

RESEARCH ARTICLE

Willingness to Accept and Willingness to Pay for Residential Properties: A Hedonic Model Approach [version 1; peer review: 1 approved, 1 approved with reservations]

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Abstract

The world over is becoming urbanized, and people are migrating to cities in large numbers in search of opportunities. The increased urbanization has posed challenges such as congestion, rising crime, and growing urban poverty. The governments respond by providing amenities such as schools, hospitals, and housing to meet to increase in demand for these facilities. However, there is a need for the provision of facilities that meets the expectations of the people, particularly on the proximity of amenities and bundles of utility-bearing housing characteristics. In an attempt to address the challenge mentioned, the study estimated the hedonic characteristics influencing the willingness to accept and willingness to pay for housing facilities in the Eastern Cape Province, South Africa. Using a multiple linear regression model and artificial neural network, the study found out that properties with a bathroom, garage and large floor size have a higher value compared to properties without these facilities. When making decisions to acquire a property, buyers consider the availability of discounts and the prevailing property price. Overall, willingness to pay and accept decisions are mainly determined by location and the price at which homogeneous neighborhood properties were sold. Therefore, the study recommends that urban town planners and other housing authorities prioritize the construction of properties with larger floor areas, parking bays, and bathrooms using a cost-effective mechanism that makes the properties affordable to residents.


Keywords

Residential Properties, Willingness to Accept, Willingness to Pay, Hedonic Regression Model, Artificial Neural Network

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Introduction

Tan (1999) defines residential properties as a collection of multidimensional characteristics combined to determine the price. Herath & Maier (2010) also mentioned that the number of distinguishing features a housing unit possesses determines a property's price. According to McCord *et al.* (2018), buyers perceive residential properties as a bundle of utility-bearing characteristics differently since they have different needs. Young working couples value properties near their workplaces higher compared to properties far from their workplaces (Macdonald *et al.*, 2014). Residents with school children value properties close to schools more than properties not close to schools (Huang & Hess, 2018). However, other residents might refer to these amenities as 'not-in-my-backyard (NIMBY) facilities due to the negative externalities such as the noise of school children, ambulances with sirens, and emergency helicopter landing brought by these amenities. For instance, other residents may not be willing to pay more for properties near schools because of negative externalities such as noise associated with the properties (Metz, 2015).

As such, the implicit value of properties can be revealed by the utility derived from structural features and the quality of the neighbourhood environment associated with the property. Suppose the bundle of utility-bearing characteristics does not satisfy the buyer's needs. In that case, buyers are willing to pay less than the market value of a property despite the importance of property characteristics to the seller/owners. So amid growing demand for public amenities and housing structural features that best meet residents' expectations, there is a need to establish a bundle of utility-bearing housing characteristics of facilities that improve the quality of life.

In line with sustainable development goal 11 (<https://www.un.org/sustainabledevelopment/cities/>), which aims to ensure access to adequate, safe, and affordable housing by 2030 and the South African government's infrastructure development plan (2050) towards achieving safe, affordable residential properties (Department of Public Works and Infrastructure, 2021; United Nations, 2016), there is need to provide housing facilities with utility-bearing characteristics that meet residents' needs. According to the South African government's infrastructure development plan (2050), there are several government priorities that include social cohesion and safe communities, spatial integration in human settlements, and massive infrastructure development to support amenities such as water, energy, and transport projects. These projects need to improve the value of residential dwellings. Therefore, hence their proximity to residential properties matters. To understand the phenomenon in-depth, the study estimated the effects of public amenities and housing features on housing values and willingness to pay for housing facilities in the Eastern Cape Province, South Africa.

Description of the study area

The study was carried out in the Eastern Cape Province of South Africa. The Eastern Cape province has the second-largest geographic footprint compared to all South African provinces,

encompassing 14% of the country's total surface area (Human Sciences Research Council Economic, 2014). The province is home to seven million people, or 12.6% of the overall population of 55.7 million people. Compared to other provinces, the Eastern Cape has the highest unemployment rate in the country, standing at 47.1%, while around 880,000 people live in poverty (Eastern Cape Socio-Economic Consultative Council, 2021). The province contributes approximately 7.7% of the country's overall GDP.

Despite the province being regarded as one of the impoverished provinces in South Africa, buyers have been attracted to two main metros: Buffalo City Municipality and Nelson Mandela Bay, out of the eight metropolitans in South Africa where buyers are opting to go (Turok & Borel-Saladin, 2014). The Eastern Cape's housing industry's future looks bright, given the region's coastline, particularly in Port Elizabeth and East London. These coastal cities are attracting younger buyers, with the majority of new homeowners between the ages of 36 and 49 and young individuals under the age of 35 (Centre for Affordable Housing Finance in Africa, 2020). Over the years, the region has also seen more significant investments, which shows growing investor confidence and is expected to stimulate market sentiment and demand (Stats Biz, 2021). Figure 1 shows metros with high demand for residential properties across South Africa.

