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Research Article

Determinants of Residential Real Estate Property Prices in Ethiopia: The Case of Bahir Dar City

Tamirat Mekonnen Mekuria[1, *] , **Seid Hussen Yimam**[2] ,
Yohans Teshome Negashi[3]

[1]Department of Real Property Valuation, Institute of Land Administration, Oda Bultum University, Chiro, Ethiopia

[2]Department of Real Property Valuation, Institute of Land Administration, Bahir Dar University, Bahir Dar, Ethiopia

[3]Department of Real Property Valuation, College of Business and Economics, Dire Dawa University, Dire Dawa, Ethiopia

Abstract

The Ethiopian real estate industry has grown in the previous two decades, especially in the capital city of the country and regional capitals, including Bahir Dar. Real estate prices have doubled and even tripled in a few years because of different factors. Thus, the purpose of this study is to analyse the factors affecting residential real estate prices in Ethiopia, particularly in Bahir Dar City. For this purpose, the study used both purposive and stratified random sampling techniques. Descriptive and inferential statistics were used to analyze the data, and the ordinary least squares method was used to identify the factors that influence residential real estate prices. The hedonic regression model result reveals that R^2 statistics (0.880) indicate that 88% of the variation in residential real estate prices can be explained by variation in the independent variables. Hedonic regression model results revealed that plot size, floor area, number of rooms, age of the house, external wall finishing material, ceiling finishing material, the direction of the house, distance of the property from the main road, and involvement of brokers in the transaction process, were major micro-factors that had a significant effect on residential real estate prices at the 5% level of significance. Furthermore, the interview results show that the challenges faced by real estate developers mostly include loans and aid issues, high-interest rates, mortgage restrictions, the financial capacity of real estate companies, delays in plan approvals, and rising costs of construction materials are among the major challenges affecting investment in real estate. The study suggests that the municipality of Bahir Dar City should provide an adequate supply of land to real estate developers, improve infrastructure development, and federal and regional governments should provide the credit lending mechanism by lowering interest rate especially for low-income class.

Keywords

Hedonic Regression Model, Micro-Factors, Property Prices, Residential Real Estate

*Corresponding author: tamemekonnen16@gmail.com (Tamirat Mekonnen Mekuria)

1. Introduction

Real estate or real property refers to a type of asset that can't be moved physically, like land or resources [12]. Land and landed resources are distinct from other goods and services due to their immobility. Real estate includes the actual ground as well as buildings or other improvements that are permanently affixed to it [23]. Real estate is a business, not a vocation [4]. It is a sizable enterprise that is vital to the economy of the nation.

According to a study real estate is divided into residential and non-residential properties [21]. Residential properties include both single-family and multi-family residences and are defined as properties used as housing or dwelling. These properties could be found in a city, a rural location, or a suburban environment. Buildings used for commerce, industry, hotels, institutions, and recreation are included in non-residential properties.

In recent years, in Ethiopia, accumulated demand for residential housing on the one hand and the low supply of residential real estate, on the other hand, have pushed residential real estate prices beyond the affording capacity of the majority of the residents [34]. The Ethiopian real estate market has experienced high demand for housing, while available units are unaffordable to most residents, especially to the middle and lower-income section of the population, who seek to own homes due to rising prices [1].

The Ethiopian real estate industry has grown in the previous two decades, especially in the capital city of the country, and regional capitals, including Bahir Dar. However, real estate prices have doubled and even tripled in a few years because of different factors and the concern of many of the residents is the lack of adequate affordable housing especially the middle and lower income class seeking to own homes due to rising pricing. Therefore, the investigation of the real estate market in Ethiopia, including Bahir Dar City is a significant part of the country's economic situation analysis, and it is important to identify the determinants of house price dynamics.

2. Literature Review: Factors

The micro-elements influencing real estate pricing have been the subject of numerous research studies. A study in Gahanna that looked at the elements affecting residential property prices in Ghana identified four criteria as having a substantial impact on the cost of homes in the area: location, number of bedrooms, housing amenities, and neighborhood amenities [26]. Additionally, [2] recognized location and construction quality as key direct determinants when studying the components that must be taken into consideration for analytical forecasting of future trends in the variation of real estate prices in Slovenia. According to [2], the main elements influencing property values include proximity to a major road, the number, and size of bedrooms, amenities, a

motorable access road, drainage, and security.

Physical characteristics of the property

Physical qualities include an estate's appearance, quality, and design as well as the building's actual plan [22]. Real estate developments are known for their extended physical lives, which necessitates greater structure, layout, and design due to the real estate industry's evolving technologies [15]. Higher demand will result from people's willingness to buy properties with better layouts, designs, and structures, which will increase competition for such properties. This leads to high prices on such properties, and vice versa for the poorly laid and designed structure [15].

Neighborhood

A residential property's price directly correlates with its neighborhood. People who live nearby have an impact on the level of comportment a resident can experience there, according to [14]. While hostile neighbors are a symptom of an unfriendly community, which lowers the market for residential property in those places, friendly neighbors are a sign of a healthy and pleasant neighborhood, which enhances the demand for property [32]. Competition, which raises the price of residential real estate.

Property Location

The geographic position of the subject property is referred to as the property's physical location [27]. This has an impact on residential home pricing because different localities will command varying prices [22]). Homes in urban regions will command higher prices, while comparable properties in rural areas will command lower prices.

Accessibility of property and availability of amenities

The level of convenience and accessibility of a place or particular land is determined by how far the property is located from the place of work, shopping centers, or any other place that one needs to visit regularly [2]. The main determinants of how convenient and accessible a place is are traffic, the road network, and road conditions [19]. Most people prefer to reside in highly convenient and accessible areas, so the demand for residential houses in these areas increases. The increased level of demand for residential houses then contributes to an increase in the prices of residential houses. Poorly accessible and inconvenient areas attract few people and, therefore, low demand for residential property, thus low prices. Proximity to facilities and amenities is the fourth factor that influences residential property prices. Properties that are situated near facilities such as hospitals, gyms, supermarkets, education centers, and other fundamental facilities attract higher demand from residents because most people like to reside in places where it is convenient to access these facilities [7]. This high demand contributes to competition on the subject property, thus leading to a higher price. These amenities help meet people's basic needs [24]. For instance, if one has kids that he or she intends to enroll in a school that is close to home, he or she would acquire a property with a

school within a convenient distance. This makes such properties more expensive due to the high level of competition.

Security

Humans need safety to develop in life and find fulfillment after meeting their physiological demands for food and shelter [20]. It applies to any vulnerable and valuable asset, including a person, house, neighborhood, community, country, or organization. Neighborhood crime is a problem for both societal safety and public health; it can directly harm residents through its violent manifestations and indirectly harm residents through stress and its effects on health [17]. An area is deemed unsafe if there are vandalism indications there and suspicious places are found nearby [13] everyone desires to live in safe areas; therefore, they avoid settling in dangerous residential neighborhoods [16]. This lowers the demand for residential homes in certain locations, which has an impact.

