial empirical evidence on the relationship between housing rent and other independent variables.

Chapter 4: Data Analysis and Results

4.1 Introduction

This part focuses on the research results obtained from the survey questionnaire delivered during the field investigation in the study area's two neighbourhoods, A-Block and B-Block. Descriptive statistics including frequency, percentages, mean scores, median scores, and standard deviations are used to analyse the findings of the research. Moreover, this part also includes an analysis of the study's dependent and independent variables using various inferential statistics including the t-test and correlation. Regression analysis is the focus of this section's later part, which attempts to explore the pattern and magnitude of an independent variable's effect on a dependent variable. Finally, using the backward regression model, an HPM is constructed to explain the housing rent (dependent variable) of the study area.

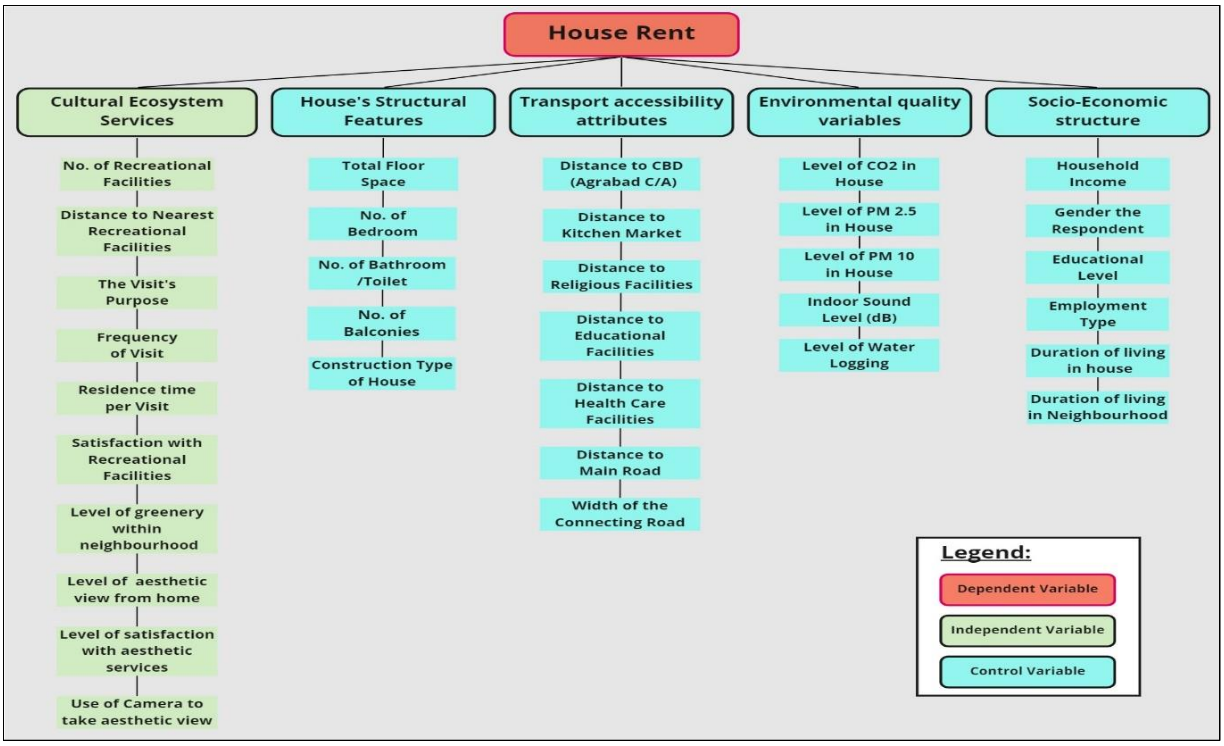
4.2 Overview of the Study Area

Chattogram is the second largest city of Bangladesh with an area of 155.40 sq.km. and population of 73,00,000 (BBS, 2011), which is also considered as a commercial capital of the country. In Chattogram, Halishahar Housing Estate is one of the planned residential area, covering an area of 51.24 square kilometers (12,662 acres) and having a population of 222,697 people (Muhammadi, 2017). There are seven blocks inside the Halishahar Housing Estate in Chattogram, and two of these blocks (A and B block) was selected to be the focus of the research investigation (Map 1).

4.3 Description of the Dependent and Independent Variables

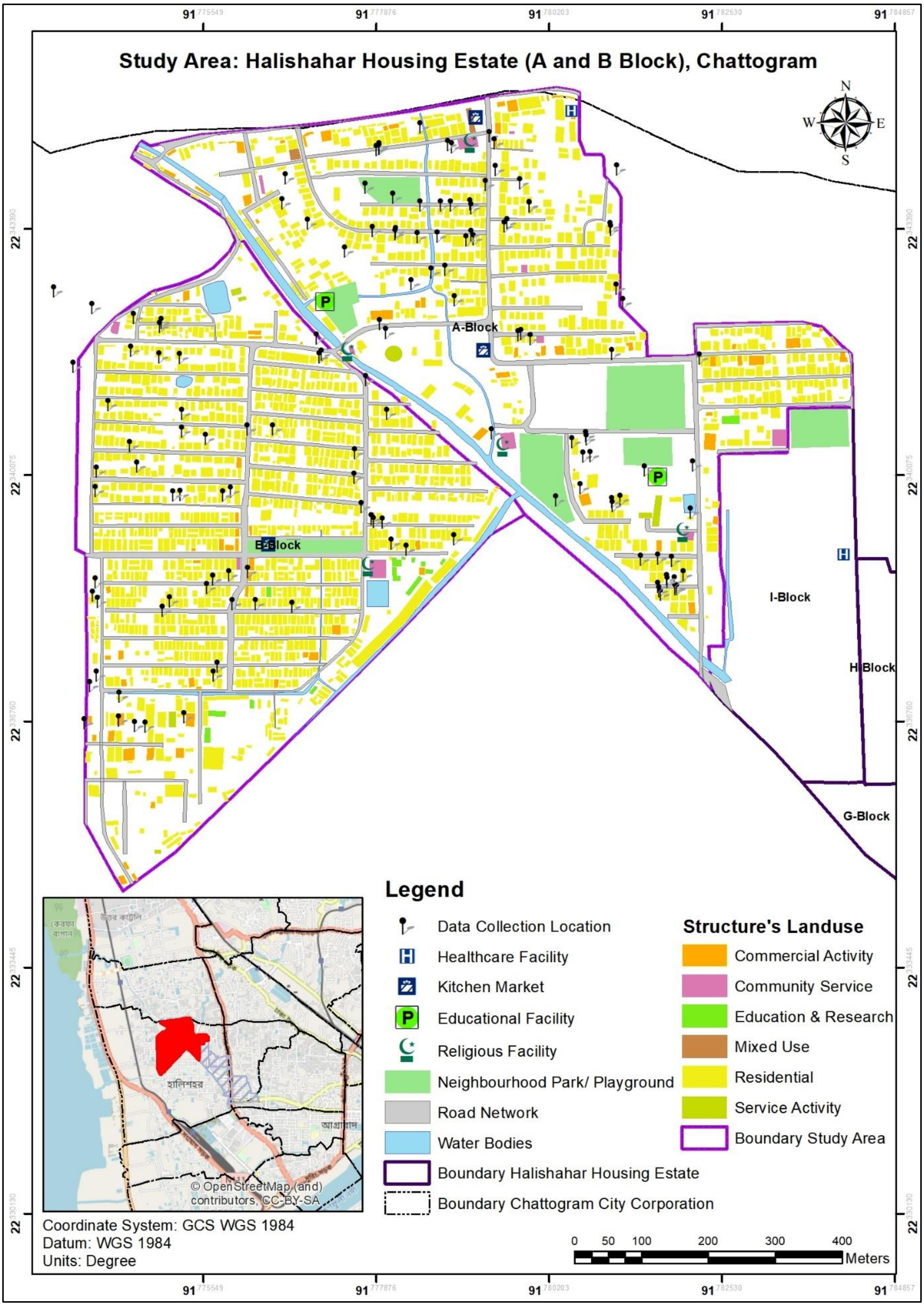
Different indicators (Figure 6) are used to analyse the variation and to answer the research question and research sub-questions (discussed in Chapter 1). This section presents a detailed discussion of the descriptive statistics of all indicators, as well as the correlation of all indicators with the housing rent (dependent variable) of the research area.

Figure 6: Classifying indicators, independent, independent and control variables.



Source: Author, 2022

Map 1: Location of the study area.



Source: Author, 2022

4.3.1 Demographic and Socio-Economic Structure of the Respondents

This study used a household questionnaire to collect 136 responses from two blocks (A-Block & B-Block) of Halishahar Housing Estate in Chattogram (from June 2022- July 2022). Out of 136 responses, 60 responses are collected from the study area's B-Block and 76 from A-Block. Among the respondents, 91.18% are male and only 8.82% are female (Figure 21, Appendix 3). Female respondents are slightly higher in A-Block (10.5%) compared to the B-Block (6.7%). In terms of highest level of education, 36.76% of respondents completed graduation, following 35.29% completed higher secondary level, 22.06% secondary school level and 5.88% primary level (Figure 19, Appendix 3). The number of respondents accomplishing the graduation level in A-Block (46.1%) is higher than the B-Block (25%) (Table 26, Appendix 3). In the study region, the majority of respondents are involved in the business activity (50.74%), followed by private service (25.74%) and government service (11.76%) (Figure 20, Table 27, Appendix 3).

According to Table 9 (Appendix 3), the mean monthly household income in the research region is 41,066.18 Bangladeshi Taka (BDT), while the median and standard deviation are 40,000.00 and 15,675.51 BDT, respectively. However, there is a substantial disparity between the lowest and greatest monthly income in the study region, with the minimum and maximum ranges of family income being 8,000.00 and 100,000.00 BDT, separately. In terms of how long respondents have lived in the neighbourhood, it is found that the majority (37.50%) have lived there for 6–10 years, while 31.62% have lived there for 1–5 years (Figure 23, Appendix 3). In contrast, 27.94% of study area respondents have been in their present house for less than a year, followed by 47.79% who have been in it for between one and five years (Figure 22, Appendix 3).

4.3.2 Housing Rent

The mean monthly house rent in the study area is 11,078.68 BDT, as shown in Table 9 (Appendix 3). While the median monthly rent for a home is 10,000 BDT, 50% of the data on rental rates are above the median and 50% are below the median. The survey also revealed that the research area's housing rent ranges from 1,200 BDT to 25,000 BDT.

4.3.3 Cultural Ecosystem Services (CES)

Within the study area, there are six neighbourhood parks, which serve as the primary source of cultural ecosystem services. Out of these six, only one is located in the B-Block of the study area, while five of the neighbourhood parks are located in the A-Block (Table 10, Appendix 3). The study reveals that recreational facilities (parks/playgrounds) are within a range of 5 to 600 meters from respondents' homes (Table 9, Appendix 3), with a mean and median distance of 147.14 meters and 118.00 meters, respectively. Figure 8 (Appendix 3) indicates that just 26.47 percent of respondents use these recreation facilities once a month, whereas 23.53 percent use them a few times each week. Only 13.67% of respondents regularly use these recreational facilities. On the other hand, table 11 (Appendix 3) shows that the maximum frequency of visiting these recreational sites inside A-Block are 31.6% (a few times per week) and 43.3% within B-Block (once in a month). In order to enjoy their time, 49.26% of respondents spends between 30 and 60 minutes inside these recreational facilities (Figure 9, Appendix 3). In addition, a substantial proportion of respondents (44.12 %) said that they use these recreational services for less than 30 minutes. Table 12 (Appendix 3) shows that most A-Block respondents (69.70%) spend 30 to 60 minutes at recreation places, whereas most B-Block respondents (76.70%) spend only less than 30 minutes. According to Figure 10 (Appendix 3), the majority of respondents in the research area utilize their accessible recreational services to go for a walk (47.06%) and for mental refreshment (38.24%) purpose. When respondents are asked to rate their level of satisfaction with the neighbourhood's recreational services on a "Likert scale" (1 to 5), 37.50 % indicates that they are "satisfied" and 35.29 % indicate that they are “not satisfied or unsatisfied" (Figure 11, Appendix 3). On a

Likert scale from 1 to 5, 41.18% of respondents in the research region rated the level of greenery in their neighbourhood as "good," while 32.35% rated it as "neither poor nor good" (Figure 12, Appendix 3). In term of level of scenic and aesthetic view from home (within Likert scale 1 to 5), 41.91% respondents of the study area indicates as “neither poor nor good”, although 36.03% indicates as “good” (Figure 13, Appendix 3) . On a Likert scale of 1 to 5, 40.44 % of respondents say they are "not satisfied or unsatisfied" with the level of satisfaction they have with aesthetic services provided from home; on the other hand, 35.29 % say they are "satisfied" (Figure 14, Appendix 3). Regarding the usage of camera to capture the scenic beauty of the surroundings (on a Likert scale from 1 to 5), the majority of respondents (40.44%) state that they never do so, while 31.62% indicate that they do so rarely (Figure 15, Appendix 3).

4.3.4 House’s Structural Features

According to survey findings, the mean and median total floor area of a house are 1,067.79 and 1,000.00 square feet respectively (Table 9, Appendix 3). Moreover, the respondents of the study area specify the smallest and largest floor area of a house are 200.00 and 2,200.00 square feet correspondingly. During the survey, the majority of respondents from the A-Block neighbourhood (65%) informed that they have 2 bedrooms in their house for living with their families, whereas in the B-Block 76.7% also stated that they have two bedrooms (Table 19, Appendix 3). Almost half of the respondents (55.30%) of A-Block mentioned that they have 2 bathrooms/ toilets in their home, while, in the B-Block 58.30% informed that they have only 1 bathroom/ toilet (Table 20, Appendix 3). Table 21 (Appendix 3) shows that, In terms of balcony/veranda, the majority of B-Block homes (73.30 percent) have one, whereas A-Block houses have a mix of three (38.20%), one (30.30%), and two balconies (28.90%). According to the study's housing construction types (Figure 16, Appendix 3), 93.53% of respondents live in pucca homes, which have a concrete roof and floor, 0.74% in semipucca homes, which have a tin shed roof, and 0.74% in katcha homes (i.e. made up of bamboo, mud, grass etc.). The majority of respondents from A-Block (86.80%) claimed that their residence is 5 to 15 years old, whilst respondents from B-Block (46.70%) indicated that theirs is 15 to 25 years old (Table 23, Appendix 3).

4.3.5 Transport Accessibility Attributes

Respondents from the research region provided specific information throughout the questionnaire survey regarding the transportation accessibility to various neighbourhood facilities. The majority of the homes in Halishahar Housing Estate are easily accessible through the connecting road since it is one of the planned residential areas within Chattogram city. Residents from 93.40% in A-Block and 98.30 % in B-Block mentioned having a 20-foot-wide access road connecting to their home (Table 24, Appendix 3). Table 9 (Appendix 3) reveals that most respondents live 560 to 1526 meters from the main road (Port connecting road), with a mean and median distance of 1015.21 and 990.50 meters. The study area is quite far from the central business district (CBD) of Chattogram city. The mean and median distances between the CBD and the residents of A and B Block who were surveyed are 4055.51 and 4093.50 meters, respectively (Table 9, Appendix 3). The questionnaire survey reveals that health care facilities within the research region are insufficient, since there are no specialized hospital facilities other than two primary treatment centers. Table 9 (Appendix 3) shows that the mean and median distance of these primary treatment centers from the residence are 495.19 and 397.00 meter, respectively. In terms of other community amenities such as school, religious centers, and kitchen markets, the areas that were studied have some facilities to satisfy the people' day-to-day needs. According to the data shown in Table 9 (Appendix 3), the residents of the study region live a mean distance of 278.60 meters away from educational facilities, 178.93 meters away from religious facilities, and 222.39 meters away from kitchen market facilities, respectively.

4.3.6 Environmental Quality Attributes

The interior air quality, the indoor sound level, and the level of waterlogging in the neighbourhood area are the indicators that are utilized to collect information to understand the environmental quality of the research region.

The "American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)" recommends that indoor CO^2 levels should not exceed 700 ppm, whereas ambient levels range between 300 and 500 ppm (Government of Canada, 2021). The allowable concentration of PM10 in a residential area is 150ug/m^3 (24 hours), whereas the WHO recommends 50ug/m^3 (24 hours), according to Bangladeshi and WHO ambient air quality regulations (Hossen & Hoque, 2016). However the WHO recommends 25ug/m^3 (24 hours), Bangladesh's ambient air quality regulations state that 65ug/m^3 (24 hours) is the acceptable concentration of PM2.5 in residential areas (Hossen & Hoque, 2016). The allowable noise level for residential areas throughout the day (from 6 am to 9 pm) is 55 dB, according to the indoor sound quality standard established by Bangladesh's Department of Environment (Aziz et al., 2021).

Table 9 (Appendix 3) shows the mean and median carbon dioxide ($C0^2$) concentrations within the residences in the study area, which are both somewhat higher than the ambient range of 300 to 500 ppm. These values are 571.79 and 568.00 ppm, respectively. Moreover, according to Table 9 (Appendix 3), the mean and median PM10 concentrations inside of study area homes are 61.44ug/m^3 and 58.00ug/m^3, respectively. These values are greater than WHO guidelines but lower than DOE, Bangladesh. When it comes to the PM2.5 concentration inside the study area homes, the mean and median values are 35.65ug/m^3 and 31.00ug/m^3, separately. These levels are likewise greater than WHO standards but lower than DOE, Bangladesh (Table 9, Appendix 3). The situation with waterlogging in the study area during the wet seasons is not terrible. More than 80% of respondents from A-Block and 61.7% of respondents from B-Block claimed that they do not have any water logging issues during the rainy season (Table 25, Appendix 3). This indicates that the waterlogging issue to some degree affects the B-Block.

4.4 Correlation between Dependent (House Rent) and Others Variables

The correlations indicate relationships between dependent (house rent), independent (CES), and control variables (house structural characteristics, transport accessibility attributes, environmental quality attributes, and socio-economic factors). This study uses Pearson correlation coefficient. The correlation analysis evaluates the indicators' association. The correlation coefficient ranges from -1 to +1, and the significant value establishes the association between two parameters (Figure 25, Appendix 3). In subsequent sections of this chapter, correlation analysis is also used to develop multiple regression models to study other variables' influence on the dependent variable.

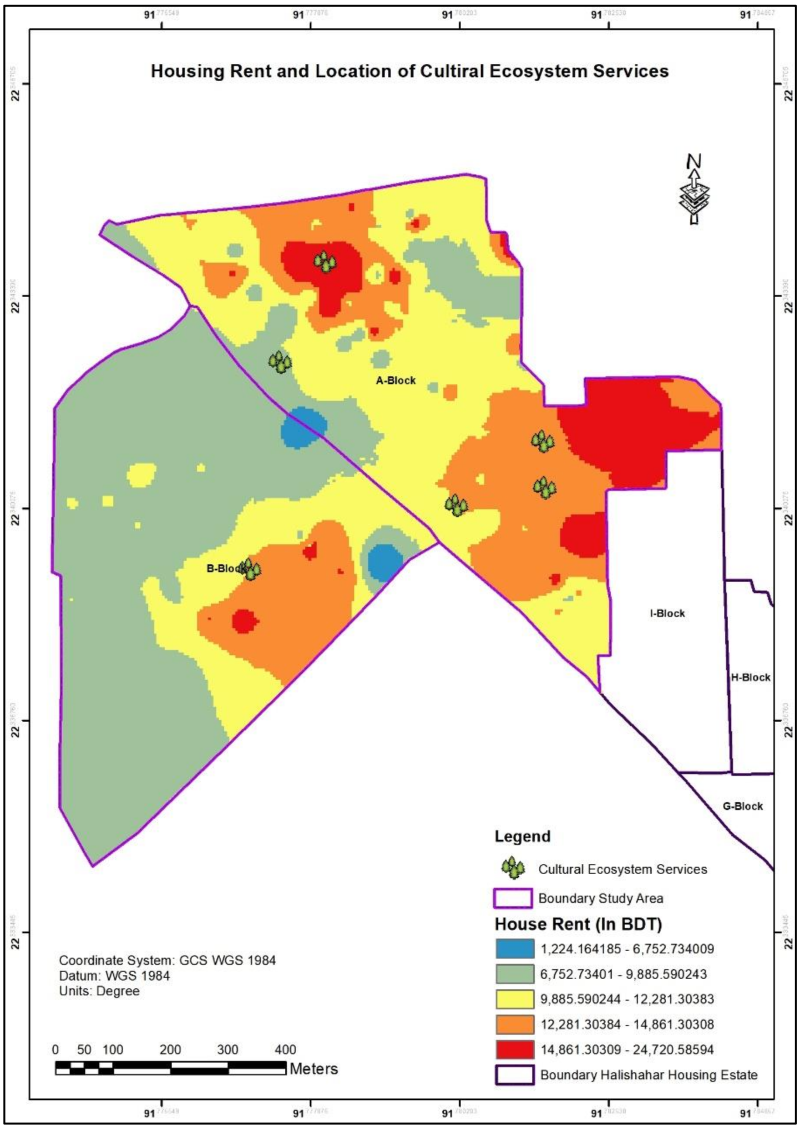
Table 31 (Appendix 3) indicates the correlation between housing rent and all CES indicators. With coefficient values of +0.640, +0.595, +0.532 +0.526, and +0.525, respectively, the level of satisfaction with neighbourhood's recreational facilities, the frequency of visits to neighbourhood's recreational facilities, average time spent at recreation sites, the level of greenery in the neighbourhood to provide scenic view, and the level of aesthetic view from residence are all moderately positively correlated with house rent in the study area. However, the distance between the home and recreational facilities is moderately negatively correlated (-0.518) with the house rent for the study area. Furthermore, with the coefficient values of +0.435 and +0.345, separately, number of available recreational facilities within neighbourhood and the level of satisfaction with aesthetic services from residence are weakly positively correlated with house rent of the study area.

Table 32 of appendix 3, shows the correlation between housing rent and all indicators of house’s structural features. It appears from the correlation table that total floor area of the house, number of bedrooms, number of bathroom/ toilet and number of balcony/ veranda have strong positive correlation with the house rent, with coefficient value of +0.966, +0.884, +0.880 and +0.843, respectively. However, the age of the Structure is weakly positively correlated with house rent of the study area with a coefficient value of -0.414.

Table 33 (Appendix 3) shows the correlation between housing rent and all indicators of transport accessibility attributes. Here, distance of the Main Road, distance of the nearest health care facility, distance of the nearest religious facility, distance of the CBD and distance of the nearest educational facility and distance of the nearest kitchen all are weakly negatively correlated with house rent of the study area, with the coefficient of -0.415, -0.378, -0.344, -0.336, -0.268 and -0.111, respectively.

Table 34 (Appendix 3) explains the correlation between housing rent and all indicators of environmental quality. Concentration of carbon dioxide ($C0^2$) inside the home and sound level (dB) inside the house are weakly negatively correlated with house rent of the study area, with the coefficient of -0.198 and -0.118, individually.

Map 2: Distribution of housing rent & location of CES in the study area.



Source: Author, 2022

Table 35 of appendix 3, also describes the correlation between housing rent and all indicators of socio-economic attributes. Household's monthly income has a moderate positive correlation (+0.789) with the housing rent of the study area. On the other hand, Duration of living in the house, respondents' highest level of education and duration of living in the neighbourhood have weakly positive correlation with the housing rent, with coefficient of +0.459, +0.415 and +0.213, respectively.

4.5 Overview of Housing rent and CES of the Study Area

According to the findings of the questionnaire survey, the research area's lowest and highest monthly housing rents are 1,200.00 and 25,000.00 BDT, respectively (Table 9, Appendix 3). The amount of the monthly housing rent for the two study blocks of the Halishahar Housing Estate also differs significantly. Map 2 clearly shows that the A-Block of the study area now has a substantially higher housing rent than the B-Block. Moreover, CES provision is also more prevalent in the A-Block (Five) than the B-Block (only one). As a result, one of the main reasons of the higher rent for homes in the study area's A-Block might be due to the presence of more CES facilities. Figure 7 displays some images of the cultural ecosystem services that are available in the study region.