Over the decade, the increased demand for housing witnesses in the Eastern Cape Province must be matched with increased public amenities and the construction of residents, which best meets the residents' expectations depending on their needs. Since housing has been defined as a bundle of utility-bearing characteristics, there is a need to establish housing facilities that increase residents' satisfaction in the province. For policymakers to understand residents' preferences, the study seeks to estimate the utility-bearing characteristics that influence housing values and the willingness to pay using parametric hedonic prices and artificial neural network models.

Theoretical background

The theoretical framework of the hedonic hypothesis states that all products are characterized by their attributes (Wierenga, 1984). According to Lancaster (1966); Rosen (1974), the price of any good can be viewed as a function of its inherent utility-bearing characteristics. According to Wierenga (1984), a product is conceived as a bundle of characteristics with want-satisfying properties to the consumer. In Lancaster's framework, characteristics are the attributes that matter in the consumer's utility function. The consumer chooses the combination of characteristics that provides the highest level of utility given the affordability constraint. According to the standard hedonic price model developed by Rosen (1974), the price of residential property is assumed to be explained by a hedonic price function, $P = f(x)$, where x represents a residential property attribute (Rosen, 1974). Each buyer of a residential property chooses a bundle attribute to maximize utility subject to a budget constraint (Lancaster, 1976). The implicit or hedonic price of a given characteristic changes the price of a

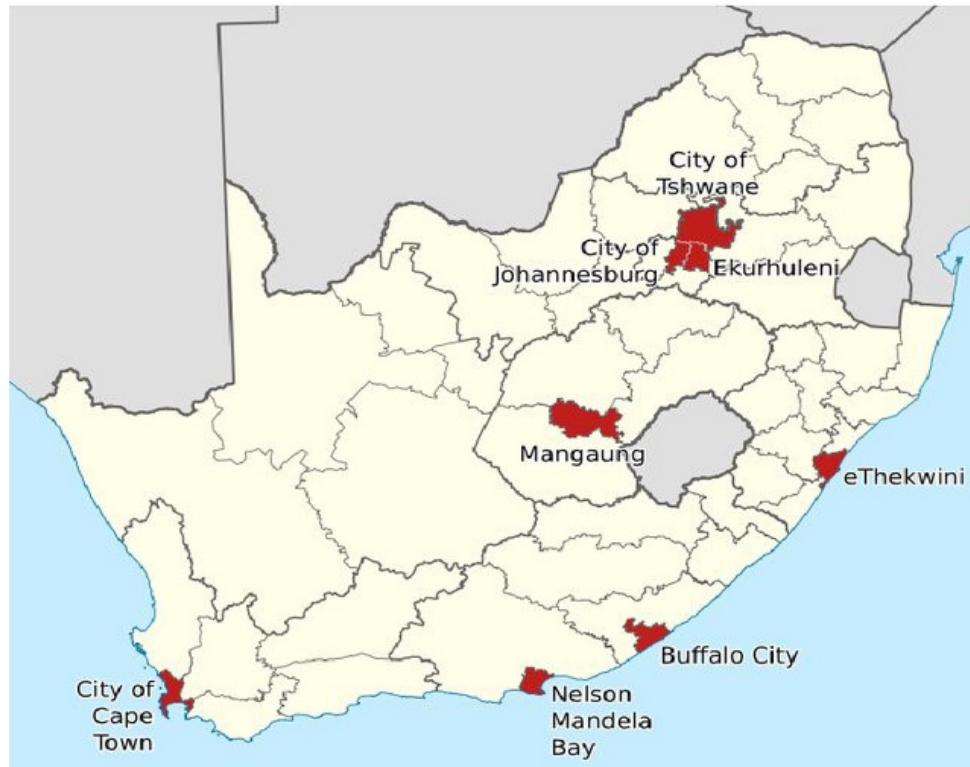


Figure 1. Metros in South Africa, buyers of residential property are interested in. Source: Turok & Borel-Saladin (2014)

property. The economic models are derived mainly from the theoretical framework (Lancaster, 1966; Rosen, 1974). The study follows the hedonic modelling approach to property valuations. Hedonic features such as amenities and structural features are essential because consumers view housing as a bundle of consumer-bearing utility. Buyers are willing to pay more if the bundle of housing characteristics meets the buyer's needs. However, if the bundle of housing characteristics fails to satisfy buyer needs. In that case, consumers may be willing to pay less than the property's value.

