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Determinants of single-family residential property values in Ethiopia: a comparative analysis of willingness to pay or receive and real transaction data

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Abstract

Purpose – This study aims to identify determinants of single-family residential property values and fill the gap by analyzing respondents' willingness to pay/receive data alongside real transaction data. Ordinal logistic regression and ordinal least square regression were used.

Design/methodology/approach – Ordinal logistic regression effectively analyzes willingness-to-pay/receive data, accommodating the ordered nature of property value responses while incorporating multiple influencing factors. Ordinal least square regression quantifies the impact of continuous and categorical predictors on real transaction data.

Findings – Findings revealed strong associations between property values and several variables. Analysis of willingness-to-pay/accept data from 232 respondents showed significant impacts of factors such as the number of rooms, site area, construction material, property orientation, property age and proximity to bus stations and the central business district ($p < 0.05$). Similarly, ordinal least square regression analysis of transaction data confirmed the significance of most of these factors, except for property orientation, which indicates the difference of preference in the local market or reporting inconsistencies, demand further investigation. Variables such as views, proximity to wetlands, roads, green areas, religious institutions and schools were statistically insignificant across both data sets ($p > 0.05$).

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Practical implications – It provides a robust basis for housing and urban development strategies. The stakeholders such as real estate developers, urban planners and policymakers are encouraged to incorporate these findings into housing policies, land value capture initiatives and urban planning frameworks to enhance residential property value and align with sustainable urban development goals.

Originality/value – This study contributes original insights into single-family residential property valuation by integrating willingness-to-pay and transaction data, substantiating the determinants of property value.

Keywords Appraisal, Ethiopia, Housing, Ordinal least square regression, Residential property, Value

Paper type Research paper

1. Introduction

Nowadays, real estate valuation is a crucial concern, particularly in the context of rapid urbanization and increasing property transactions, especially in developing countries. Beyond that, the requirements of governments and regulators progressively increased and with expectations of valuation users continuing to grow, consistency, objectivity and transparency are fundamental to building and sustaining public confidence and trust in valuation (Abidoye and Chan, 2016; SINGH, 2022; Wang and Li, 2019; RICS, 2021; IVS, 2022). Valuers serve stakeholders such as buyers, sellers, financial institutions, government bodies, real estate developers, insurance companies and legal entities. Valuers should always focus on the actual task at hand at a specific point in the valuation process and the role of valuers should be to assess value in the light of evidence normally obtained through analysis of comparable transactions (RICS, 2021). Therefore, real property valuation plays a crucial role in setting negotiation bases, determining lending values, establishing tax policies, assessing investment values and supporting judicial proceedings.

In this dynamic environment, real estate remains a favored asset because of its inherent appreciation and resistance to inflation (Igbinosa, 2011). Given the asymmetry of information in real estate markets, the dynamics of local markets and the heterogeneous nature of real estate products, professional valuers serve as intermediaries, providing reliable estimates for buyers, sellers and governing bodies. Hence, more efficient and accurate property assessments with valuers may enhance land use planning, land tenure security and credit and finance availability in rural areas by appropriately addressing these variables. This, in turn, promotes investments, sustainable agriculture and infrastructure expansion, all of which support rural development (Singh, 2022). However, it's important to acknowledge that valuers may have divergent opinions regarding property value, and estimations may vary within a legitimate range from actual sale prices (Boyd and Irons, 2002). While valuers should reflect markets, they should also be aware of sustainability features and the implications for property values in the short, medium and longer term.

In developed countries, courts often establish acceptable levels of inaccuracy and variance for property valuations (Crosby *et al.*, 1998). Nevertheless, the degree of valuation accuracy varies globally, as evidenced by variations between countries such as Nigeria and the UK (Effiong, 2015).

Real property valuers employ different approaches such as the cost approach, sales comparison approach and income capitalization approach to estimate property worth (Ling and Archer, 2018). Though there are different approaches to valuation, Valuers are not required to use more than one method for the valuation of an asset, particularly when the valuer has a high degree of confidence in the accuracy and reliability of a single method, given the facts and circumstances of the valuation engagement (IVS, 2022). However, since the 1980s, the Computer Assisted Mass Appraisal (CAMA) approach has become a useful instrument for large-scale appraisals, especially for tax purposes (Wang and Li, 2019).

Through the integration of computer-assisted systems and statistical models, CAMA streamlines valuation processes and improves the efficiency of large-scale data analysis.

In Ethiopia, property valuation practices are still in their nascent stages, influenced by a lack of standardized procedures, professional expertise, institutional frameworks and other factors (Asres, 2019; Asres *et al.*, 2020; Asnakew and Amogne, 2021; Negashi, 2022). Despite these limitations, the increasing demand for property valuation necessitates the advancement of valuation practices (Nguyen and Bui, 2019), particularly as Ethiopia begins to recognize the significance of its stock market and property tax. With the growing demand for valuation, Ethiopia needs to think about creating a CAMA valuation method in the future to update its procedures for valuing real estate and ascertain certain valuation tasks of the valuer. The CAMA valuation method needs the comprehension of the factors that determine residential property values. As a result, the primary goal of this study is to identify these determining characteristics, which may provide the basis for creating a strong valuation framework that can be used in a variety of industries. The findings of this research may provide an awareness for the government, institutions, real estate stakeholders, and other relevant parties about the need to update Ethiopia's property valuation procedures which are essential to ensuring fairness, equity, and accountability, ultimately contributing to sustainable economic growth and development.

2. Literature review

Valuations of real property may be required for different purposes with the valuer's responsibility to understand the purpose of a valuation. Real estate valuation is a complicated process, particularly in large coverage because of the wide range of variables, even external variables outside of the property may affect its value. Among others, some of the variables include laws and regulations of the state, the environment, economic indicators, the particulars of the property in issue and social influences. A valuer may be required to use bases of value that are defined by statute, regulation, private contract, or another document (IVSC, 2016). Moreover, real estate value is contextual by nature and highly dependent on local circumstances (Ling and Archer, 2018; Sayce *et al.*, 2006; Shapiro *et al.*, 2012; Mooya, 2016). It should also be underlined that there is no perfect valuation and the question is how the valuer reduces the variation by analyzing the variables in detail (Mcallister and Mcallister, 2007).

Considering these complications, the literature explores the core ideas of valuation as well as Ethiopia's legal framework for property rights. Furthermore, Ethiopia's property valuation experiences and the factors that influence property value and the concept of computer-assisted mass appraisal (CAMA) are also reviewed. Analyzing the determinants of property value in the theoretical and empirical literature in conjunction with the pilot survey bases the variable identification for investigation.