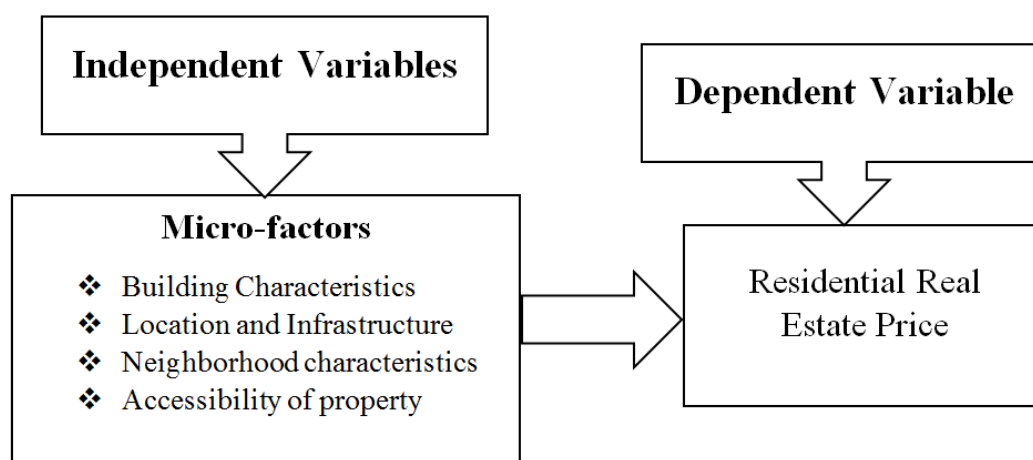*Factors Affecting Residential Housing Prices in Ethiopia*

As was previously said, physical, locational, and amenity aspects may all have an impact on the value of a home. Valuers, planning authorities, and policymakers, therefore, place great importance on identifying the connections between residential property values and various tangible and intangible dwelling characteristics, amenities, etc. [25]. Housing, in the opinion of [35], consists of a variety of characteristics, including not only the structure of the home itself but also all the additional services to which a person has access when purchasing or renting a home. The price a buyer is willing to pay is linked to these characteristics. Due to this, two identical homes that were constructed in different places were sold for different prices.

According to [9], evaluation of both owner-occupied and rental housing standards must take into account at least three groups of characteristics: the quality of the accommodation, accessibility to the neighborhood's basic infrastructure and services, and social and economic access to those services. According to [11], a variety of factors, such as the materials of the roofs, which can be measured by their durability, services (such as water taps, electricity, and sewage), and access to public infrastructures (such as the ease of access to transportation, schools, and health centers), can affect the quality of accommodations.

Examined the price of housing in Addis Ababa for small families by using a hedonic pricing model [25]. According to the study's findings, the real estate market is significantly influenced by location and plot size. Therefore, an increase in a plot size by 10% will result in a 5.5% increase in real estate values in the vicinity of CMC. Compared to Alemgena, where the same percentage increase raises home prices by 4.5 percent, [37] looked at the implicit price of housing attributes concerning the physical and geographical location of Addis Ababa. According to the study's findings, the floor area, plot size, and housing typology have a favorable, significant impact on Addis Ababa home prices. However, Addis Ababa house prices (and more especially, real estate values) are significantly negatively impacted by a home's age. In addition, the study by [31] explained that the factors that determine the price of a rental home in Hawassa include the number of rooms, the total square footage occupied by the home, accessibility to public transportation, access to health facilities, and housing typology.

In general, the qualities that are associated with a house have a strong correlation with its value. One of the most important qualities of housing is its proximity to social infrastructure such as employment and educational opportunities, as well as to public transportation and other amenities [26] As a result, a rental property in a city center that is close to social infrastructure and services would command a higher rate than one in the city's outer reaches, where access to these amenities is either impossible or non-existent.
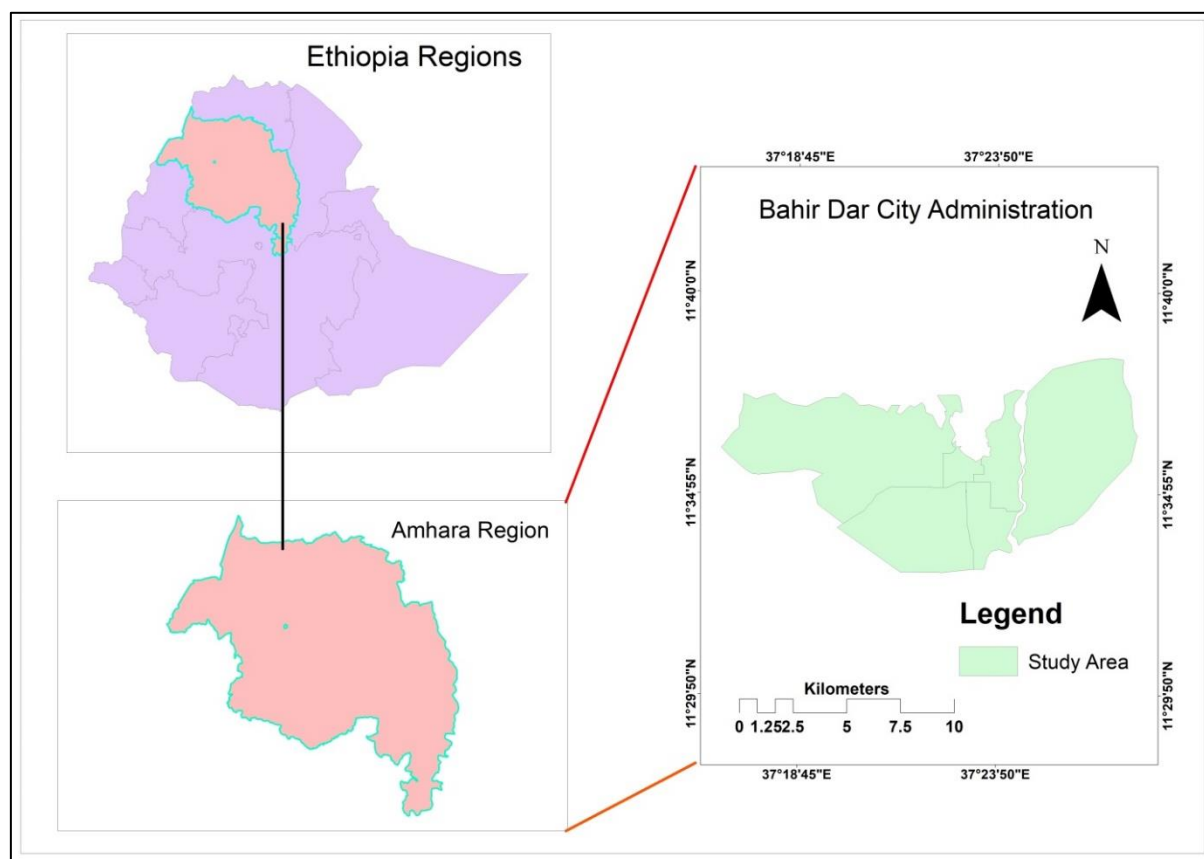

Source: Theoretical and empirical literature, (2024)

Figure 1. The conceptual framework.