Figure 7: Cultural Ecosystem Services within the research area.

Source: Field Survey, 2022

Moreover, according to the Independent Samples Levene's T-test (Table 36, Appendix 3), there are significant differences between two neighbourhood blocks in the research area in terms of the monthly house rent, the distance to recreational facilities, the frequency of visits to recreational sites, the amount of time spent in recreational sites, the satisfaction level with recreational facilities, the amount of greenery, and the aesthetic view from homes. Therefore, equal variances cannot be assumed. Therefore, it can be concluded that there are significant differences in CES and housing rent between Blocks A and B of the study area.

4.6 Regression Models Results

Regression analysis discovers associations between independent and dependent variables. Variables that are significantly correlated (both positively and negatively) with house rent are selected to develop multiple regression models for this section (Tables 31, 32, 33, 34, and 35; Appendix 3). In addition, the issue of multicollinearity has been taken into account while identifying variables for constructing regression models. Five multiple regression models are developed to explain sub research questions. Finally, an HPM is developed by considering all variables (both independent and control variables) and using the backward multiple regression method to explain the study area's housing rent (dependent variable). Furthermore, 1,000 WILD bootstrap samples are used to assess divergence from the real sample size (136).

4.6.1 House Rent and Cultural Ecosystem Services

This multiple regression model examines association between CES and house rent. Before analysing regression model findings, it's vital to test model assumptions. In this case, four assumptions must be satisfied: normality, homoscedasticity, multicollinearity, and linearity. Histograms (Figure 26, Appendix 3) and the normal P-P plot (Figure 27, Appendix 3) confirm normality and linearity, while the scatter plot (Figure 28, Appendix 3) reveals no heteroscedasticity. Menard (2001) indicated that VIF>5 is reason for concern and VIF>10 represents a severe collinearity issue; hence, VIF<10 is prescribed to reduce the problem of multicollinearity in the regression model. Table 2's VIF value demonstrates the regression model is multicollinearity-free.

Table 2: Multiple regression model for house rent and CES.

Variables	LRM (a)					SRM (b)				
	Coeff.	**Std. Error**	**t-stat**	**Sig.**	**VIF**	**Coeff.**	**Std. Error**	**t-stat**	**Sig.**	**VIF**
(Constant)	3404.398	1450.230	2.347	0.02*		8.5400	0.16	55.15	<.001*	
Distance between house and recreational facilities (In meter)	-5.386	2.707	-1.989	**0.049***	1.816	-0.0010	0.00	-1.76	0.081	1.82
Frequency of visits to recreational facilities	447.675	319.101	1.403	0.163	3.464	0.0480	0.03	1.40	0.164	3.46
Average time spent at recreation sites	1154.557	466.564	2.475	**0.015***	1.640	0.1210	0.05	2.42	**0.017***	1.64
Level of satisfaction with recreational facilities	1336.849	545.468	2.451	**0.016***	4.181	0.0890	0.06	1.52	0.131	4.18
Level of greenery in the neighbourhood	-755.665	552.028	-1.369	0.173	4.060	-0.0430	0.06	-0.73	0.465	4.06
Level of scenic and aesthetic view from residence	1005.822	514.554	1.955	**0.05***	2.992	0.0940	0.06	1.70	0.091	2.99
Level of satisfaction with aesthetic services from residence	51.646	439.549	0.117	0.907	2.274	0.0020	0.05	0.04	0.966	2.27
R^2	*0.509*					*0.445*				
Adjusted R^2	*0.482*					*0.415*				
F-stat	*18.962*					*14.661*				
Sig (F)	*<.001**					*<.001**				
df	*135*					*135*				

Note:
** p≤.05 (2-tailed)*
LRM means "Linear Regression Model"; and, SRM means "Semi-log Regression Model".
(a) Dependent Variable: Monthly House Rent (In BDT)
(b) Dependent Variable: Log of Monthly House Rent

Source: Author, 2022

In the preceding regression model, "monthly house rent" is the dependent variable for linear regression, whereas "log of monthly house rent" is the dependent variable for semi-log regression. In the paper's literature review, it was revealed that using nonlinear regression models (semi-log and double-log) might improve model performance. Nevertheless, according to Table 2, the LRM model’s adjusted R^2 explains around 48% of the variability of the dependent variable by the independent variables (i.e., the data adequately match the regression line), while the SRM model explains only about 42%. LRM is thus the preferred model for finding the CES factors that influence the house rent in the research area. The LRM explains with 95% confidence level that one unit increase in the “level of satisfaction with recreational facilities" and "level of scenic and aesthetic view from residence", increase the house rent by 1,336.849 and 1,005.822 BDT successively, holding other factors constant. Moreover, for every one meter increase in distance between house and recreational facilities, the house decrease by 5.386 BDT, holding other factors constant (with 95% CI). Furthermore, for every one unit increase in average time spent at recreation sites, house rent also increase by 1,154.557 BDT, holding other factors constant (with 95% CI).

4.6.2 House Rent, CES and House's Structural Features

Below, a multiple regression model examines the relationship between CES, structural features and rent. The histograms (Figure 29, Appendix 3) and normal P-P plot (Figure 30, Appendix 3) indicate normality and linearity, and the scatter plot (Figure 31, Appendix 3) reveals no heteroscedasticity in the model. In addition, the VIF<10 in Table 3 demonstrates that the regression model have no multicollinearity.

Table 3: Multiple regression model for house rent, CES and structural features.

Variables	LRM (a)					SRM (b)				
	Coeff.	**Std. Error**	**t-stat**	**Sig.**	**VIF**	**Coeff.**	**Std. Error**	**t-stat**	**Sig.**	**VIF**
(Constant)	2356.25	1153.30	2.04	0.043		8.0890	0.16	51.71	<.001*	
Distance between house and recreational facilities (In meter)	0.56	1.42	0.39	0.694	2.03	-0.0001	0.00	-0.75	0.455	2.03
Frequency of visits to recreational facilities	61.80	165.56	0.37	0.710	3.79	-0.0020	0.02	-0.10	0.922	3.79
Average time spent at recreation sites	-69.45	256.12	-0.27	0.787	2.01	0.0450	0.04	1.30	0.197	2.01
Level of satisfaction with recreational facilities	75.45	282.31	0.27	0.790	4.55	-0.0070	0.04	-0.17	0.865	4.55
Level of greenery in the neighbourhood	76.10	289.00	0.26	0.793	4.52	0.0280	0.04	0.71	0.477	4.52
Level of scenic and aesthetic view from residence	-299.61	269.77	-1.11	0.269	3.34	-0.0050	0.04	-0.14	0.891	3.34
Level of satisfaction with aesthetic services	22.21	219.51	0.10	0.920	2.30	-0.0070	0.03	-0.25	0.806	2.30
Total number of bedrooms	1181.78	309.46	3.82	**<.001***	6.10	0.0040	0.04	0.10	0.923	6.10
Total number of bathroom/ toilet	2107.55	249.56	8.45	**<.001***	3.26	0.2230	0.03	6.58	**<.001***	3.26
Total number of balcony/ veranda	1129.33	310.27	3.64	**<.001***	6.14	0.1960	0.04	4.65	**<.001***	6.14
Age of the Building or Structure	90.61	238.54	0.38	0.705	1.90	0.1440	0.03	4.44	**<.001***	1.90
R^2	*0.883*					*0.786*				
Adjusted R^2	*0.873*					*0.767*				

Variables	LRM (a)					SRM (b)				
	Coeff.	Std. Error	t-stat	Sig.	VIF	Coeff.	Std. Error	t-stat	Sig.	VIF
F-stat	*85.00*					*41.502*				
Sig (F)	*<.001**					*<.001**				
df	*135*					*135*				
Note: ** p≤.05 (2-tailed)* *LRM means "Linear Regression Model"; and, SRM means "Semi-log Regression Model".* *(a) Dependent Variable: Monthly House Rent (In BDT)* *(b) Dependent Variable: Log of Monthly House Rent*										

Source: Author, 2022

According to Table 3, the LRM model's adjusted R^2 explain around 87% of the variability of the dependent variable by the independent variables, while the SRM model explains only about 77%. LRM is thus the best model for explaining the regression. According to this regression model, the CES variables are no longer significant after including all structural characteristics variables to investigate the relationship with housing rent. In the LRM, the p-values of no of bedroom, no of bathroom and no of balcony are within significant level (below 0.05). Therefore, with 95% CI, it can be reported that, one increased in no of bedroom, bathroom and balcony in a house, increase the rent of the house by 1,181.78, 2,107.55 and 1,129.33 BDT individually (holding other factors constant). Table 37 (Appendix 3) also shows that the structural elements of the house have a substantial moderating influence in the regression model, with the value of "Interaction term" being significant (p<.001) at the 95 percent CI.

4.6.3 House Rent, CES and Transport Accessibility

This multiple regression model is applied to explore the association between CES, transport accessibility and house rent. The histograms (Figure 32, Appendix 3) and normal P-P plot (Figure 33, Appendix 3) prove the assumption of normality and linearity, while the scatter plot (Figure 34, Appendix 3) also shows no evidence of heteroscedasticity in this model. Furthermore, the VIF<10 from Table 4 confirms that the regression model does not exhibit any evidence of multicollinearity.

Table 4: Multiple regression model for house rent, CES and transport accessibility.

Variables	LRM (a)					SRM (b)				
	Coeff.	Std. Error	t-stat	Sig.	VIF	Coeff.	Std. Error	t-stat	Sig.	VIF
(Constant)	3191.18	1586.67	2.01	0.046		8.4650	0.17	50.47	<.001*	
Distance between house and recreational facilities (In meter)	-7.26	3.37	-2.15	**0.033***	2.80	-0.0010	0.00	-2.30	**0.023***	2.80
Frequency of visits to recreational facilities	486.79	322.93	1.51	0.134	3.52	0.0540	0.03	1.59	0.114	3.52
Average time spent at recreation sites	1209.52	472.45	2.56	**0.012***	1.67	0.1330	0.05	2.66	**0.009***	1.67
Level of satisfaction with recreational facilities	1357.23	549.76	2.47	**0.015***	4.22	0.0950	0.06	1.64	0.104	4.22
Level of greenery in the neighbourhood to provide scenic view	-821.60	564.08	-1.46	0.148	4.21	-0.0510	0.06	-0.85	0.395	4.21
Level of scenic and aesthetic view from residence	956.07	524.25	1.82	0.071	3.08	0.0880	0.06	1.60	0.113	3.08

Variables	LRM (a)					SRM (b)				
	Coeff.	Std. Error	t-stat	Sig.	VIF	Coeff.	Std. Error	t-stat	Sig.	VIF
Level of satisfaction with aesthetic services	2.96	443.89	0.01	0.995	2.30	-0.0080	0.05	-0.16	0.870	2.30
Distance of nearest religious facility from home (In meter)	1.85	2.56	0.72	0.472	1.56	0.0005	0.00	1.68	0.096	1.56
Distance of nearest kitchen market from home (In meter)	1.86	2.82	0.66	0.513	1.84	0.0002	0.00	0.76	0.448	1.84
R2	*0.513*					*0.460*				
Adjusted R2	*0.478*					*0.422*				
F-stat	*14.751*					*11.947*				
Sig (F)	*<.001**					*<.001**				
df	*135*					*135*				
Note: ** p≤.05 (2-tailed)* *LRM means "Linear Regression Model"; and, SRM means "Semi-log Regression Model".* *(a) Dependent Variable: Monthly House Rent (In BDT)* *(b) Dependent Variable: Log of Monthly House Rent*										

Source: Author, 2022

Table 4 specifies that the LRM model's adjusted R^2 explain around 48% of the variability of the dependent variable by the independent variables, while the SRM model explain about 42% only. LRM is thus the chosen model for model for explaining the regression.

According to this regression model, still three CES variables are significant ($p<.05$) after including all transport accessibility variables to investigate the relationship with housing rent, these are distance to recreational facilities, average time spent in recreational facilities and Level of satisfaction with recreational facilities. On the other hand, no variables of transport accessibility are found significant in this model. Table 38 (Appendix 3) also shows that the transport accessibility has no substantial moderating influence in the regression model, with the p value of "Interaction term" P=-1.39, at the 95% CI.

4.6.4 House Rent, CES and Environmental Quality

Multiple regression model below evaluates association between CES, environmental quality and housing rent. Histograms (Figure 35, Appendix 3) and the normal P-P plot (Figure 36, Appendix 3) confirm normality and linearity, while the scatter plot (Figure 37, Appendix 3) reveals no heteroscedasticity. Table 5's VIF<10 demonstrates the regression model lacks multicollinearity.

Table 5: Multiple regression model for house rent, CES and environmental quality.

Variables	LRM (a)					SRM (b)				
	Coeff.	Std. Error	t-stat	Sig.	VIF	Coeff.	Std. Error	t-stat	Sig.	VIF
(Constant)	10984.13	6742.69	1.63	0.106		9.1960	0.69	13.33	<.001	
Distance between house and recreational facilities (In meter)	-5.47	2.88	-1.90	0.060	2.12	-0.0010	0.00	-1.93	0.057	2.12
Frequency of visits to recreational facilities	348.43	318.22	1.10	0.276	3.57	0.0350	0.03	1.08	0.283	3.57
Average time spent at recreation sites	1193.27	463.71	2.57	**0.011***	1.68	0.1300	0.05	2.75	**0.007***	1.68
Level of satisfaction with recreational facilities	1661.63	548.97	3.03	**0.003***	4.39	0.1330	0.06	2.38	**0.019***	4.39

Variables	LRM (a)					SRM (b)				
	Coeff.	Std. Error	t-stat	Sig.	VIF	Coeff.	Std. Error	t-stat	Sig.	VIF
Level of greenery in the neighbourhood	-723.45	549.64	-1.32	0.191	4.17	-0.0420	0.06	-0.74	0.460	4.17
Level of scenic and aesthetic view from residence	851.32	510.21	1.67	0.098	3.05	0.0700	0.05	1.35	0.181	3.05
Level of satisfaction with aesthetic services	-54.12	444.05	-0.12	0.903	2.40	-0.0090	0.05	-0.21	0.836	2.40
Concentration of $C0^2$ inside home (In ppm)	-0.77	11.82	-0.07	0.948	1.24	0.0010	0.00	0.73	0.467	1.24
PM2.5 concentration within home (in ug/m3)	-4.63	29.88	-0.16	0.877	3.88	-0.0001	0.00	-0.04	0.969	3.88
PM10 concentration within home (in ug/m3)	6.64	21.14	0.31	0.754	3.94	0.0010	0.00	0.29	0.774	3.94
Indoor sound level (in dB)	-146.94	52.20	-2.82	**0.006***	1.20	-0.0240	0.01	-4.43	**<.001***	1.20
The level of waterlogging in the neighbourhood	196.36	281.00	0.70	0.486	1.15	0.0300	0.03	1.04	0.303	1.15
R^2	*0.544*					*0.527*				
Adjusted R^2	*0.500*					*0.481*				
F-stat	*12.252*					*11.442*				
Sig (F)	*<.001**					*<.001**				
df	*135*					*135*				

Note:
** p≤.05 (2-tailed)*
LRM means "Linear Regression Model"; and, SRM means "Semi-log Regression Model".
(a) Dependent Variable: Monthly House Rent (In BDT)
(b) Dependent Variable: Log of Monthly House Rent

Source: Author, 2022

Table 5 states that the LRM model's adjusted R^2 explain around 50% of the variability of the dependent variable by the independent variables, while the SRM model explains about 48%. LRM is therefore the chosen model for interpreting the regression model.

According to this regression model, still two CES variables are significant ($p<.05$) after including all environmental quality variables to investigate the relationship with housing rent, these are, average time spent in recreational facilities and Level of satisfaction with recreational facilities. On the other hand, indoor sound level is significant with $p<.05$. Therefore, with a confidence interval of 95%, it can be stated that for one dB increase in indoor sound level within the house, the rent of the houses decrease by 146.94 BDT (holding other factors constant). Moreover, Table 39 (Appendix 3) indicates that the environmental quality has no substantial moderating influence in the regression model, with the p value of "Interaction term" P=1.337, at the 95% CI.

4.6.5 House Rent, CES and Socio-Economic Attributes.

This multiple regression model is applied to explore the association between CES, socio-economic features and house rent. The histograms (Figure 38, Appendix 3) and normal P-P plot (Figure 39, Appendix 3) prove the assumption of normality and linearity, while the scatter plot (Figure 40, Appendix 3) is showing no evidence of heteroscedasticity in the model. Furthermore, the VIF value (less than 10) from Table 6 satisfies that the regression model does not show any evidence of multicollinearity.

Table 6: Multiple regression model for house rent, CES and socio-economic attributes.

Variables	LRM (a)					SRM (b)				
	Coeff.	Std. Error	t-stat	Sig.	VIF	Coeff.	Std. Error	t-stat	Sig.	VIF
(Constant)	212.11	1270.06	0.17	0.868		2.5020	0.60	4.20	<.001*	
Distance between house and recreational facilities (In meter)	-2.85	2.02	-1.41	0.162	1.93	-0.0002	0.00	-0.88	0.381	1.93
Frequency of visits to recreational facilities	239.49	232.34	1.03	0.305	3.50	0.0260	0.02	1.08	0.284	3.49
Average time spent at recreation sites	592.20	345.88	1.71	0.089	1.72	0.0490	0.04	1.34	0.184	1.73
Level of satisfaction with recreational facilities	829.19	402.14	2.06	**0.041***	4.32	0.0490	0.04	1.18	0.242	4.29
Level of greenery in the neighbourhood	-468.18	406.40	-1.15	0.252	4.19	-0.0330	0.04	-0.77	0.442	4.17
Level of scenic and aesthetic view from residence	738.14	380.68	1.94	0.055	3.12	0.0600	0.04	1.50	0.136	3.12
Level of satisfaction with aesthetic services	-73.70	321.03	-0.23	0.819	2.31	-0.0020	0.03	-0.06	0.953	2.30
Household's monthly income/ log of income	0.13	0.01	9.87	**<.001***	1.55	0.5950	0.06	9.67	<.001*	1.75
Respondents' highest level of education	293.33	207.13	1.42	0.159	1.28	0.0250	0.02	1.10	0.275	1.40
Duration of living in the house	-117.18	284.22	-0.41	0.681	1.73	-0.0002	0.03	-0.01	0.995	1.74
R^2	*0.748*					*0.724*				
Adjusted R^2	*0.728*					*0.702*				
F-stat	*37.11*					*32.798*				
Sig (F)	*<.001**					*<.001**				
df	*135*					*135*				

Note:
** p≤.05 (2-tailed);*
LRM means "Linear Regression Model"; and, SRM means "Semi-log Regression Model";
(a) Dependent Variable: Monthly House Rent (In BDT)
(b) Dependent Variable: Log of Monthly House Rent

Source: Author, 2022

Table 6 states that the LRM model's adjusted R^2 explain around 73% of the variability of the dependent variable by the independent variables, while the SRM model explains more with about 70%. LRM is therefore the preferred model to explain. According to this regression model, only one CES variables is significant ($p<.05$) after including all socio-economic variables to investigate the relationship with housing rent, which is, level of satisfaction with recreational facilities. Then again, household's monthly income is also significant with $p<.05$. Therefore, with a confidence interval of 95%, it can be reported that for every 1000 BDT increase in household income, the house rent also increases by 130 BDT (holding other factors constant). Moreover, Table 40 (Appendix 3) indicates that the socio-economic variables have no substantial moderating influence in the regression model, with the p value of "Interaction term" P=-1.28, at the 95% CI.

4.7 Choosing Hedonic Price Model for the Research Area

A backward regression model is developed, similar to other research (Gisondi et. al., 2009; Rahman et al., 2021), to assess how well the models perform in estimating the housing rent in the study area. To find the optimal model for this research, 15 models are built using backward regression methods (Table 41, Appendix 3). Incorporating variables is done using the F-to-Enter and F-to-Remove criteria. "Probability-of-F-to-enter <= 0.05, Probability-of-F-to-remove >= 0.06)" is the backward criterion used in the model. The Model 15 (Table 7) has been selected as the better model with maximum significant variables ($p<.05$). Moreover, Figures 41, 42, and 43 in Appendix 3 prove that Model 15's assumptions for normality, linearity, and homoscedasticity are true. Table 7's VIF value, which is less than 10, confirms that the model is likewise devoid of multicollinearity problems.

Table 7: Backward multiple linear regression model (Model 15).

Model	Variables	Coeff.	Std. Error	t-stat	Sig.	VIF
15	(Constant)	1230.81	497.94	2.47	**0.015***	
	Frequency of visits to neighbourhood’s recreational facilities	534.89	108.36	4.94	**<.001***	1.37
	Total number of bathroom/ toilet	2685.69	227.61	11.80	**<.001***	2.29
	Distance of nearest kitchen market from home (In meter)	2.98	1.15	2.59	**0.011***	1.06
	Household's monthly income (In BDT)	0.07	0.01	5.75	**<.001***	2.16
	R^2	*0.854*				
	Adjusted R^2	*0.849*				
	F-stat	*191.115*				
	Sig (F)	*<.001**				
	df	*135*				

Note:
** $p \leq .05$ (2-tailed);*
Dependent Variable: Monthly House Rent (In BDT)

Source: Author, 2022

As a result, the final HPM can be represented by the following structural equation:

$$\begin{aligned}&\textit{Monthly House Rent} = 1230.81 + 534.89\\ &\times (\textit{Frequency of visits to recreational facilities}) + 2685.69\\ &\times (\textit{Total number of bathroom/ toilet}) + 2.98\\ &\times (\textit{Distance to nearest kitchen market}) + 0.07\\ &\times (\textit{Household's monthly income}) \qquad \ldots\ldots\ldots\ldots\ldots (v)\end{aligned}$$

According to HPM (Table 7), adjusted R2 explain around 85% of the variability of the dependent variable by the independent variables. In this HPM, all variables are statistically significant (less than 0.05). Therefore, one unit increase in visits to recreational sites is associated with a 534.89 BDT rise in rent, holding other factors constant (with 95% CI). In addition, one increased in no of bathroom in a house, increase the rent of the house by 2,685.69 BDT, holding other factors constant (with 95% CI). Increasing one-meter distance to kitchen market raises house rent by 2.98 BDT, other things held constant (with 95% CI). Moreover, for every 1,000.00 BDT increase in household’s monthly income, housing rent in the study region increases by 70 BDT, keeping other parameters constant (with 95% CI).

Furthermore, WILD Bootstrap regression with 1,000 samples is also performed to measure final HPM regression results. Table 8 shows that with a 1,000-sample size, there is no change in coefficient values and still p value is significant for all variables ($p<.05$). As a result, increasing the sample size has no effect on the final HPM model results.

Table 8: WILD bootstrap regression for selected HPM

Variables	Coefficient	Bootstrap Bias	Std. Error	Sig. (2-tailed)
(Constant)	1230.81	26.64	468.74	**0.013***
Frequency of visits to neighbourhood’s recreational facilities	534.89	-0.37	130.33	**<.001***

Variables	Coefficient	Bootstrap Bias	Std. Error	Sig. (2-tailed)
Total number of bathroom/ toilet	2685.69	-6.05	211.63	**<.001***
Distance of nearest kitchen market from home (In meter)	2.98	-0.02	0.93	**0.003***
Household's monthly income (In BDT)	0.07	0.00	0.02	**<.001***
Note: *Dependent Variable: Monthly House Rent (In BDT)* ** p≤.05 (2-tailed)* *Unless otherwise noted, bootstrap results are based on 1000 wild bootstrap samples*				

Source: Author, 2022

During the questionnaire survey, study area's respondents were also asked about their house-renting preferences. Figure 24 (Appendix 3) shows that a considerable proportion of respondents (53.68 %) report that the monthly cost of housing is their top determining factor when renting a property in the research region. This conclusion correlates with the final HPM, since balancing rent to income is crucial to them. However, 11.03 percent of respondents prefer better structural features when renting a property.