2.1 Property rights and valuation

The valuation of real estate hinges on both the attached rights and physical characteristics. Real property entails a bundle of rights, which may be subject to various limitations. State and local land use restrictions typically diminish the value of this bundle of rights (Ling and Archer, 2018). Land rights or encumbrances imposed on these rights are recognized as factors affecting the value of real estate (Metzner and Kindt, 2017). Therefore, understanding the rights associated with real estate is crucial and hence the valuation of property requires considering the rights, privileges or conditions that attach to the ownership interest (Adetiloye and Eke, 2014; IVS, 2022). The breadth of property rights, particularly when they are informal or partial, can hinder access to various forms of financing, including mortgages

and have a substantial impact on property value depending on whether they are legally recognized (Asnakew and Amogne, 2023; IVS, 2022).

Land rights are generally vested in the government and the public in Ethiopia's legal system with private ownership of land being historically absent (Daniel Weldegebriel Ambaye, 2012; FDRE Constitution, 1995; Proclamation No. 456, 2005). Presently, holding rights and leasehold rights are exercised in Ethiopia for rural and urban land, respectively. The formal land rights envisaged in different laws of Ethiopia (FDRE Constitution, 1995; Proclamation No. 456, 2005; Proclamation No. 721, 2011; Proclamation No. 1161, 2019; Proclamation No. 574, 2008) are indicated in Table 1.

According to the Royal Institute of Chartered Surveyors, 2013, the valuation of real estate encompasses all rights, interests and benefits associated with ownership, including any negative aspects relating to the interest being assessed (Parker, 2016). Valuers must therefore explicitly outline the extent of these rights, interests and benefits, which may include obligations, encumbrances and liabilities. Additionally, valuation systems and processes should be equipped to consider the full spectrum of rights, interests and encumbrances. Property valuation entails forming an opinion of value-in-exchange based on certain assumptions. It represents a financial projection of the future net benefit of acquiring an interest in the property and typically provides a snapshot estimate of the exchange price at a specific moment (Wyatt, 2013). To align with socio-economic welfare objectives, valuations should adhere to principles of transparency, coherence and consistency, conducted by honest, impartial and competent valuers (FAO, 2017).

While the purposes of valuation vary, they generally yield political, social and economic welfare advantages for society, governments, firms and organizations (FAO, 2017) including:

Table 1. Land rights and restrictions explained in statute

Federal laws	Explanations
1995 constitution	The right to ownership of rural land, urban land and natural resources, is exclusively vested in the state and the people of Ethiopia. The land is a common property of the nations, nationalities and peoples of Ethiopia and shall not be subject to sale or other means of exchange. Ethiopian peasants have the right to obtain land free of charge and it is protected against eviction from their possession
Proclamation No 456 / 2005	Any peasant farmer or semi-pastoralist and pastoralist shall have held the right to use rural land for agriculture and natural resource development, lease and bequeath to members of his family or other lawful heirs and includes the right to acquire "property produced on the land thereon by his labor or capital and' to sale, exchange and bequeath same. Peasant farmers/pastoralists engaged in agriculture for a living shall be given rural land free of charge with no time limit
Proclamation No721/2011	No person may acquire urban land other than through the lease holding system. "lease" means "a system of land tenure by which the right of use of urban land is acquired under a contract of a definite period; with payment
Proclamation No 1161 / 2019	Expropriation of land for public purposes shall be made only based on approved land use plans; urban structural plans; or development master plans and the procedures should be transparent, participatory, fair and accountable. Payments for expropriation are property compensation, displacement compensation, displacement assistance, economic loss compensation and social ties discontinuance and moral damage compensation with payment in advance of compensation commensurate to the value of the property
Proclamation No. 574 / 2008	Any urban landholder whose land holding is dispossessed because of the implementation of urban plans shall be paid compensation

Source(s): Compiled by the authors

- ensuring equity in tax assessments and fairness in compensation for expropriation;
- incorporating both market and non-market values in transactions involving formal, customary, communal and informal tenure rights;
- providing objective price information in situations with limited transactions, such as privatization of state assets or large-scale land acquisitions;
- serving as a key component of risk assessment for loans secured by tenure rights;
- assessing the value implications of planning policies and development decisions;
- mitigating risks associated with land occupation, development and investment; and
- offering reassurance to individuals and businesses regarding the fairness of tenure rights transactions and helping to minimize disputes.

2.2 Real property valuation experience of Ethiopia

Property valuation practice in Ethiopia has a long history witnessed from historical examples such as: King Lalibela compensated individuals whose land was expropriated for the construction of the 11th Lalibela hewn church in the thirteenth century; Kings ruling through Fiteha Negest compensated individuals for property loss because of pressing public necessity during the 15th century; King Sahel Selassie provided compensation to peasants displaced by the construction of his palace at Ankobar in the 19th century; Emperor Menelik II's reign, compensated (often double the property's value) for the land taken to infrastructure projects such as the Dire Dawa-Harar road and the Ethio-Djibouti railroad, compensation for appropriated land included When Minilik promulgated the Addis Ababa City Land Charter in 1908 (Ambaye, 2015). Similarly, the 1931, 1955, 1987 and 1995 constitutions of Ethiopia, guaranteed just compensation for expropriation. The Civil Code of (1960) Art 1474(1) and Proclamation 1161/2019, stipulate compensation for expropriation and the amount to be equal to the actual damage caused (Proclamation No. 1161, 2019; Civil Code of Ethiopia, 1960). Despite the historical precedence of property valuation in Ethiopia, the accuracy of valuation practices remains sluggish and fraught with compliance issues (Asnakew and Amogne, 2021; Asres *et al*., 2020). The absence of international valuation standards or domestic standards in the country has resulted in inconsistent and incomplete regulations, mostly about expropriation valuation. There is a critical need for improvements in property valuation procedures to lower errors and increase the accuracy of valuation. As the need for valuation increases nationwide, both in private and government institutions, the consequences of land expropriation for development – such as public services, urban housing, infrastructure and rural development, attention should be given to valuation all over in regulatory issues, institutional arrangements and trained professionals. However, the absence of a single entity for valuation in Ethiopia currently makes efforts to standardize and enhance the valuation process more difficult.