3. Materials, Methods and Description of the Study Area

Study Area Description

Bahir Dar, the capital city of the ANRS, is one of the fastest-growing and highly populated cities in the country, with a population of over 323,000 (MoUDC, 2014). It is located in the north-western part of the country at about 570 km from Addis Ababa, having a latitude of 110 36'- 11.60N and longitude of 370 23'-37.3830 E/11.6;37.383 with an elevation of 1840 meters above sea level.

Source: Google map

Figure 2. Map of the study area.

Research Approach

There are three approaches available for researchers to design their research methodology: quantitative, qualitative, and mixed methods [5]. The mixed methods approach is a vital method for comparing outcomes, spotting bias in study designs, making explicit connections between various steps, and effectively applying triangulation [6].

A "mixed methods research" approach involves gathering both quantitative and qualitative data, integrating the two types of data, and employing unique designs that may include philosophical presumptions and theoretical frameworks. This type of study is predicated on the fundamental premise that combining qualitative and quantitative methods yields a better understanding of a research problem than either method by itself. Using a mixed-methods approach, this takes a pragmatic viewpoint and successively gathers quantitative and qualitative data for the design [5]. To address its objectives and issues, this study has employed a mixed research method. In this study, the quantitative data were presented with the help of regression model, tables, percentages, frequencies, figures, and charts. However, the qualitative data were also analyzed using the narrative mechanism, which uses tabulated figures converted into statements.

Research Design

A scientific study plan known as the research design directs the researcher in the collection, analysis, and interpretation of data [18]. A mixed research approach comprises three research designs, namely exploratory sequential, explanatory sequential and convergent parallel [5]. To analyse the factors that influence the price of residential real estate, the study used convergent parallel mixed methods. Convergent parallel mixed methods are a form of mixed methods design in which

the researcher converges or merges quantitative and qualitative data to provide a comprehensive analysis of the research problem. In this design, the investigator typically collects both forms of data at roughly the same time and then integrates the information into the interpretation of the overall results [5].

Sampling Techniques

It is critical to choose an appropriate sampling technique and determine a representative sample size in any study. The study used a purposive and stratified sampling design in the survey. A purposeful sampling technique was used to select two real estate companies based on experience and capacity of operations and the nature of the residential real estate. Additional reason for choosing those real estate companies because of the current operational capacity mainly focused on villa or single family homes. Stratified random sampling techniques are used to address the issue of location differences.

Sample Size

The study's sample size was obtained by using the Yamane formula, a simplified method for calculating small sample sizes developed by [36], and a total of 134 sample property owners were drawn as shown in Equation 3. To determine samples from each real estate company, proportional sample allocation techniques were employed to survey the target population. Table 1 illustrates the sample allocation for real estate companies during the survey.

The simplified formula for the sample determination as shown in Equation 1 is as follows:

$$n = N / (1+N (e^2)) \qquad (1)$$

Where; n = number of samples to be collected

✓ N = population size

✓ e = level of precision (marginal error) in this study at 7% (0.07)

The information obtained from the study area shows that 300 residential real estate properties have been transacted in Bahir Dar City by selected real estate companies. Considering this population size and the commonly used level of precision, i.e., 7%, the desired sample size would be

$$n = 300/ (1 + 300x (0.07)^2) = 121.45 \approx 121 \qquad (2)$$

The response rate of this study is expected to be 90% since the survey would be carefully planned and there would be strict follow-up in the survey process. This means it is crucial to add some allowance to compensate for the effect of the non-response to the survey questionnaire. Thus, considering a non-response rate of 10%, the required sample size for the study would be

$$n = 121/ 0.9 = 134 \qquad (3)$$

Since sample size cannot be fractioned and an increase in sample size enhances the reliability of the study result, the required sample size for this study would be 134. This sample size would be proportionally allocated for each study stratum, as indicated in the following table.

Table 1. Distribution of sample residential real estate properties in the study area.

Real Estate Company Name	Type of Real Estate Development	Investment status	Site(s)	Total transacted properties	Sample size = (NJ/N)*n
ACAPULIKO	Residential	Operational	Dagmawi Minilik	110	49=(110/300)*134
MULUGETA	Residential	Operational	Dagmawi Minilik	190	85=(190/300)*134
			Total	300	134

Source: Own survey result, May 2024

Methods of Data Collections

Both qualitative and quantitative types of data collected through primary and secondary methods of data collection. The primary data collected through survey questionnaires and key informant interview. Secondary data also collected from published and unpublished research journals, reports from real estate developers, and internet sources. The open and close end survey questionnaires conducted to gather information about factors affecting the price of residential real estate.

Method of Data Analysis

Data collected from different sources has been edited, interpreted, and analyzed using descriptive and inferential statistical methodologies. Descriptive statistics recorded include percentages, frequencies, means, and standard deviations. Inferential statistics are used to determine the relationship among variables and to make a prediction by using ANOVA, t-tests, and correlation coefficients. Multiple regression analysis was used to examine the determinants of residential house prices. After the completion of the data collection, the data were coded and entered into SPSS version 26. The results were presented in a table format, and SPSS was excessively used in the analysis.

Model Specifications

In this study, the hedonic pricing model was applied to estimate the factors that determine the price of residential real estate properties. The most common functional form recommended in the hedonic literature is the semi-logarithmic form. This form is preferred because it fits the data particularly well and because the coefficient estimates generated from the model can be interpreted as being the proportion of a good's price that is directly attributable to the respective characteristics of that good (Halvorsen and Palmquist, 1980). Thus, the researchers used semi-logarithmic forms for the models in this study. More specifically, the natural logarithm of the residential real estate price is treated as a dependent variable. The theoretical model is specified as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + ui \quad (4)$$

The following formula was used to translate the variables to our study:

$$LOG\_RREP = \beta_0 + \beta_1 \log(GPA) + \beta_2 \log(FLA) + \beta_3 \log(NR) + \beta_4 \log(AH) + \beta_5 FFM + \beta_6 (EWFM) + \beta_7 (BR) + \beta_8 (CFM) + \beta_9 (DH) + \beta_{10} \log(DMR) + \beta_{11} (LG) + \beta_{12} (ART) + ui \quad (5)$$

Where:

LOG_RREP = Logarithm of Residential Real Estate Price (Dependent Variable). To make interpretation of the regression coefficients easy the dependent variable is transformed into logarithmic form.

Log = Log-transformed value of the continuous variables. Transformation of logarithm is used to reduce complexity of values.