4.8 Discussion

This research is a first effort to use HPM to analyse the influence of cultural ecosystem services, structural aspects of the property, environmental attributes, accessibility to transportation, and socioeconomic characteristics of the respondents on monthly housing rent in Chattogram City.

Moreover, this research identified and defined the cultural ecosystem services in an urban context, as well as the factors that influence housing rent. Map 2 and the results of the independent Samples T-test (Table 36, Appendix 3) reveal that there is a significant difference in housing rent and CES indicators between Blocks A and B of the research region. House rent in Block-A is significantly higher than in Block-B. Furthermore, CES provision is more prevalent in the A-Block (Five) than in the B-Block (only one). As a result, the existence of additional CES services may be one of the key reasons for the higher rent for residences in the study area's A-Block.

Moreover, there is a strong association between CES and the area's housing rent. Correlation coefficient of CES and house rent (Table 31, Appendix 3) indicates that most of the CES indicators are moderately positively correlated (both positive and negative) with house rent in the study area. The regression model for house rent and CES also explains that "distance to recreational facilities," "average time spent at recreation sites," "level of satisfaction with recreational facilities," and "level of scenic and aesthetic view from home" all have a significant (p.05) influence on the study area's house rent.

For instance, every one-meter increase in distance between the house and the recreational facilities reduces the house rent by 5.386 BDT. Also, for a unit increase in the average time sent to recreation sites increase the rent of the house by 1.154.56 BDT. Furthermore, with the increase in the level of satisfaction of recreational facilities, increase the rent of the house by 1336.85 BDT. In addition, the rent of the house also increases by 1.005.82 BDT with an increase in the level of scenic and aesthetic view of the residence of the study area. However, the influence of cultural ecosystem services on housing rent is consistent with findings of earlier researches (Aranda, 2016; Mao et al., 2020; Sander & Haight, 2012; Jim & Chen, 2006).

While considering how structural characteristics influence the relationship between CES and house rent, it indicates that structural features of the house have a significant moderating influence on CES and house rent. For every additional addition of bedrooms, bathroom/toilet and balcony, the rental of the house increases by 1,181.78, 2,107.55 and 1,129.33 BDT respectively. The structural features of the house, such as the number of bedrooms, bathroom/

toilet, and balcony/ veranda, increase the house rent of the study, which is also consistent with previous research (Ojetunde et al., 2012; Akter et al., 2013; Rahman et al., 2021; Kolbe & Wüstemann, 2014; 18. Hussain et al., 2019; Islam et al., 2020; Yasmin, 2017; Hussain et al., 2021).

Moreover, this research showed that transportation accessibility has no significant moderating influence on the relationship between CES and housing rent in the research region, which contradicts the findings of Rahman et al (2021). As the study has been conducted only within two neighbourhood blocks of a housing area, hence the spatial scope of this study could not be really adequate to obtain the influence of transportation accessibility. Furthermore, a similar study spanning the entire Chattogram city region, may yield different findings regarding the influence of transportation accessibility on CES-housing rent relationship.

Environmental quality and socioeconomic characteristics have also no substantial moderating influence on the relationship between CES and house rent in the study area.

However, it has been found that when the indoor sound level increases, rent decreases significantly, which is consistent with the findings of other scientific researches (Michael et al., 2000; Shinozaki et al., 2019; Jim & Chen, 2006; Rahman et al., 2021). Furthermore, the study revealed that a higher level of household income leads to a higher rental price of the residence due to an increase in affordability. The findings of this socio-economic attribute are also consistent with prior research findings (Wen et al., 2005; Rahman et al., 2021; Hussain et al., 2019; Sharmin, 2013).

Finally, a hedonic price model is being developed using a backward regression model, taking into account all variables, including CES that may have a potential influence in determining housing rent in the research area. The final HPM (Table 7) reveals that CES (i.e. frequency of visits to recreational facilities) is one of the most significant variables in explaining the study area's housing rent, alongside structural, transportation accessibility, and socioeconomic variables.

The dependent variable in this HPM model is the housing rent. According to the HPM, the following four indications are the most expressive determinants in determining housing rent in the research area:

a) Frequency of visits to recreational facilities,
b) Total number of bathroom/ toilet,
c) Distance to nearest kitchen market,
d) Household's monthly income.

The findings from the final HPM are quite similar to the findings from several previous studies. For instance, the presence of green infrastructure, better structural attributes, and different transport accessibility in an urban area have an influence on the price of housing or the rent in that area (Hussain et. al., 2019, Rahman et al., 2021).

Furthermore, the results of WILD bootstrap regression with 1,000 samples indicate that there is no change in coefficient values and still p value is significant for all variables ($p<.05$). As a result, increasing the sample size has no effect on the final HPM model results.

The findings of this research, notably the final HPM, are highly consistent with the expected relationship with dependent variables, as shown in the operationalization table (Chapter 3).

Chapter 5: Conclusions

In conclusion, the research described the CES in an urban residential context and estimated their influence on housing rent in the area under investigation. In order to determine the outcomes of this study, two chosen neighbourhood blocks were evaluated. According to the findings of this research, CES has a major influence on the determination of housing rent in the studied region. Only structural elements are shown to have a moderate influence on the relationship between housing rent and CES when control factors are taken into account. The association between housing rent and CES is not shown to be moderately influenced by other control factors such as transportation accessibility, environmental quality, and socio-economic characteristics. The factors that have the greatest influence on housing prices in the study area among the various CES indicators are the distance to recreational facilities, the amount of time spent at recreational sites, the degree of satisfaction with recreational services, and the quality of the scenic and attractive views from residences. Furthermore, housing rent and the availability of CES services varied across the two study blocks. According to the literature review, cultural ecosystem services have a significant influence on the valuation of the housing rent (Doss and Taff, 1996; Anderson and West, 2006; Cho et al., 2008). Jim and Chen (2006) revealed that proximity to green and blue infrastructure significantly raises residential housing prices in urban areas. Furthermore, Troy and Grove (2008) found that neighbourhood park proximity is highly appreciated by the housing market. As a result, the finding for CES in this research is remarkably consistent with prior findings in different parts of the world. Moreover, in this research, the difference in house rent and CES between two chosen neighbourhood blocks was determined using descriptive statistics and an inferential statistic like the T-test. The association between various indicators of home rent (DV), CES (IV), and other control variables was also explained using a correlation analysis. Multiple regression analysis models were also used in order to determine the link between various dependent and independent variables. Finally, HPM was suggested as the model that, after taking the influence of independent and control factors into account, can best explain the housing price in the research region.

5.1 Answering Sub Research Questions

This section is an attempt to address the research questions of this study. Chapter 4 (Data Analysis and Results) reveals that cultural ecosystem services, in addition to other characteristics, has a significant influence on the housing rent in the research region.

All regression models, in chapter 4, are evaluated and found to fulfil the multiple linear regression assumptions. For all models, plots of the standardized residuals vs the standardized predicted values reveal homoscedasticity, the predicted result and the P-P plot reveal linearity normality of residuals. The VIF for each statistically significant explanatory variable is less than seven, according to the regression coefficients table, indicating no or negligible multicollinearity.

Sub-question 1: Is there a difference in housing rent and cultural ecosystem services between Block-A and Block-B of the study area?

Table 36 (Appendix 3) and Map 2 shows that housing rent and CES variables vary across Blocks A and B of the study area. The rent in Block-A is much greater than in Block-B. The A-Block has more CES than the B-Block. The presence of more CES services may be one factor for the increased rent in the A-Block study region.

Sub-question 2: What is the association between the study area's cultural ecosystem services and house rent?

Table 2 shows the linear regression model (LRM) for housing rent and CES variables, which explain 48% of the variation (adjusted R^2). This regression model reveal that CES had a significant influence on housing rent in the research region, in terms of, recreational facility satisfaction (beta= 1336.849, p=.016), distance to recreational facilities (beta=- 5.386, p=.049), and time spent at recreational sites (beta= 1154.557, p= 0.015) and level of scenic and aesthetic view (beta= 1005.822, p=.05). This recreational service is one of the most influential criteria within CES in determining housing rent in the research area.

Sub-question 3: Do other factors (like structural elements of a property, transportation accessibility, environmental quality and socio-economic characteristics of respondents) have an influence on the house rent in the study area?

Linear regression model (LRM) for housing rent, CES and structural features variables explain about 87% of the variation (adjusted R^2). This regression model shows the great influence of house's structural features on the association of CES and housing rent of the study area. No CES indicators are found significant within this regression model. While, three structural features are found significant in this model, these are, number of bedroom (beta= 1181.78, p<.001), number of bathroom/toilet (beta= 2107.55, p<.001), number of balcony/ veranda (beta= 1129.33, p<.001). Moreover, Table 37 (Appendix 3) also shows that the structural features variables has substantial moderating influence in the regression model, with the p value of "Interaction term" P<.001, at the 95% CI.

However, linear regression model (LRM) for housing rent, CES and transport accessibility explain 48% of the variation (adjusted R^2). The study reveals no significant variables for transport accessibility factors, while three CES variables (distance to recreational services, time spent at recreation sites and satisfaction level of recreational facilities) are found significant in this model. Moreover, Table 38 (Appendix 3) also shows that the transport accessibility has no substantial moderating influence in the regression model, with the p value of "Interaction term" P=-1.39, at the 95% CI.

In addition, linear regression model (LRM) for house rent, CES and environment quality attributes accounts for 50% of the variation (adjusted R^2). In this regression model, only one indicators of environment quality attributes is found significant, in terms of Indoor sound level (beta= -146.94, p<.006). Whereas, two CES variables (time spent at recreation sites and satisfaction level of recreational facilities) are found significant in this model. Moreover, Table 39 (Appendix 3) indicates that the environmental quality has no substantial moderating influence in the regression model, with the p value of "Interaction term" P=1.337, at the 95% CI.

However, linear regression model (LRM) for house rent, CES and socio-economic features explain more than 72% of the variation (adjusted R2). In this regression model, only household's monthly income is found significant (beta= 0.13, p<.001), which belongs to socio-economic features. While, one CES variables (satisfaction level of recreational facilities) are also found significant in this model.

It is evident from the above discussion that there is a significant difference in the quantity and availability of CES between Block A and Block B of the Halishahar Housing Estate. In addition, it is also found that the rent for housing in Block A is much higher than in Block B, indicating an association between rent and CES availability. Moreover, there is a substantial association between cultural ecosystem services and housing rent. In addition, house's structural features have a significant moderating influence on the relationship of CES and house rent. On the other hand, transportation accessibility, environmental quality and socio-economic features have no substantial moderation effect on the relationship of CES and house rent within the research region.

5.2 Recommendations for Future Research

This research indicates that CES has a great influence in determining the house rent within the urban residential setting. Moreover, broader cultural ecosystem services benefit the environment and the neighbourhood's quality of life (Aranda, 2016; Mao et al., 2020; Biswas, 2022).

In this study, monthly housing rent was used as a proxy for housing price, but other housing valuation variables such as housing transaction price (Kolbe & Wüstemann, 2014) or land and property value (Aranda, 2016) could provide more detailed evidence on the relationship between housing price and CES in an urban residential setting. Therefore, it is recommended to utilize this housing-pricing factors as a dependent variable in future research in the other neighbourhood areas of Chattogram city.

Furthermore, transport accessibility attributes are found not significant in the regression model for “house rent, CES and transport accessibility”, which contrasts the findings of Rahman et al. (2021) for Khulna city. Their study was for Khulna City Corporation as a whole (Rahman et. al., 2021). While this study attempted to conduct within only two neighbourhood blocks of the Chattogram due to time and resource constraints. Therefore, it is difficult to generalize the result for transportation accessibility attributes across the Chattogram region. Similar studies are also suggested in the future for the city of Chattogram as a whole, to better understand the conclusion of the hedonic pricing model.

Moreover, officials and decision-makers from Chattogram City Corporation (CCC) and Chattogram Development Authority (CDA) might utilize this study's findings for spatial and policy planning. While designing a detailed layout design for a new neighbourhood area, the findings would be taken into consideration in order to offer further cultural ecosystem services through nature-based solutions.

Furthermore, other than the hedonic price model, further economic models such as "the contingent valuation approach", "the trip cost method", "choice experiments" and "the benefit transfer method" can also be used in the future research to evaluate cultural ecosystem services in other urban area of Bangladesh. Particularly, findings of this study could serve as a valuable argument for further research for this research area.

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Appendix 1: Research instruments and timeline

Respected Sir/ Madam,
My name is Md. Sadat Khan and I am now enrolled in the MSc. Master Course in Urban Management and Development at IHS-Erasmus University Rotterdam in the Netherlands. The purpose of this research is to ascertain the association between cultural ecosystem services and residential house rent in Chattogram. You are chosen at random to complete the questionnaire. Several questions, including those about your personal information, will be asked throughout the interview process. The interview is around twenty minutes long. Please rest assured that any information you supply will be kept strictly secret and used for academic reasons exclusively. This information will be kept strictly confidential and will not be split with third parties. I hope you can contribute significantly to our study by responding to this questionnaire.

Respondent selection: This survey should be carried on individuals and households who live in rented homes in the Halishahar Housing Estate area of Chattogram City. The respondent must be over the age of eighteen (18).

***Serial Number**:* …………………
(Note for the interviewer: Please input the Serial Number before commencing the main part of this interview)

1. How much does your house or apartment rent on a monthly basis?…………………
(In Bangladeshi Taka)

The following questions will measure your opinion of the neighbourhood's recreational and aesthetic ecosystem services. Please choose the best answer.

Recreational Ecosystem Services:
The term "recreational ecosystem services" refers to the multiple advantages that humans get from landscapes and the environmental amenities (i.e. Park, playfield, water bodies, garden etc.).

2. Is there any space within your neighbourhood for recreational facilities?
(i.e. park, playfield, lake, canal, garden, etc.)

- ○ Yes
- ○ No

3. How many recreational facilities are available in your area?……………………………
(i.e. park, playfield, lake, canal, garden, etc.)

4. What is the distance between your residence and the recreational facilities?...................
(in Meter)

5. What is the reason for your visit to the recreational sites?
(i.e. park, playfield, lake, canal, garden, etc.)

- ○ Playing Game
- ○ Mental Refreshment
- ○ Take a Walk
- ○ Physical Exercise
- ○ Garden Party
- ○ Gossiping with Friends
- ○ Others (Please specify below)

If you choose "Others" in the previous question, please elaborate. …………………………

6. How often do you visit your neighbourhood's recreational facilities?

- ◯ Hardly or Never Visit
- ◯ Once in a Month
- ◯ A couple of times per month
- ◯ A couple of times per week
- ◯ Daily

7. How long do you spend on average at recreational sites?

- ◯ Less than 30 Min
- ◯ 30-60 Min
- ◯ 60-90 Min
- ◯ 90-120 Min
- ◯ More than 120 Min

8. Please indicate your level of satisfaction with your neighbourhood's recreational facilities.

- ◯ Highly unsatisfied
- ◯ Unsatisfied
- ◯ Not satisfied or unsatisfied
- ◯ Satisfied
- ◯ Highly satisfied

Aesthetic Ecosystem Services:

Aesthetic value is the interaction of humans with their environment in associated with natural beauty, as determined by individual views and assessments.

9. How do you rate the level of greenery in the neighbourhood in terms of providing a scenic view or beauty?

(i.e. Scenic view or beauty from green space around house, park, playfield, lake, canal, garden, etc.)

- ◯ Exceptionally poor/ Not available
- ◯ Poor
- ◯ Neither poor nor good
- ◯ Good
- ◯ Excellent

10. What level of scenic and aesthetic view are you able to enjoy from your residence?

(i.e. a view from a window or balcony)

- ◯ Exceptionally poor/ Not available
- ◯ Poor
- ◯ Neither poor nor good
- ◯ Good
- ◯ Excellent

11. How satisfied are you with aesthetic services, like the scenic and aesthetic view from your home?

- ◯ Highly unsatisfied
- ◯ Unsatisfied
- ◯ Not satisfied or unsatisfied
- ◯ Satisfied
- ◯ Highly satisfied

12. How frequently do you use your camera to capture the visual and aesthetic beauty of your surroundings?

- ◯ Never
- ◯ Occasionally
- ◯ Rarely
- ◯ Usually
- ◯ Always

House's Structural Features

13. What is the total floor space of your residence / house / flat / apartment?......................
(In Square feet)

14. What is the total number of bedrooms in your residence? ………………………………

15. What is the total number of bathroom/ toilet in your residence?...................................

16. What is the total number of balcony/ veranda in your residence? …………………….

17. What is your building's/ structure's age?

- ◯ Less than 5 years
- ◯ 5-15 years
- ◯ 15-25 years
- ◯ 25-35 years
- ◯ More than 35 years

18. What is the type of construction of your house or building?

- ◯ Katcha
- ◯ Semi-Pucca
- ◯ Pucca

Transport Accessibility Attributes

19. How far away is the nearest educational facility (i.e. Primary school) from your home (in meter)? …………………….

20. How far away is the nearest health care facility (i.e. Hospital, Clinic) from your home (in meter)? …………………….

21. How far away is the nearest religious facilities (i.e. Mosque, Temple or Church) from your home (in meter)? …………………….

22. How far away is the nearest kitchen market from your home (in meter)? …………………….

23. How far away is the Central Business District (Agrabad Commercial Area) from your home (in meter)? …………………….

24. How far away is the Main Road (Port Connecting Road) from your home (in meter)? …………………….

25. What is the width of the road connecting to your residence? (in feet)? …………………….

Environmental Quality Attributes

26. What are the "Carbon dioxide (CO_2)" levels inside the house (in ppm)? ……………..
Note to interviewer: Please do not inquire of the interviewee; instead, note the reading from the "Air Quality Measurement Device."

27. What are the "PM 2.5" levels inside the house (in ppm)? ………………………………
Note to interviewer: Please do not inquire of the interviewee; instead, note the reading from the "Air Quality Measurement Device."

28. What are the "PM 10" levels inside the house (in ppm)? ………………………………
Note to interviewer: Please do not inquire of the interviewee; instead, note the reading from the "Air Quality Measurement Device."

29. What is the overall volume of sound inside the house (in dB)? …………………………
Note to interviewer: Please do not inquire of the interviewee; instead, note the reading from "Sound Measurement Device."

30. What is the extent of the water logging that you are experiencing in your neighbourhood? ………………………………
(Mainly water logging during rainy season)

- ◯ No water logging
- ◯ Very Low
- ◯ Low
- ◯ High
- ◯ Extreme

31. How you rank your preferences when looking for a residence for rent?

Preference Parameter	Rank (1-10)
Amount of monthly house rent	
Proximity to recreational facilities (i.e. park, playfield, lake, canal, garden, etc.)	
Having an aesthetic view of natural beauty from home	
House with better structural's features (i.e. floor space, rooms and balconies)	
Better environmental attributes	
Proximity to educational facilities	
Proximity to religious facilities	
Proximity to health care facilities	
Proximity to kitchen market	
Proximity to Central Business District (Agrabad C/A)	

32. Do you want to contribute anything else about the factors that influence the price of houses in your neighbourhood?

……………………………………………………………………………………………………
……………………………………………………………………………………………………

Respondent's Background Information

33. Respondent's Full Name:
34. House Number and Address:
35. Location (Pin) of the Address on Google Maps:

latitude (x.y °)
longitude (x.y °)

36. What is your gender? *(Do not read this aloud)*

- ◯ Male
- ◯ Female

37. How long have you lived you lived at this address?

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ 11-15 years
- ◯ 16-20 years
- ◯ Above 20 years

38. How long have you lived in this Neighbourhood?

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ 11-15 years
- ◯ 16-20 years
- ◯ Above 20 years

39. What is your highest educational level?

- ◯ No schooling
- ◯ Primary School
- ◯ Secondary School
- ◯ Higher Secondary
- ◯ Graduation
- ◯ Others (Please specify below)

If you choose "Others" in the previous question, please elaborate
………………………………......

40. Which Occupation Do You Have?

- Unemployed
- Private service holder
- Government service holder
- Business
- Retired person
- Unpaid household work
- Student
- Others (Please specify below)

If you choose "Others" in the previous question, please elaborate. …………………………….....

41. What is your household's monthly wage? ……………………………………………
(In Bangladeshi Taka)

Thanking Note: I'd want to convey my appreciation for accepting to participate in the interview and for your valuable time.

Thank you again!

Timeline

The timeline for this study provides a clear roadmap for completing the thesis within the allotted period. It entails the formulation of questionnaires and sampling, data collection, data analysis and interpretation, as well as thesis preparation and submission. The time period begins in June 2022 and ends in August 2022 (refer to table-02).

Activity & Month	**May, 2022**		**June, 2022**				**July, 2022**				**August, 2022**
	3rd Week	4th Week	1st Week	2nd Week	3rd Week	4th Week	1st Week	2nd Week	3rd Week	4th Week	1st Week
Questionnaire Formulation & sampling	■										
Field data collection		■	■	■	■						
Data analysis and interpretation					■	■	■				
Thesis writing						■	■	■	■	■	■
Draft Submission							■				
Final Submission											■

Appendix 2: Previous studies on housing price using HPM Model.