2.3 Determinants of real property value

A multitude of factors influence the valuation of real property and comprehending these determinants is vital for appraisers, real estate professionals, investors and stakeholders in the real estate sector. There is the absence of an active interaction between sellers and buyers, as in the normal market, in establishing prices and this may cause asymmetry of information for buyers and sellers in the real estate market (Adetiloye and Eke, 2014). With the pinpoint that these pieces of information need individual investigations and professional judgments, hence valuation is both a science and an art, and the role of values is significant in the real estate market. Therefore, professional appraisers contribute to stakeholder understanding by

identifying these determinant variables. It is also important to consider that the variables may vary depending on the social, economic and cultural status of the residents. For instance, when the economic level of the residents is ranked as high-income households, the demand for luxurious components of the property may be worth high while low-income households will be willing to pay low for those components of the property. These local demand behaviors and segmented markets with heterogeneous products make a valuation to be made with professionals who analyze those determinants. Various scholars have endeavored to identify these variables over time. For instance, Scarrett (2008) discusses determinant variables related to the physical aspects of the subject property, including its location, site characteristics, building condition, adaptability for future changes and contractual matters such as lease terms, covenants, payment reviews and payment modes. According to Ling and Archer (2018), government interventions at the local, state and national levels in areas such as land use controls, property taxation, building regulations, civil rights, subsidies, housing finance support, income taxation, transportation infrastructure and public amenities such as schools, significantly impact property values. They also suggest that the interplay between the user market, capital market and property market influences property values. Likely, Ridker and Henning (1967) categorize property determinant variables into property-specific characteristics, location attributes, tax and public service considerations, submarket variables and neighborhood characteristics.

While various studies have identified numerous variables, the role of each variable varies depending on the locality. Economic development, governmental influences and social and environmental factors differ from one community to another, thereby impacting property values differently. Consequently, the significance of each determinant variable can vary geographically. In summary, Table 2 provides a general overview of the identified variables from different studies:

The value of property, as identified by various scholars, is contingent upon diverse factors, which can broadly be categorized into macroeconomic factors affecting an entire country's economy and microeconomic factors specific to individual properties. Hence, Macroeconomic variables are taken into account as constants in this study for all residential properties in the study region. Instead, the emphasis is on identifying microeconomic determinants, which include some selected variables related to physical properties, location, neighborhood and environmental elements.

The literature suggests that there is an association between the price and determinant variables while the association may be either directly or indirectly. This implies that it should be acknowledged that certain variables may require adjustment expenses, which could ultimately lower the exchange rate, and on the contrary, other variables are those that benefit the buyer and for which the buyer is ready to pay. For instance, according to Lieske *et al.* (2021), factors such as street connectivity and higher density in surrounding areas negatively impact property prices. Therefore, it is essential to comprehend how these factors affect residential property values and the degree of the impact on value during the appraisal process.

Once the experts identify the determinants, it is also important to note that the legal rooms as well as the application of the valuation approach, might differ depending on the kind of property and the valuation's goal should be delegated to the valuer's dedication. Various methods of valuation may be appropriate depending on the situation. Additionally, professionals may choose methods that allow for effective data management, which saves time, energy and money when valuing many properties, as in the case of property taxation.

2.4 The concept of computer-assisted mass appraisal

There is no universally accepted definition of mass appraisal, while generally, it is the systematic process of estimation of the worth of many properties. For instance, according to

Table 2. Determinant variables of residential property value

Author	Residential property value determinants
Abraham (2016)	Population, real GDP, immigration housing credit from the demand side gross fixed capital formation (GDP) and residential investment on the supply determine residential value
Abidoye and Chan (2016)	Property location, neighborhood characteristics, property state of repair, size of the property, availability of neighborhood security and age of the property
Igbinosa (2011)	Property category, neighborhood attractiveness, number of bathrooms, the dimension of land, the year property is or to be sold or evaluated, the number of bathrooms, the property type and the neighborhood category are determinant variables
Adegoke *et al.* (2017)	Number of toilets, existence of burglary alarm and condition of the building
May *et al.* (2011)	Proximity to public parks, proximity to welling station, property rights
Kauko (2022)	Safety and security issues
Wong *et al.* (2020)	Credit availability and the cross-border investment fund
Lieske *et al.* (2021)	Street connectivity, density and type of train station; urban design characteristics, differing notions of accessibility, explicit consideration of scale and spatial effects
Ahmed *et al.* (2020)	New houses, covered area and the number of bedrooms, number of schools and proximity, proximity to the industrial area
Hassan *et al.* (2021)	Demographic background, finance, location, dwelling features, neighborhood, infrastructure facilities, environment, developer service quality and superstitious belief
Haider and Miller (2000)	Improved accessibility to certain desired features, such as the subway system, or proximity to a desired or a despised characteristic, such as a highway and locational variables
Olowofeso and Oyetunji (2016)	Fluctuation in macroeconomic variables (exchange rate, gross domestic product and inflation rate)
Binoy *et al.* (2022)	Access to transportation facilities, commercial establishments, crime sources, wetland classification and disaster history

Source(s): Compiled by the authors

Wang and Li (2019), mass appraisal can be defined as a systematic evaluation of groups of properties using standardized procedures. It focuses on the estimation of the worth of large groups of properties rather than individual ones and is envisaged as it originated in the USA during the 1920s (Liman *et al.*, 2017). This method of valuation, which is time and cost-effective, is used to estimate large, but similar properties. Nowadays, with the increasing volume of real estate transactions globally, mass appraisal methods have been widely adopted in numerous countries for various purposes, including different modalities of land value capture such as property tax (Wang and Li, 2019). As business activities expand across national borders because of globalization, CAMA becomes increasingly essential for ensuring consistent valuation approaches (Kauko and D'Amato, 2008). Economic globalization necessitates a uniform valuation method worldwide, and efforts such as the International Accounting Standards/International Financial Reporting Standard and the International Valuation Standard seek to address this issue (Kauko and D'Amato, 2008), although the degree of acceptance of these non-binding standards varies among countries.

Various mass appraisal approaches exist, including well-established methods such as Parametric Multiple Regression Analysis and emerging ones such as geographically weighted regression (GWR) and genetic algorithm (Kauko and D'Amato, 2008). According to Mccluskey *et al.* (2013), GWR stands out for its cost-effectiveness, user applicability and predictive accuracy in mass appraisal, however, it needs large, extensive data. Nowadays, rapid urbanization and economic development in developing countries including Ethiopia, underscore the need for modern property valuation practices. Therefore, the development of

CAMA valuation approaches could help bridge the gap in the practice of property valuation, making it imperative to identify determinant variables of residential properties as an initial step toward enhancing property valuation practices.

2.5 Conceptual framework

Based on the literature, researchers understand that real estate price, unlike other personal properties, is influenced by both macro and microeconomic factors (Figure 1). While macro variables may remain relatively constant within a local market with cross-sectional data, the value of real estate at a specific time within a particular local market is predominantly determined by microeconomic variables, alongside the condition of the target property itself. Consequently, it can be summarized that the value of a property is contingent upon its physical characteristics, locational attributes and environmental/neighborhood features within a given local market context.

