# Residential Pricing in Addis Ababa: Do Urban Green Amenities Influence Residents' Preferences for a House?[1]

**Dawit Woubishet Mulatu[2], and Tsegaye Ginbo[3]**

***Abstract***

*Urban green amenities can play a vital role in realizing sustainable development and healthy life in cities. However, the direct economic value of green amenities is seldom measured in monetary terms, and studies on urban green amenity valuation in developing countries, including Ethiopia, are scanty. This study uses the hedonic pricing method to investigate the impact of urban green amenities on subjective as well as actual rental prices of residential houses in Addis Ababa. Results indicate that residents attach a positive value to urban green amenities. Specifically, the availability of, and access to, attractive landscape and natural features in a nearby area increase the average price of a house by 45 percent. Similarly, availability and access to parks increase the average rental value of a house by 50 percent. This indicates that residents are willing to pay for green amenities in their neighborhood. Incorporating green amenities in designing urban residential areas and real estate developments can provide premium benefits to investors.*

**Keywords:** Urban green amenities, residential pricing, environmental valuation, and hedonic pricing
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[2] Environment and Climate Research Center (ECRC), Policy Studies Institute (PSI). Email: dawitwmulatu@gmail.com. Cellphone: +251911603699. And, World Bank, Environment, Natural Resources and the Blue Economy Global Practice, Africa Region, Ethiopia, dmulatu@worldbank.org
[3] Department of Economics, Swedish University of Agricultural Sciences. Email: tsegaye.ginbo@slu.se. Cellphone: +46720136799.

## 1. Introduction

The majority of the world population currently live in urban areas. In 2014, people residing in urban areas have reached 53 percent; this figure is expected to grow further to 66 percent by 2050 (UNDESA, 2014). The rate of urbanization is higher in developing countries, including those in Africa, despite the current low level of urban population and according to UNDESA (2014), Africa is urbanizing at a faster rate than other areas and will reach 56 percent by the year 2050, a 25 percent increase from 2014. As the world continues to urbanize, sustainable development challenges will be increasingly apparent in cities. The problem will become more acute in low and middle-income countries where the pace of urbanization is fast; and formulating integrated policies will be crucial to improve the lives of urban dwellers and sustain a healthy city environment.

In Ethiopia, the current rate of urbanization is high. According to the World Bank (2015), urbanization in Ethiopia is increasing by 5.4 percent a year, putting it among the fastest ten urbanizing countries in the world. This provides both an opportunity to transform the economy and a challenge to manage the negative impacts of urban expansion. It also highlights such factors as rural-urban migration, expansion of existing cities and transformation of small rural villages into towns as the main drivers of the current rapid urbanization in Ethiopia. Rapid urbanization demands balanced investments in basic infrastructure including health, education, road facilities, clean water supply, sewage services, housing and recreational facilities (AfDB, 2016). The provision of these facilities is providing a challenge in Ethiopia's urban areas including the capital city, Addis Ababa.

Addis Ababa is easily the largest urban area in Ethiopia and serves as the headquarters for the African Union (AU) and other international institutions including the United Nation Economic Commission for Africa (UNECA). Already facing growing environmental challenges, the city is expanding with unbalanced development of infrastructure and services. Among other problems, this has created an issue over the provision of adequate housing for residents and of green amenities. As one response, the city government designed a structural plan that designated around 22,000 hectares of land within the city, about 41percent of the Addis Ababa's total

land area, for green area development. The successful implementation of this and protection of green amenities in Addis Ababa, however, also requires support from the private sector including real estate developers, individual house builders and buyers. Assigning an economic value to urban green amenities, green spaces, parks, street trees and other related urban ecosystem services, is also vital to implement the plan. In this context, understanding the value residents place on urban green amenities can provide important insights for urban planners and decision-makers to develop the city's green infrastructure.

Studies on the impact of urban green amenities on the price of residential houses have been very limited in developing countries particularly in Africa. Most concentrate on developed and emerging or middle-income economies. In middle-income economies, for example, studies such as Jim and Chen (2006), Chen and Jim (2010), He et al. (2010), Chaudhry (2013), and Zrobek et al. (2015) have reported varied results and have provided limited conclusive knowledge to inform policy makers. In developing countries, there has been a misconception that more attention should be given to development with less interest or care for environment, resulting in a lack of concern. However, recent evidence has encouraged the possibility of pursuing development at the same time as ensuring environmental protection; Wakeford et al. (2017) and Okereke et al. (2019) have provided detail of encouraging practices of green innovation among industrial firms, and institutional platforms in Ethiopia have begun to promote green industrial development. This underlines the possibility that developing countries can pursue green development paths virtually from the outset of their development, unlike most developed countries which facilitated economic development first and had to start to cleanup later. Studies on environmental protection in developing countries are urgently necessary to support green policy design and implementation.