Author	Research Title	Study Area	Method & Functional Form	Variables
Akter et al., 2013	"Analysis of Potential Factors Bringing Disparity in House Rent of Dhaka City"	Dhaka City, Bangladesh	Weighted index method	DV-"House Rent"; IV- "External appearance of the buildings; Surrounding land use type; Road distance from house; Availability of open space; Presence of utility facilities; Type of structure; Total number of flats; Average area of each unit flat"
Aranda, 2016	"Assessing the impact of Green Infrastructure on Land Values"	Cali City, Colombia	HPM (Simple linear regression) & GIS (OLS)	DV- "Land Value"; IV- "Green Infrastructure- No of Tree; Number of Tree Species; Green m^2; Vegetation coverage; Bike lines; Pedestrian lines; Exposure to fluvial flooding"; CV- "Public transport efficiency; Public roads quality; Public transport stops; Distance to CBD; Commercial activities; Cultural amenities; Health amenities; Floor Space Index (FSI); Homicides; Robbery rates; Noise pollution; Contact to water bodies (within 80m); Life Satisfaction Index"
Rahman, et al., 2021	"Effects of Transportation Accessibility on Residential Housing Rent: Evidence from Metropolitan City of Khulna, Bangladesh"	Khulna City, Bangladesh	HPM (Simple linear regression & Semi-log regression)	DV- "Housing Rent" IV- "Structural attributes (floor space, no of bedroom, bathroom, drawing room, veranda, age of property); Environmental attributes (Air & Noise pollution); Neighbourhood attributes (Socio-economic variables, municipal services); Transportation attributes (Network access to the major road, minor road, CBD, wholesale market or commercial area, educational facilities, and recreational facilities); Landuse variables (Percentage of residential, commercial, industrial, agricultural land uses, open space (park, waterbody), and community facilities)"
Kolbe & Wüstemann, 2014	"Estimating the value of urban green space: a hedonic pricing analysis of the housing market in Cologne, Germany"	Cologne, Germany	Semi-log regression	DV-"House prices (transaction price)"; IV- "Floor area; Age of house; Urban Green Space (forests, parks, farmland, fallow land); CV-water bodies"
Hussain, et al., 2019	"The effect of sustainable urban planning and slum disamenity on the value of neighboring residential	Islamabad, Pakistan	HPM (Simple linear regression & Semi-log regression)	DV-"Sustainable Rent Value"; IV- "Environmental Attribute (Scenic Beauty, Noise, Pollution, Crime); Structural Attribute (House size, Bedrooms, Bathrooms, House Age, Living room, Garage, Lawn); Locational Attribute (Accessibility to

Author	Research Title	Study Area	Method & Functional Form	Variables
	property: Application of the hedonic pricing model in rent price appraisal"			amenities; Distance to city center, park, hospital, school, waste site, transport facilities); Neighbourhood Attributes (Socio-economic conditions of nearby residents, Neighbourhood Infrastructure, Roads and streets)"
Islam, et al., 2020	"The value of environmental (dis) amenities in the urban housing market: evidence from Khulna, Bangladesh"	Khulna, Bangladesh	HPM (Semi-log regression & Log-log regression)	DV- "House Rent"; IV- "Household income; Structural Characteristics (Age of the building, Room numbers, Garage); Neighbourhood Characteristics (School, Hospital, Stationary shop); Environmental Characteristics (Ventilation, Accessibility to open space, Water logging, Landfill)"
Sharmin, 2013	"Hedonic analysis of open spaces in urban residential neighborhood of Dhaka"	Dhaka City, Bangladesh	HPM (Simple linear regression) & GIS (OLS)	DV- "House Rent"; IV- "Structural variables (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); Neighbourhood variables (distance to district center, kitchen market, supermarket, primary health service area, hospital, nearest primary school, socio-cultural service area, technical and administrative service areas, public transportation roads and stations, metro stations, railway and railway stations, energy lines and high power electric networks, proportion of vacant houses, median age of the residents, median household income of the residents, percentage of residents with college degree); Environmental variables (distance to sport facilities and areas, parks and play grounds, greenways, golf courses, lakes and watersheds, urban forests, urban wetlands, waste disposal lands, hazardous waste landfills, air pollution, noise, underground water contamination, natural hazards risks-earthquake and flood)"

Author	Research Title	Study Area	Method & Functional Form	Variables
Islam, 2006	"Impact of accessibility on house rent in Dhaka city: a hedonic price approach"	Dhaka City, Bangladesh	HPM (Semi log regression & Log-log regression)	DV- "House Rent"; IV- "Distance to CBD; Access road width; Main road width; Distance from main road; Distance to community services; Distance to work place; Electricity supply; Water supply; Gas supply; Floor Area; Type of building; Quality of Building"
Rahman, 2014	"Impacts of Urban Environmental Amenities on Housing–A Case Study on Uttara Model Town"	Dhaka City, Bangladesh	HPM (Simple linear regression)	DV- "House Rent"; IV- "Distance to park; Building height; No of bedroom; No of bathroom; Face; Side; Size; Distance from road; Noise; Air Quality"
Yasmin, 2017	"The Impact of View and Accessibility Amenities on High-Rise Residential Properties in the City of Dhaka: A Hedonic Pricing Model"	Dhaka City, Bangladesh	HPM (Simple linear regression)	DV- "House Price"; IV-" STRUCTURAL ATTRIBUTES (No. of bedroom, bathroom, balcony); VIEW AMENITIES (Proximity to water body, green area/park); LOCATION VARIABLES (Distance from adjacent structure, Accessibility to reputable school, Distance to market/ shopping mall, daily grocery, hospital, transportation service)"
Hussain et al., 2021	"Impact of urban village disamenity on neighboring residential properties: empirical evidence from Nanjing through hedonic pricing model appraisal"	Nanjing, China	HPM (Semi log regression)	DV- "House Price"; IV- "Structural variable (floor area, age, bedrooms, living room, dining room, floors & bathrooms); Neighborhood variables (Distance to the central business district (CBD), school, park, subway & highway); Critical variable distance of the apartment from the nearest urban village; grocery, hospital, transportation service)"
Bashar, 2012	"Structural, Spatial and Other Attributes of House Price: The Case of Bangladesh"	Dhaka & Brahmanbaria city, Bangladesh	HPM (Simple linear regression)	DV- "House Rent"; IV- "In-house (Age, floor level, bedroom, bathroom, floor condition, no of veranda, flat view); Communication Facilities (rail, bus, kitchen market, primary school, hospital, commercial area); Other facilities (water supply, gas, electricity, drain, street light, waste mgt, access road, security); water logging; environmental quality; communal harmony; crime rate"
Nazir, at al., 2015	"Role of green infrastructure in determining house value in Labuan using hedonic pricing model"	Labuan, Malaysia	HPM (Simple linear regression)	DV- "Housing Price"; IV- "Distance to town, fire bridged, commercial area, Having Parking area, water bodies, sloping land, community center, Lot size, House extension, Perimeter road & access road, location of bus & taxi stand, easy access to botanical garden/park, school, distance to nearness greenway, No of bedroom, distance to work place, house material,

Author	Research Title	Study Area	Method & Functional Form	Variables
				solar system, facilities for disable people, distance to police station”
Łaszkiewicz et al., 2022	“Valuing access to urban greenspace using non-linear distance decay in hedonic property pricing”	Oslo, Norway	HPM (Penalized Spline Spatial Error Method)	DV- “Property Price” IV- “Distance to pocket park; small park; medium park; large park; Marka N; Marka E; Socioeconomic index; commercial amenities; cultural amenities; school; fjord; metro; highway; Noise below 55; Noise 55–64; Noise 65+”

Source: Author, 2022

Appendix 3: Survey response

Table 9: Descriptive statistics of dependent and independent variables.

Description of Indicators	Frequency	Mean	Median	Std. Deviation	Minimum	Maximum
Monthly House Rent (In BDT)	136.00	11078.68	10000.00	3707.30	1200.00	25000.00
Number of available recreational facilities within neighborhood	136.00	3.24	5.00	1.99	1.00	5.00
Distance between house and recreational facilities (In meter)	136.00	147.14	118.00	114.27	5.00	600.00
Frequency of visits to neighborhood's recreational facilities	136.00	2.88	3.00	1.34	1.00	5.00
Average time spent at recreation sites	136.00	1.63	2.00	0.63	1.00	4.00
Reason of visiting recreational sites	136.00	2.79	3.00	1.09	1.00	7.00
Level of satisfaction with neighborhood's recreational facilities	136.00	3.26	3.00	0.86	2.00	5.00
Level of greenery in the neighbourhood to provide scenic view	136.00	3.21	3.00	0.84	2.00	5.00
Level of scenic and aesthetic view from residence	136.00	3.18	3.00	0.77	2.00	5.00
Level of satisfaction with aesthetic services from residence	136.00	3.15	3.00	0.79	2.00	5.00
Frequency of camera use to capture the scenic beauty of the surroundings	136.00	1.94	2.00	0.88	1.00	4.00
Total floor area of house (In square feet)	136.00	1067.79	1000.00	292.79	200.00	2200.00
Total number of bedrooms	136.00	2.55	2.00	0.91	1.00	5.00
Total number of bathroom/ toilet	136.00	1.82	2.00	0.82	0.00	4.00
Total number of balcony/ veranda	136.00	1.68	1.00	0.91	0.00	3.00
Construction Type of the house or structure	136.00	2.98	3.00	0.19	1.00	3.00
Age of the Building or Structure	136.00	2.40	2.00	0.66	1.00	5.00
Distance of nearest educational facility from home (In meter)	136.00	278.60	253.50	156.74	16.00	710.00

Description of Indicators	Frequency	Mean	Median	Std. Deviation	Minimum	Maximum
Distance of nearest health care facility from home (In meter)	136.00	495.19	397.00	277.44	109.00	1084.00
Distance of nearest religious facility from home (In meter)	136.00	178.93	147.00	112.32	23.00	488.00
Distance of nearest kitchen market from home (In meter)	136.00	222.39	199.50	110.68	35.00	533.00
Distance of the CBD (Agrabad C/A) from home (in meter)	136.00	4055.51	4093.50	244.82	3564.00	4604.00
Distance of the Main Road (PC Road) from home (in meter)	136.00	1015.21	990.50	269.13	560.00	1526.00
The width of the access road to the home (In feet)	136.00	20.66	20.00	3.64	15.00	40.00
Concentration of carbon dioxide (C02) inside the home (In ppm)	136.00	571.79	568.00	21.29	515.00	690.00
PM2.5 concentration within the home (in ug/m3)	136.00	35.65	31.00	14.86	13.00	86.00
PM10 concentration within the home (in ug/m3)	136.00	61.44	58.00	21.20	22.00	120.00
General sound level inside the house (in dB)	136.00	52.93	52.40	4.73	45.40	72.50
The level of waterlogging in the neighbourhood	136.00	1.49	1.00	0.86	1.00	4.00
Household's monthly income (In BDT)	136.00	41066.18	40000.00	15675.51	8000.00	100000.00
Respondents' highest level of education	136.00	4.03	4.00	0.91	2.00	5.00
Respondent's occupation	136.00	3.61	4.00	1.37	1.00	8.00
Respondent's Gender	136.00	0.91	1.00	0.28	0.00	1.00
Duration of living in the house	136.00	1.99	2.00	0.77	1.00	4.00
Duration of living in the neighbourhood	136.00	2.90	3.00	1.07	1.00	6.00

Source: Field Survey, 2022

Table 10: Number of available recreational facilities within neighborhood.

Halishahar Housing Block	Frequency	Percent
Block B	1.00	16.67
Block A	5.00	83.33
Total	**6.00**	**100.00**

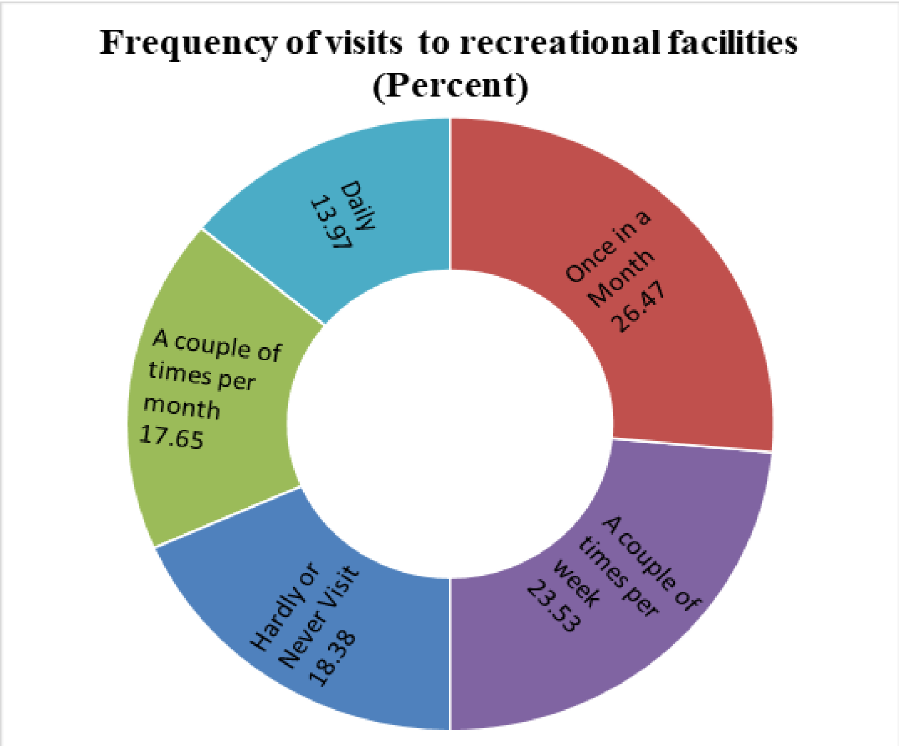
Source: Field Survey, 2022

Table 11: Frequency of visits to neighborhood's recreational facilities (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Hardly or Never Visit	12	15.8
	Once in a Month	10	13.2
	A couple of times per month	15	19.7
	A couple of times per week	24	31.6
	Daily	15	19.7
	Total	76	100.0
B-Block	Hardly or Never Visit	13	21.7
	Once in a Month	26	43.3
	A couple of times per month	9	15.0
	A couple of times per week	8	13.3
	Daily	4	6.7
	Total	60	100.0

Source: Field Survey, 2022

Figure 8: Frequency of visits to neighborhood's recreational facilities.



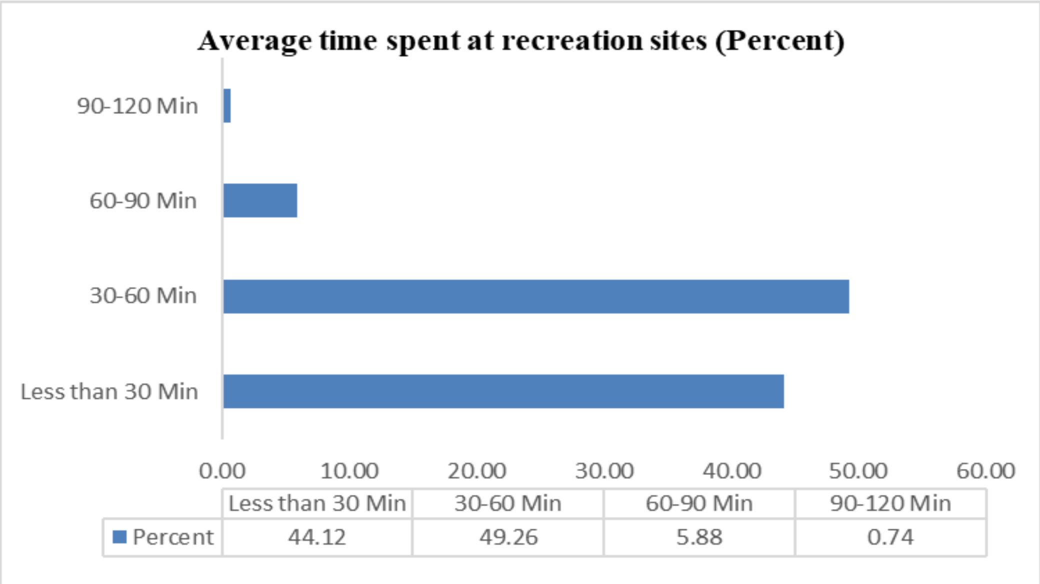
Source: Survey, 2022

Table 12: Average time spent at recreation sites (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Less than 30 Min	14	18.4
	30-60 Min	53	69.7
	60-90 Min	8	10.5
	90-120 Min	1	1.3
	Total	76	100.0
B-Block	Less than 30 Min	46	76.7
	30-60 Min	14	23.3
	Total	60	100.0

Source: Survey, 2022

Figure 9: Average time spent at recreation sites.



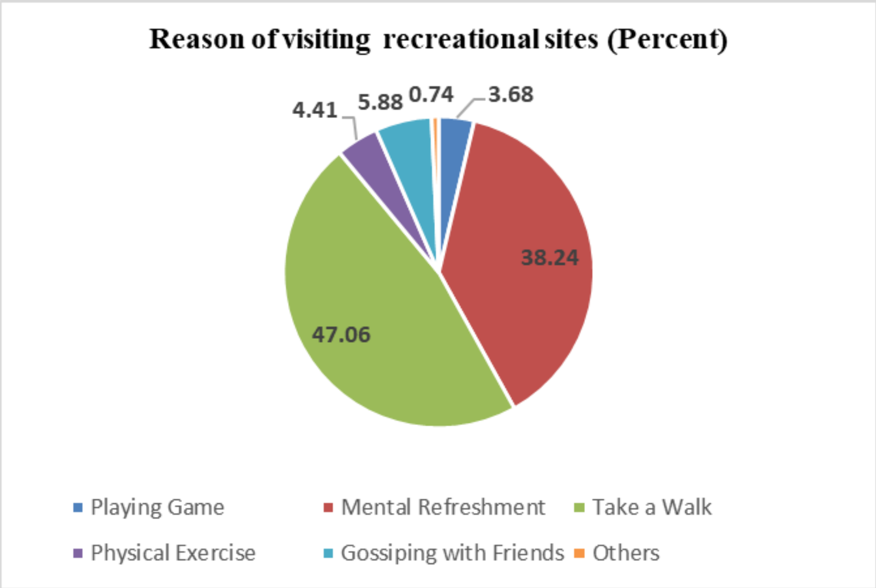
Source: Survey, 2022

Table 13: Reason of visiting recreational sites (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Playing Game	3	3.9
	Mental Refreshment	32	42.1
	Take a Walk	34	44.7
	Physical Exercise	3	3.9
	Gossiping with Friends	4	5.3
	Total	76	100.0
B-Block	Playing Game	2	3.3
	Mental Refreshment	20	33.3
	Take a Walk	30	50.0
	Physical Exercise	3	5.0
	Gossiping with Friends	4	6.7
	Others	1	1.7
	Total	60	100.0

Source: Survey, 2022

Figure 10: Reason of visiting recreational sites.



Source: Survey, 2022

Table 14: Level of satisfaction with neighborhood's recreational facilities (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Unsatisfied	10	13.2
	Not satisfied or unsatisfied	22	28.9
	Satisfied	37	48.7
	Highly satisfied	7	9.2
	Total	76	100.0
B-Block	Unsatisfied	20	33.3
	Not satisfied or unsatisfied	26	43.3
	Satisfied	14	23.3
	Total	60	100.0

Source: Survey, 2022

Figure 11: Level of satisfaction with neighborhood's recreational facilities.

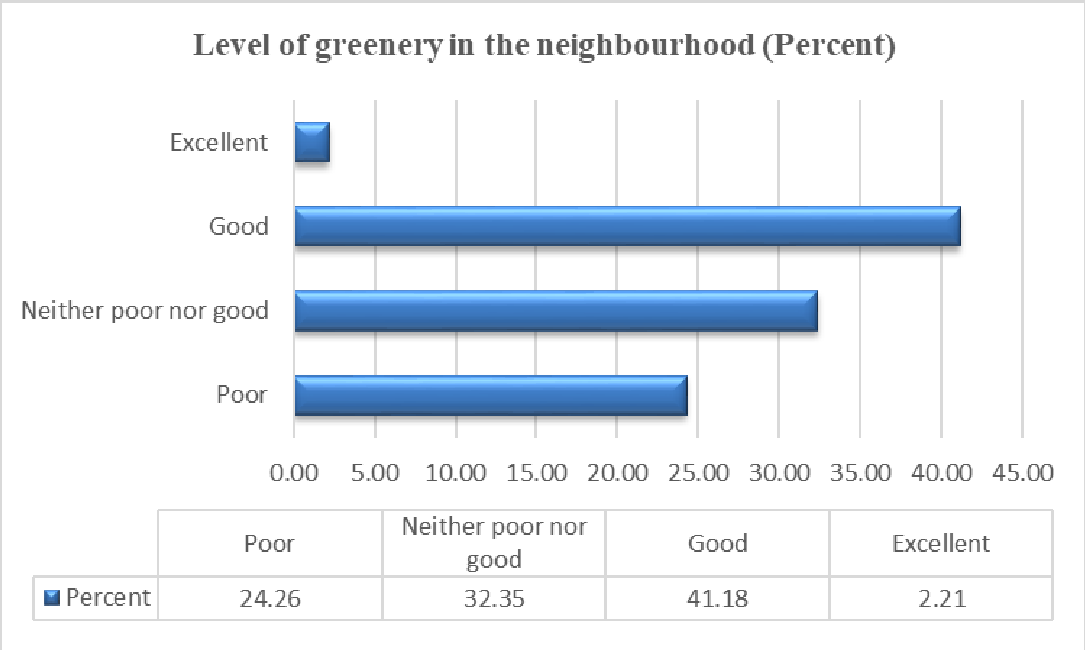
Source: Survey, 2022

Table 15: Level of greenery in the neighbourhood to provide scenic view (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Poor	15	19.7
	Neither poor nor good	13	17.1
	Good	45	59.2
	Excellent	3	3.9
	Total	76	100.0
B-Block	Poor	18	30.0
	Neither poor nor good	31	51.7
	Good	11	18.3
	Total	60	100.0

Source: Survey, 2022

Figure 12: Level of greenery in the neighbourhood to provide scenic view.



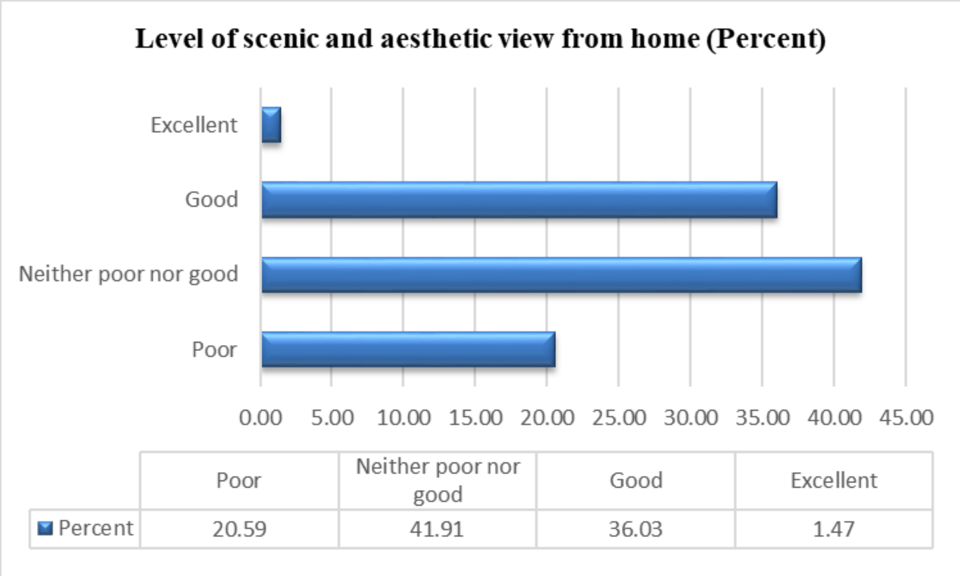
Source: Survey, 2022

Table 16: Level of scenic and aesthetic view from home (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Poor	12	15.8
	Neither poor nor good	22	28.9
	Good	40	52.6
	Excellent	2	2.6
	Total	76	100.0
B-Block	Poor	16	26.7
	Neither poor nor good	35	58.3
	Good	9	15.0
	Total	60	100.0

Source: Survey, 2022

Figure 13: Level of scenic and aesthetic view from home.



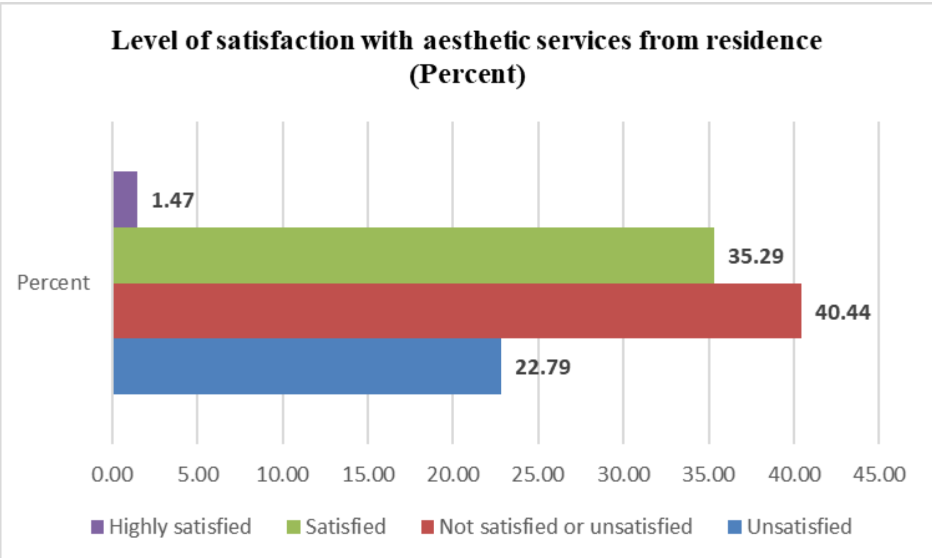
Source: Survey, 2022

Table 17: Level of satisfaction with aesthetic services from residence (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Unsatisfied	13	17.1
	Not satisfied or unsatisfied	29	38.2
	Satisfied	32	42.1
	Highly satisfied	2	2.6
	Total	76	100.0
B-Block	Unsatisfied	18	30.0
	Not satisfied or unsatisfied	26	43.3
	Satisfied	16	26.7
	Total	60	100.0

Source: Survey, 2022

Figure 14: Level of satisfaction with aesthetic services from residence.