The hedonic model is traced to as early as Haas (1922). The model has gained momentum in recent literature as an econometric model that accurately estimates how stakeholders value residential properties. The hedonic price model calculates the market price of a house after the exact mathematical relationship between the house price and the house's qualities is established. The hedonic technique has gained general acceptance in dealing with changes in the qualitative features of heterogeneous structures (Abidoye & Chan, 2018; Ahmed *et al.*, 2020; de Haan & Erwin, 2013; Diewert, 2013; Gilbert, 2013; Lee & Lee, 2015; Liang & Gao, 2021; Monson, 2009; My-Linh, 2020; Pope, 2008; Sirmans & Macpherson, 2003; Tan, 1999; Walsh & Mui, 2017). Hedonic pricing has several benefits, including getting around some of the limitations

of conventional valuation techniques by using regression to estimate house prices. For instance, unlike other systems, it can reduce the significant subjective effect of appraisers on house value. Furthermore, the hedonic pricing model can assist in lowering estimation costs and it is typically a recommended model when estimating home prices. The hedonic pricing model has been extensively applied in many prior studies. Hedonic models have been adopted to estimate the effect of land and floor size, type, structure, number of bedrooms, number of bathrooms of residential properties, distance to the city centre, and local amenities (such as parks, squares, schools, and shopping malls) on property prices.

Previous studies which investigated the effects of public amenities and housing structural features have found out that structural features and public amenities are essential in determining property values. According to Ayan and Erkin (2014); Benítez-Silva *et al.*, (2015), homes with larger floor areas and more bedrooms are typically bought by large families. It is because huge homes offer roomier, more pleasant spaces. As a result, properties with more bedrooms and larger floor areas increases the value of residential properties. Some families may even use their homes as workplaces or businesses, resulting in larger homes getting a higher value than smaller properties (Ayan & Erkin, 2014; Benitez-Silva *et al.*, 2009; Kain & Quigley, 1972). A house with a brand-new, contemporary

structure may be sold for more. Buyers are eager to purchase modern new build homes to meet their basic needs. As a result, these homes are expensive (Cebula, 2009).

Studies such as Cebula (2009); Jaglarz (2021); Limsombunc *et al.* (2004); Simona Canepa (2019) have stressed on the importance of bathrooms in modern day housing. These studies have concluded that bathrooms plays an essential role in improving the well-being of households and this residential properties with bathrooms are valued more as compared to residential properties without bathrooms. Distance between the property and business centre, work centre, or other vital sub-centres influencing residents' everyday life has positively affected property values (Ayan & Erkin, 2014). Ottensmann *et al.* (2008) found that a decrease in 10 minutes of travel time was accompanied by an increase in the property value by 3.1%. Studies such as Benson *et al.* (1998); My-Linh (2020); Stetler *et al.* (2010); Song *et al.* (2022) have also found that residential properties near parks, squares, schools and shopping malls have higher values when compared not in close proximity to these facilities. Other studies were also in contrary to these findings as they mention that close proximity to schools can reduce property values due to external effects of noise from school children (Metz, 2015). Although other studies are in contrary with the vast growing literature, public amenities and desirable housing features remains essential to households and increases the value of properties.

Methods

Econometrics technics established from the hedonic model theoretical framework include the parametric models such as log-linear OLS, Box-Cox OLS, and Weighted Least Square. Non parametric models such the kernel approach and local polynomial regression. The semi-parametric method includes aspects of both parametric and non-parametric methods. According to Owusu-Ansah (2013), all of the approaches amongst aforementioned are equal to the others. The nature and aims of the housing study will primarily determine the approach or model to be used. However, among these econometric techniques, multiple ordinary least squares regression analysis (MRA) has been the widely used approach in property valuations, according to Radzi *et al.* (2012), because of its well-established methodology, long history of application, and widespread acceptance among practitioners and academics. However, the multiple linear regression model has been castigated due to its inability to deal with inter-variable relations, nonlinearity, and multicollinearity. These challenges have given rise to other non-parametric techniques, such as the artificial neural networks (ANN) (Abidoeye & Chan, 2018).

The use of ANN in explaining the importance of each attribute when determining house prices has gained momentum in recent literature (Abarca, 2021; Ghodsi *et al.*, 2010; Ghorbani & Afgheh, 2017; Nemati *et al.*, 2020). According to Limsombunchai (2004), a neural network is an artificial intelligence model created to mimic the human brain's learning process. The model is divided into three levels: input data (property attributes), hidden layer(s), and output layer (estimated house price). According

to Papadopoulos *et al.* (2021), these models consist of an input layer of neurons that sends signals to a hidden middle layer. The hidden layer of neurons computes weights and sends them to the output layer, which aggregates data and generates the final output. According to Ghorbani and Afgheh (2017), artificial neural networks can predict non-linear trends in varied data and provide a versatile computational framework for modelling a wide range of non-linear trends.