3. Research methods

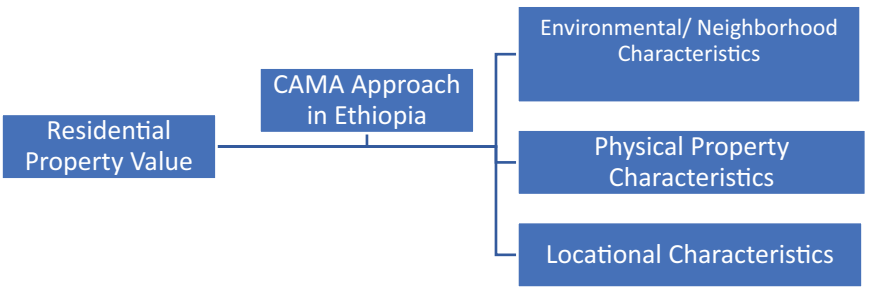
Drawing from existing literature, this study endeavors to use a suitable methodology. This section provides a general overview of the site location, hypothesized independent variables, sample size determination and data analysis tools.

3.1 Site location and description

Debre Markos, the capital city of the East Gojam zone, is an emerging urban center with a population exceeding 147,000 (Figure 2). The city is undergoing rapid expansion in all directions, accompanied by extensive urban development projects. The increasing urbanization and development initiatives necessitate regular property valuation to meet various needs. Consequently, there is a pressing need for a valuation model to estimate property values effectively for diverse purposes. Therefore, this study aims to develop an ordinal least square regression model tailored to the city's specific context. This model aims to minimize costs and resource expenditure while maximizing the uniformity and accuracy of property valuation.

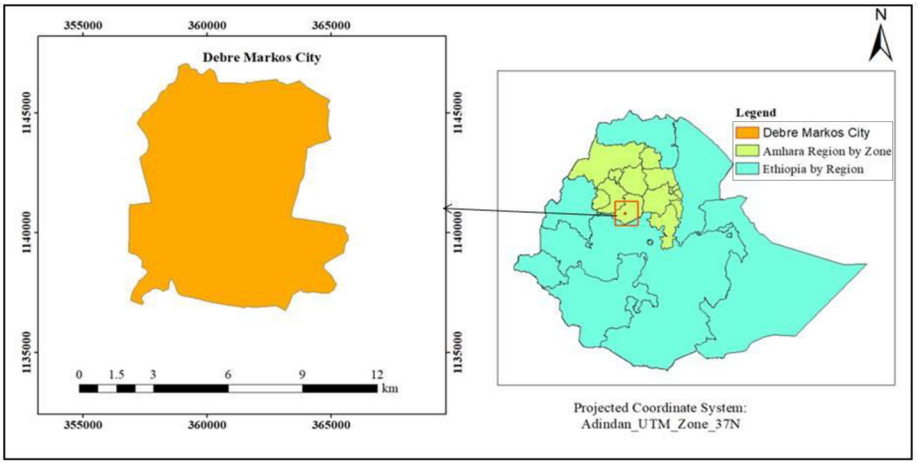
3.2 Research design and approach

This study adopts a survey research design to investigate the determinants of residential property value. Survey data from property owners are used to identify these determinants



Source(s): Compiled by the authors

Figure 1. Conceptual framework for determinants of residential property value



Source(s): Authors' own work (2024)

Figure 2. Location map of the study area

based on owners' perceptions. Additionally, transacted properties are surveyed using a snowball sampling method. Subsequently, an ordinal least square regression model is developed using the surveyed properties and related characteristics. The analysis of the results follows a mixed approach incorporating both qualitative and quantitative analysis methods.

3.3 Sample size and sampling technique

Two populations are analyzed using different methods in this study. The first population comprises the total number of residential property owners, from whom the determinants of residential property value are elicited based on their perceptions. The second population encompasses the total number of transacted properties within the last three fiscal years. As noted by Haile (2022), approximately 81.22% of households in the country are estimated to be homeowners. Therefore, it is anticipated that 81.22% of households are homeowners. Using the sample size determination formula developed by Cochran (1963):

$$n = \frac{z^2 \cdot p \cdot q}{e^2}$$

where:

n = sample size;
Z^2 = value of the normal curve that cuts off an area at the tails;
e = desired level of precision (margin of error of ± 5%);
p = estimated proportion of attributes in the population (81.22% for this study); and
q = 1-p.

Hence, the total sample size amounts to 235. However, among these respondents, 3 were not properly addressed, resulting in the analysis being based on data from 232 respondents. Following the identification of property value determinants from homeowners' perceptions, a model was developed using data from recently sold properties in the study area. To do so, the

snowball sampling method was used to select 67 sold properties within the last three years that were included for model calibration. Snowball sampling was employed because formal transaction records are on the one hand poorly maintained and on the other hand, do not accurately reflect actual transaction values. In many cases, buyers and sellers intentionally report falsified transaction amounts to reduce property transfer costs, making it challenging to rely on official data for analysis. Therefore, sales data were collected from the brokers of 67 properties recently sold. Additionally, document analysis, key informant interviews and focus group discussions were conducted to complement the data and those qualitative substantiations were used to saturate the data. Subsequently, the collected data were coded, and an ordinal least square regression model was used to identify the determinants of residential property value.

3.4 Identified variables as determinants of residential property value

The researchers identify hypothesized variables as determinants of value through literature reviews and pilot surveys during the pretest phase of questionnaire development. Based on insights gleaned from the literature and feedback from the pretest respondents, the following variables are considered determinants of residential property value in the study area: Number of rooms (NR), site area (SA), construction materials (CM), orientation (O), design (D), age (A), view (V), distance to Central Business District (DCBD), distance to wetland (DWL), position relative to the front road (PFR), distance to bus/taxi station (DBS), distance to the nearest green area (DGA), distance to religious institutions (DRI) and distance to schools (DS). Thus, the projected model for residential property value is formulated as follows:

$$PV = \beta 0 + \beta 1NR + \beta 2SA + \beta 3CM + \beta 4O + \beta 5D + \beta 6A + \beta 7V + \beta 8DCBD + \beta 9DWL + \beta 10PFR + \beta 11DBS + \beta 12DGA + \beta 13DRI + \beta 14DS + \in$$

where: PV is the ordinal dependent variable.

NR, SA, CM, O, D, A, V, DCBD, DWL, PFR, DBS, DGA, DRI, DSNR, SA, CM, O, D, A, V, DCBD, DWL, PFR, DBS, DGA, DRI, DS are the independent variables.

$\beta 0, \beta 1 \ldots, \beta 14$ are the coefficients of the model and ϵ is the error term.

4. Results and discussions

4.1 General description of the data

The literature review highlights a unique aspect of real property valuation: its value is influenced by a complex determinant both within and outside the property itself. This study aims to dissect these determinants of real property value using statistical analysis conducted with statistical package for the social sciences (SPSS) software. The study attempts to present the general description data, then describe the model used for this analysis, and finally analyze the regression result of the study.

To begin, respondents' willingness to pay or receive for a property is assessed, with values ranging from extremely high to extremely low, based on various determinant factors. These factors are represented in the SPSS analysis as shown in Table 3 below.