A second reason for the limited study of the impact of urban green amenities on house prices in developing countries has been a lack of the required data. The standard hedonic studies use secondary data on the market price of houses to estimate the value of environmental goods and services. This method has an advantage when property sales and their characteristics

are generally readily available4. However, applying a hedonic pricing method is challenging in developing countries for two main reasons. Market prices of houses are commonly distorted due to high transaction costs resulting from the asymmetric information and involvement of several intermediaries in house market value chains. As a result, the existing price of houses does not reflect the actual preferences of house buyers. Secondly, the secondary data on house prices is usually not available especially in developing countries such as Ethiopia. In fact, relying on secondary data on house prices for non-market valuation of environmental goods and services is unlikely to capture the real value people attach to the amenities under consideration. Using the subjective valuation of environmental goods, however, can help fill the gap in data.

In Ethiopia, studies on the valuation of urban green amenities are nonexistent. There are some Master's theses level, including Juhar (2014) and Teshager (2014), which focused on estimating the economic value of parks and forests, improved urban waste management practices and river water quality improvements. Juhar (2014) examined the valuation of forests in rural areas, while Teshager (2014) investigated residents' willingness to pay for the improvement of urban river quality. Sema (2010) found differences in house prices across various districts in Addis Ababa although the reasons for locational deviation in residential prices remained unclear. Overall research on the effect of environmental valuation and the role of green amenities on house prices in Ethiopia have been unavailable.

This study aims to contribute to the existing literature in two main ways. First, it combines subjective house values and actual rental prices to investigate the impact of urban green amenities on residential house prices within the hedonic pricing framework. Secondly, our study contributes to the ongoing debate about the need to consider environmental protection, at the same time as addressing pressing issues of poverty eradication in the context of developing countries. Our results provide evidence that people value environmental quality and hence policies targeting development to help to create a balance with the environment.

[4] For details of the application of a hedonic pricing model: http://www.ecosystemvaluation.org/hedonic_pricing.htm (date 10-07-2017)

The second section of the paper presents a brief review of related literature; Section 3 is devoted to our methodology and is followed by our empirical results and discussion. Section 5 provides conclusions.

## 2. Literature Review

Indirect values of environmental amenities are commonly measured through their effect on the value of properties like residential houses. The typical empirical approach for estimating the value of green amenities is to measure their effect on house prices using the Hedonic Pricing (HP) method. As noted by Monson (2009), the hedonic pricing model can help in measuring the effects of both tangible and intangible characteristics of a house, including outside influencing factors, on its price. Several studies in different countries have employed the hedonic pricing method to estimate the value of environmental goods and services, although others have used contingent valuation and choice experiment methods.

One of the issues among existing literature has been inconclusive results regarding the impact of urban green amenities on house prices. Studies such as Luttik (2000), Tajima (2003), Jim and Chen (2006), Adekunle et al. (2008), Conway et al. (2008), Chen and Jim (2010), Chaudhry (2013), and Giergiczny and Kronenberg (2014) all found urban green amenities had a positive effect on residential house prices in developed and middle-income countries. Conversely, He et al. (2010) and Zrobek et al. (2015) did not find any positive effects of green amenities on residential prices.

Luttik (2000) investigated the effect of various environmental factors on the price of houses using the hedonic pricing method in Netherlands. His result indicated variations in house price by landscape types with a house with a garden facing water connected to a lake produced a 28 percent higher price. Similarly, Tajima (2003) showed that the proximity to urban open spaces had a positive impacts on property values, while proximity to highways had negative impact. Giergiczny and Kronenberg (2014) estimated the value of street trees in the city center of Lodz in Poland using the choice experiment approach and indicated that residents were

willing to pay the highest price for greening streets and confirmed the general importance of planting trees.

Studies in middle-income countries similarly reported varied results regarding the effects of urban green amenities on residential prices. Jim and Chen (2006), Adekunle et al. (2008), Chen and Jim (2010), Lo and Jim (2010), Donfouet et al. (2011) and Chaudhry (2013) all found that urban green amenities had a positive impact on residential prices. Chaudhry (2013) used the hedonic pricing method to examine the impact of key environmental attributes on the market rates of residential plots in the city of Chandigarh in India and indicated that proximity to lake and leisure valley chains of green spaces raised housing prices by about 10 and 2 percent respectively. The study demonstrated the possibility of increasing prices of urban residential property in areas near the lake. Jim and Chen (2006) indicated that a view of green spaces and proximity to water increased housing prices by 7.1 percent and 13.2 percent, respectively.