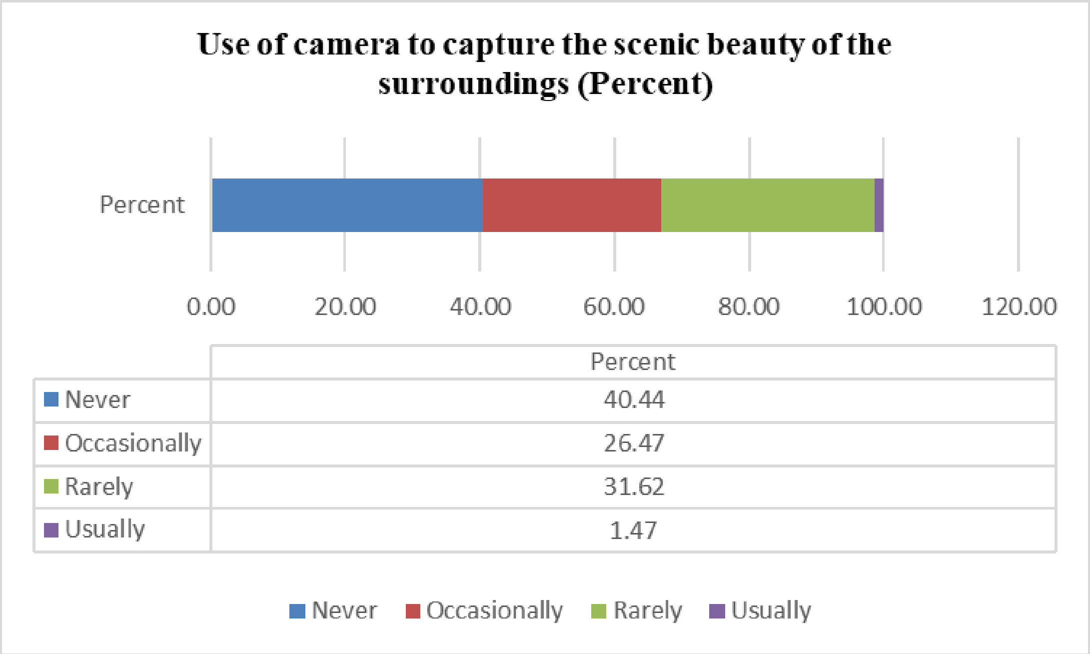
Source: Survey, 2022

Table 18: Use of camera to capture the scenic beauty of the surroundings (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Never	25	32.9
	Occasionally	25	32.9
	Rarely	25	32.9
	Usually	1	1.3
	Total	76	100.0
B-Block	Never	30	50.0
	Occasionally	11	18.3
	Rarely	18	30.0
	Usually	1	1.7
	Total	60	100.0

Source: Survey, 2022

Figure 15: Use of camera to capture the scenic beauty of the surroundings.



Source: Survey, 2022

Table 19: Total number of bedrooms (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	1	1	1.3
	2	35	46.1
	3	19	25.0
	4	18	23.7
	5	3	3.9
	Total	76	100.0
B-Block	1	4	6.7
	2	46	76.7
	3	5	8.3
	4	4	6.7
	5	1	1.7
	Total	60	100.0

Source: Survey, 2022

Table 20: Total number of bathroom/ toilet (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	1	14	18.4
	2	42	55.3
	3	16	21.1
	4	4	5.3
	Total	76	100.0
B-Block	0	2	3.3
	1	35	58.3
	2	19	31.7
	3	3	5.0
	4	1	1.7
	Total	60	100.0

Source: Survey, 2022

Table 21: Total number of balcony/ veranda (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	0	2	2.6
	1	23	30.3
	2	22	28.9
	3	29	38.2
	Total	76	100.0
B-Block	0	4	6.7
	1	44	73.3
	2	6	10.0
	3	6	10.0
	Total	60	100.0

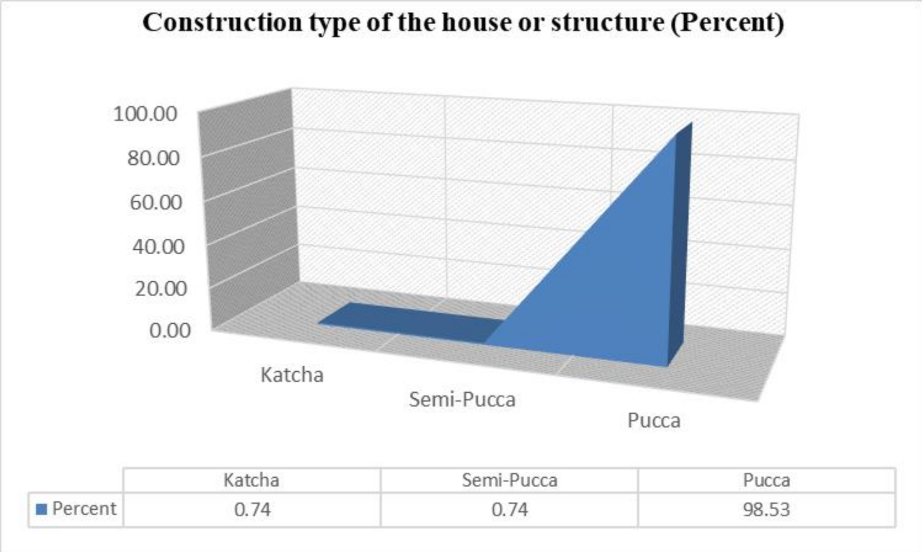
Source: Survey, 2022

Table 22: Construction Type of the house or structure (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Pucca	76	100.0
	Total	76	100.0
B-Block	Katcha	1	1.7
	Semi-Pucca	1	1.7
	Pucca	58	96.7
	Total	60	100.0

Source: Survey, 2022

Figure 16: Construction Type of the house or structure.



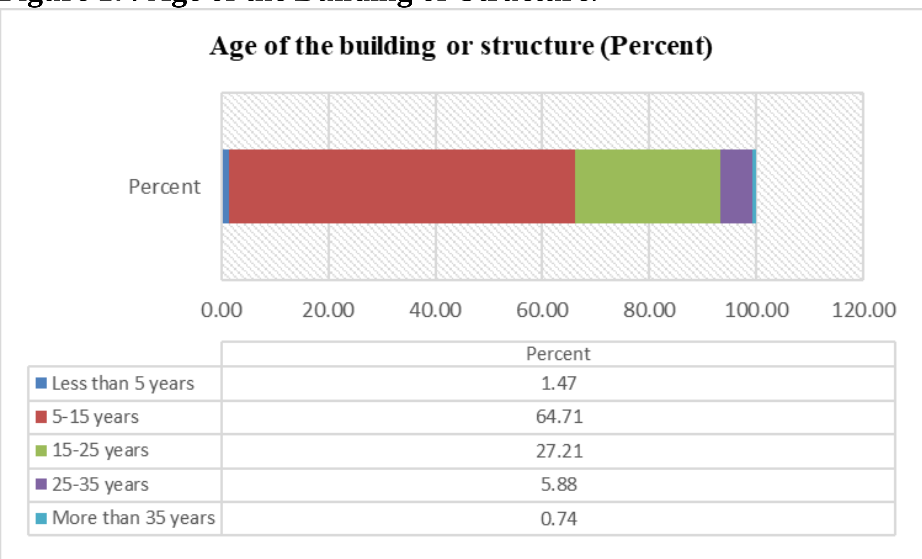
Source: Survey, 2022

Table 23: Age of the Building or Structure (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	5-15 years	66	86.8
	15-25 years	9	11.8
	25-35 years	1	1.3
	Total	76	100.0
B-Block	Less than 5 years	2	3.3
	5-15 years	22	36.7
	15-25 years	28	46.7
	25-35 years	7	11.7
	More than 35 years	1	1.7
	Total	60	100.0

Source: Survey, 2022

Figure 17: Age of the Building or Structure.



Source: Survey, 2022

Table 24: The width of the access road to the home (In feet).

Halishahar Housing Block		Frequency	Percent
A-Block	20	71	93.4
	35	1	1.3
	40	4	5.3
	Total	76	100.0
B-Block	15	1	1.7
	20	59	98.3
	Total	60	100.0

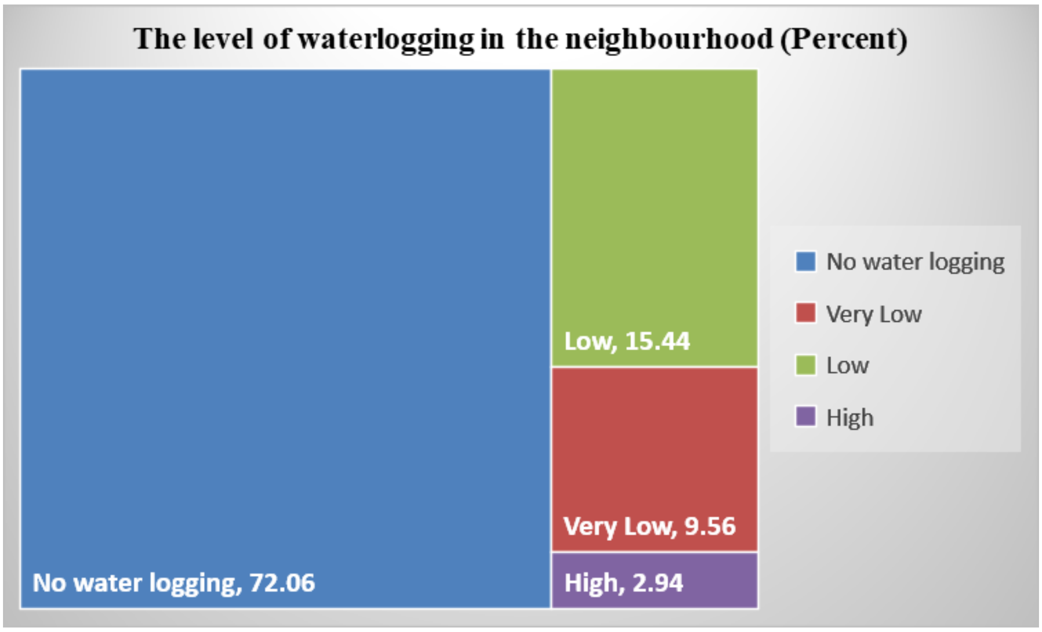
Source: Survey, 2022

Table 25: The level of waterlogging in the neighbourhood (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	No water logging	61	80.3
	Very Low	6	7.9
	Low	7	9.2
	High	2	2.6
	Total	76	100.0
B-Block	No water logging	37	61.7
	Very Low	7	11.7
	Low	14	23.3
	High	2	3.3
	Total	60	100.0

Source: Survey, 2022

Figure 18: The level of waterlogging in the neighbourhood.



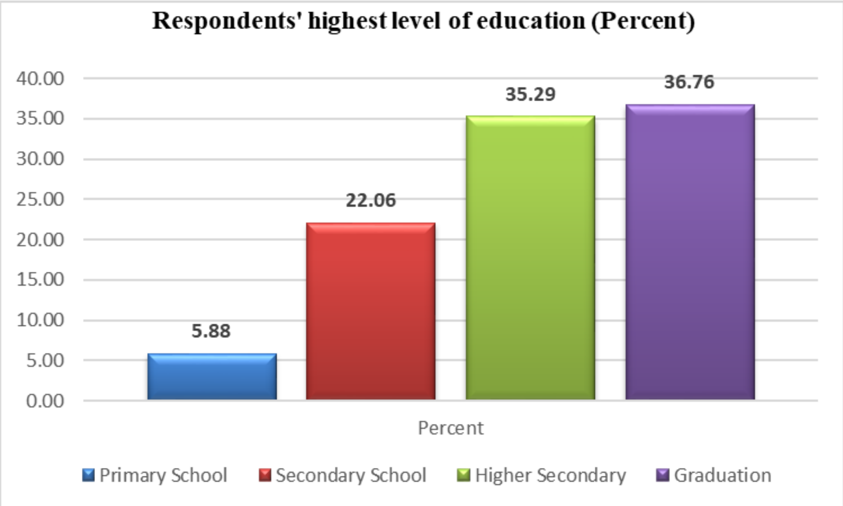
Source: Survey, 2022

Table 26: Respondents' highest level of education (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Primary School	2	2.6
	Secondary School	9	11.8
	Higher Secondary	30	39.5
	Graduation	35	46.1
	Total	76	100.0
B-Block	Primary School	6	10.0
	Secondary School	21	35.0
	Higher Secondary	18	30.0
	Graduation	15	25.0
	Total	60	100.0

Source: Survey, 2022

Figure 19: Respondents' highest level of education.



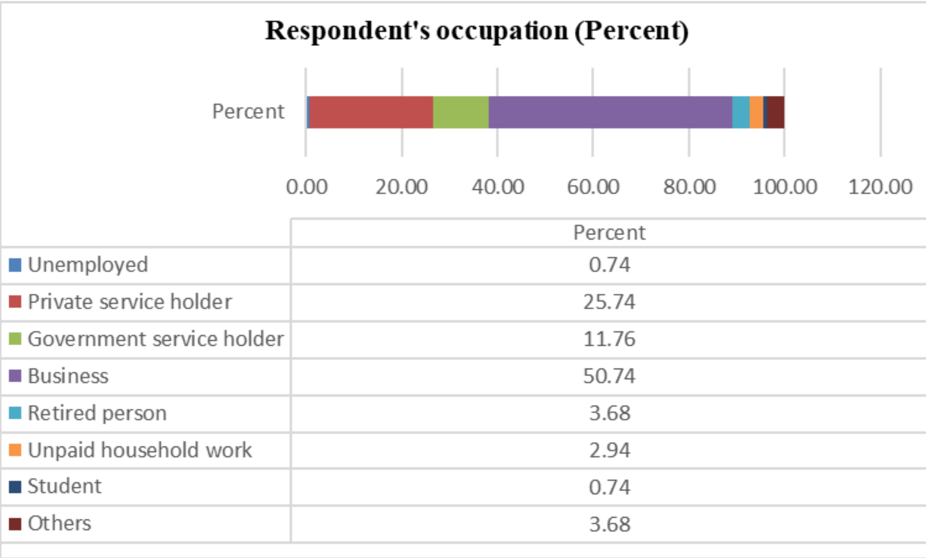
Source: Survey, 2022

Table 27: Respondent's occupation (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Private service holder	21	27.6
	Government service holder	11	14.5
	Business	34	44.7
	Retired person	4	5.3
	Unpaid household work	4	5.3
	Others	2	2.6
	Total	76	100.0
B-Block	Unemployed	1	1.7
	Private service holder	14	23.3
	Government service holder	5	8.3
	Business	35	58.3
	Retired person	1	1.7
	Student	1	1.7
	Others	3	5.0
	Total	60	100.0

Source: Survey, 2022

Figure 20: Respondent's occupation.



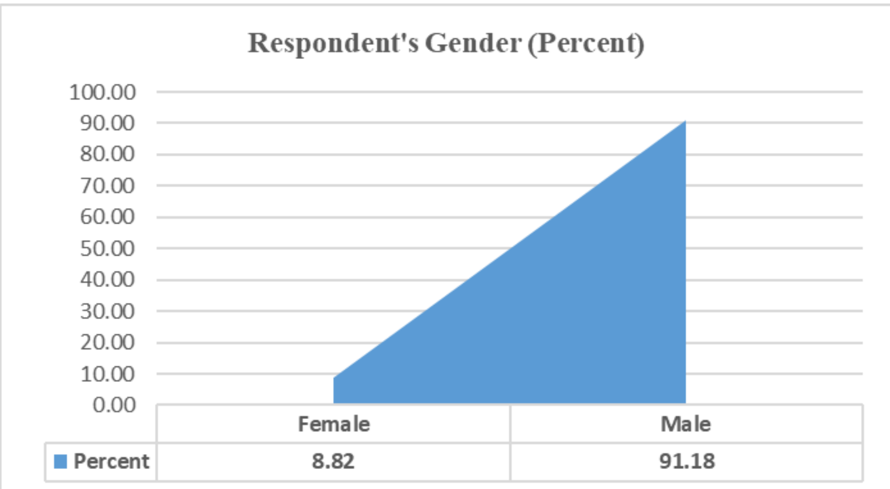
Source: Survey, 2022

Table 28: Respondent's Gender (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Female	8	10.5
	Male	68	89.5
	Total	76	100.0
B-Block	Female	4	6.7
	Male	56	93.3
	Total	60	100.0

Source: Survey, 2022

Figure 21: Respondent's Gender.



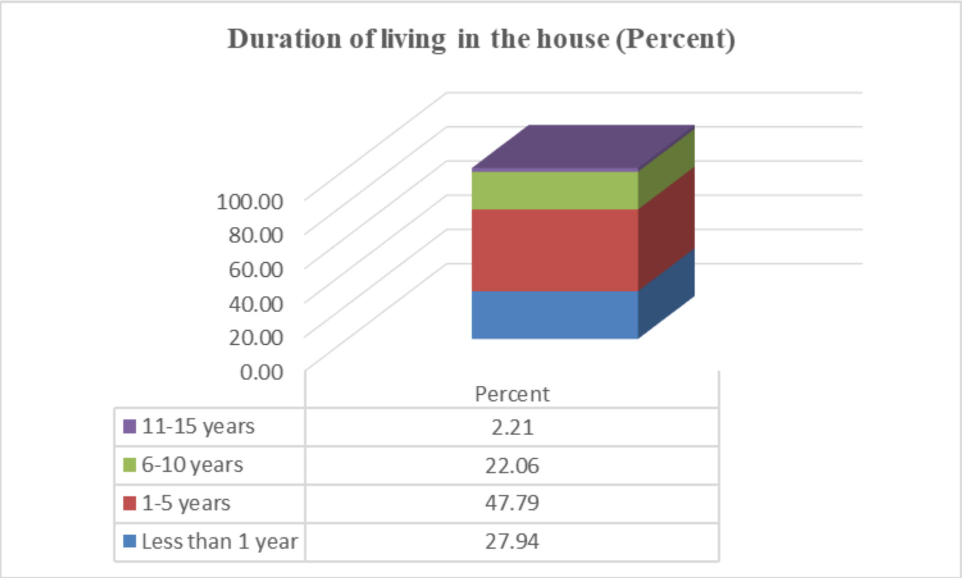
Source: Survey, 2022

Table 29: Duration of living in the house (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Less than 1 year	10	13.2
	1-5 years	41	53.9
	6-10 years	23	30.3
	11-15 years	2	2.6
	Total	76	100.0
B-Block	Less than 1 year	28	46.7
	1-5 years	24	40.0
	6-10 years	7	11.7
	11-15 years	1	1.7
	Total	60	100.0

Source: Survey, 2022

Figure 22: Duration of living in the house.



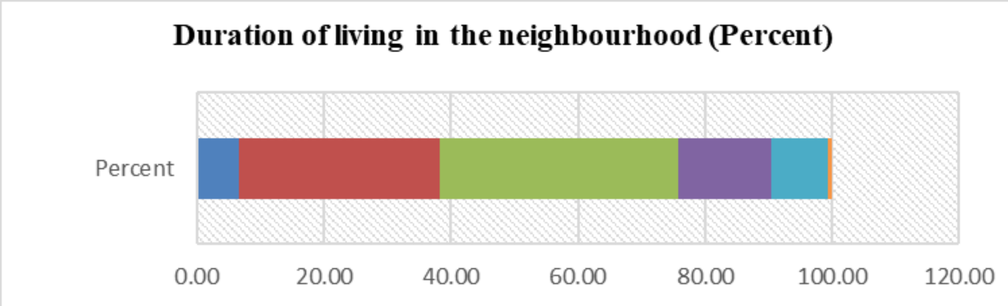
Source: Survey, 2022

Table 30: Duration of living in the neighbourhood (Block wise).

Halishahar Housing Block		Frequency	Percent
A-Block	Less than 1 year	2	2.6
	1-5 years	22	28.9
	6-10 years	28	36.8
	11-15 years	16	21.1
	16-20 years	7	9.2
	Above 20 years	1	1.3
	Total	76	100.0
B-Block	Less than 1 year	7	11.7
	1-5 years	21	35.0
	6-10 years	23	38.3
	11-15 years	4	6.7
	16-20 years	5	8.3
	Total	60	100.0

Source: Survey, 2022

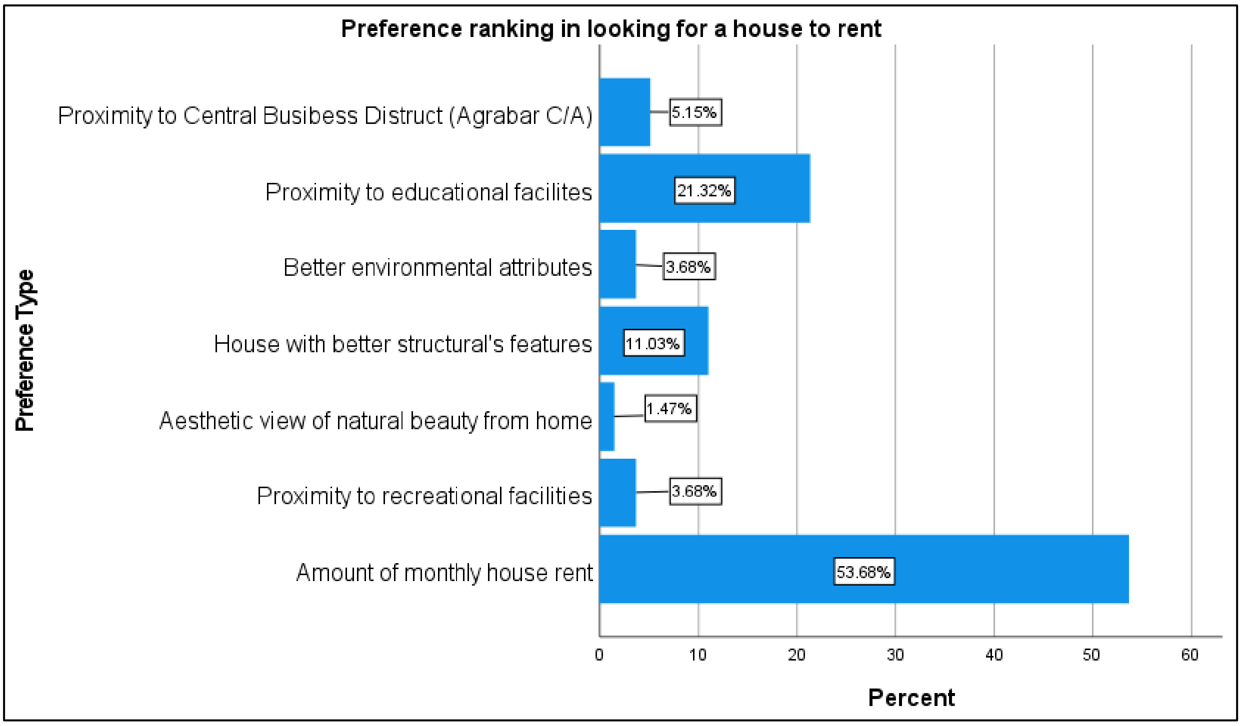
Figure 23: Duration of living in the neighbourhood.



	Percent
Less than 1 year	6.62
1-5 years	31.62
6-10 years	37.50
11-15 years	14.71
16-20 years	8.82
Above 20 years	0.74

Source: Survey, 2022

Figure 24: Ranking preference for renting a home in the study area (1st choice).



Source: Survey, 2022

Table 31: Pearson correlation of house rent and indicators of CES.