The sample size is randomly divided into two sets, namely the training set and the forecasting set, in line with conventional analytical methodology (Limsombunc *et al.*, 2004). The model produces an output (estimated house price) for a particular input. The model then compares the output of the model to the real output (actual house price) (Limsombunchai, 2004). The total mean square error is used to determine the accuracy of this value, and then backpropagation is utilized to try to decrease prediction errors by modifying the connection weights. Out-of-sample forecasting is then used to assess both models' predicting ability, after which the r squared and the Root Mean Square Error (RMSE) are calculated and compared. The model with a higher r squared and lower RMSE was considered relatively superior (Limsombunc *et al.*, 2004).

According to Ghorbani and Afgheh (2017), one of the apparent advantages of using the artificial neural network (ANN) model compared to other non-linear models is that artificial neural networks are global estimators that can carry out approximations of any function with any arbitrary precision. Such networks do not require any prior assumptions about the form of the data in the modelling process, and they are generally data-based models (Nemati *et al.*, 2020). Although ANN has only been applied in a limited number of cases for property assessments or forecasts, it has been found that it is superior to the ordinary least squares regression (Limsombunchai, 2004; Nemati *et al.*, 2020). Thus the study adopted both the ordinary least squares regression and the artificial neural network to estimate the effects of public amenities and housing features on housing value and the willingness to pay for residential properties in the Eastern Cape Province in South Africa.

Data collection

Data used in the study was obtained from Property 24 (<https://www.property24.com/>) from August 2021 to January 2022. Property24 is a property portal where property listings for sale and rent from leading real estate agents are advertised. Property24 helps sellers, home buyers, and renters find apartments, houses, townhouses, vacant land, and farms across South Africa. Residential properties from two leading metros in the Eastern Cape Province, Buffalo City Municipality, and Nelson Mandela Bay, were considered. The data obtained was limited to location of the property, floor size, price per floor size, ask price by sellers, willingness to pay by buyers, discounts provided, homogeneous neighbourhood house prices, number of bedrooms, number of bathrooms, availability of a kitchen, office, sitting rooms, garages, pool, garden and schools, public service and shopping malls within 5km. However, the number of explanatory variables included in the analysis was restricted to model

specification criterion when estimating a linear regression model.

Model specification and estimation techniques

The study utilized the ordinary least squares regression and the artificial neural network to estimate the effects of housing structural features and public amenities on housing values and willingness to pay for residential properties in the Eastern Cape Province in South Africa. The regression model which was adopted to evaluate the influence of house attributes and public amenities on residential property values is specified in [Regression model 1](#):

$$\text{Log}(WTA) = \beta_0 + \beta_1 \text{LOC}_i + \beta_2 \text{ERF}_i + \beta_3 \text{PERF}_i + \beta_4 \text{PERF}_i + \beta_5 \text{GARA}_i + \beta_6 \text{SM}_i + \beta_7 \text{BATH}_i + \beta_8 \text{NHP}_i + \varepsilon_i \quad (\text{Regression model 1})$$

[Regression model 1](#) estimates the effects of residential property characteristics and public amenities on residential property values. Variables included in [Regression model 1](#) include the location of the property (LOC), the floor size (ERF), price per square meter of the floor size (PERF), the availability of parking space (GARA) and bathrooms (BATH), proximity to public amenities such as shopping malls, with food and entertainment, medical facility, and bus stops (SM) and lastly the prices at which homogeneous houses in the same neighbourhood were prices at (NHP). In literature, these explanatory variables significantly influence the value of residential properties (Lisi & Iacobini, 2013; McCord *et al.*, 2018; Tan, 1999). [Regression model 1](#) utilized the log-linear approach where willingness to accept (property value) is in log form while the explanatory variables are in linear form. The function form follows the findings from Bello and Moruf (2010), who concluded that using the log-linear model to determine property valuations provides robust results compared to the other functional forms. The second model illustrated the factors influencing willingness to pay. The model is specified in [Regression model 2](#):

$$\text{Log}(WTP) = \beta_0 + \beta_1 \text{LOC}_i + \beta_2 \text{HP}_i + \beta_3 \text{Log}(\text{NHP})_i + \beta_4 \text{Log}(\text{DISC})_i + \varepsilon_i \dots \dots \dots \quad (\text{Regression model 2})$$

[Regression model 2](#) estimates factors influencing willingness to pay for residential properties in Eastern Cape, South Africa. Explanatory variables in the model include the property's location (LOC), the property prices (HP), the price sellers willing to accept, the availability of discounts (DISC), and prices of homogeneous residential properties in the same neighbourhood that have been sold (NHP). Buyers usually bargain or negotiate with sellers as they are not willing to pay for what sellers are willing to accept. So buyers primarily seek properties where sellers are willing to offer discounts, where the selling price leaves the buyer with a surplus. Buyers also consider the prices of other homogeneous properties sold in the same neighbourhood. If the price charged align with other properties, they are willing to pay the prevailing market price. Buyers often practice this to address overpricing caused by asymmetric information in the market (Chau & Choy, 2011).