Chen and Jim (2010) analyzed the amenity and dis-amenity effects arising from the heterogeneous urban landscape in the Chinese city of Shenzhen. They indicated that residential gardens were the most attractive landscape attraction resulting in an average increase in house prices of 17.2 percent. Lo and Jim (2010) investigated residents' recreational use of urban green spaces and assessed their monetary value using CVM in Hong Kong. The result indicated over 80 percent of the respondents were willing to pay to recover a hypothetical reduction of urban green spaces area by 20 percent due to urban development. This suggested resident placed a significant monetary value on the non-marketed services of urban green spaces, a value that could provide an important addition to green space planning and nature conservation as part of city development and management.

Adekunle et al. (2008) assessed an economic valuation of the environmental service functions of forest trees in urban areas of Nigeria using CVM. Donfouet et al. (2011) also analyzed the preferences, attitudes and motives of urban park visitors towards a policy that aimed at endowing a park with more amenities using CVM. The study revealed that 78 percent of respondents were willing to pay an increased entrance fee if the park was endowed with more amenities. The results also indicated that improved urban parks could result in increased welfare gains for the visitors and improve environmental quality.

However, He et al. (2010) and Zrobek et al. (2015) did not find a positive association between the prices of residential houses and environmental amenities in middle-income countries. While He et al. (2010) indicated the negative effect of accessibility of recreational facilities and parks on house price in Beijing, they also showed the main determinants of house purchase prices were the price of land, the ratio of the area of building to the total area, and the distance to city downtown amenities. Zrobek et al. (2015) qualitatively surveyed residents' choice of residential locations in Poland and indicated the quality of the environment was not the main criterion in determining choice of residential location despite high levels of environmental awareness among the respondents. A quiet neighborhood and scenic value were regarded as the most important determinants.

Along with these inconclusive results about the role of green amenities in house prices, a key consideration in the literature is the issue of spatial location. Urban amenities are not single house specific in the sense that several observations in a sample share the same amenities, and it is, therefore, necessary to control spatial correlation of variables, a point missed by the majority of existing studies. According to Cho et al. (2008), while people put a positive value on green amenities, the type of features preferred varies according to the location or the degree of urbanization. This emphasizes that spatial issues are important in green amenity valuation. Conway et al. (2008) estimated the effect of green spaces in Los Angles, controlling for spatial autocorrelation. The results showed that neighborhood green space in the immediate vicinity of houses had a significantly positive impact on house prices. One interesting aspect of the findings of these studies is that there is variation between clustering and non-clustering of data at spatial levels. So, consideration of spatial aspects of the data is required because green amenities and other neighborhood infrastructures are not specific to a given house. Houses in a similar area share common facilities and tend to have somewhat similar values, but most of the existing literature on hedonic pricing does not provide for this spatial autocorrelation.

In Ethiopia, studies on the value of green urban amenities particularly on residential pricing are lacking, though a few Master's thesis studies have tried to estimate the economic value of parks and forests, of urban waste management or of river water quality improvements. Juhar

(2014) applied CVM to measure the value of forests in Ethiopia using the case of 'Wof-Washa' natural forest, and the findings indicated the respondents' willingness to pay Birr 19.75 per year for forest conservation. Teshager (2014) estimated households' willingness to pay for protection of river water from pollution in Addis Ababa using the choice experiment method. He found that respondents were willing to pay an yearly average of Birr 90.34, 12.89 and 27.87 and 1.48 for improved river water quality, river water volume, recreational facilities and a riparian buffer zone, respectively. Sema (2010), however, indicated that location had a substantial influence on housing prices in Addis Ababa, noting a 10 percent rise in plot area increased housing prices by 5.5 percent and 4.5percent around CMC and Alemgena areas of the city, respectively.

Overall, empirical studies concerning the valuation of urban ecosystem services in the Ethiopian context are limited. This underlines that the need for research on urban ecosystems and greening activities are needed to support sustainable urban planning and implementation decisions.

## 3. Methodology

### 3.1 Data

We conducted a survey of 640 households in five sub-cities of Addis Ababa. The survey covered 21Woredas 5 located in the major river basins of Addis Ababa. However, data obtained from 350 households were used for the empirical analysis of this particular paper for two practical reasons. First, we focused only on the demand side of the housing market and estimated buyers' value of urban green amenities. We, therefore, excluded the observations of the households who owned the house they were living in. The second reason is that some of the respondents provided 'I Don't Know' responses and were hence excluded from the analysis due to missing values for key variables.