Pearson Correlation	Monthly House Rent (In BDT)	Number of available recreational facilities within neighborhood	Distance between house and recreational facilities (In meter)	Frequency of visits to neighborhood's recreational facilities	Average time spent at recreation sites	Level of satisfaction with neighborhood's recreational facilities	Level of greenery in the neighbourhood to provide scenic view	Level of scenic and aesthetic view from residence	Level of satisfaction with aesthetic services from residence	Frequency of camera use to capture the scenic beauty of the surroundings
Monthly House Rent (In BDT)	1.000	0.435	-0.518	0.595	0.532	0.640	0.526	0.525	0.345	0.043
Number of available recreational facilities within neighborhood	0.435	1.000	-0.532	0.321	0.565	0.370	0.351	0.347	0.213	0.109
Distance between house and recreational facilities (In meter)	-0.518	-0.532	1.000	-0.596	-0.503	-0.501	-0.502	-0.407	-0.195	0.079
Frequency of visits to neighborhood's recreational facilities	0.595	0.321	-0.596	1.000	0.449	0.804	0.683	0.523	0.361	0.038
Average time spent at recreation sites	0.532	0.565	-0.503	0.449	1.000	0.544	0.500	0.445	0.264	0.174
Level of satisfaction with neighborhood's recreational facilities	0.640	0.370	-0.501	0.804	0.544	1.000	0.766	0.642	0.509	0.127

Pearson Correlation	Monthly House Rent (In BDT)	Number of available recreational facilities within neighborhood	Distance between house and recreational facilities (In meter)	Frequency of visits to neighborhood's recreational facilities	Average time spent at recreation sites	Level of satisfaction with neighborhood's recreational facilities	Level of greenery in the neighbourhood to provide scenic view	Level of scenic and aesthetic view from residence	Level of satisfaction with aesthetic services from residence	Frequency of camera use to capture the scenic beauty of the surroundings
Level of greenery in the neighbourhood to provide scenic view	0.526	0.351	-0.502	0.683	0.500	0.766	1.000	0.764	0.657	0.107
Level of scenic and aesthetic view from residence	0.525	0.347	-0.407	0.523	0.445	0.642	0.764	1.000	0.696	0.168
Level of satisfaction with aesthetic services from residence	0.345	0.213	-0.195	0.361	0.264	0.509	0.657	0.696	1.000	0.183
Frequency of camera use to capture the scenic beauty of the surroundings	0.043	0.109	0.079	0.038	0.174	0.127	0.107	0.168	0.183	1.000

Source: Author, 2022

Table 32: Pearson correlation of house rent and indicators of structural features.

Pearson Correlation	Monthly House Rent (In BDT)	Total floor area of house (In square feet)	Total number of bedrooms	Total number of bathroom/ toilet	Total number of balcony/ veranda	Age of the Building or Structure
Monthly House Rent (In BDT)	1.000	0.966	0.884	0.880	0.843	-0.414
Total floor area of house (In square feet)	0.966	1.000	0.878	0.853	0.854	-0.396
Total number of bedrooms	0.884	0.878	1.000	0.803	0.862	-0.368
Total number of bathroom/ toilet	0.880	0.853	0.803	1.000	0.723	-0.429
Total number of balcony/ veranda	0.843	0.854	0.862	0.723	1.000	-0.501
Age of the Building or Structure	-0.414	-0.396	-0.368	-0.429	-0.501	1.000

Source: Author, 2022

Table 33: Pearson correlation of house rent and indicators of transport accessibility attributes.

Pearson Correlation	Monthly House Rent (In BDT)	Distance of nearest educational facility from home (In meter)	Distance of nearest health care facility from home (In meter)	Distance of nearest religious facility from home (In meter)	Distance of nearest kitchen market from home (In meter)	Distance of the CBD (Agrabad C/A) from home (in meter)	Distance of the Main Road (PC Road) from home (in meter)	The width of the access road to the home (In feet)
Monthly House Rent (In BDT)	1.000	-0.268	-0.378	-0.344	-0.111	-0.336	-0.415	0.010
Distance of nearest educational facility from home (In meter)	-0.268	1.000	0.714	0.677	-0.061	0.479	0.667	-0.026
Distance of nearest health care facility from home (In meter)	-0.378	0.714	1.000	0.731	0.111	0.583	0.887	-0.220
Distance of nearest religious facility from home (In meter)	-0.344	0.677	0.731	1.000	0.301	0.626	0.748	-0.165
Distance of nearest kitchen market from home (In meter)	-0.111	-0.061	0.111	0.301	1.000	-0.183	0.016	-0.101
Distance of the CBD (Agrabad C/A) from home (in meter)	-0.336	0.479	0.583	0.626	-0.183	1.000	0.878	-0.097
Distance of the Main Road (PC Road) from home (in meter)	-0.415	0.667	0.887	0.748	0.016	0.878	1.000	-0.177

Pearson Correlation	Monthly House Rent (In BDT)	Distance of nearest educational facility from home (In meter)	Distance of nearest health care facility from home (In meter)	Distance of nearest religious facility from home (In meter)	Distance of nearest kitchen market from home (In meter)	Distance of the CBD (Agrabad C/A) from home (in meter)	Distance of the Main Road (PC Road) from home (in meter)	The width of the access road to the home (In feet)
The width of the access road to the home (In feet)	0.010	-0.026	-0.220	-0.165	-0.101	-0.097	-0.177	1.000

Source: Author, 2022

Table 34: Pearson correlation of house rent and indicators of environmental quality.

Pearson Correlation	Monthly House Rent (In BDT)	Concentration of carbon dioxide (C02) inside the home (In ppm)	PM2.5 concentration within the home (in ug/m3)	PM10 concentration within the home (in ug/m3)	General sound level inside the house (in dB)	The level of waterlogging in the neighbourhood
Monthly House Rent (In BDT)	1.000	-0.198	0.075	0.086	-0.118	-0.006
Concentration of carbon dioxide (C02) inside the home (In ppm)	-0.198	1.000	0.060	0.032	0.295	0.026
PM2.5 concentration within the home (in ug/m3)	0.075	0.060	1.000	0.853	0.070	-0.149
PM10 concentration within the home (in ug/m3)	0.086	0.032	0.853	1.000	0.046	-0.085
General sound level inside the house (in dB)	-0.118	0.295	0.070	0.046	1.000	0.020

Pearson Correlation	Monthly House Rent (In BDT)	Concentration of carbon dioxide (C02) inside the home (In ppm)	PM2.5 concentration within the home (in ug/m3)	PM10 concentration within the home (in ug/m3)	General sound level inside the house (in dB)	The level of waterlogging in the neighbourhood
The level of waterlogging in the neighbourhood	-0.006	0.026	-0.149	-0.085	0.020	1.000

Source: Author, 2022

Table 35: Pearson correlation of house rent and indicators of socio-economic attributes.

Pearson Correlation	Monthly House Rent (In BDT)	Household's monthly income (In BDT)	Respondents' highest level of education	Duration of living in the house	Duration of living in the neighbourhood
Monthly House Rent (In BDT)	1.000	0.789	0.415	0.459	0.213
Household's monthly income (In BDT)	0.789	1.000	0.397	0.394	0.180
Respondents' highest level of education	0.415	0.397	1.000	0.275	0.034
Duration of living in the house	0.459	0.394	0.275	1.000	0.574
Duration of living in the neighbourhood	0.213	0.180	0.034	0.574	1.000

Source: Author, 2022

Figure 25: Implication of Pearson correlation coefficient value.

Correlation Coefficient Value (r)	Direction and Strength of Correlation
-1	Perfectly negative
-0.8	Strongly negative
-0.5	Moderately negative
-0.2	Weakly negative
0	No association
0.2	Weakly positive
0.5	Moderately positive
0.8	Strongly positive
1	Perfectly positive

Source: Ratnasari et al., 2016.

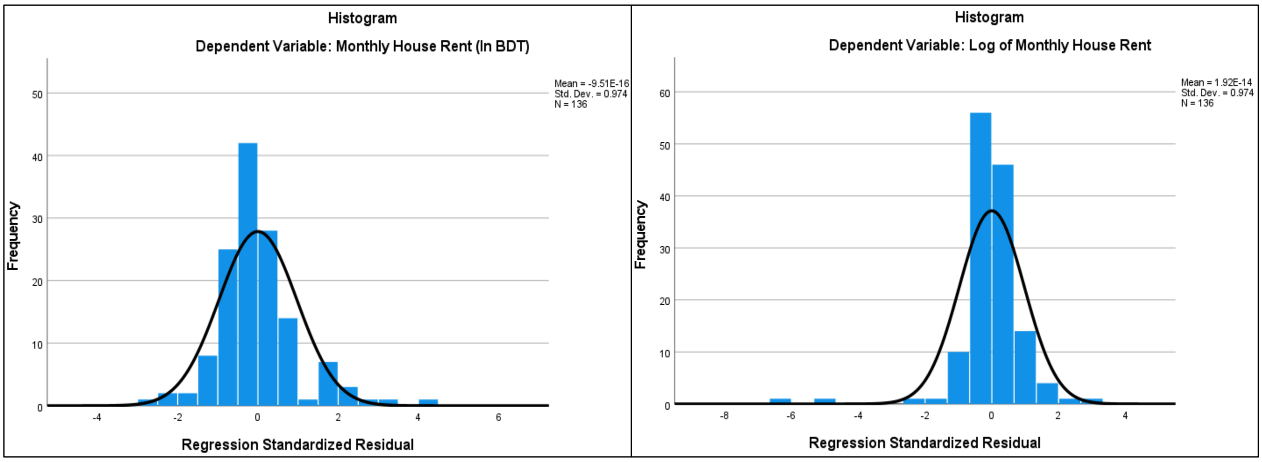
Table 36: Independent Samples T-Test of "dependent variable (House Rent)" and "independent variables (CES)".

No			Levene's Test for Equality of Variances		t-test for Equality of Means							
			F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							One-Sided p	Two-Sided p			Lower	Upper
1.	Monthly House Rent (In BDT)	Equal variances assumed	5.426	.021	5.594	134	<.001	<.001	3236.579	578.614	2092.180	4380.977
		Equal variances not assumed			5.754	133.996	<.001	<.001	3236.579	562.447	2124.157	4349.001
2.	Distance between house and recreational facilities (In meter)	Equal variances assumed	35.781	<.001	-7.277	134	<.001	<.001	-122.031	16.770	-155.198	-88.863
		Equal variances not assumed			-6.740	78.992	<.001	<.001	-122.031	18.106	-158.070	-85.991
3.	Frequency of visits to neighborhood's recreational facilities	Equal variances assumed	2.834	.095	3.926	134	<.001	<.001	.863	.220	.428	1.298
		Equal variances not assumed			3.994	132.858	<.001	<.001	.863	.216	.436	1.291
4.	Average time spent at recreation sites	Equal variances assumed	.018	.895	7.920	134	<.001	<.001	.714	.090	.536	.892

No			Levene's Test for Equality of Variances		t-test for Equality of Means							
			F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							One-Sided p	Two-Sided p			Lower	Upper
		Equal variances not assumed			8.214	133.176	<.001	<.001	.714	.087	.542	.886
5.	Level of satisfaction with neighborhood's recreational facilities	Equal variances assumed	2.425	.122	4.615	134	<.001	<.001	.639	.139	.365	.914
		Equal variances not assumed			4.675	131.815	<.001	<.001	.639	.137	.369	.910
6.	Level of greenery in the neighbourhood to provide scenic view	Equal variances assumed	8.472	.004	4.340	134	<.001	<.001	.590	.136	.321	.859
		Equal variances not assumed			4.450	133.921	<.001	<.001	.590	.133	.328	.853
7.	Level of aesthetic view from residence	Equal variances assumed	10.516	.001	4.286	134	<.001	<.001	.538	.125	.290	.786
		Equal variances not assumed			4.391	133.873	<.001	<.001	.538	.122	.296	.780
Note- Grouping Variable for all ***t-test*** *are: A-Block and B-Block*												

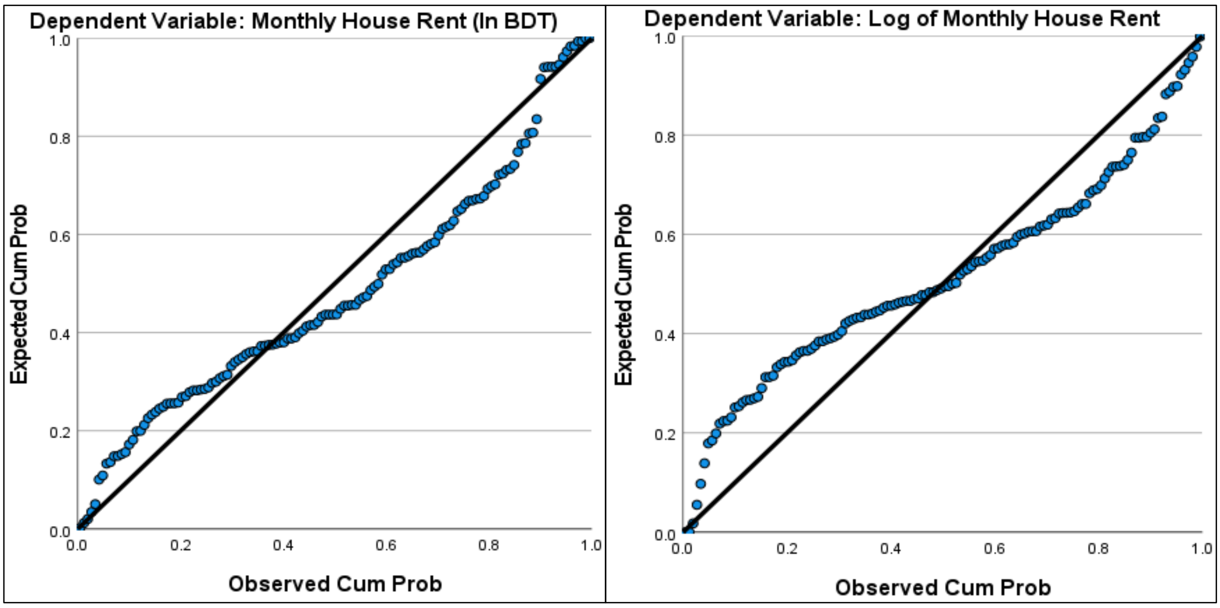
Source: Author, 2022

Figure 26: Histogram of regression standardized residual of LRM and SRM (CES).



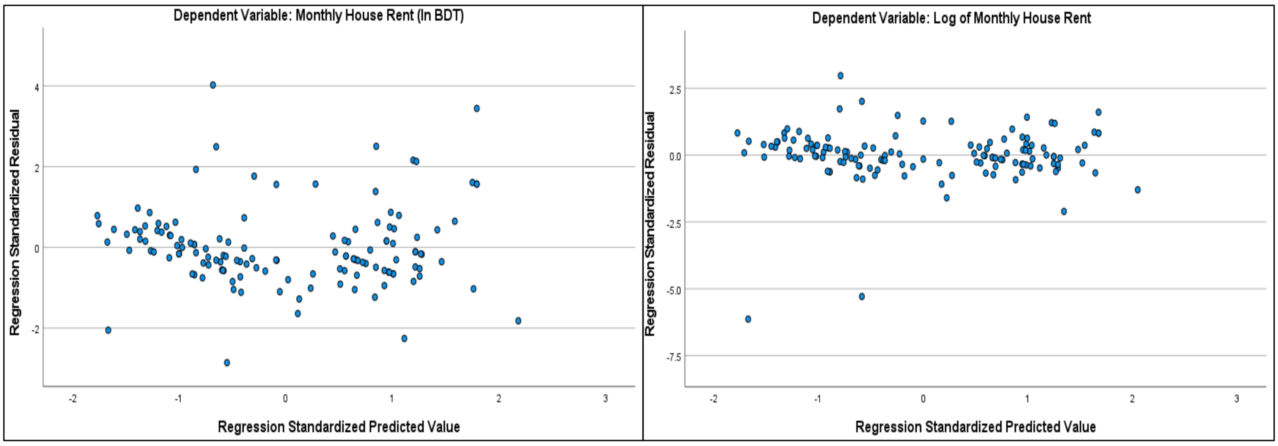
Source: Author, 2022

Figure 27: Normal P-P plot of regression standardized residual of LRM and SRM (CES).



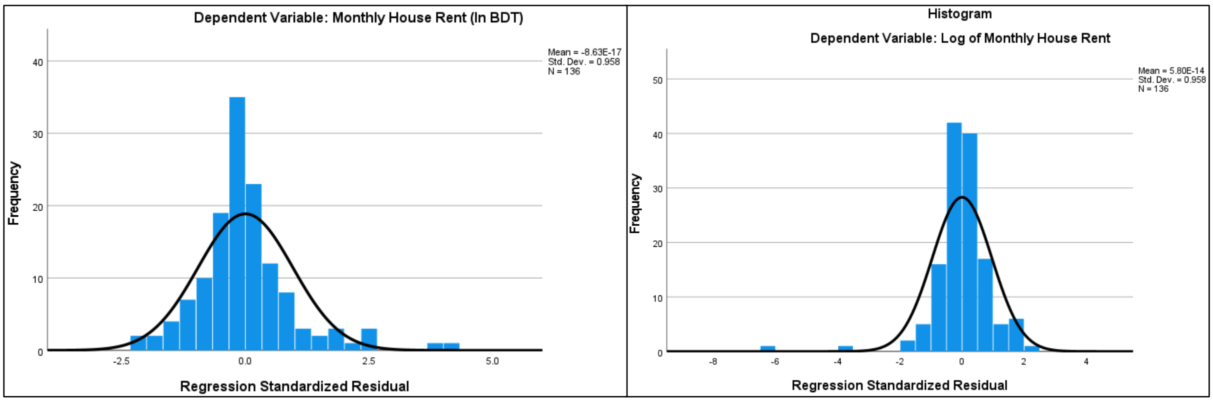
Source: Author, 2022

Figure 28: Scatter plot of regression standardized residual & predicted value of LRM and SRM (CES).



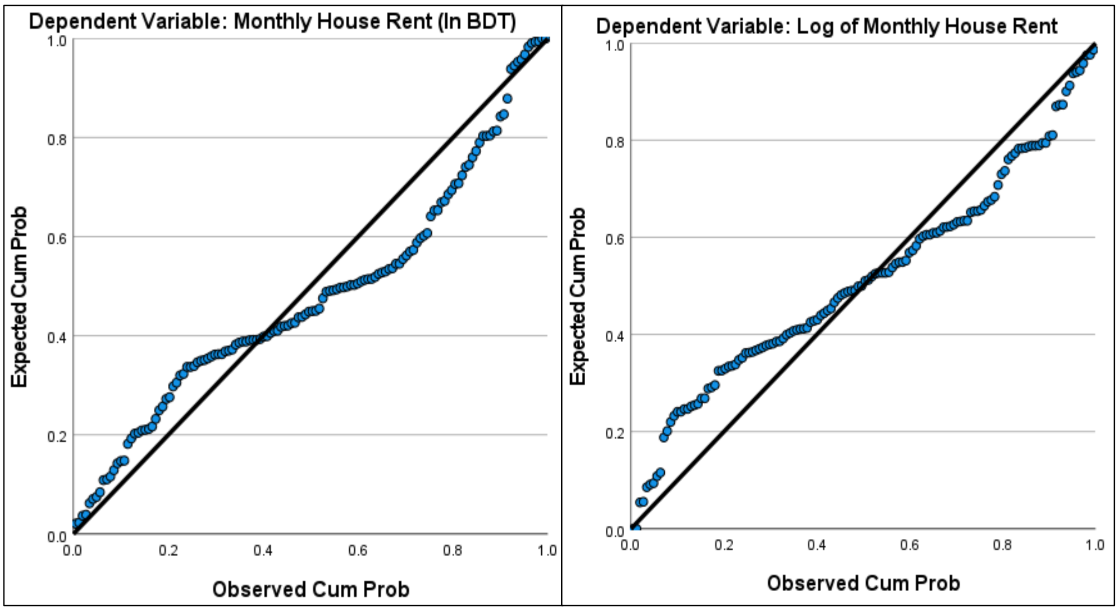
Source: Author, 2022

Figure 29: Histogram of regression standardized residual of LRM and SRM (CES & Structural Features).



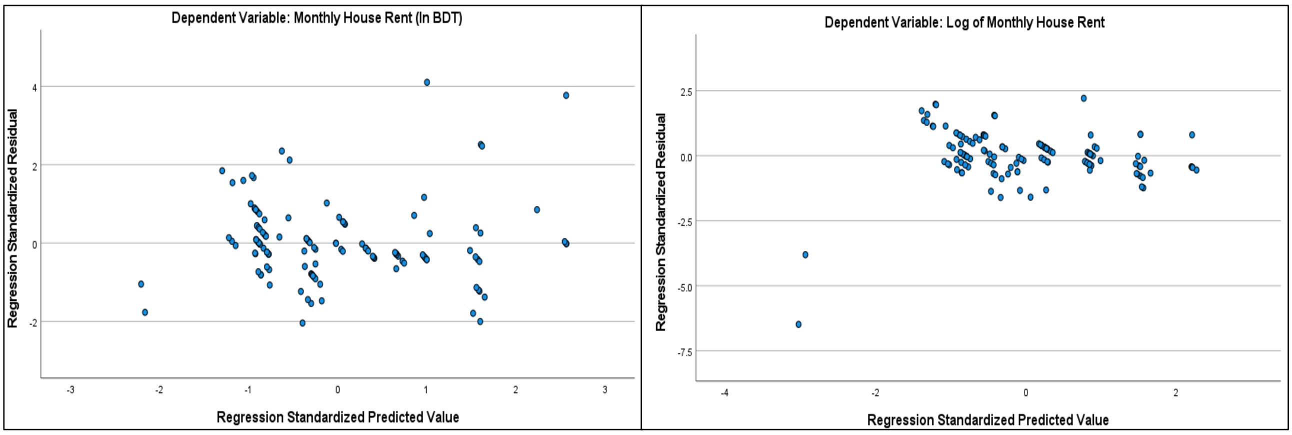
Source: Author, 2022

Figure 30: Normal P-P plot of regression standardized residual of LRM and SRM (CES & Structural Features).



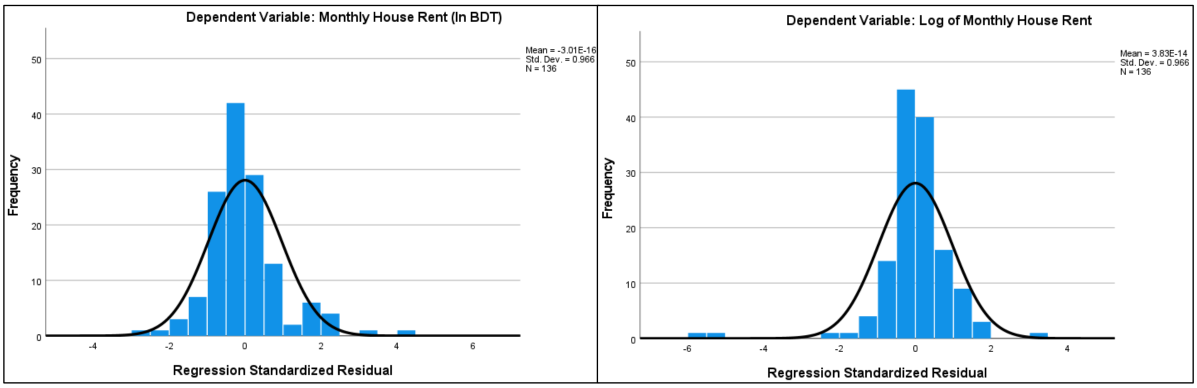
Source: Author, 2022

Figure 31: Scatter plot of regression standardized residual & predicted value of LRM and SRM (CES & Structural Features).