β_O = Constant term (Intercept)

$\beta_1, \beta_2, \beta_3, \ldots \beta_n$, = Beta coefficients

Beta coefficients are the parameters to be estimated in the model. The result is interpreted in terms of percentage.

u_i = refers to the error term or the error of the estimate

The explanatory variables that are expected to determine the price of a residential real estate are represented as;

Log (GPA) = Logarithm form of Gross Plot Area in square meter

Log (FLA) = Logarithm form of Floor Area in square meter

Log (NR) = Logarithm form of Number of Rooms

Log (AH) = Logarithm form of Age of the houses

FFM= Floor Finishing Materials

EWFM= External Wall Finishing Materials

CM= Ceiling Finishing Materials

BR= Broker/Agent

DH= Direction of the house

Log (DMR) = Logarithm form of distance of the property from the main road in meter

LG= Land Grade

ART= Accessible Road Type

The multiple regression function expresses the effect of each of the independent variables on the dependent variable. The value of β will be the degree of effect on price. A positive or negative sign will the direction of the relationships. The higher value of β, the higher the effect of the particular variable on price, (Julius, 2012).

Variables choice and definition

Many variables affect the price of residential real estate. As a starting point, the literature review guided the selection of 12 variables for the study. These independent variables were also selected based on the nature and type of real estate in the study areas. Table 2 contains a list of independent variables based on a review of the literature on determinant variables for residential real estate properties.

Table 2. Measurement and description of the variable.

Short name	Variable name	Data Type	Measurement	Description of variable	Expected sign
Log_ RREP	Residential real estate price	Numerical	Scale	Defined as natural logarithm of residential real estate price. It is a continuous variable measured in Ethiopian Birr.	Dependent variable
Log_ GPA	Gross plot area	Numerical	Scale	Log-transformed value of gross plot area. It is a continuous variable measured in square meter	(+)
Log_ FLA	Floor area	Numerical	Scale	Log-transformed value of floor area. It is a continuous variable measured in square meter	(+)
Log_ NR	Number of rooms	Numerical	Scale	Log-transformed value of the number of rooms. It is a continuous variable measured in numbers.	(+)
Log_ AH	Age of the house	Numerical	Scale	Log-transformed value of the age of house. It is measured in years	(-)

Short name	Variable name	Data Type	Measurement	Description of variable	Expected sign
FFM	Floor finishing material	Categorical	Ordinal	It is a categorical variable based on the quality of material Ceramic tile=1, Cement screed=2	(+)
EWFM	External wall finishing material	Categorical	Ordinal	It is a categorical variable based on the quality of material 1=Quartz paint, 2= Plastered, 3=Granit paint	(+)
BR	Broker/Agent	Dummy	Nominal	It is a dummy variable 1= indicates transaction is facilitated by brokers and 0= indicates transaction is held without involvement of brokers	(+)
CFM	Ceiling finish material	Categorical	Ordinal	It is a categorical variable based on the quality of material 1=Gypsum, 2= Plastic	(+)
DH	Direction aspect of the house	Dummy	Nominal	It is a dummy variable 1= East aspect, 0= Non- East aspect	(-)
Log_ DMR	Distance of property from the main road	Numerical	Scale	Log-transformed value of distance from the property to the main road. It is a continuous variable measured in meter	(-)
LG	Land Grade	Categorical	Ordinal	It is a categorical variable 1= First grade, 2=Second grade, 3= Third grade, 4= Fourth grade	(+)
RT	Accessible Road Type	Categorical	Ordinal	It is a categorical variable 1= Asphalt, 2= Cobblestone, 3= Gravel, 4= Earthen	(+)

Source: Author, 2024

4. Results and Discussions

Inferential Analysis and Diagnostic Tests

The price of a residential real estate is determined by a combination of factors that are assessed by the buyer. These factors include the location of the property, the size and quality of the home, the condition of the property, and the current state of the real estate market. The hedonic price model assists in relating the property's attributes to its price. Each of these property characteristics implies an implicit price. The physical aspects of the structure, the property's location, the surrounding area, and accessibility are the important factors that buyers consider.

The multiple linear regression analysis for this study took into account the age of the house, gross plot area, floor area, proximity to the main road, external wall finishing materials, floor finishing materials, ceiling finishing materials, number of rooms, the direction of the houses, involvement of brokers in the transaction process, land grade, and accessible road type. The study has found that nine of the explanatory variables have a statistically significant impact on the price of residential real estate in the research area. The result of multiple linear regression or the hedonic model is shown below.

Descriptive statistics

The data for the study was taken from primary and secondary sources. The required data were collected from homeowners, real estate developers, and brokers. This study used cross-sectional data because the data is for one point in time for the various variables. The study aims to identify and analyze factors affecting the price of residential real estate in Bahir Dar City.

There are six prominent continuous variables in this study. Those variables are residential real estate sales price, gross plot size, floor area, number of rooms, age of the house, and distance from the property to the main road. The descriptive statistics of these variables are presented in Table 3. Descriptive statistics for categorical variables are presented in Table 4.

Table 3. Descriptive statistics of continuous variables.

Descriptive Statistics					
Continuous variable	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Residential Real Estate Sales Price in birr	103	1,200,000	12,500,000	4,567,106.80	283,2045.367
Gross plot area in square meters (m^2)	103	200	500	295.94	61.813
Floor area in square meters (m^2)	103	100	250	123.08	24.324
Age of the house	103	1	15	5.13	3.824
Number of rooms	103	3	5	4.17	.772
Distance from the property to the main road in meter	103	234	817	543.95	144.213
Valid N (listwise)	103				

Source: Field survey result, 2024

To check the description regarding residential real estate prices, see Table 3. The finding indicates that the minimum residential real estate is worth 1,200,000 Ethiopian birr and the maximum price is 12,500,000 Ethiopian birr. On average, residential real estate prices are 4,567,106 Ethiopian birr. The minimum plot size is 200 m^2, and the maximum area is 500 m^2. The average plot size is 295 m^2. In terms of structural attributes, the minimum floor area is 100 m^2, and the maximum area is 250 m^2. On average, the floor area is 123 m^2. The minimum age of a house is 1 year, and the maximum age of a house is 15 years. The mean value of proximity to the main road is 543.95 meters.

Table 4. Descriptive statistics of categorical variables.