Results

A total of 120 properties were included in the analysis. These results were analysed using the ordinary least squares regression (model A) and the multilayer perceptron of the artificial neural network (Model B). Results obtained from linear regression (Model A) and the multilayer perceptron of the artificial neural network (Model B) are depicted in [Table 1](#) and [Table 2](#). These results depicted that residents place a higher value on residential properties with larger floor sizes. An increase in floor size by one square meter increases value of a property by 27% (ordinary least squares) and 36% (artificial neural network), respectively. A larger floor size determines the size and number of rooms. Properties with more rooms and large sizes are valued more than properties with few rooms of small sizes. The study has further depicted that an additional bathroom significantly increases the value of a property by 9.4% and 1.5%, respectively. People place higher values on properties with contemporary modern bathrooms are valued more as compared to those housing designs without this facility.

Results obtained from the study have further shown that the availability of parking space on a property significantly increases the value of property by 14.6% and 4.5% respectively. The availability of parking space reduces cost associated with paying parking services after working hours. The reduction in cost is incorporated by sellers when valuing their properties resulting in higher property values. The study also noted that if a property is situated in a well-established location, the property is given a higher value by 12.7% and 1.4%, respectively, compared to less established locations. Well-established locations have developed roads, business centres, well run municipalities, well-managed waste and energy, and easy access to public services such as hospitals and government services. Due to these benefits, properties located in well-established locations are valued more than less established locations. The study has further found that prices of homogenous properties sold in a neighbourhood significantly influence the value attached a property when owners are deciding their willingness to accept. The results depicted that neighbourhood prices determine approximately 58.9% and 20.8% of sellers' willingness to accept, respectively. The prices of these homogeneous properties significantly determine the value sellers/owners attach to their properties.

Regarding the fitness of the models, the ordinary least squares regression on model A has the best fit since the R squared (85.5%) and the adjusted R squared (84.4%) are above 80%, implying that the explanatory variables included in the model are accurately estimating the value of the properties. The Durbin-Watson statistic is within the range of 2; the model does not suffer from serial correlation. The F statistic that tests the explanatory variables' overall joint significance is high and significant at 1%. The root means square error of model A is less than one, and it reflects the goodness of fit of model A. The artificial neural network of regression model B has an

Table 1. Residential properties' attributes' influence on Willingness to Accept.

Dependent Variable	Willingness to Accept (WTA) Property Value	
	Linear Regression	Multilayer Perceptron
	Model A	Model B
Location	0.127**	0.014
Floor Size	0.270***	0.363
Price per floor area	0.243***	0.350
Bathroom	0.094*	0.015
Parking Space	0.146**	0.045
Shopping Mall in a 5km radius	0.124**	0.005
Neighbourhood House Prices	0.589***	0.208
R Squared	85.5%	89.8%
Adjusted R Squared	84.4%	
Durbin Watson (Testing for Serial Correlation)	2.102	
RMSE	0.724	0.053
F – Statistic	71.840***	

Source: SPSS v26

Model 1 - [*** (0.01 level of significance), ** (0.05 level of significance) and * (0.1 level of significance)]

Model 2 - [No underlying assumption of significance]

Table 2. Factors influencing willingness to pay for Residential Properties.

Dependent Variable	Willingness to Accept (WTA) Property Value	
	Linear Regression	Multilayer Perceptron
	Model A	Model B
Willingness to Accept (Property Value)	0.401***	0.788
Log (Discount)	0.083***	0.073
Log (Neighbourhood House Prices)	0.557***	0.099
Location	0.038*	0.039
R Squared	96.3%	99.7%
Adjusted R Squared	96.1%	
Durbin Watson (Testing for Serial Correlation)	2.155	
RMSE	1.265	0.001
F – Statistic	665.569***	
Breusch-Pagan test (Homoscedasticity)	0.059	

Source: SPSS v26

Model 1 [*** (0.01 level of significance), ** (0.05 level of significance) and * (0.1 level of significance)]

Model 2 [No underlying assumption of significance]