Our sampling followed a two-stage procedure. At the first stage, out of the 700 Enumeration Areas (EAs) in the five sub-cities, we identified 237 EAs around and within the buffer area of the major rivers and river lines

[5] A *woreda* is the administrative unit equivalent to sub-district under sub-cities in Addis Ababa.

using the 2007 population census of Ethiopia. Then we randomly selected forty EAs out of the 237 EAs in which to conduct the survey. Each EAs has on average150-200 households. The second stage involved the selection of 16 households from each EA using equal probability systematic sampling procedures. We selected a central starting point in each EA from which we identified four quadrants to ensure representation of samples from all directions. The identification of the sample starting point in the EA was undertaken by using GPS coordinate points around the central part of the enumeration area and visualizing the X and Y coordinates to plot a point on the map. We then selected four households from each of four directions (north, south, east and west) using a random walk pattern approach. Four enumerators were assigned to each EA to gather the data by selecting the households with the help of eligibility screening questionnaires with the enumerators walking north, south, east and west.

Using a random walk pattern, we selected every 15th household in EAs having at least 175 households. For EAs with total households of less than 175, we selected every 10th household for interviews. In case where the selected household was not available for interview, the survey team revisited twice and if they could still not find the head of the household, they substituted the next household available (n+1) on their random route walk. We pilot tested the questionnaire on 20 households before conducting the final survey, improving on the basis of the feedback provided. The questionnaire included various questions related to socioeconomic characteristics of the respondents' and urban green amenities.

## 3.2 Model Specification

This study applied the standard hedonic pricing approach to measure the value of urban green amenities in residential pricing in Addis Ababa, Ethiopia. According to Monson (2009), a hedonic pricing model can help to measure the effect of intangible characteristics on the overall transaction price of a house. It explains observed economic behavior when there are many and different personal preferences in the housing market. Common factors included in a hedonic pricing model are a wide array of location features, physical features, environmental features,

economic factors, and preferences of individual households and their unique needs (Monson, 2009; Liebelt et al., 2018). Consequently, we specify our empirical model as indicated in Equation (1):

$$\boldsymbol{P = \alpha + \beta X + \gamma Z + \varepsilon \#} \qquad (1)$$

where $P$ is the average price of house representing the value of the house (in our case the subjective value buyers' attach to the house and the rent they actual pay). The fixed value of $\alpha$ is the minimum price a buyer is willing to pay for a home before even considering all of the qualities and environmental amenities. In Equation (1), $X$ represents the vector of house characteristics and $Z$ is the environmental features peculiar to the particular location of the house. Parameters, $\beta$ and $\gamma$ are vectors of monetary value that correspond to the house characteristics and the green urban amenity features of the house, respectively. The final term $\varepsilon$ stands for a vector of random error that includes unpredictable determinants of the house price.

In our hedonic price model, we consider the house buyer's subjective price of house and actual monthly rent value as a function of house location, materials with which a house is built, the characteristics of house itself, the nature of surrounding environment and green amenities. We estimate two separate models to investigate the value of urban green amenities in residential pricing in Addis Ababa. The respondents' subjective house price is used as a dependent variable in the first model; the actual rental price per month is considered as the dependent variable in the second model. Location is defined in terms of the sub-city in which the house is located; house characteristics include house construction materials, size of the compound, the size of the house area, house renovation, and the total number of rooms and bedrooms of the house. Neighborhood facilities included access and quality of secondary schools, access to piped water, and safety and crime conditions. Environmental amenities include the view of attractive landscapes and nature areas, street views and availability, and access to, parks and green spaces. For spatial concerns about the

commonness of green amenities in a given vicinity, we included the sub-city as a control in the explanatory variable.

## 4. Results and Discussion

### 4.1 Descriptive Analysis

Out of the total sample, only 30.2 percent of respondents lived in the house they owned with about 64.5 percent lived in the house they rented. The remaining 5.3 percent were using the house in which they were living without payment. For the purpose of empirical analysis, this study focused on the demand side and chose 413 households who do not own the house and who wanted to buy it. As we noted above, 63 observations were dropped due to 'I Don't Know' and no response. Our empirical analysis is therefore based on the responses obtained from 350 households.