Each variable represents a different aspect of the property, such as construction material, size, orientation, design, age, amenities and proximity to various locations. The variations of these determinants from site to site as well as property to property are suggested to increase or decrease the value of the property. With overwhelming this in mind, these variables were analyzed to understand their impact on the perceived value of the real property. The respondents in the study area were requested to fill out their feelings and willingness to pay or receive for the property in line with the independent variables and their category. After the data is taken from the perceptions or willingness to pay or receive of the respondents, it is

Table 3. Representation of variables in SPSS software

S. No.	Variables	Representations in SPSS
	Property value (DV)	5 = extremely high, 4 = high, 3 = medium, 2 = low, 1 = extremely low
1	Type of construction material (CM)	5 = block, 4 = brick, 3 = mixed, 2 = mud and wood,1 = others
2	Site area (SA)	5 = >= 500, 4 = 251–499, 3 = 201–250, 2 = 151–200, 1= <=150
3	Orientation (O)	5 = main gate to the east, 4 = main gate to the south, 3 = main gate to the north, 2 = main gate to the west, 1 = others
4	Design (D)	5 = rectangle with four side slant roof, 4 = L shape, 3 = rectangle with two side slant roof, 2 = circle, 1 = others
5	Age of the property (A)	5 = Below or equal to 10, 4 = 11–20, 3 = 21–30, 2 = 31–40, 1 = above 40
6	View (v)	5 = very high satisfaction in view, 4 = high satisfaction, 3 = medium satisfied in view, 2 = low satisfaction in vie,1 = No satisfaction at all
7	Distance to CBD (DCBD)	5 = very short distances up to 5-minute walking, 4 = short distances up to 10-minute walking, 3 = medium distances up to 20-minute walking, 2 far in distance up to 30-minute walking distance, 1 = far in distance above 30-minute walking distance
8	Number of rooms	5= >= five rooms, 4 = four rooms, 3 = three rooms, 2 = two rooms, 1 = one room
9	Distance to wetland (DWL)	5 = very far in distance above 2 km 4 = far in distance from 2 km to 1.5 km, 3 = medium distance from 1.5 km to 1 km, 2 = short in distance from 1 km to 500 m, 1 = very short distance within 500 m
10	Position to front road (PFR)	3 = high level of the site concerning road elevation, 2 = equal level of the site with road elevation, 1 = lower site level
11	Distance to bus station (DBS)	5 = very short distances up to 5-minute walking, 4 = short distances up to 10-minute walking, 3 = medium in distance up to 15-minute walking distance, 2 = far in up to 20-minute walking, 1 = very far in the distance of more than 20-minute walking
12	Distance to green area (DGA)	5 = very short distances up to 5-minute walking, 4 = short distances up to 10-minute walking, 3 = medium in distance up to 15-minute walking distance, 2 = far in up to 20-minute walking, 1 = very far in distance more than 20-minute walking
13	Distance to religious institution (DRI)	5 = very short distances up to 5-minute walking, 4 = short distances up to 10-minute walking, 3 = medium in distance up to 15-minute walking distance, 2 = far in up to 20-minute walking, 1 = very far in distance more than 20-minute walking
14	Distance to school	5 = very short distances up to 5-minute walking, 4 = short distances up to 10-minute walking, 3 = medium in distances up to 15-minute walking distance, 2 = far in distance up to 20-minute walking, 1 = very far in distance of more than 20-minute walking

Source(s): Authors' own work

substantiated with real transaction data. Before proceeding with the discussion of their response, the general descriptions of respondents (age, sex, income, job and education level composition of respondents) are indicated in Table 4.

The demographic data provided offers valuable insights into the composition of the study participants (see Table 4). Age distribution indicates a balanced representation across different age groups, with 22% falling between 18 and 40 years, 38% between 41 and 60 years and 41% above 60 years old. This suggests a broad range of perspectives and experiences within the sample and the required information on the willingness to pay or receive is expected to be from age bias. Income distribution among respondents shows a varying range, with 30% categorized as low-income earners, 47% as middle-income earners

Table 4. General descriptions of the respondents

Description	No	%
Age		
18–40	51	22.00
41–60	87	38.00
above 60	94	41.00
Sum	232	100.00
Sex		
M	127	55.00
F	105	45.00
Sum	232	100.00
Job		
Private	138	59.00
NGO	3	1.00
Government	91	39.00
Sum	232	100.00
Income		
Low	69	30.00
Middle	109	47.00
High	54	23.00
Sum	232	100.00
Education		
Below high school	37	16.00
High school to diploma	78	34.00
Degree	96	41.00
Master and above	21	9.00
Sum	232	100.00

Source(s): Authors' own work

and 23% as high-income earners. This diversity in income levels could influence their perceptions and priorities regarding real property. Regarding gender, there is a slight predominance of males, accounting for 55% of the respondents compared to 45% of females. This gender distribution may reflect broader societal trends or specific factors related to property ownership and valuation.

In terms of education, respondents exhibit a range of educational backgrounds, with 16% having education below high school, 34% completing high school to diploma level, 41% holding a degree and 9% having a master's degree or above. This suggests a mix of educational attainment levels, which could impact their understanding of property valuation concepts and decision-making processes. The distribution of respondents across different job sectors further adds to the diversity of the sample, with 59% employed in the private sector, 1% in NGOs, and 39% in government positions. These varied occupational backgrounds may influence respondents' perspectives on property value, depending on factors such as stability of income, industry trends and employer benefits related to housing.

Overall, this demographic analysis underscores the importance of considering diverse demographic characteristics when studying determinants of real property value. Understanding how these factors intersect with individuals' perceptions and preferences can provide valuable insights for policymakers, real estate professionals and researchers in the field. A general description of the respondent's responses is described in Table 5.

Table 5. General description of the response data

Residential property determinants	N	Range	Min.	Max.	Mean	SD
Number of rooms	232	4	1	5	2.660	0.934
Site area	232	4.00	1.00	5.00	2.664	0.888
Type of construction material	232	4.00	1.00	5.00	2.612	1.126
Orientation/ exposure	232	4.00	1.00	5.00	2.599	1.064
Design	232	4.00	1.00	5.00	2.045	1.110
Age	232	4.00	1.00	5.00	2.681	1.113
View	232	4.00	1.00	5.00	2.0323	0.743
Distance to Central business district	232	4.00	1.00	5.00	2.351	0.816
Distance to wet land	232	4.00	1.00	5.00	2.147	0.668
Position to front road	232	2.00	1.00	3.00	1.108	0.807
Distance to bus/ taxi station	232	4.00	1.00	5.00	2.147	0.742
Distance to green area	232	4.00	1.00	5.00	2.030	0.717
Distance to religious institutions	232	4.00	1.00	5.00	1.892	0.734
Distance to school	232	4.00	1.00	5.00	2.034	0.726
Property value	232	4.00	1.00	5.00	3.582	0.908
Valid N (listwise)	232					

Source(s): Authors' own work

The provided data presents descriptive statistics for various factors potentially influencing property value, as well as the property values themselves. Across factors such as number of rooms, site area, type of construction material, orientation/exposure, age and proximity to amenities, there appears to be a relatively consistent range, minimum, maximum, mean and standard deviation. This consistency suggests that these variables exhibit similar levels of variability within the data set. Interestingly, the mean property value is notably higher than the other factors, indicating that property value is relatively high on average compared to individual attributes such as number of rooms or site area. This suggests that either other factors beyond the physical attributes of the property affect the value or there may be also variables included in this study that need more investigation to incorporate variables that have a significant influence on property values.