R squared of 89.8% (Mwanyepedza, 2023b), and a lower root mean squared error of 0.053. Comparing the ordinary least squares and the artificial neural network, the artificial neural network has a more robust predictive power than the ordinary least squares since the artificial neural network has a higher r squared of 89.8 compared to that of model A of 85.5%. The root means the square error of 0.053 of the artificial neural network is much lower than that of the ordinary least squares. Therefore, the findings from the study are consistent with the growing literature, which notes that the multilayer perceptron of the artificial neural network provides a better predictive model than the linear regression model (Bajracharya, 2010; Ghodsi *et al.*, 2010; Ghorbani & Afgheh, 2017; Limsombunchai *et al.*, 2004; Limsombunchai, 2004; Maier & Dandy, 2000; Mohd Radzi *et al.*, 2012; Moreno *et al.*, 2011; Nemati *et al.*, 2020; Papadopoulos *et al.*, 2021).

The study further estimated the factors influencing willingness to pay for residential properties in the Eastern Cape, South Africa. The study has shown that the prevailing prices of residential properties significantly influence a buyer's willingness to pay. The results obtained from the study have shown that buyers' willingness to pay increases by 40.1% and 78.8% if the prevailing market price is high. Consumers tend to gauge a product's quality based on its price. However, numerous empirical studies have demonstrated that when customers are unclear about a product's quality, they frequently believe that a more fantastic product price denotes better quality (Bedeian, 1971; Nöhning, 2011; Steenkamp, 1988). The study has further noted that the availability of discounts increases consumers' willingness to pay by 8.3% and 7.3%, respectively. Buyers believe good deals enable them to obtain consumer surplus since they are rational agents willing to pay less than the product's value. To avoid paying more than the actual value of a product, buyers check the price of houses sold in the same neighbourhood. If the property price aligns with other homogeneous properties previously sold, buyers' willingness to pay increases by 55.7% and 9.9%, respectively. Buyers are also willing to pay more if the property being sold is in a well-established location. Buyers' willingness to pay for correctly juxtaposed property increases by 3.8% and 3.9% respectively.

Considering the overall robustness of the models, the ordinary least squares have an R squared of 98.1% and an adjusted R squared of 96.1%. The two proxies are all above 80%, implying that changes in the independent variables explain variations in the willingness to pay. The model has a Durbin-Watson test of 2.155, which is around 2, and it explains that there is no serial correlation in the model. After conducting the Breusch-Pagan test, the squared residuals did not increase as hedonic characteristics changed. The significance level was more than 0.05, indicating that the model is not suffering from Heteroskedasticity. The root means the square error is low, and the F statistic, which measures joint significance, is significant at 1%. On the same note, the multilayer perceptron of the artificial neural network model has shown a lower root mean square error which is 0.001, and a high r squared of 99.7% (Mwanyepedza, 2023b). The multilayer perceptron

of the artificial neural network has demonstrated a more predictive power since it has shown a higher r squared and a lower root mean square error than that of the linear regression model. These results are also consistent with the finding from regression model 1, which analysed the effect of house attributes and public amenities on property values and other previous empirical findings such as those (Ghorbani & Afgheh, 2017; Maier & Dandy, 2000; Nemati *et al.*, 2020; Papadopoulos *et al.*, 2021).

Discussion

After estimating the effects of housing characteristics and public amenities on residential properties, the study found that property attributes such as the availability of bathrooms, floor size and parking spaces significantly influence property values. According to Simona Canepa (2019), bathrooms play a pivotal role in improving the well-being of people, and over the years, the role of a bathroom has evolved from a service room to a wellness room, a room where time can be spent. In addition, Jaglarz (2021) further asserted that bathrooms are special place for health care, widely understood as keeping the body in cleanliness and good psychophysical condition, a place looking after beauty, a place of relaxation, fitness, a place with health functions, including those related to medical prophylaxis. Such facilities' availability makes a residential properties more of a home as it goes beyond a stay (Baugh, 1989). Therefore, properties with bathrooms especially contemporary ones get valued more than properties without bathrooms. The study has further asserted that, residential properties with parking spaces are valued more than those without parking bays. Demand for parking by residents is strongly determined by car ownership (De Groote *et al.*, 2018). Ownership has increased strongly in the South Africa, with 6,872,000 cars in 2005 to 9,600,412 cars in Dec 2015 (Luke, 2018). The increase in car ownership is also associated with an increase in demand for sectional multi-storey residential properties with limited parking space as compared to number residents owning the property. The demand for sectional properties has increased from 8 percent in 2003 to 22 percent in 2018, showing a percentage increase of 14%. The increase in demand for residential properties with parking spaces due to the aforementioned factors is contributing to the increase in value of properties with parking spaces. Structurally, the study has further shown that floor size of residential properties significantly increase the value of a property. Families requires properties with larger floor areas to accommodate their movable properties. Properties with larger floor areas have attracted families who are wealthier it larger floor areas implies more bigger sized rooms which accommodates extended families, friends and even work from home facilities.