**Table 1: Descriptive statistics of the main variables of house characteristics**

| Variables | Details of variables | Mean | SD* | Min | Max |
|---|---|---|---|---|---|
| House price | Continuous variable measured in USD[6] | 20,372 | 36,600 | 110 | 296,053 |
| House rent | Continues variable measured in USD | 18 | 44.8 | 0.09 | 350.9 |
| House renovation | Dummy variable taking the value '1' if house is renovated (Yes) or '0' if not | 0.42 | 0.49 | 0 | 1 |
| Total rooms | Continuous variable measured in numbers | 2.25 | 1.28 | 1 | 17 |
| Bedrooms | Continuous variable measured in numbers | 0.93 | 0.65 | 0 | 3 |
| Compound (house) size | Continuous variable measured in meter square | 73.9 | 202.8 | 6 | 3500 |

*Standard deviation

As indicated in Table 1, the mean price of a house was found to be 20,371 USD with the maximum price being 296,052 USD. The average

[6] US Dollars

monthly house rent value was about 18 USD. The number of total rooms, bedrooms and the size of house compound areas were important house characteristics that might influence buyers' choice of a house. The average number of the rooms was 2 with a minimum being 1 and a maximum of 17, with the majority of the houses having a small number of rooms. The average number of bedrooms was about one, though there were also houses with no specific standalone bedrooms; the maximum number of bedrooms was found to be three. In addition, the size of the house compound showed significant variation. The mean area of respondents' living compounds was about 74 square meters, with a minimum of 6 sq. mt. and a maximum of 3500 sq. mt. The high variation in the size of the living compound was reflected by a standard deviation of about 203 square meters.

As shown in Table 2, only 7 percent of the respondents had separate bathrooms. This indicates that the majority of houses lack basic facilities for sanitation services. In addition, only about 2 percent of houses had air conditioning, that is access to fresh air through a window. Other important facilities for residential houses in cities are access to reliable piped water and electricity supply. About 91 percent of the respondents have access to piped water, and although the proportion of sample households without water access is relatively small, the lack of reliable and potable water supply is critical given its implication for the health and sanitation of residents. About 22 percent of the residents believed that their neighborhood was less privileged concerning the availability of drinking water supply while about 37 percent believed that their area was more fortunate as compared to other areas (see Figure 1). Access to electricity is found to be about 99 percent (Table 2) but its reliability was limited due to frequent power outages in the city.

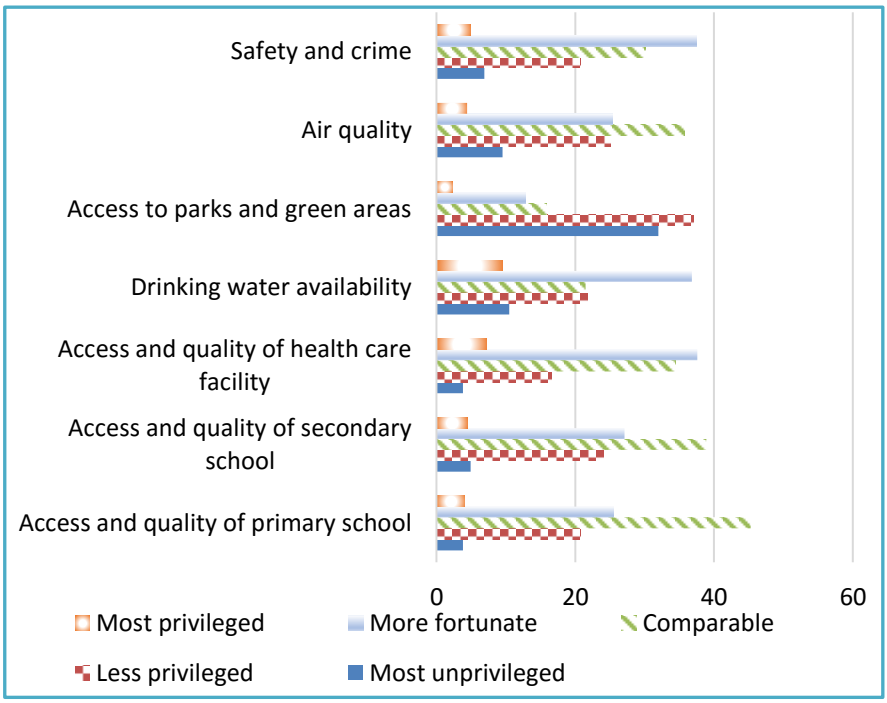
**Table 2: Description of access and availability of urban green amenities and other facilities**