Categorical variable		Frequency	Percent
Broker involvement in the transaction process	No	19	18
	Yes	84	82
	Total	103	100
External wall finishing materials	Quartz paint	87	86
	Plastered with cement	16	14
	Total	103	100
Floor finishing materials	Ceramic tile	88	86
	Cement screed	15	14
	Total	103	100
Ceiling finishing materials	Gypsum	89	87
	Plastic	14	13
	Total	103	100
Direction of the house	East Aspect	66	64
	Non-East Aspect	37	36
	Total	103	100
Land Grade	Grade_ 1	32	31
	Grade_ 2	53	52

Categorical variable		Frequency	Percent
	Grade_ 3	18	17
	Total	103	100
	Asphalt	8	7.8
	Cobblestone	8	7.8
Accessible Road Type	Gravel road	33	32
	Earthen	54	52.4
	Total	103	100

Source: Field survey result, 2024

As indicated in Table 4, most of the sampled residential real estate were transacted with brokers' assistance, which is 84 (82%), and the remaining 19 (18%) were transacted without brokers' involvement in the transaction process. On the other hand, from this total number of sampled residential real estate, 87 (86%) and 16 (14%), respectively, of the external wall finishing materials of the residential real estate are finished with quartz paint and plaster with cement. According to floor finishing materials, 88 (86%) of residential real estate are finished with ceramic tile, and 15 (14%) of properties are finished with cement screed.

According to the investigation, 87% of the residential real estate studied had ceilings finished with gypsum, while the remaining 13% had ceilings finished with plastic. As depicted in Table 7, 64% of the sampled residential real estate was located in the east aspect, and 36% of the houses were located in the non-east aspect.

Correlation Analysis

The benefit of correlation, according to [28], is that it reveals the intensity and direction (positive or negative) of associations among and between variables. To determine the link, one uses the Pearson correlation coefficient (r). If the Pearson correlation has an absolute value greater than 0.8, there is multicollinearity. Correlation values around zero were seen as indicating no association between the variables, whereas values near one indicated a strong or positive relationship between the variables, and values near negative one indicated a negative relationship between the variables. The price of the residential real estate and its dimensions were examined in this study, using Pearson correlation analysis to ascertain the relationship between the independent variables (age of the house, gross plot area, floor area, number of rooms, distance from the property to the main road, external wall finishing materials, floor finishing materials, ceiling finishing materials, the direction of the house, broker involvement in the transaction, land grade, and accessible road type).

The sign of the coefficient indicates the direction of the relationship. A positive correlation means that when one variable rises, so do the other variables, while a negative correla-

tion means that as one variable rises, the other variable falls. The findings of the correlation study between the microfactor dimensions and the dependent variable (the price of residential real estate) are shown in Table 8. The strength and direction of a relationship—whether positive or negative—are revealed by the correlation coefficient. The relationship's values (from -1 to +1) [30] assert that correlation is perhaps the simplest and most practical way to gauge the degree of relationship between two or more variables. According to general recommendations from [30], correlations between 0.01 and 0.30 are regarded as small, and 0.30 and 0.70 are considered moderate 0.70 and 0.90 are considered large; and 0.90 and 1.00 are considered extremely large.

According to Pearson correlation results, it has been found that the gross plot area (also known as "plot size"). Floor area, number of rooms, direction of the house, external wall finishing, ceiling finishing materials, and involvement of brokers in the transaction process have a positive correlation with price of residential real estate. The age of the house and the distance from the property to the main road have a negative relationship with the price of residential real estate by values of -0.729 and -0.639 respectively.

Normality Test

In multiple linear regression analysis, the relationship between the dependent and independent variables must be linear. To meet the normality assumption, the logarithm forms of the residential real estate prices and the continuous type of independent variables, including gross plot area, floor area, number of rooms, age of the houses, and distance from the property to the main road were taken. Further, the Mahalanobis distance was used to remove the outlier effects. Mahalanobis distance is the distance of a particular case from the centroid of the remaining cases, where the centroid is the point created by the means of all the variables [10]. By using the Mahalanobis distance, 22 outliers were found, and removed from 125 sampled data points based on comparing the Mahalanobis distance against the critical value by using the chi-square critical value table with the number of independent variables as the degree of freedom value. These outliers can have a significant impact on the regression line and

skew the results of the analysis. Removing outliers can improve the accuracy and reliability of regression analysis by reducing the impact of extreme values on the regression line. This approach can lead to more accurate predictions and conclusions based on the available data.

To check whether the data is distributed normally or not, the study used the numerical method; the Shapiro-Wilk test. In addition, the study used a graphical method to check whether the data The Shapiro-Wilk test was first developed by [29]. According to this test, there are null and alternative hypotheses, which are stated as:

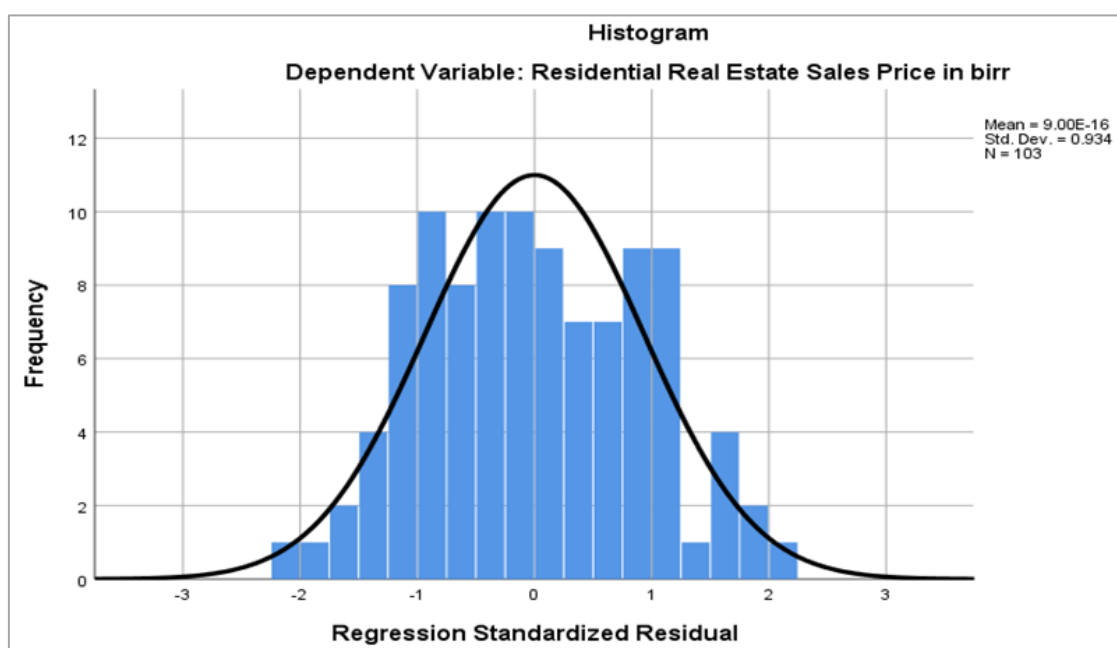H_O: The sample data are normally distributed.

H_1: The sample data are significantly different than a normal population.