Overall, this analysis underscores the complex interplay of various factors in determining property values. While physical attributes such as number of rooms or site area contribute to property value, other factors such as location, amenities and market dynamics also play crucial roles. Understanding these dynamics is essential for accurate property valuation and informed decision-making in real estate markets.

4.2 Model description and data analysis

This research employed an ordinal logistic regression model to analyze respondents' willingness to pay or receive for property using ordinal determinant variables. The frequency distribution of respondents' willingness to pay or receive for the property, along with their respective percentages, is presented in Table 6. Table 6 provides a comprehensive overview of respondents' willingness to pay or receive across different levels. According to Table 6, 6.5% of respondents express a strong willingness to pay or receive a very high value for the property based on the determinants identified. Additionally, a substantial portion, accounting for 61.6% of respondents, indicates a high willingness to pay or receive for the property with these determinants. Similarly, 21.6%, 4.3% and 6.0% of respondents are willing to pay medium, low and very low values for the property, respectively, considering the identified

Table 6. Degree of willingness to pay or receive for the property with the determinants

Case processing summary		
Willingness to pay agreement category	*N*	Marginal percentage
Property value		
Very low	14	6.0
Low	10	4.3
Medium	50	21.6
High	143	61.6
Very high	15	6.5
Valid	232	100.0
Missing	0	
Total	232	

Source(s): Authors' own work

determinants. These findings offer valuable insights into the distribution of willingness to pay or receive among respondents and provide a basis for further analysis of the determinants influencing property valuation.

In ordinal logistic regression, an essential assumption is that the model-fitting information should demonstrate significance, typically indicated by a *p*-value of less than 0.05 for a 95% confidence interval. This significance refers to a substantial improvement in fit compared to the null hypothesis, which posits no significant difference between the baseline model and the final model. When the model fitting information is significant, as shown in Table 7, it indicates rejection of the null hypothesis and acceptance of the alternative hypothesis. In practical terms, this suggests a meaningful relationship between the dependent, i.e. property value, and independent variables under consideration. This significance underscores the validity and reliability of the regression model in explaining the relationship between the variables and the property value.

Another crucial assumption of the ordinal logistic regression model pertains to goodness of fit statistics, which assess how well the observed data align with the fitted or assumed model. The null hypothesis associated with goodness of fit states that the observed data demonstrate a satisfactory level of correspondence with the fitted model. In this context, the significance value (*p*-value) for the model fitting statistics should ideally be greater than 0.05 for the model to adequately fit the data. Upon examination of Table 8, it is evident that this assumption is satisfied for this study, as the *p*-value indicates acceptance of the null hypothesis.

The significance of this finding lies in its implication for the reliability and validity of the regression model. A non-significant *p*-value for goodness of fit statistics suggests that the

Table 7. Model fitting information

Model fitting information				
Model	−2 Log Likelihood	Chi-Square	df	Sig.
Intercept only	515.523			
Final	405.984	109.539	33	0.000

Note(s): Link function: Logit
Source(s): Authors' own work

Table 8. The goodness of fit statistics table

	Goodness-of-Fit		
	Chi-Square	df	Sig.
Pearson	900.027	910	0.587
Deviance	438.509	910	0.924

Note(s): Link function: Logit
Source(s): Authors' own work

observed data closely match the expected outcomes (property value for this study) predicted by the model. Consequently, we can have greater confidence in the model's ability to accurately capture the relationship between the dependent and independent variables, thereby enhancing the robustness of the study's findings.

In addition to the assumptions previously discussed, another significant aspect of ordinal logistic regression analysis is the interpretation of the pseudo-R-squared values. These values represent the proportion of variance explained by the independent variables to the dependent variable within the regression model. For this study, the pseudo-R-squared values, as presented in Table 9, the relatively high pseudo-R-squared values across all measures imply that a substantial portion of the variability in property value can be attributed to the factors under investigation

The pseudo-R-Square values provided, including Cox and Snell (0.739), Nagelkerke (0.799) and McFadden (0.537), offer valuable insights into the explanatory power of the ordinal logistic regression model employed in this study. These metrics indicate how well the independent variables explain the variance in the dependent variable, which, in this case, is property value. These findings underscore the substantial impact of the independent variables on determining property value within the regression model. The high pseudo-R-Square values signify a strong relationship between the independent variables and property value, indicating that the model effectively captures the underlying factors influencing property valuation.

The test of parallel lines conducted in this study aimed to assess the assumption that the location parameters (slope coefficients) remain consistent across different response categories within the ordinal logistic regression model. The test results, as presented in the table, provide insights into the model's appropriateness and validity. The results of this test are presented in Table 10. The high *p*-value (0.848) suggests that there is no significant difference between the observed and expected data, thus failing to reject the null hypothesis.

Table 9. Pseudo *R*-Square test result

Pseudo *R*-square	
Cox and Snell	0.739
Nagelkerke	0.799
McFadden	0.537

Note(s): Link function: Logit
Source(s): Authors' own work

Table 10. Test of parallel line

Model	Test of parallel lines[a] −2 Log Likelihood	Chi-Square	df	Sig.
Null hypothesis	353.449			
General	204.199[b]	149.249[c]	168	0.848

Note(s): The null hypothesis states that the location parameters (slope coefficients) are the same across response categories: [a]link function: logit; [b]the log-likelihood value cannot be further increased after maximum number of step-halving; and [c]the chi-square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain
Source(s): Authors' own work

Finally, the parameter estimates table (see Table 11) represent the coefficients obtained from a logistic regression model. Each coefficient corresponds to a predictor variable, indicating the strength and direction of its relationship with the property value.