| Variable | Description of variables | "Yes" response (%) |
|---|---|---|
| Bathroom | Dummy variable for the availability of separate bathrooms. The variable takes the value 1 if 'Yes' and 0 if 'No' | 7.4 |
| Air conditioning | Dummy variable for the availability of air conditioning in a house, taking the value of 1 if 'Yes', 0 if 'No' | 2 |
| Piped water | Dummy variable for the access to piped water for a house, which takes the value 1 if 'Yes, 0 if 'No' | 90.7 |
| Electricity | Dummy variable for the access to electricity for a house which takes the value 1 if 'Yes', 0 if 'No' | 98.7 |
| Landscape, and nature view | Dummy variable for the view to attractive landscapes, and nature areas which takes the value 1 if Yes', 0 if 'No' | 21.7 |
| Attractive street view | Dummy variable for the view to attractive streets with trees and other features which takes the value 1 if 'Yes', 0 if 'No' | 24.3 |
| Other attractive view | Dummy variable representing the view to other attractive features (other than landscapes, nature areas, and streets) which takes the value 1 if 'Yes, 0 if 'No' | 7.7 |
| Green space availability | Dummy variable for the availability of green spaces or areas covered with trees, grasses and others which takes the value 1 or if 'Yes', 0 if 'No' | 37 |
| **Parks availability** | **Dummy variable for the availability of parks around the living area which takes the value 1 if 'Yes', 0 if 'No'** | **48.9** |

Regarding the urban green amenities, about 22 percent of the respondents had a view of attractive landscapes and nature areas. Landscape and nature areas include any environmental features including mountains, forests, valleys or related features. Similarly, about 24 percent of the houses have attractive street views. The availability of green spaces and parks near to the residential area also determined the attractiveness of the location and about 37 percent of respondents agreed that there were green spaces or areas covered by trees, grasses and other features around their house. Despite

concerns that the status, size or development of a park might not be as good as they wished, more than 48 percent of the residents indicated that their house was located near to a park (see Table 2).

**Figure 1: Residents' perception about neighborhood infrastructure and environmental facilities**




In addition to green amenities, the relative access and quality of education and health infrastructure and facilities also determine residents' choice of location. Figure 1 presents residents' perception about the facilities in their house location areas. About 45 percent of respondents indicated that their village was comparable to other areas in the city in terms of primary school access and quality. In addition, about 21 percent rated their neighborhood less privileged while about 4 percent ranked it as most unprivileged concerning primary education access and quality. As far as secondary education was concerned, a slightly lower proportion of respondents (about 4 percent) agree that their village was unprivileged compared to other areas in the city, but about 39 percent believed that their neighborhood compared adequately with other villages in the city regarding

the quality and access to secondary education. About 25 percent and 27 percent of respondents believed that their neighborhood was more fortunate regarding access and quality of primary and secondary education. A higher proportion of respondents said their village was more fortunate than other areas in the city concerning e access and quality of health care facilities (Figure 1). Put in specific terms, about 38 percent of respondents believed their neighborhood was more fortunate compared to other areas in the city. About 7 percent of the residents rated access and quality of health care facilities in their village as most privileged compared to other areas.

Safety and crime condition in a given area is also an important factor for residents' preference of a location. The respondents were asked to rate the safety and crime conditions in their neighborhood as compared to other places. Results indicated about 37 percent of the residents believed their village was more fortunate compared to other places in the city. About 30 percent and 21 percent of respondents rated their neighborhood comparable or less privileged, respectively. It should be noted the ratings are only based on the respondents' perceptions and beliefs about their neighborhood relative to other villages they know in the city.

The residents were also asked to rate the air quality in their neighborhood in terms of smoke, smog, particles, dust and smell. About 39 percent of the respondents rated the air quality in their neighborhood comparable to other places in the city; but 9.5 percent believed that the quality of air in their village was most unprivileged in comparison to other areas. A contradiction in responses to air quality was that a similar proportion of respondents (about 25percent) rated their neighborhoods is less privileged or more fortunate than other areas.

## 4.2 Empirical Results

In the empirical analysis, we have used the regression analysis of both linear and log-linear hedonic pricing model specifications. We checked the appropriateness of functional form using a Box-Cox test. The test result indicated lower Residual Sum of Square (RSS)values (516.77 and 1132) for the log-linear regression model as compared to linear specification (3.5132e+11 and 455664) for house price and rent models respectively. We

rejected the null hypothesis stating that the two models are the same due to high Box-Cox static of 457.39 for house price and 455.70 for rent model tests that are greater than the critical value of 341.39 Chi-square estimates at 5 percent level of significance and 325 degrees of freedom. The result showed that log-linear models fit our data very well, implying that house prices have no linear relationship with the explanatory variables where marginal values increase with the house attributes but start declining after certain higher levels. Hence, we reported the regression results from the log-linear model specification that include the natural logarithms of dependent variables, namely the average subjective price of a house (the value residents willing to pay) and the actual monthly house rent value.