The test recommends rejecting the null hypothesis when the P-value is less than the selected alpha value (in this case, 0.05) and accepting the null hypothesis if it is greater than the alpha value. The result of the Shapiro-Wilk test for the data indicates that the data is normal. The sig (P-value) of 0.899, which is greater than 0.050 (level of significance) in Table 9, implies that the null hypothesis is accepted and the alternative hypothesis is rejected, so it can be concluded that the data have a normal distribution.

Table 5. Tests of Normality.

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Unstandardized Residual	.054	103	.200[*]	.992	103	.899

Source: Regression model result, 2024

Source: Regression model result, 2024

Figure 3. Test of normality using histogram.

Similarly, the normal distribution of the data on the histogram is presented in Figure 3. If the residuals are normally distributed, the histogram should be bell-shaped. Figure 3 indicates the normality of the distribution because the histogram shape is a bell shape and the data are approximately normally distributed.
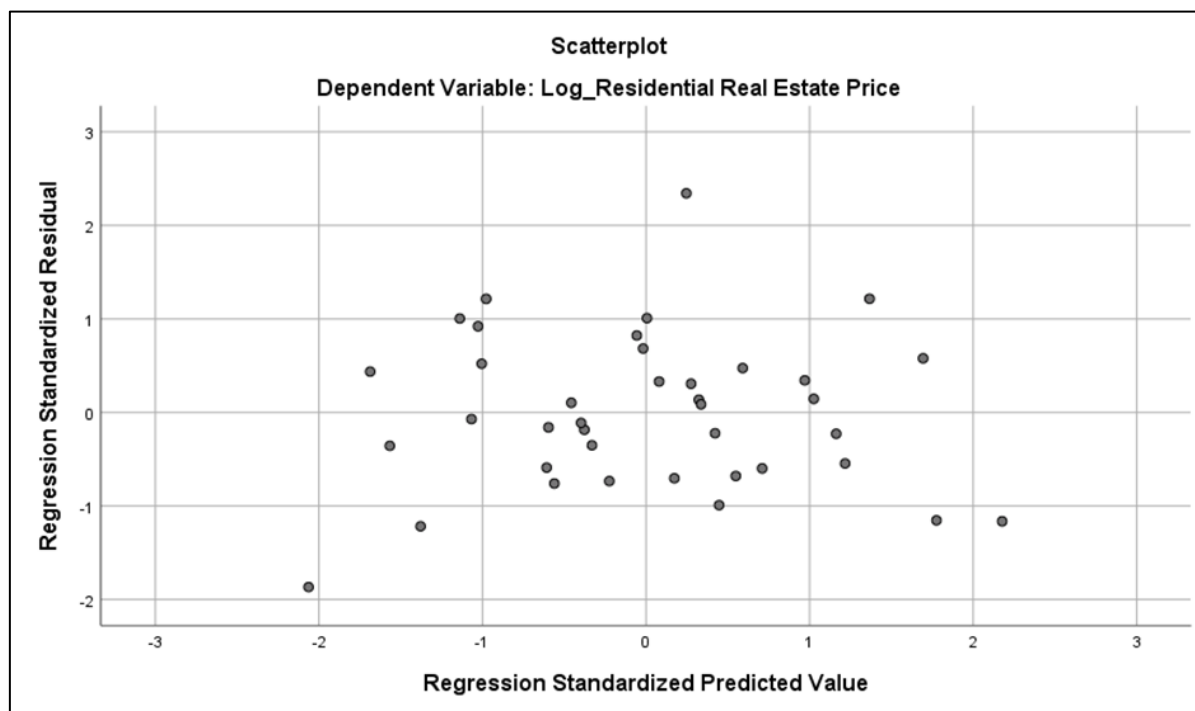
Test for Multicollinearity

According to [33], multicollinearity is a condition where two or more explanatory variables in a multiple regression model are highly correlated. Multicollinearity problems oc-

cur when the explanatory variables are highly correlated with each other. In this study, the VIF (variance inflation factor) was used to determine whether or not there was a multicollinearity problem. The values are less than 10, and the tolerance margin is greater than 0.1. Thus, based on Table 10, each value is below 4, and the tolerance margin is greater than 0.1. That means there is no problem of multicollinearity in the data presented in the Table 6.

Test of Homoscedasticity

Homoscedasticity means that the variance of errors is the same across all levels of the independent variables or every observed value feature. Ordinary least squares assume that all observations are equally reliable. When the variance of errors differs at different values of the independent variables, heteroscedasticity occurs. Heteroscedasticity is a violation of the homoscedasticity test. The scatter plot of residuals is given below, and it does not portray any obvious pattern. That means these residuals are equally distributed above and below zero on the X-axis and to the left and right of zero on the Y-axis. This is often indicated in the Figure 4:

Source: Regression model result, 2024

Figure 4. Scatter plot of regression standardized residuals and regression standardized predicated value.

Table 6. Test for multicollinearity.

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Broker involvement in the transaction process	0.711	1.407
	External wall finishing material	0.477	2.095
	Floor finishing material	0.586	1.706
	Ceiling finishing material	0.739	1.353
	Direction of the house (East=1 Non-East=0)	0.753	1.328
	Land grade	0.685	1.460
	Accessible road type	0.865	1.156
	Log_ floor area in square meter	0.262	3.814

Model	Collinearity Statistics	
	Tolerance	VIF
Log_ Gross plot area in square meter	0.292	3.427
Log_ Age of the house in years	0.392	2.548
Log_ Number of rooms	0.605	1.654
Log_ Distance from property to the main road in meter	0.555	1.800

Dependent Variable: Log_ Residential Real Estate Price

Source: Regression model result, 2024

Autocorrelation (Independence of observation)

Multiple linear regression models assumes that the observations should be independent of one another or the values of residuals are independent. In this study, the Durbin-Watson test was employed to detect the problem of auto-correlation in the data or the correlation between errors. Particularly, it tests whether adjacent residuals are correlated or whether there must be independence of observations. The test statistic can vary between 0 and 4, with a value close to 2, meaning that the residuals are uncorrelated [8]. According to the regression model result, the Durbin-Watson statistics are 1.835, falling between the expected two critical values of 1.5 and 2.5, implying that there is no autocorrelation in the data (see Table 7).

Linearity Assumption

The linearity of the relationship between the dependent and independent variables represented the degree to which the change in the dependent variable is associated with the independent variable. To check the linear relationships between the dependent and independent variables, this study used R, R is the correlation between the dependent variable and independent variables in multiple regression models. The value of the multiple correlation coefficients between the explanatory variables and the dependent variable ranges from 0 to 1, therefore, higher values of R represent a higher correlation between the dependent variable and the independent variables. The model summary table shows a strong relationship between dependent variables and explanatory (independent) variables with values of 0.938. Hence, in this study, multiple linear regression analysis is used to determine the relationship between dependent variables and independent variables. In addition, this study used a scatterplot matrix to check the linear relationship between the predictors and the outcome, as presented in Appendix 4. The scatterplot matrix tells us the linear relationship between the price of residential real estate and the predictor variables.