The threshold estimates in the provided analysis illuminate the property value (PV) and respondents' willingness to engage with the explained variables. Different PV categories serve as reference points, with the highest category (5, indicating a very high pay willingness to pay or receive) acting as the reference in this study. These estimates delineate both the

Table 11. Estimate result of determinants

	Parameter estimates						
						95% confidence interval	
	Estimate	SE	Wald	df	Sig.	Lower bound	Upper bound
Threshold							
[PV = 1.00]	−9.637	1.435	45.095	1	0.000	−12.449	−6.824
[PV = 2.00]	−8.974	1.414	40.282	1	0.000	−11.745	−6.203
[PV = 3.00]	−7.220	1.368	27.840	1	0.000	−9.902	−4.538
[PV = 4.00]	−2.839	1.278	4.936	1	0.026	−5.343	−0.334
Location							
NR	0.371	0.156	5.655	1	0.017	−0.677	−0.065
SA	0.369	0.162	5.149	1	0.023	−0.687	−0.050
CM	0.473	0.146	10.473	1	0.001	−0.760	−0.187
O	0.337	0.142	5.632	1	0.018	−0.615	−0.059
D	0.132	0.132	1.003	1	0.317	−0.391	0.127
A	0.378	0.129	8.618	1	0.003	−0.631	−0.126
V	0.280	0.191	2.147	1	0.143	−0.095	0.656
DCBD	0.781	0.191	16.731	1	0.000	−1.155	−0.407
DWL	0.294	0.216	1.848	1	0.174	−0.130	0.719
PFR	0.093	0.182	0.264	1	0.608	−0.449	0.263
DBS	0.478	0.193	6.113	1	0.013	−0.857	−0.099
DGA	0.104	0.202	0.266	1	0.606	−0.292	0.501
DRI	0.109	0.206	0.279	1	0.597	−0.296	0.514
DS	0.152	0.197	0.589	1	0.443	−0.235	0.538

Note(s): Link function: Logit
Source(s): Authors' own work

magnitude and direction of the relationship between PV categories and respondent responses. Notably, as PV decreases from the highest category, a reverse relation is observed, suggesting that lower property values are associated with decreased willingness to engage with the highest property value.

Conversely, the location parameter estimates elucidate the magnitude and direction of the relationship between the dependent variable and independent variables. Among the variables included in the model, seven are statistically significant at a 95% confidence interval. Specifically, NR, SA, CM, O, A, DBS and DCBD exhibit statistical significance ($p < 0.05$), indicating their substantial impact on the property value. The positive coefficients for NR, SA, CM, O, A and DCBD suggest that being in these locations is associated with higher odds of property value. On the other hand, variables such as V, DWL, PFR, DGA, DRI and DS do not demonstrate statistical significance ($p > 0.05$), indicating that they do not exert a significant impact on property value in this model. This suggests that these variables may not play a substantial role in predicting the property value within the context of this analysis. Here, we offer a brief overview of these considerations for each significant variable:

- *Number of rooms (NR)* – The positive estimate value of 0.371 signifies a direct relationship between the number of rooms and willingness to pay or receive more for the property. This suggests that as the number of rooms increases, there is a corresponding increase in the willingness to pay or receive more for the property, and conversely, as the number of rooms decreases, the willingness to pay or receive more decreases as well. This direct association underscores the intuitive notion that larger properties with more rooms tend to command higher prices. Moreover, the significance level for this variable is 0.017, indicating a statistically significant impact on the willingness to pay or receive more for the property.
- *Site Area (SA)* – In this study, an examination of the relationship between the site area and the willingness to pay or receive for a property reveals an important correlation. The analysis suggests a positive association, indicating that as the site area increases, so does the willingness of households to invest more in the property. This finding underscores the perception that larger site areas hold greater value for potential buyers, prompting a heightened financial commitment. Moreover, the significance level of this relationship, evaluated at a 95% confidence interval, is notable with a p-value of 0.023, indicating statistical significance. Thus, the study highlights a positive correlation between site area and willingness to pay or receive, with larger sites associated with increased financial investment from potential buyers.
- *Type of construction materials (CM)* – This study also explores the impact of construction material types on the willingness to pay or receive for a property. The analysis reveals a clear direct relationship between the quality of construction materials and property value. As the quality of construction materials improves, there is a corresponding increase in property value. The significance level of this relationship is highly notable with a p-value of 0.001, indicating strong statistical significance. These findings emphasize the critical role of construction material quality in influencing property value.
- *Orientation (O)* – The orientation or exposure of a property, suggested by brokers as a significant factor, is included as a variable in the model. The analysis confirms a significant positive relationship between property orientation and willingness to pay or receive. Higher numerical representations of orientation correspond to an increased willingness to pay or receive, as validated by regression results and the significance value of 0.018.

- *Age of the property (A)* – The age of the property is considered a determinant variable, with the analysis revealing a positive relationship with property value. Newer properties tend to be valued higher, as indicated by the significance level of 0.003. The ordinal representation system underscores that newer properties are perceived as more valuable compared to older ones.
- *Distance to bus station (DBS)* – The analysis confirms a direct relationship between the distance to a bus station and willingness to pay or receive for a property, with a significance level of 0.013. Shorter distances are associated with higher property values, aligning with the ordinal representation system used in the analysis.
- *Distance to central business district (DCBD)* – Similarly, there is a strong positive relationship between distance to the central business district and willingness to pay or receive for a property. Properties closer to the CBD are valued higher, as indicated by the significant estimate result of 0.781 and a significance level of 0.000.

While these variables exhibit statistical significance, the remaining variables do not reach the threshold for significance at the 95% confidence level. The qualitative analysis of FGD and key informant interviews also substantiates that these variables are lower valued from the demand preference, and might be insignificant because local buyers do not prioritize aesthetic features or scenic views when determining property value. However, their lack of significance in this model may not necessarily diminish their importance in alternative scenarios or when considered alongside additional variables, and this study suggests further studies to be conducted by increasing the scope of the study.

4.3 Ordinal least square regression analysis

To validate the ordinal logistic regression analysis, this study uses real transaction data rather than relying solely on assessments of willingness to pay or receive for property, as done in ordinal least squares regression. However, using transaction data presents challenges due to ambiguities in the accuracy of this data within the study area. Specifically, discrepancies exist among three sources of property transaction data for a given property: data from brokers, the municipality and purported transaction agreements.

Municipality experts estimate the value of a sold property for transaction tax assessment purposes, but the contracting parties often submit bogus sale agreement documents to the municipality, complicating this study. Recent research (Asnakew *et al.*, 2024) has shown that bogus transaction agreements are commonly used to formalize informal property holdings. The study found that the use of bogus sale contract documents is widespread across all observed transactions in the study area. While further investigation is needed to understand why these bogus documents are prevalent, initial inquiries with brokers suggest that the motivation is to minimize property transaction taxes payable to the government. Despite inconsistencies in data from different sources, this study relies on brokers' data for the analysis. The ordinal least square regression results are discussed below.