Furthermore, we also checked the multi-collinearity problem among the variables using the Variance Inflation Factor (VIF) test. The test result showed the mean VIF value of below 1.5 with VIF values for all individual variables less than 3, indicating no multi-collinearity among the variables in both models. We also controlled for potential spatial correlation by adding the sub-city in the regression analysis. Unlike the standard hedonic pricing approach, we controlled for the socio-economic factors in modelling the subjective values people attach to houses. Results indicated that the income of household affects resident's willingness to pay and the rent value they attach to the house. For instance, households with higher income were willing to pay higher house prices and rental value as compared to low-income groups. This indicates that the value of houses depends not only on the house characteristics and environmental factors but also on people's ability to pay (wealth).

### *Effects of location factors on house value*

One of the factors that affect residential prices is the location of the house. As presented in Table 3, residents are willing to pay a higher price for houses located in Lideta sub-city as compared to Gulele and Kirkos sub-city. This might be because of residents preferred central locations in the city and their convenience for commute to work. Lideta and Kirkos sub-cities are centers for businesses and residential apartments with relatively better infrastructure, including connectivity to the new Light Railway Transit. In addition to the physical location of a particular house, residents also care

about the facilities available around the location of a house. These include access and quality of economic and social infrastructures such as schools, water, and other related facilities. As a result, we included variables representing access and quality of neighborhood infrastructures as dummies taking one for most privileged and fortunate responses as compared to another neighborhood, zero otherwise. Our regression results of the house price model show that access and quality of school do have a positive effect on house value. This is reflected by the positive and statistically significant coefficient of access and quality of secondary schools. Access to piped water also increased the price of house respondents willing to pay. Contrary to our expectation that safety and crime condition of an area would influence house value, the coefficient was found to be statistically insignificant in both house price and rent models.

***Effects of house characteristics on the house value***

In addition to location, the type of materials which the house is constructed can determine the price and rental value of a house. The material by which the house built can affect the strength and durability of a house. To examine this effect, we incorporated the categorical variable of the main materials for house construction using concrete, bricks, wood with mud and cement, metal sheet and stones. For this purpose, we keep concrete as a base variable. Our results indicate that residents paid 156 percent and 51 percent lower prices respectively for houses that were built of a metal sheet and stones, and wood with mud and cement, as compared to concrete. The results indicate that rent values were respectively 164 percent, 208 percent and 257 percent lower for houses constructed with bricks, wood with mud and cement, and wood with mud as compared to concrete. In Addis Ababa, most houses are old and not built with modern construction materials; the majority are built of wood with mud, and of cement with wood and mud.

The size of the house area, the total number of rooms and bedrooms were also found to be important factors that affect the value residents assign to the house. An increase in the area of a house increased the price residents were willing to pay by 1.2 percent and significant at 1 percent, keeping other things constant. However, it turned out to be statistically insignificant in the rent model. The price of houses that residents were willing to pay also

increases by about 16 percent as the number of total rooms increases. The total number of rooms has no statistically significant effect on the house rent value, but the number of bedrooms can negatively affect the rent value by up to 60 percent. The probable reason for this is that when residents rent a house, they can adjust rooms for different purposes. The size of house area, the number of total rooms and bedrooms explain the subjective price of the house rather than its rental value as the coefficients of these all turn out to be statistically insignificant in the rent model, except for the number of bedrooms. The compound size, however, significantly and positively affects the house rental value, as compound size increased by square meter, the rental value increased by 0.09%. Residents attached higher rental values to a renovated house. Renovated houses (those houses that have had major renovation during the last two years) have 176 percent higher rental value as compared to non-renovated houses.

**Table 3: Regression results from the hedonic house price and rent models**

| Variables | Subjective price model | | Rent model | |
|---|---|---|---|---|
| | Coefficients* | P-value | Coefficients | P-value |
| *Sub-city (Base variable: Gulele)* | | | | |
| Lideta | 1.22***(0.226) | 0.000 | 0.289 (0.546) | 0.597 |
| Kirkos | 0.698** (0.306) | 0.023 | -0.565 (0.188) | 0.188 |
| Arada | 0.297 (0.204) | 0.147 | -0.348 (0.313) | 0.266 |
| Addis-Ketema | 0.301 (0.261) | 0.250 | 0.290 (0.396) | 0.465 |
| Household Sex | 0.185 (0.202) | 0.361 | -0.203 (0.330) | 0.539 |
| Household age | -0.0026 (0.004) | 0.583 | -0.010 (0.006) | 0.122 |
| Marital Status | -0.0073 (0.209) | 0.972 | 0.243 (0.325) | 0.454 |
| Household Income | 0.263** (0.957) | 0.006 | 0.651*** (0.144) | 0.000 |
| *House construction material (Base variable: Concrete)* | | | | |
| Brick | -0.349 (0.456) | 0.444 | -1.649 (0.832) | 0.048 |
| Wood with mud and cement | -0.518*(0.296) | 0.081 | -2.088**(0.620) | 0.001 |
| Wood with mud | -0.143(0.302) | 0.635 | -2.57***(0.613) | 0.000 |
| Metal sheet & stones | -1.56 **(0.635) | 0.014 | -1.515 (0.959) | 0.115 |
| Compound size | 0.0002 (0.0002) | 0.169 | 0.0009* (0.0005) | 0.082 |
| House area size | 0.012**(0.004) | 0.006 | 0.0016 (0.006) | 0.794 |
| House renovation | 0.021 (0.160) | 0.892 | 1.762*** (0.257) | 0.000 |
| Total rooms | 0.166** (0.051) | 0.001 | 0.096 (0.068) | 0.158 |
| Bedrooms | 0.435** (0.134) | 0.001 | -0.601** (0.215) | 0.006 |