Regression Analysis (Model Estimation Result)

The study is looking to explain the factors revealed that are being considered in determining residential real estate prices. Based on the hedonic pricing model, the factors are identified through various past studies in different contexts. This study has attempted to see the impact of those factors on the price determination of residential real estate in Bahir Dar City. The study has taken into three dimensions of the property, which include structural attributes and locational attributes, and Accessibility attributes. Structural attributes included the age of the property (in years), floor area (in square meters), gross plot area (in square meters), number of rooms, external wall finishing material, floor finishing material, ceiling finishing material, Land grade, and direction of the house (East = 1; Non-East = 0). Locational attributes include the distance from the property to the main road. Accessibility attributes include accessible road type. Based on these factors, Table 7 shows the model summary, and as can be seen, the explanatory power of these variables is 88%, which is significant as well. However, the overall model fitness can be observed in Table 7, and the results show that the model is good for the prediction of the dependent variable.

Strength of the model

Table 7 shows the multiple regression results for the overall fit of the model. From the findings, the R square of the below model is 0.880. This implies that the hedonic regression model can explain 88% of the variation in residential real estate prices. As the value shows, 88% of the variation in the dependent (residential real estate sales price) variable can be explained by variation in the independent variables. Leaving only 12% unexplained, which means the remaining 12% is explained by other variables that are represented by the error term.

***Table 7**. Overall model summary.*

Model Summary[b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.938[a]	.880	.864	.01557	.880	55.175	12	90	.000	1.835

Predicators: (Constant), Direction of the house (East=1 Non-East=0), Log_ Distance of the property from the main road in meter, External wall finishing material, Ceiling finishing material, Accessible road type, Log_ Number of Rooms, Land grade, Floor finishing material, Log_ Gross plot area in square meter, Log_ Age of the House in years, Broker involvement in the transaction process, Log_ Floor Area in square meter

Dependent Variable: Log_ Residential Real Estate Price

Source: Regression model result, 2024

Analysis in Table 8 represents the F-test output. The null means that there is zero variance in the dependent variable. From the findings, the F-test is highly significant with a statistic of 55.175 and a significance level of less than 0.05, and we can therefore conclude that the model explains a significant amount of the variance in residential real estate prices. The F-ratio in the ANOVA table shows that the explanatory variables statistically significantly predict the dependent variable, $F_{(12, 90)}=55.175$, $p<0.05$ (i.e., the regression model is a good fit for the data).

***Table 8**. ANOVA[a].*

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.161	12	.013	55.175	.000[b]
	Residual	.022	90	.000		
	Total	.182	102			

Dependent Variable: Log_ Residential Real Estate Price

Predictors: (Constant), Direction of the house (East=1 Non-East=0), Log_ Distance of the property from the main road in meter, External wall finishing material, Ceiling finishing material, Accessible road type, Log_ Number of Rooms, Land grade, Floor finishing material, Log_ Gross plot area in square meter, Log_ Age of the house in years, Broker involvement in the transaction process, Log_ Floor Area in square meter

Source: Regression model result, 2024

***Table 9**. Regression Coefficients for Regression Model.*

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	14.539	.450		32.320	.000

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Broker involvement in the transaction process	.468	.202	.126	2.320	.023[*]
External wall finishing material	.383	.183	.138	2.089	.040[*]
Floor finishing material	.035	.025	.083	1.391	.168
Ceiling finishing material	.023	.023	.054	1.008	.013[*]
Direction of the house (East=1 Non-East=0)	.456	.160	.150	.285	.036[*]
Land grade	-.009	.011	-.048	-.865	.389
Accessible road type	-.001	.008	-.005	-.094	.925
Log_ Floor Area in square meter	.601	.175	.307	3.441	.001[*]
Log_ Gross plot size in square meter	.335	.110	.258	3.052	.003[*]
Log_ Age of the House in years	-.187	.054	-.250	-3.434	.001[*]
Log_ Number of rooms	.148	.066	.131	2.240	.028[*]
Log_ Distance of the property from the main road in meter	-.097	.031	-.191	-3.115	.002[*]

Dependent Variable: Log_ Residential Real Estate Price
* Statistically significant at 0.05

Source: Regression model result, 2024

Table 9 shows the value of each coefficient. This model confirmed that structural factors (building characteristics), age of the property, gross plot size, floor area, number of rooms, external wall finishing material, ceiling finishing material, and direction of the house are statistically significant in affecting the price of residential real estate. Also, based on locational attributes, the distance from the property to the main road is statistically significant. In addition to these factors, the brokers' involvement in the transaction is statistically significant. Table 9 shows that the coefficients of these variables have a p-value of less than 0.05.

The hedonic regression model shows variables that were significant in the overall model, that is, age of the property (t = -3.434, p-value = 0.001), gross plot area (plot size) (t = 3.052, p-value = 0.003), distance of the property from the main road (t = -3.115, p-value = 0.002), a broker involved in the transaction (t = 2.320, p-value = 0.023), ceiling finishing material (t = 1.008, p-value = 0.013), the direction of the house (t = 0.285, p-value = 0.036), external wall finishing material (t = 2.089, p-value = 0.040), and a number of rooms (t = 2.240, p-value = 0.028). The results of the regression model indicate that the prices of residential real estate are influenced by building characteristics. In addition, these brokers' involvement in the transaction also influenced residential real estate prices. However, the land grade, accessible road type, and floor finishing material, are not significant variables. The p-value of those variables is greater than 5%, so these variables have no significant effect on the sales price of residential real estate properties.

Therefore, from the above Table 9, 14.539 is the intercept of this linear relationship, which indicates if the independent variables were all rated as zero, residential real estate prices rising would be 14.539. According to the regression result, the age of the property and distance of the property from the main road has a negative relationship with the sales price of residential real estate. According to different literatures, older houses are often associated with a lower house price compared to newer houses. In the current study, we found that the age of a house has a significant effect on the price of residential real estate. The sign of building age is negative, indicating that the older the house is, the lower the house price. This study's results show that a relatively new house with good quality has a higher price than an old or low-quality house. A 1-year increase in the age of the house leads to a decrease in the price of residential real estate by (18.7%), *ceteris paribus*.

The property near the main road has a higher price than the property far from the main road. The property is far from the main road; at a distance of one meter, the sales price of the residential real estate will decrease by (9.7%). The re-

gression result reveals that keeping other explanatory variables constant, an addition of 1 square meter to the plot size leads to a change in the price of residential real estate by (33.5%). This result is consistent with the findings of (Guntermann et al., 2015, and Gu, 2018), that residential properties with a larger plot size have a higher price than those with a smaller plot size. The OLS regression suggests that with an addition of floor size by 1 square meter, the price of residential real estate increases by (60.1%). As the number of rooms increased by one room, the price of residential real estate increased by (14.8%).