Based on the result of Table 12, as explained with Multiple R-squared [d], it was indicated that approximately 73.16% of the variance in the dependent variable (property value) is explained by the independent variables in the model. This is a reasonably high value, suggesting a good fit of the model to the data. The Adjusted R-squared [d] result, which adjusts the *R*-squared value for the number of predictors in the model, provides a more accurate measure of the model's explanatory power, particularly when multiple predictors are used. An adjusted *R*-squared of 0.659 indicates that around 65.9% of the variance is explained when accounting for the number of predictors for those significant variables. The Multiple *R*-squared and Adjusted *R*-squared values together provide strong evidence that the model is

Table 12. Ordinal least square diagnosis table

Input features	OLS_Output	OLS diagnostics Dependent variable	PV
Number of observations	67	Akaike's information criterion (AICc) [d]	2025.472
Multiple R-Squared [d]	0.7316	Adjusted R-Squared [d]	0.659
Joint F-Statistic [e]	10.124	Prob (>F), (14,52) degrees of freedom	0.000*
Joint Wald statistic [e]	535.069	Prob (>chi-squared), (14) degrees of freedom	0.000*
Koenker (BP) statistic [f]	23.654	Prob (>chi-squared), (14) degrees of freedom	0.060
Jarque–Bera statistic [g]	23.307	Prob (>chi-squared), (2) degrees of freedom	0.069

Source(s): Authors' own work

both effective and reliable in explaining the variance in property values, while also accounting for the complexity of including multiple predictors. This makes the model a valuable tool for understanding the factors that influence property values in the study area. Hence, the model well fits the data, the ordinal least square regression result is indicated in Table 13 below.

The results of the ordinal least squares regression are summarized in Table 13, which highlights the significant variables at a 95% confidence interval. The variance inflation factor (VIF) values for all variables are relatively low, indicating that multicollinearity is not a major issue in this model. Typically, large VIF values (>7.5) suggest redundancy among explanatory variables, but this is not the case here. Based on Table 13, six variables – NR, SA, CM, A, DCBD and DBS – are significant, meaning the value of residential property depends on these variables. Variables SA (size of the property), CM (commercial activity), NR (neighborhood rating), A (age of the property), DCBD (distance to central business district) and DBS (distance to basic services) show significant relationships with the dependent variable after adjusting for robust standard errors. Some of these variables have a direct relationship with property value, while others have an inverse relationship. Specifically: SA, CM and NR have a positive or direct relationship with property value,

Table 13. Ordinary least square regression results

Variable	Coefficient [a]	SE	Summary of OLS results – model variables *t*-statistic	Probability [b]	Robust_SE	Robust_t	Robust_Pr [b]	VIF [c]
Intercept	−956622.300	1073006.576	−0.892	0.377	1184163.470	−0.808	0.423	–
NR	238196.954	132359.594	1.800	0.048*	107326.441	2.219	0.030848*	1.213
SA	33910.867	3355.980	10.105	0.0000*	2729.534	12.424	0.000000*	1.211
CM	268364.025	118501.126	2.265	0.027729*	132187.238	2.030	0.047468*	1.288
O	137311.312	115559.779	1.188	0.240	115740.447	1.186	0.241	1.093
D	−195399.286	126300.827	−1.547	0.128	109560.596	−1.783	0.080	1.221
A	−32181.679	17778.147	−1.810	0.046*	10303.343	−3.123	0.002921*	1.492
V	−74607.311	120268.305	−0.620	0.538	115426.333	−0.646	0.521	1.201
DCBD	−27622759.12	9163174.004	−3.015	0.003974*	10601268.632	−2.606	0.011933*	1.387
DWL	55816.157	138526.285	0.403	0.689	103611.527	0.539	0.592	1.141
PFR	49665.435	126746.109	0.392	0.697	114373.785	0.434	0.666	1.258
DRI	−720.499	109131.640	−0.007	0.995	80672.581	−0.009	0.993	1.218
DGA	−94505.709	139504.023	−0.677	0.501	122706.322	−0.770	0.445	1.233
DBS	−342941.707	134702.231	−2.546	0.013901*	106037.067	−3.234	0.002124*	1.229
DS	−19864.461	151131.395	−0.131	0.896	119244.838	−0.167	0.868	1.450

Note(s): *significance variables at 95%confidence interval
Source(s): Authors' own work

indicating that as these variables increase, so does the property value. A, DCBD and DBS have indirect relationships with property value, suggesting that increases in these variables correspond to decreases in property value. On the other hand, the intercept and several other variables (V, O, D, DWL, PFR, DRI, DGA, DS) do not show significant effects on property value, and this study suggests further study as to why the variables are insignificant with increasing the scope of the study. This indicates that these variables do not significantly contribute to the variance in property values within the context of this model.

5. Conclusion and recommendation

Nowadays property valuation is serving buyers, sellers, financial institutions, government bodies, real estate developers insurance companies and legal entities, and is a significant profession for many perspectives and urban developments in the country. This study aimed to identify the determinants of residential property value using both willingness to pay or receive data from respondents and real transaction data. To do so ordinal logistic regression analysis and ordinal least square regression analysis are used for the analysis of willingness to accept data and real transaction data. The findings from the ordinal logistic regression analysis of willingness to pay or receive data indicated that the variables number of rooms, site area of the property, type of construction material, orientation, age of the property, distance to the bus station and distance to the central business district significantly impact property values ($p < 0.05$).

When analyzing real transaction data with ordinal least squares regression, the significant determinants of property value included number of rooms, site area of the property, type of construction material, age of the property, distance to bus station and distance to the central business district. However, the orientation variable, which was significant in the willingness to pay or receive analysis with ordinal logistic regression, was found to be insignificant in the real transaction data analysis with ordinal least squares regression. This may imply that, though buyers and sellers are willing to accept or receive for the variable orientation, the increased amount in real transaction price is not visible and this may need further study. The remaining variables such as good view, distance to wetland, position to the front road, distance to a green area, distance to a religious institution and distance to school do not demonstrate statistical significance ($p > 0.05$), indicating that they do not exert a significant impact on property value in this model and may imply buyers and sellers are not willing to pay for these variables in the study area. This study pinpointed the selected and identified significant variables to be considered in property valuation for various purposes and recommends additional research to be conducted to understand the discrepancy in the significance of the orientation variable between willingness to pay or receive/accept data and real transaction data including extensive data and appropriate models such as a geographically weighted regression model. The limited availability of real transaction data (only 67 are used for this analysis) posed a significant challenge, and hence it demands to record complete and accurate data officially in the future. Therefore, municipalities should also improve the organization and accessibility of transaction data. Real estate developers, Local governments, urban planners and other stakeholders should consider the significant determinants when developing housing policies and urban development plans to ensure they align with the factors that truly affect property values to maximize demand satisfaction.

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