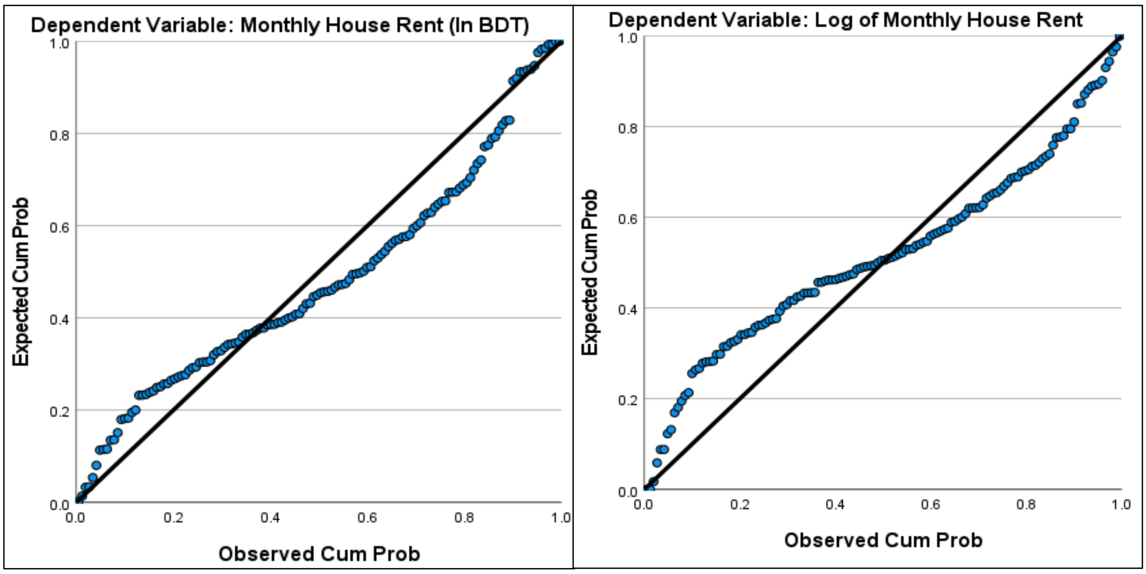
Source: Author, 2022

Figure 32: Histogram of regression standardized residual of LRM and SRM (CES & Transport Accessibility).



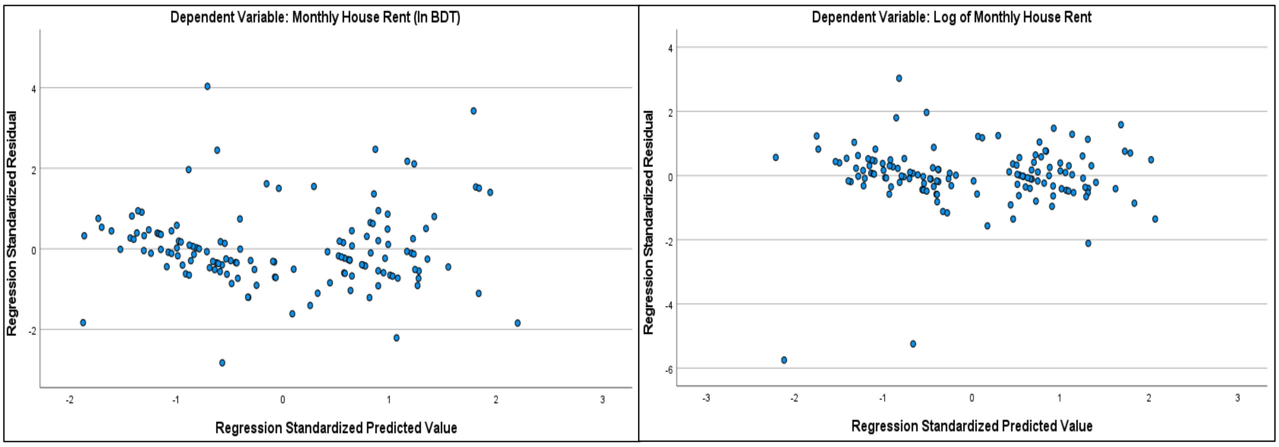
Source: Author, 2022

Figure 33: Normal P-P plot of regression standardized residual of LRM and SRM (CES & Transport Accessibility).



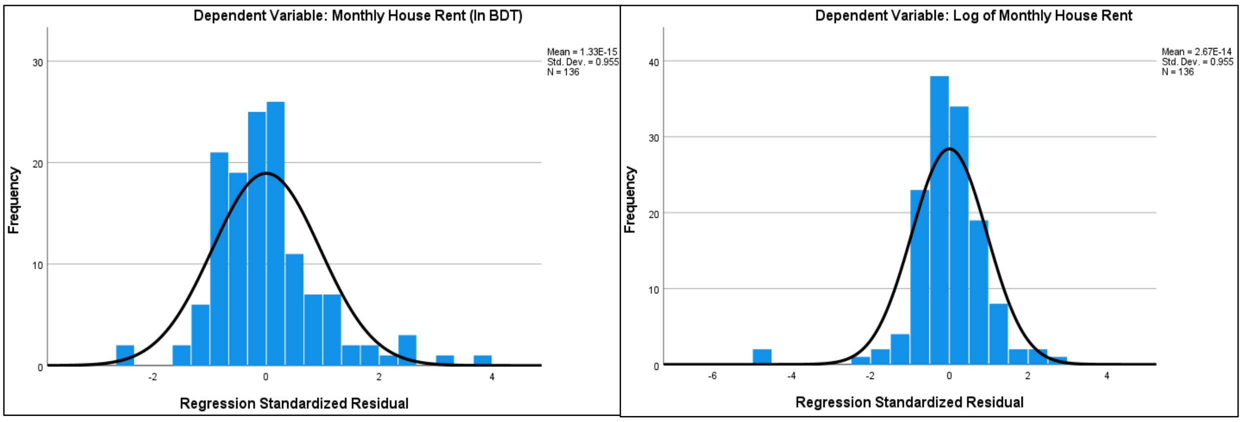
Source: Author, 2022

Figure 34: Scatter plot of regression standardized residual & predicted value of LRM and SRM (CES & Transport Accessibility).



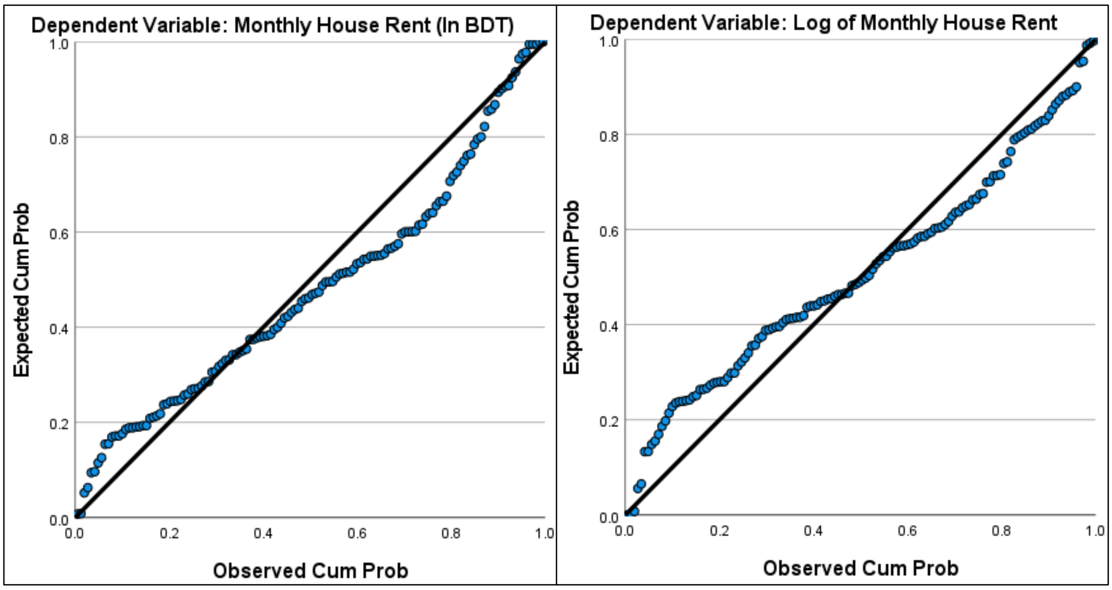
Source: Author, 2022

Figure 35: Histogram of regression standardized residual of LRM and SRM (CES & Environmental Quality).



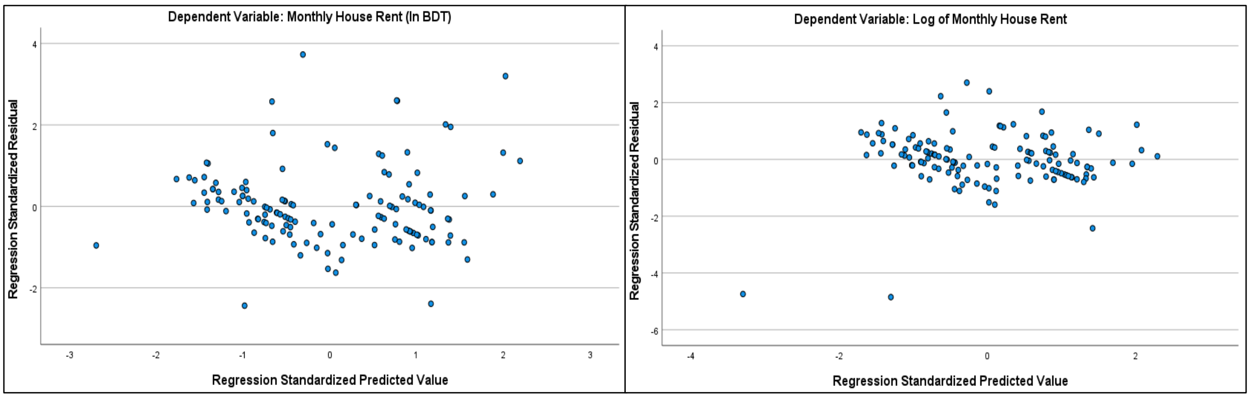
Source: Author, 2022

Figure 36: Normal P-P plot of regression standardized residual of LRM and SRM (CES & Environmental Quality).



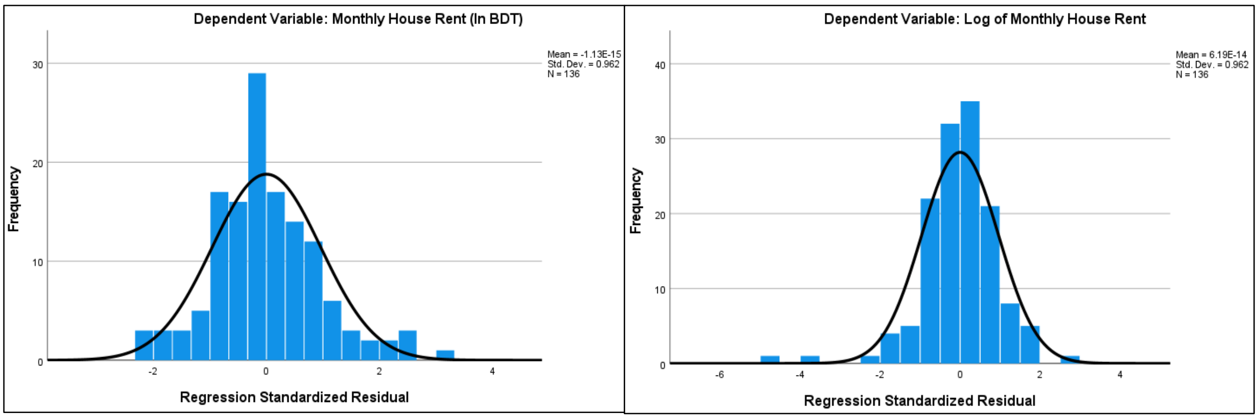
Source: Author, 2022

Figure 37: Scatter plot of regression standardized residual & predicted value of LRM and SRM (CES & Environmental Quality).



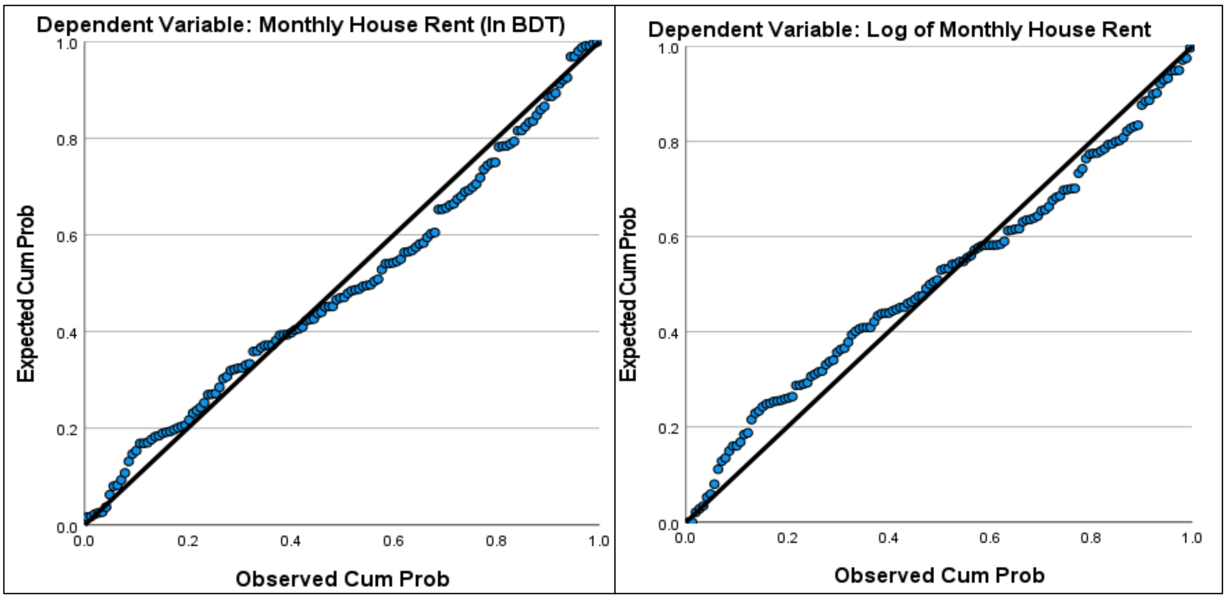
Source: Author, 2022

Figure 38: Histogram of regression standardized residual of LRM and SRM (CES & Socio-economic Attributes).



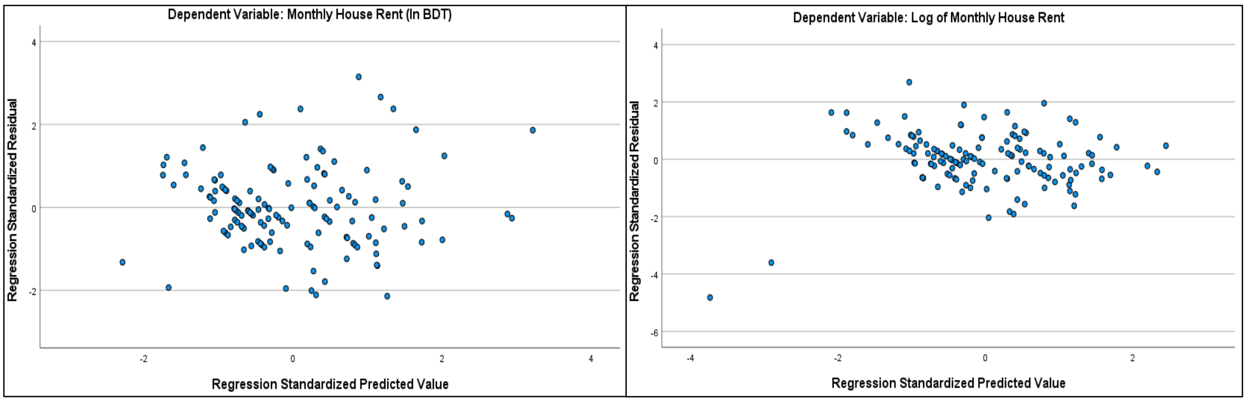
Source: Author, 2022

Figure 39: Normal P-P plot of regression standardized residual of LRM and SRM (CES & Socio-economic Attributes).



Source: Author, 2022

Figure 40: Scatter plot of regression standardized residual & predicted value of LRM and SRM (CES & Socio-economic Attributes).



Source: Author, 2022

Table 37: Multiple regression model for moderation effect of house's structural features.

Variables	Coeff.	Std. Error	t-stat	Sig.	VIF
(Constant)	4285.435	1076.594	3.981	**<.001***	
Distance between house and recreational facilities (In meter)	0.765	1.294	0.591	0.555	1.935
Frequency of visits to neighborhood's recreational facilities	64.756	150.344	0.431	0.667	3.586
Level of satisfaction with neighborhood's recreational facilities	-52.068	250.413	-0.208	0.836	4.109
Level of scenic and aesthetic view from residence	-296.272	195.011	-1.519	0.131	2.004
Total number of bedrooms	1069.621	278.462	3.841	**<.001***	5.673
Total number of bathroom/ toilet	1820.204	239.246	7.608	**<.001***	3.442
Total number of balcony/ veranda	1255.296	285.779	4.393	**<.001***	5.982
Age of the Building or Structure	-242.14	226.73	-1.068	0.288	1.973
Interaction Term	**79.605**	**19.55**	**4.072**	**<.001***	**1.498**
R2	*0.947*				
Adjusted R2	*0.896*				
F-stat	*121.1*				
Sig (F)	*<.001**				
df	*135*				
Note: ** p≤.05; Dependent Variable: Monthly House Rent (In BDT)*					

Source: Author, 2022

Table 38: Multiple regression model for moderation effect of transportation accessibility.

Variables	Coeff.	Std. Error	t-stat	Sig.	VIF
(Constant)	4207.825	1543.414	2.726	**0.007***	
Distance between house and recreational facilities (In meter)	-9.152	3.39	-2.7	0.008	2.729
Frequency of visits to neighborhood's recreational facilities	275.934	320.361	0.861	0.391	3.349
Level of satisfaction with neighborhood's recreational facilities	1493.261	516.038	2.894	**0.004***	3.589
Level of scenic and aesthetic view from residence	716.599	428.889	1.671	0.097	1.993
Distance of nearest religious facility from home (In meter)	0.489	2.596	0.188	0.851	1.547
Distance of nearest kitchen market from home (In meter)	0.453	2.815	0.161	0.872	1.766
Interaction Term	**-294.132**	**211.577**	**-1.39**	**0.167**	**1.277**
R2	*0.488*				
Adjusted R2	*0.460*				
F-stat	*17.437*				
Sig (F)	*<.001**				
df	*135*				
Note: ** p≤.05; Dependent Variable: Monthly House Rent (In BDT)*					

Source: Author, 2022

Table 39: Multiple regression model for moderation effect of environmental quality.

Variables	Coeff.	Std. Error	t-stat	Sig.	VIF
(Constant)	11844.19	6656.684	1.779	0.078	
Distance between house and recreational facilities (In meter)	-7.039	2.758	-2.552	0.012	1.882
Frequency of visits to neighborhood's recreational facilities	172.606	316.293	0.546	0.586	3.4
Level of satisfaction with neighborhood's recreational facilities	1830.83	514.28	3.56	**<.001***	3.712
Level of scenic and aesthetic view from residence	634.396	405.913	1.563	0.121	1.86
Concentration of carbon dioxide (C02) inside the home (In ppm)	-4.111	11.878	-0.346	0.73	1.211
PM2.5 concentration within the home (in ug/m3)	-5.329	30.328	-0.176	0.861	3.85
PM10 concentration within the home (in ug/m3)	8.821	21.203	0.416	0.678	3.828
General sound level inside the house (in dB)	-122.855	53.902	-2.279	0.024	1.229
The level of waterlogging in the neighbourhood	196.096	282.182	0.695	0.488	1.118
Interaction Term	**453.035**	**338.963**	**1.337**	**0.184**	**1.078**
R2	*0.52*				
Adjusted R2	*0.482*				
F-stat	*13.545*				
Sig (F)	*<.001**				
df	*135*				
Note: ** p≤.05; Dependent Variable: Monthly House Rent (In BDT)*					

Source: Author, 2022

Table 40: Multiple regression model for moderation effect of socio-economic attributes.

Variables	Coeff.	Std. Error	t-stat	Sig.	VIF
(Constant)	604.426	1262.412	0.479	0.633	
Distance between house and recreational facilities (In meter)	-3.528	1.946	-1.813	0.072	1.772
Frequency of visits to neighborhood's recreational facilities	152.052	227.232	0.669	0.505	3.318
Level of satisfaction with neighborhood's recreational facilities	827.451	374.85	2.207	0.029	3.729
Level of scenic and aesthetic view from residence	491.244	294.602	1.667	0.098	1.852
Household's monthly income (In BDT)	0.133	0.013	10.09	**<.001***	1.528
Respondents' highest level of education	258.001	210.192	1.227	0.222	1.312
Duration of living in the house	-91.817	277.53	-0.331	0.741	1.635
Interaction Term	**-101.309**	**79.14**	**-1.28**	**0.203**	**1.083**
R2	*0.742*				
Adjusted R2	*0.726*				
F-stat	*45.688*				
Sig (F)	*<.001**				
df	*135*				
Note: * p≤.05; Dependent Variable: Monthly House Rent (In BDT)					

Source: Author, 2022

Table 41: Backward Multiple Linear Regression Model.