The study has further noted that the location of a residential property directly affects residential property values. Location has been discussed in the literature in different ways. According to Hurtubia *et al.* (2010), it has been discussed regarding the neighborhood's qualities, including features like vistas, parks, schools, and community services. Other locational factors that affect residential property value include those that are related to the neighbourhood, such as environmental aspects,

levels of safety, and existing urban infrastructures like roads, drainage systems, public transportation, health and education facilities, and other neighbourhood services (Fernandez-Duran *et al.*, 2011). The study has found that these location decisions significantly influence the value of residential properties. The study has further alluded that close proximity to shopping malls significantly influence property values. Shopping malls are now playing an increasingly important role in people's daily lives and can offer residents with huge conveniences. As a result, people are residential property dwellings which are of close proximity shopping malls are valued more (Wilhelmsson & Long, 2020). Zhang *et al.* (2019) also concluded shopping mall has a significant impact on housing prices although the significance decays with distance. Therefore, shopping malls are of paramount importance when determining house values.

Previous studies have investigated the effect of neighbourhood characteristics on house prices and little attention have been given to neighbourhood prices of homogeneous properties. The study has estimated the effects of neighbourhood prices of homogeneous properties. The study found that prices at which neighbourhood homogeneous properties were sold at significantly influence property prices. This show that property owners check prices other properties have been sold at before valuing their properties. In literature the concept is borrowed from the relative valuation model. Relative valuation model states that peers and competitors are taken into consideration before analysing and determining the value of assets (Jr, 2013). Relative valuation according to Pétursson (2016) states that similar assets should be priced similarly, and it assumes that the markets are correct on average, but individual assets are mispriced. In the case of residential property valuation, owners/sellers consider valuations decisions by their peers before valuing their properties since they individually mispriced. Relative pricing plays a significant role in addressing mispricing caused by individually pricing properties.

The study has further estimated the factors influencing buyers' willingness to pay for housing units in the market. The study has found that the property's location significantly influences buyers' willingness to pay. Locational decisions have been discussed regarding proximity to public amenities, state of public infrastructure such as schools, and hospitals, waste and energy management, and neighbourhood disamenities such as noise, crime, and pollution. Buyers prefer to acquire properties in geographic locations that are desirable and best meet their needs. Tan (1999) has defined housing as a bundle of multidimensional utility-bearing characteristics based on individual needs, so buyers will prefer a local with a bundle of utility-bearing characteristics that increases that meet their needs and improve their well-being. The results show that prevailing market prices significantly influence buyers' willingness to pay. Consumers tend to gauge a product's quality based on its price. However, numerous empirical studies have demonstrated that when customers are unclear about a product's quality, they frequently believe that a more fantastic product price denotes better quality (Nähring, 2011). Housing quality can be measured by gauging the quality of materials used, proximity to amenities and their ability to satisfy the

buyer's needs. However, this information may not be readily available as the real estate sector is characterized by imperfect information. Buyers end up using price as a signal.

Furthermore, the availability of consumer discounts has increased the buyer's willingness to pay for the property. The availability of discounts leaves buyers better off as it increases consumer surplus since buyers will have paid less than what the sellers were willing to accept. Therefore, buyers will be willing to settle a transaction with a higher consumer surplus than with none. One of the strategies buyers use to avoid being overcharged is to check the prices of other homogeneous properties sold in suburbs of interest. If the price is in line with other properties sold in that area, then the willingness to pay increases. Zhou *et al.* (2015) noted that information asymmetry might exist due to search disadvantages as those who do not live in the area where they want to buy their property might be unaware of the prevailing market prices of houses in that area. This could result in buyers paying a higher premium than those who live within the suburbs. To address this challenge, buyers tend to check the price of other homogeneous products sold in the same neighbourhood they are interested.

Recommendations

The study was limited to the data obtained from Property 24 (<https://www.property24.com/>) from August 2021 to January 2022 for two leading metros in the Eastern Cape Province, Buffalo City Municipality and Nelson Mandela Bay. The data obtained was limited to asking prices, the actual property sold for, structural characteristics such as the number of bedrooms, and public amenities such as near schools, shopping centres, and medical facilities from 120 properties. The study utilized estimation techniques that best suit the available data and the study's results remained unbiased. Given the results obtained, the recommended that public amenities and desired housing structural features remain crucial in valuing properties and providing decent accommodation. Public amenities such as banks and post offices, affordable and easy access to utilities such as electricity, water, natural gas and internet, clean air; general and specialized shops and markets; hospitals, clinics, and other medical facilities; libraries and cinemas; local buses and railway stations and airports and ferry terminals significantly influence the value attached to residential properties. Therefore, to improve the quality of life for residents and increase property values of residential properties, local authorities should construct public amenities close to residents.