Many experts agree that real estate brokers play an important role in the real estate industry. However, their findings demonstrate that even if real estate agents play a significant role in the market by contacting buyers and sellers, they may monopolize the market and take advantage of clients, especially in areas where there are flaws in the market. Similar findings were obtained from this study in Bahir Dar City, where the majority of real estate deals involve brokers, who do a fantastic job of connecting the two sides. Brokers, however, charge more than they did and have a significant impact on price increases. This occurs when there is an information asymmetry, and as a result, both parties are asked to pay more for their perceived advantages. This is in line with the findings of the study by Marete (2011), who also claims that home buyers who acquired their property through an agent or broker are subjected to additional demands by forming a conspiracy with one or both participants. According to this study, there will be a 46.8% change in the sales price of residential real estate with broker engagement.

The material from which the ceiling finishing material of the building is made also determines the price of residential real estate. Many studies support the idea that real estate with better quality and a long-lasting ceiling-finishing material

has better value. As depicted in Table 9, those properties finished through gypsum and painting has a better selling price than those properties finished through plastic. The expected price change in residential real estate with ceilings finished with gypsum is increased by 2.3% compared to plastic ceiling finishing material types. This result is consistent with the finding of [3], which states that the construction material, which directly affects the cost of construction, has a significant effect on the price of real estate. The price of residential real estate with quartz paint external wall finishes increase by 38.3% compared to plaster with cement external wall types.

The direction of the house has a statistically significant effect on the residential real estate price. According to the regression results, the house located in the east direction has a higher price difference than the house located in the non-east direction. As depicted in coefficient Table 9, those buildings located in the east direction have a better selling price than those located in the non-east direction. The expected price difference in residential real estate located in the east aspect increases by 45.6% compared to residential real estate located in the non-east aspect.

The amount to which each variable influences the price of residential real estate in the area is shown by the standard coefficient (Beta) value of the explanatory (independent) variable. It is presented in Table 9 above. It gives a picture of how influential or important the independent factors are about the price of residential real estate. The influence of the variable increases with beta magnitude. So, based on the analysis's findings, the brokers' role in the deal, the direction of the house, and floor area have the greatest impact on the residential real estate property price in the study area.

From the above Table 9, therefore, the model is thus as indicated below;

$$Log\_RREP = 14.593 + 0.468(BR) + 0.383(EWFM) + 0.023(CFM) + 0.456(DH) + 0.601(Log\_FLA)$$
$$+ 0.335(Log\_GPA) - 0.187(Log\_Age) + 0.148(Log\_NR) - 0.097(Log\_DMR) + errors$$

Table 10. Summary of Hypothesis Testing.

S.N	Hypothesis	Sig (P-Value)	Level of Significance	Conclusion
1	H1: There is significant relationship between age of the house and prices of residential real estate property	0.001	0.05	Accepted
2	H2: There is significant relationship between number of rooms and prices of residential real estate property	0.028	0.05	Accepted
3	H3: There is significant relationship between floor area and prices of residential real estate property	0.001	0.05	Accepted
4	H4: There is significant relationship between proximity to the main road and prices of residential real estate property	0.002	0.05	Accepted
5	H5: There is significant relationship between gross plot area and prices of resi-	0.003	0.05	Accepted

S.N	Hypothesis	Sig (P-Value)	Level of Significance	Conclusion
	dential real estate property			
6	H6: There is significant relationship between broker involvement in the transaction and prices of residential real estate property	0.023	0.05	Accepted
7	H7: There is significant relationship between external wall finishing materials and prices of residential real estate property	0.040	0.05	Accepted
8	H8: There is significant relationship between floor finishing materials and prices of residential real estate property	0.168	0.05	Reject
9	H9: There is significant relationship between ceiling finishing materials and prices of residential real estate property	0.013	0.05	Accepted
10	H10: There is significant relationship between direction of the house and prices of residential real estate property	0.036	0.05	Accepted
11	H11: There is significant relationship between land grade and prices of residential real estate property	0.389	0.05	Reject
12	H12: There is significant relationship between accessible road type and prices of residential real estate property	0.925	0.05	Reject

Source: Researcher, 2024

5. Conclusion and Recommendations

Conclusions

The framework of price determinants for the research area was also developed using 12 variables that were discovered and categorized into the known residential real estate price determinants. To determine the price of residential real estate in the study area of Bahir Dar City, information on the variables taken into account was requested from property owners, real estate developers, and brokers.

Findings from the correlation analysis result showed the price of residential real estate has a positive relationship with the ten explanatory variables: gross plot area, floor area, number of rooms, external wall finishing materials, floor finishing materials, ceiling finishing materials, the direction of the house, brokers involvement in the transaction process, land grade, and accessible road type. It was found that the price of residential real estate has a negative relationship with the age of the house, and its proximity to the main road.

According to the findings of the regression model result, gross plot size, floor area, number of rooms, age of the house, proximity to the main road, the direction of the houses, external wall finishing material, ceiling finishing materials, and broker involved in the transaction process were identified as statistically significant factors in residential real estate prices at 5% level of significance.

In general, the coefficients of the regression results show that factors like gross plot area, floor area, number of rooms, age of the house, distance from the property to the main road, the direction of the house, external wall finishing material,

ceiling finishing materials, and brokers' involvement in the transaction process have major influence on the prices of residential real estate.

Recommendations

This study has identified the significant factors that affect the price of residential real estate properties, and describe the challenges that real estate developers confront in Bahir Dar City. Thus, the study has forwarded the following recommendations in light of conclusions that have been presented thus far:

1) The real estate developers should invest in quality finishes and analyze the target market to understand the size of plots and the size of houses they most likely prefer.
2) This study suggests that the government should concentrate on providing sufficient land to real estate developers to restrict the increase in property prices and make housing affordable for the middle and lower-income classes in the city.
3) The paper also urges governments to actively pursue data collection and analysis of housing market trends. The information available was quite limited but crucial for making policy decisions, particularly in court.
4) Since the current real estate prices seem to exclusively target the upper class and the diaspora, the government should develop a system, such as a price index for residential real estate sectors that would allow it to monitor the real estate price increase.
5) The government should improve infrastructure developments that will improve the real estate sector's capacity to develop affordable residential real estate for their clients.
6) Finally, the government should controlling high cost of construction brought about by acquisition cost of both

land and building materials.

Abbreviations

ANOVA	Analysis of Variance
ANRS	Amhara National Regional State
CBD	Central Business District
ETB	Ethiopian Birr
LOG	Logarithm
MoUDC	Minster of Urban Development and Construction
OLS	Ordinary Least Square
SPSS	Statistical Package Software for Social Science

Author Contributions

Tamirat Mekonnen Mekuria: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Resources, Software, Writing – original draft, Writing – review & editing

Seid Hussen Yimam: Project administration, Supervision, Validation, Visualization

Yohans Teshome Negashi: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software

Conflicts of Interest

The authors declare no conflicts of interest.

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