Model	Variables	Coeff.	Std. Error	t-stat	Sig.	VIF	R2	Adj. R2	F	Sig (F)	df
	(Constant)	-1357.90	4347.82	-0.31	0.76						
	Distance between house and recreational facilities (In meter)	-1.01	2.04	-0.50	0.62	3.44					
	Frequency of visits to neighborhood's recreational facilities	348.81	180.09	1.94	0.06	3.68					
	Average time spent at recreation sites	38.96	292.74	0.13	0.89	2.15					
	Level of satisfaction with neighborhood's recreational facilities	433.28	319.24	1.36	0.18	4.77					
	Level of greenery in the neighbourhood to provide scenic view	-417.23	320.06	-1.30	0.20	4.55					
	Level of scenic and aesthetic view from residence	206.25	299.30	0.69	0.49	3.37					
	Level of satisfaction with aesthetic services from residence	34.67	250.32	0.14	0.89	2.46					
	Total number of bathroom/ toilet	2575.39	262.48	9.81	**<.001***	2.96					
1	Age of the Building or Structure	157.22	276.98	0.57	0.57	2.10	0.865	0.845	41.78	<.001	135
	Distance of nearest religious facility from home (In meter)	-2.27	1.58	-1.43	0.15	1.99					
	Distance of nearest kitchen market from home (In meter)	3.33	1.65	2.02	0.045*	2.10					
	Concentration of carbon dioxide (C02) inside the home (In ppm)	5.89	6.90	0.85	0.40	1.36					
	PM2.5 concentration within the home (in ug/m3)	21.70	17.12	1.27	0.21	4.09					
	PM10 concentration within the home (in ug/m3)	-13.36	13.45	-0.99	0.32	5.14					
	General sound level inside the house (in dB)	-25.31	31.90	-0.79	0.43	1.44					
	Household's monthly income (In BDT)	0.06	0.01	4.91	**<.001***	2.53					
	Respondents' highest level of education	159.75	168.67	0.95	0.35	1.49					
	Duration of living in the house	35.94	230.87	0.16	0.88	2.00					
	(Constant)	-1243.67	4244.48	-0.29	0.77						
	Distance between house and recreational facilities (In meter)	-1.00	2.03	-0.49	0.62	3.43					
	Frequency of visits to neighborhood's recreational facilities	347.00	178.83	1.94	0.06	3.66					
	Level of satisfaction with neighborhood's recreational facilities	438.59	315.42	1.39	0.17	4.70					
	Level of greenery in the neighbourhood to provide scenic view	-416.66	318.70	-1.31	0.19	4.55					
	Level of scenic and aesthetic view from residence	206.46	298.05	0.69	0.49	3.37					
	Level of satisfaction with aesthetic services from residence	33.60	249.14	0.14	0.89	2.46					
	Total number of bathroom/ toilet	2583.10	254.93	10.13	**<.001***	2.82					
2	Age of the Building or Structure	144.89	259.94	0.56	0.58	1.87	0.865	0.846	44.61	<.001	135
	Distance of nearest religious facility from home (In meter)	-2.30	1.55	-1.49	0.14	1.93					
	Distance of nearest kitchen market from home (In meter)	3.31	1.63	2.03	**0.045***	2.08					
	Concentration of carbon dioxide (C02) inside the home (In ppm)	5.82	6.85	0.85	0.40	1.36					
	PM2.5 concentration within the home (in ug/m3)	21.97	16.92	1.30	0.20	4.04					
	PM10 concentration within the home (in ug/m3)	-13.64	13.23	-1.03	0.30	5.01					
	General sound level inside the house (in dB)	-25.34	31.77	-0.80	0.43	1.44					
	Household's monthly income (In BDT)	0.06	0.01	4.93	**<.001***	2.53					
	Respondents' highest level of education	161.32	167.55	0.96	0.34	1.48					
	Duration of living in the house	41.07	226.69	0.18	0.86	1.94					

Model	Variables	Coeff.	Std. Error	t-stat	Sig.	VIF	R2	Adj. R2	F	Sig (F)	df
3	(Constant)	-1147.29	4166.58	-0.28	0.78		0.865	0.847	47.79	<.001	135
	Distance between house and recreational facilities (In meter)	-1.00	2.02	-0.49	0.62	3.43					
	Frequency of visits to neighborhood's recreational facilities	344.06	176.76	1.95	**0.054***	3.60					
	Level of satisfaction with neighborhood's recreational facilities	443.86	311.69	1.42	0.16	4.63					
	Level of greenery in the neighbourhood to provide scenic view	-403.44	301.99	-1.34	0.18	4.12					
	Level of scenic and aesthetic view from residence	222.68	271.59	0.82	0.41	2.83					
	Total number of bathroom/ toilet	2581.16	253.47	10.18	**<.001***	2.81					
	Age of the Building or Structure	148.21	257.71	0.58	0.57	1.85					
	Distance of nearest religious facility from home (In meter)	-2.28	1.53	-1.49	0.14	1.91					
	Distance of nearest kitchen market from home (In meter)	3.32	1.62	2.05	**0.043***	2.07					
	Concentration of carbon dioxide (C02) inside the home (In ppm)	5.68	6.74	0.84	0.40	1.32					
	PM2.5 concentration within the home (in ug/m3)	22.00	16.85	1.31	0.19	4.03					
	PM10 concentration within the home (in ug/m3)	-13.65	13.17	-1.04	0.30	5.01					
	General sound level inside the house (in dB)	-25.55	31.60	-0.81	0.42	1.43					
	Household's monthly income (In BDT)	0.06	0.01	4.97	**<.001***	2.52					
	Respondents' highest level of education	159.07	166.02	0.96	0.34	1.47					
	Duration of living in the house	37.39	224.11	0.17	0.87	1.91					
4	(Constant)	-1069.02	4123.28	-0.26	0.80		0.865	0.848	51.39	<.001	135
	Distance between house and recreational facilities (In meter)	-1.07	1.97	-0.54	0.59	3.28					
	Frequency of visits to neighborhood's recreational facilities	344.64	176.01	1.96	**0.05***	3.60					
	Level of satisfaction with neighborhood's recreational facilities	449.53	308.57	1.46	0.15	4.57					
	Level of greenery in the neighbourhood to provide scenic view	-395.23	296.74	-1.33	0.19	4.01					
	Level of scenic and aesthetic view from residence	222.42	270.48	0.82	0.41	2.82					
	Total number of bathroom/ toilet	2579.44	252.23	10.23	**<.001***	2.80					
	Age of the Building or Structure	143.74	255.27	0.56	0.57	1.83					
	Distance of nearest religious facility from home (In meter)	-2.25	1.52	-1.48	0.14	1.89					
	Distance of nearest kitchen market from home (In meter)	3.35	1.61	2.08	**0.04***	2.05					
	Concentration of carbon dioxide (C02) inside the home (In ppm)	5.61	6.70	0.84	0.40	1.32					
	PM2.5 concentration within the home (in ug/m3)	21.70	16.69	1.30	0.20	3.99					
	PM10 concentration within the home (in ug/m3)	-13.08	12.68	-1.03	0.30	4.68					
	General sound level inside the house (in dB)	-26.06	31.32	-0.83	0.41	1.42					
	Household's monthly income (In BDT)	0.06	0.01	5.01	**<.001***	2.51					
	Respondents' highest level of education	159.66	165.31	0.97	0.34	1.47					
5	(Constant)	-917.09	4101.76	-0.22	0.82		0.865	0.849	55.37	<.001	135
	Frequency of visits to neighborhood's recreational facilities	365.59	171.22	2.14	**0.035***	3.43					
	Level of satisfaction with neighborhood's recreational facilities	429.21	305.40	1.41	0.16	4.50					
	Level of greenery in the neighbourhood to provide scenic view	-370.03	292.23	-1.27	0.21	3.91					
	Level of scenic and aesthetic view from residence	231.24	269.21	0.86	0.39	2.81					

Model	Variables	Coeff.	Std. Error	t-stat	Sig.	VIF	R2	Adj. R2	F	Sig (F)	df
	Total number of bathroom/ toilet	2608.92	245.60	10.62	**<.001***	2.67					
	Age of the Building or Structure	109.13	246.46	0.44	0.66	1.72					
	Distance of nearest religious facility from home (In meter)	-2.46	1.47	-1.67	0.10	1.78					
	Distance of nearest kitchen market from home (In meter)	2.88	1.36	2.12	**0.036***	1.48					
	Concentration of carbon dioxide (C02) inside the home (In ppm)	5.13	6.62	0.78	0.44	1.29					
	PM2.5 concentration within the home (in ug/m3)	22.82	16.51	1.38	0.17	3.93					
	PM10 concentration within the home (in ug/m3)	-14.04	12.52	-1.12	0.26	4.59					
	General sound level inside the house (in dB)	-25.59	31.22	-0.82	0.41	1.42					
	Household's monthly income (In BDT)	0.06	0.01	4.99	**<.001***	2.48					
	Respondents' highest level of education	172.57	163.12	1.06	0.29	1.44					
6	(Constant)	-368.13	3897.01	-0.09	0.93		0.865	0.850	60.01	<.001	135
	Frequency of visits to neighborhood's recreational facilities	372.47	169.95	2.19	**0.03***	3.40					
	Level of satisfaction with neighborhood's recreational facilities	423.65	304.13	1.39	0.17	4.50					
	Level of greenery in the neighbourhood to provide scenic view	-395.15	285.73	-1.38	0.17	3.76					
	Level of scenic and aesthetic view from residence	216.49	266.25	0.81	0.42	2.77					
	Total number of bathroom/ toilet	2590.56	241.27	10.74	**<.001***	2.60					
	Distance of nearest religious facility from home (In meter)	-2.39	1.46	-1.64	0.10	1.76					
	Distance of nearest kitchen market from home (In meter)	2.89	1.36	2.13	**0.035***	1.48					
	Concentration of carbon dioxide (C02) inside the home (In ppm)	5.14	6.60	0.78	0.44	1.29					
	PM2.5 concentration within the home (in ug/m3)	22.49	16.44	1.37	0.17	3.92					
	PM10 concentration within the home (in ug/m3)	-13.97	12.47	-1.12	0.27	4.59					
	General sound level inside the house (in dB)	-28.85	30.23	-0.95	0.34	1.34					
	Household's monthly income (In BDT)	0.06	0.01	4.99	**<.001***	2.46					
	Respondents' highest level of education	185.56	159.92	1.16	0.25	1.39					
7	(Constant)	2229.18	2018.96	1.10	0.27		0.864	0.851	65.16	<.001	135
	Frequency of visits to neighborhood's recreational facilities	366.52	169.51	2.16	**0.033***	3.39					
	Level of satisfaction with neighborhood's recreational facilities	441.81	302.75	1.46	0.15	4.47					
	Level of greenery in the neighbourhood to provide scenic view	-393.19	285.26	-1.38	0.17	3.76					
	Level of scenic and aesthetic view from residence	210.24	265.71	0.79	0.43	2.77					
	Total number of bathroom/ toilet	2586.83	240.84	10.74	**<.001***	2.60					
	Distance of nearest religious facility from home (In meter)	-2.11	1.41	-1.50	0.14	1.65					
	Distance of nearest kitchen market from home (In meter)	2.90	1.35	2.14	**0.034***	1.48					
	PM2.5 concentration within the home (in ug/m3)	22.36	16.42	1.36	0.18	3.92					
	PM10 concentration within the home (in ug/m3)	-13.02	12.39	-1.05	0.30	4.55					
	General sound level inside the house (in dB)	-22.56	29.09	-0.78	0.44	1.24					
	Household's monthly income (In BDT)	0.06	0.01	4.99	**<.001***	2.46					
	Respondents' highest level of education	158.00	155.72	1.02	0.31	1.32					
8	(Constant)	897.09	1059.00	0.85	0.40		0.863	0.851	71.26	<.001	135

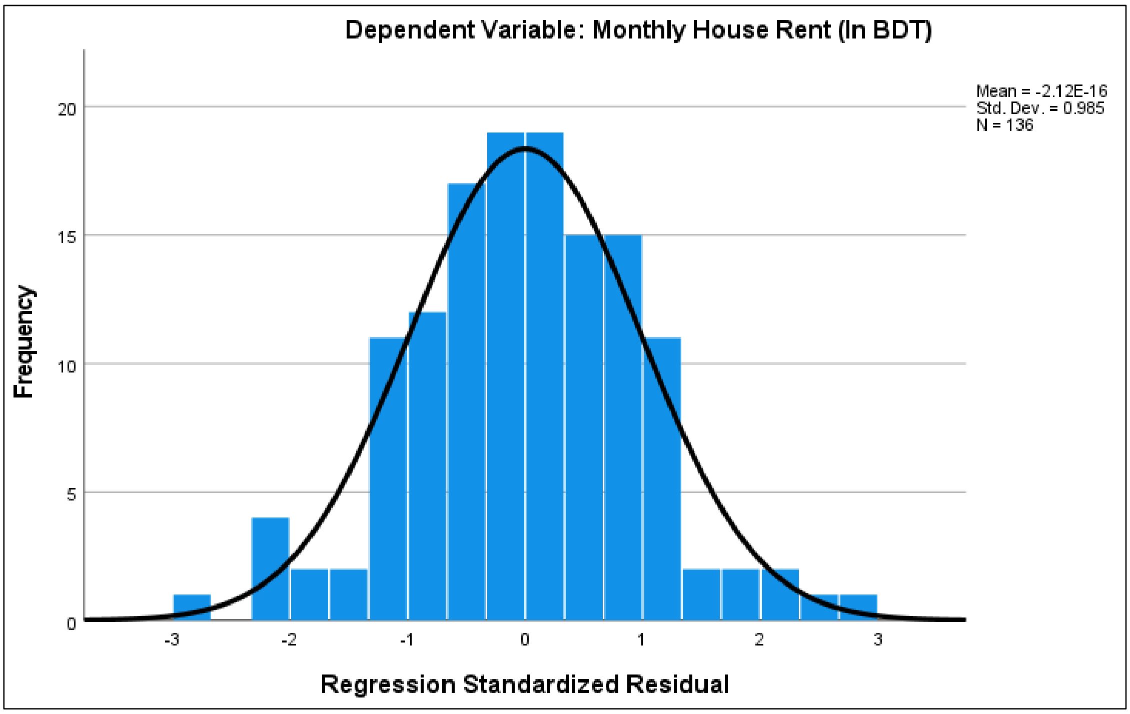
Model	Variables	Coeff.	Std. Error	t-stat	Sig.	VIF	R2	Adj. R2	F	Sig (F)	df
	Frequency of visits to neighborhood's recreational facilities	375.67	168.83	2.23	**0.028***	3.38					
	Level of satisfaction with neighborhood's recreational facilities	390.22	294.88	1.32	0.19	4.25					
	Level of greenery in the neighbourhood to provide scenic view	-384.54	284.58	-1.35	0.18	3.76					
	Level of scenic and aesthetic view from residence	230.11	264.04	0.87	0.39	2.74					
	Total number of bathroom/ toilet	2569.89	239.46	10.73	**<.001***	2.58					
	Distance of nearest religious facility from home (In meter)	-1.97	1.40	-1.41	0.16	1.62					
	Distance of nearest kitchen market from home (In meter)	3.02	1.34	2.26	**0.026***	1.46					
	PM2.5 concentration within the home (in ug/m3)	21.75	16.37	1.33	0.19	3.91					
	PM10 concentration within the home (in ug/m3)	-12.53	12.36	-1.01	0.31	4.53					
	Household's monthly income (In BDT)	0.06	0.01	5.45	**<.001***	2.25					
	Respondents' highest level of education	168.90	154.83	1.09	0.28	1.31					
	(Constant)	945.49	1056.53	0.90	0.37						
	Frequency of visits to neighborhood's recreational facilities	365.59	168.27	2.17	**0.032***	3.36					
	Level of satisfaction with neighborhood's recreational facilities	422.24	292.30	1.45	0.15	4.19					
	Level of greenery in the neighbourhood to provide scenic view	-256.53	243.51	-1.05	0.29	2.76					
	Total number of bathroom/ toilet	2606.05	235.62	11.06	**<.001***	2.50					
9	Distance of nearest religious facility from home (In meter)	-2.00	1.39	-1.43	0.16	1.62	0.863	0.852	78.46	<.001	135
	Distance of nearest kitchen market from home (In meter)	3.27	1.31	2.49	**0.014***	1.39					
	PM2.5 concentration within the home (in ug/m3)	21.65	16.35	1.32	0.19	3.91					
	PM10 concentration within the home (in ug/m3)	-11.94	12.33	-0.97	0.34	4.52					
	Household's monthly income (In BDT)	0.06	0.01	5.41	**<.001***	2.24					
	Respondents' highest level of education	188.33	153.07	1.23	0.22	1.29					
	(Constant)	541.84	970.63	0.56	0.58						
	Frequency of visits to neighborhood's recreational facilities	358.48	168.07	2.13	**0.035***	3.35					
	Level of satisfaction with neighborhood's recreational facilities	444.39	291.33	1.53	0.13	4.16					
	Level of greenery in the neighbourhood to provide scenic view	-227.16	241.56	-0.94	0.35	2.71					
10	Total number of bathroom/ toilet	2598.24	235.42	11.04	**<.001***	2.50	0.862	0.852	87.12	<.001	135
	Distance of nearest religious facility from home (In meter)	-1.66	1.35	-1.23	0.22	1.52					
	Distance of nearest kitchen market from home (In meter)	3.50	1.29	2.72	**0.007***	1.35					
	PM2.5 concentration within the home (in ug/m3)	8.37	8.91	0.94	0.35	1.16					
	Household's monthly income (In BDT)	0.06	0.01	5.42	**<.001***	2.24					
	Respondents' highest level of education	162.78	150.74	1.08	0.28	1.25					
	(Constant)	977.28	852.38	1.15	0.25						
	Frequency of visits to neighborhood's recreational facilities	344.41	167.32	2.06	**0.042***	3.33					
11	Level of satisfaction with neighborhood's recreational facilities	452.00	291.08	1.55	0.12	4.16	0.861	0.852	97.99	<.001	135
	Level of greenery in the neighbourhood to provide scenic view	-232.91	241.37	-0.97	0.34	2.71					
	Total number of bathroom/ toilet	2591.66	235.21	11.02	**<.001***	2.49					
	Distance of nearest religious facility from home (In meter)	-2.01	1.30	-1.55	0.12	1.41					

Model	Variables	Coeff.	Std. Error	t-stat	Sig.	VIF	R2	Adj. R2	F	Sig (F)	df
	Distance of nearest kitchen market from home (In meter)	3.29	1.27	2.60	**0.011***	1.31					
	Household's monthly income (In BDT)	0.06	0.01	5.45	**<.001***	2.24					
	Respondents' highest level of education	164.36	150.67	1.09	0.28	1.25					
12	(Constant)	827.05	837.82	0.99	0.33		0.860	0.852	111.91	<.001	135
	Frequency of visits to neighborhood's recreational facilities	311.07	163.67	1.90	0.06	3.19					
	Level of satisfaction with neighborhood's recreational facilities	335.76	264.92	1.27	0.21	3.45					
	Total number of bathroom/ toilet	2573.00	234.35	10.98	**<.001***	2.48					
	Distance of nearest religious facility from home (In meter)	-1.88	1.29	-1.46	0.15	1.39					
	Distance of nearest kitchen market from home (In meter)	2.98	1.23	2.43	**0.016***	1.22					
	Household's monthly income (In BDT)	0.06	0.01	5.48	**<.001***	2.24					
	Respondents' highest level of education	149.71	149.86	1.00	0.32	1.23					
13	(Constant)	1306.23	686.91	1.90	**0.059***		0.858	0.852	130.40	<.001	135
	Frequency of visits to neighborhood's recreational facilities	326.78	162.91	2.01	**0.047***	3.16					
	Level of satisfaction with neighborhood's recreational facilities	311.13	263.77	1.18	0.24	3.42					
	Total number of bathroom/ toilet	2611.04	231.23	11.29	**<.001***	2.41					
	Distance of nearest religious facility from home (In meter)	-1.91	1.29	-1.48	0.14	1.39					
	Distance of nearest kitchen market from home (In meter)	3.03	1.23	2.47	**0.015***	1.22					
	Household's monthly income (In BDT)	0.07	0.01	5.75	**<.001***	2.17					
14	(Constant)	1745.06	578.32	3.02	**0.003***		0.857	0.851	155.74	<.001	135
	Frequency of visits to neighborhood's recreational facilities	462.40	115.59	4.00	**<.001***	1.58					
	Total number of bathroom/ toilet	2669.85	226.13	11.81	**<.001***	2.30					
	Distance of nearest religious facility from home (In meter)	-2.18	1.27	-1.71	0.09	1.35					
	Distance of nearest kitchen market from home (In meter)	3.45	1.18	2.93	**0.004***	1.12					
	Household's monthly income (In BDT)	0.07	0.01	5.82	**<.001***	2.16					
15	(Constant)	1230.81	497.94	2.47	**0.015***		0.854	0.849	191.11	<.001	135
	Frequency of visits to neighborhood's recreational facilities	534.89	108.36	4.94	**<.001***	1.37					
	Total number of bathroom/ toilet	2685.69	227.61	11.80	**<.001***	2.29					
	Distance of nearest kitchen market from home (In meter)	2.98	1.15	2.59	**0.011***	1.06					
	Household's monthly income (In BDT)	0.07	0.01	5.75	**<.001***	2.16					

Note:
*Dependent Variable: Monthly House Rent (In BDT); * p≤.05; df=135;*
Variables Entered/ Removed Method: Backward (Selection criterion: Probability of F-to-enter<= .050; Probability of F-to-remove >= .060)

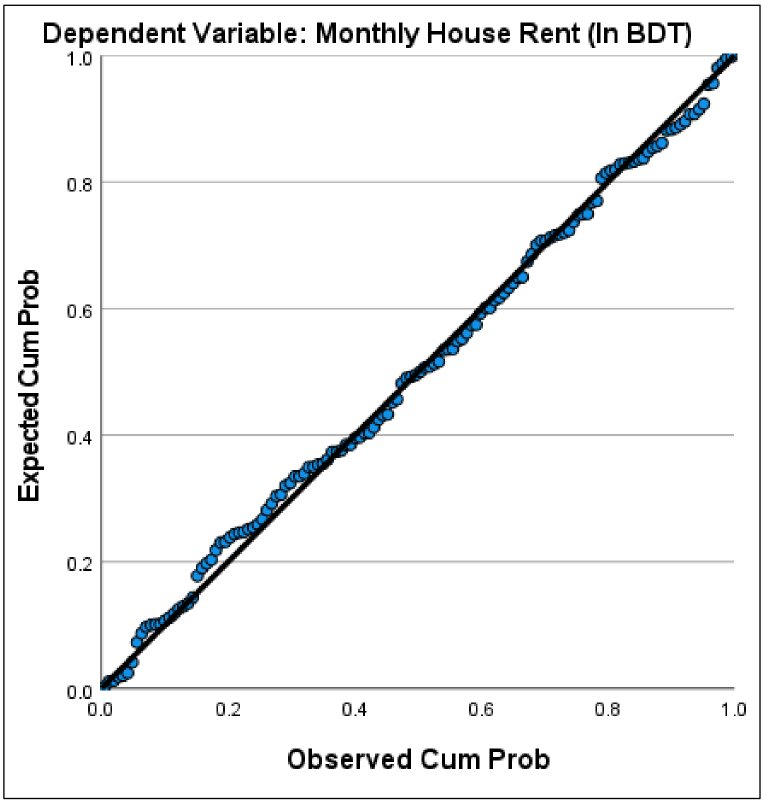
Source: Author, 2022

Figure 41: Histogram of regression standardized residual of Backward Regression Model.



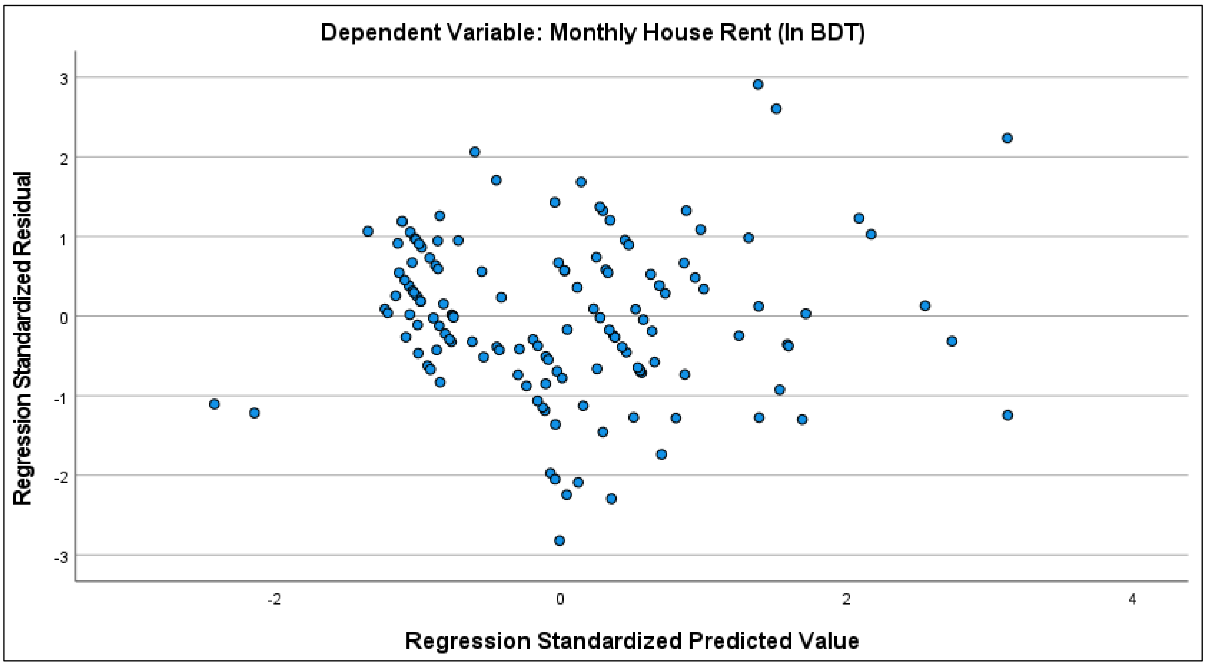
Source: Author, 2022

Figure 42: Normal P-P plot of regression standardized residual of Backward Regression Model.



Source: Author, 2022

Figure 43: Scatter plot of regression standardized residual & predicted value of Backward Regression Model.



Source: Author, 2022

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