Structural features play a significant role when determining the value of a property. Buyers expect a property to have specific utility-bearing characteristics that improve their social life. The study has shown that the availability of bathrooms, garages, and large floor areas increases the value of properties as the willingness to accept is higher when a property possesses these characteristics. Therefore, the study recommends that, for properties to have more excellent value, urban town planners should promote residential plans with more significant floor areas, bathrooms, and parking space since the study has shown that the availability of these features adds value to properties. Affordable housing with desired features and of

recommended proximity to amenities is also ideal for residents. Lastly, in line with sustainable development goals and the South African government infrastructure development plans towards achieving safe, affordable residential properties, the study contributes towards policy formulations that meet the expectations of buyers and residents. The study brings engineering to the people by bridging the gap between town planners, engineers, and the community's needs. There are well-established infrastructures across the country not being utilized due to the proximity of the amenities. The study provides insights into such issues. Again, households and communities have different needs and priorities.

Conclusion

Using data obtained from Property24, a property portal where property listings for sale and rent from leading real estate agents have been advertised. The researcher estimated the impact of hedonic property characteristics on property values and willingness to pay using a multiple linear regression model and artificial neural network. The results obtained from the study revealed that property values are mainly influenced by the structural features and public amenities of a property, such as the number of bedrooms, availability of a garage, nearness to shopping malls and the general location as well as consideration of the prices of homogeneous properties sold in the same suburbs. On the other hand, willingness to pay buyers is significantly influenced by bargaining strategies such as the availability of discounts, the value of the property, and the price at which neighbourhood properties have been sold. The results from the multilayer perceptron of the

Artificial Neural Network provided more robust results since the r squared for the model was higher than that of the linear models, and the root means the square error was lower than that of the linear model.

Data availability

Underlying data

Figshare: Willingness to Accept and Willingness to Pay on Residential Properties – A Hedonic Approach.xlsx. <https://doi.org/10.6084/m9.figshare.22200976.v3>. (Mwanyepedza, 2023a).

The project contains the following underlying data:

- Willingness to Accept and Willingness to Pay on Residential Properties - A Hedonic Approach.xlsx (Primary data used for analysis in the study and key for headings).

Extended data

Figshare: <https://doi.org/10.6084/m9.figshare.22256620.v1>. (Mwanyepedza, 2023a).

This project contains the following extended data:

- Appendix.docx. (The goodness of fit of multilayer perception (MLP) of artificial neural network (ANN) approach for willingness to accept (WTA)).

Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication).

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Courage Mlambo

Faculty of Management Sciences, Mangosuthu University, Durban, South Africa

The introduction section lacks steam. It failed to speak to the title of the study; if one were to read the introduction section without having looked at the title first, they were not going to know what the study is about. The introduction section should be concise and it should reflect and detail the main issues contained in the title of the study. The introduction section present by the study is also short.

Theoretical background – is this not supposed to be titled literature review? I can see that after discussing the theories, the study went on to review some of empirical studies? This is not theoretical in nature but rather empirical.

Data collection – how reliable is data from property 24? Please mention this. Are there any other data repositories that keep property data?

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Yes

Does the piece present solutions to actual real world challenges?

Yes

Is real-world evidence provided to support any conclusions made?

Yes

Could any solutions being offered be effectively implemented in practice?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Environmental Economics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 09 June 2023

<https://doi.org/10.21956/emeraldopenres.16132.r28890>

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Oliver Takawira 

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The study estimated the hedonic characteristics influencing the willingness to accept and willingness to pay for housing facilities in the Eastern Cape Province, South Africa. Due to high urbanisation governments are forced to build facilities that assist people moving to urban areas. The research finds that when making decisions to acquire a property, buyers consider the availability of discounts and the prevailing property price. Overall, willingness to pay and accept decisions are mainly determined by location and the price at which homogeneous neighborhood properties were sold. Therefore, the study recommends that urban town planners and other housing authorities prioritize the construction of properties with larger floor areas, parking bays, and bathrooms using a cost-effective mechanism that makes the properties affordable to residents.

The model was perfect for the analysis and methodology. The results are authentic and verifiable as well as in line with previous research. The article was well articulated, written and presented with no errors. The article properly flows that a laymen can understand and learn. The article is therefore fit for approval, acceptance and passing peer review.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Is the argument information presented in such a way that it can be understood by a non-academic audience?

Yes

Does the piece present solutions to actual real world challenges?

Yes

Is real-world evidence provided to support any conclusions made?

Yes

Could any solutions being offered be effectively implemented in practice?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Financial Economics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.