| Variables | Subjective price model | | Rent model | |
|---|---|---|---|---|
| | Coefficients* | P-value | Coefficients | P-value |
| Access to quality secondary school | 0.440**(0.178) | 0.014 | 0.036(0.283) | 0.897 |
| Piped water access | 0.391*(0.204) | 0.056 | 0.298(0.204) | 0.498 |
| Safety/crime | -0.246 (0.158) | 0.120 | -0.102 (0.227) | 0.653 |
| Street view | 0.237 (0.164) | 0.149 | 0.237 (0.164) | 0.149 |
| City buildings view | -0.168 (0.220) | 0.446 | -0.043 (0.297) | 0.885 |
| Landscape and nature areas view | 0.456** (0.189) | 0.017 | -0.177 (0.317) | 0.577 |
| Park availability | -0.07(0.166) | 0.643 | 0.508** (0.253) | 0.045 |
| Green spaces availability | 0.197 (0.159) | 0.217 | -0.129 (0.270) | 0.632 |
| **Constant** | **9.50*** (0.556)** | **0.000** | **1.15 (0.829)** | **0.164** |

Figures in parenthesis are robust standard errors. *** p<0.01, ** p<0.05, * p<0.1

### *Impact of urban environmental and green amenities on the house value*

Green amenities and other factors can affect the buyers' preferences and hence determine the value residents attached to a house. As indicated in Table 3, in addition to parks, the availability of attractive landscape and nature views near to the house has a positive determination on the price of the house. Keeping other factors constant, the view of an attractive landscapes and natural features increase the price of the house by 45 percent, which is statistically significant at 10 percent. The positive and statistically significant effect of a view of landscape and natural features on the price of the house can be expected in Addis Ababa. Residents prefer locations closer to urban forests and mountains. Our result are consistent with the findings of Chen and Jim (2010) who showed an increase in house price with availability of a garden area. We did not, however, find statistically significant evidence of the effect of park availability on the subjective price of houses that residents were willing to pay. This is similar to the finding of He et al. (2010) who reported no positive influence of accessibility of parks on the price of a house in Beijing. However, our results did indicate a positive and statistically significant relationship between availability of parks and house rent value. Rent value increases by about 50 percent for houses

located around the areas where parks are available. This provides evidence that residents put a positive value on green infrastructures in urban areas.

## 5. Conclusion

This study has examined the impact of green amenities on the residents' willingness to pay for residential houses in Addis Ababa, Ethiopia. For this purpose, we employed a hedonic pricing model with a focus on the demand side of the housing market. The results indicate that house characteristics and infrastructure influence the price and rent value of a house. Specifically, we find that the type of house construction materials, location and the size of the compound, renovation and access to secondary school influence the price of a house in Addis Ababa.

Moreover, the empirical results from the log-linear regression analysis indicated that residents attach positive value and reveal strong preferences for urban green amenities. This is reflected by the positive impact of attractive landscape and nature views, as well as the availability and access to parks in the urban area. Specifically, residents are willing to pay a 45 percent higher price for a house having a view of attractive landscapes and nature. Similarly, residents are willing to pay 50 percent higher rent for houses that have access to parks. The findings of this study highlight that landscape and nature views, as well as availability and access to urban green amenities are important factors affecting residents' decision to buy or rent a house. Residents are willing to pay higher prices for a house located around urban green amenities. Including green amenities in designing urban residential areas and real estates can, therefore, provide a positive gain for the investors and help to build green cities. Our analysis also implies that subjective value measures of house prices can be used as a proxy for house prices. It can explain residents' preferences for urban environmental services in areas where the data about the housing market is limited or not available. Thus, the subjective valuation of residents about house attributes can be used to study the relationship between house prices and urban environmental services in developing countries.

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