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The Spatial Dimensions of Real Estate Markets: Analysis of Spatial Effects on Rental Values in the CBD Wards of Kisutu, Kivukoni and Mchafukoge in Dar es Salaam

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Abstract

The location of commercial real estate in Central Business Districts (CBDs) is crucial for determining their Property Rental Values (PRV). Real estate economics predicts that properties close to amenities in prime spatial locations command higher PRV. This study focused on three wards in the CBD of Dar es Salaam, Tanzania: Kisutu, Kivukoni, and Mchafukoge. Using a Hedonic model, the research analyzed data by regressing PRV per square meter on property and neighborhood characteristics, while spatial dependence was represented through a dummy variable reflecting enjoyment from spatial amenities offered by the ocean (e.g., proximity to walkable areas/beach, ocean scenic view, quality air/breeze) and proximity to open spaces like a golf playground. The regression results indicated that proximity to walkable areas/beaches and perceived air/breeze quality positively and significantly influenced PRV, leading to USD 1.798 and USD 1.043 higher rent per square meter respectively, for areas enjoying the amenities than those otherwise. However, the presence of an ocean scenic view and proximity to open spaces did not significantly affect PRV. These findings highlight the importance of spatial amenities in contributing to PRV in CBD properties, informing real estate developers, investors, and policymakers in making informed decisions on property development, investment strategies, and promoting sustainable and equitable urban development.

Keywords: commercial real estate; property rental values; central business districts; spatial amenities

Introduction

The equilibrium condition of the real estate market is affected by the location and spatial effects (Yuan, et al., 2020). Researches in real estate rental values takes into account a property's relative location, and its position in relation to other locations since locations interact and can influence one another (Gostautas, 2017). Analyzing a range of real estate properties located in different spatial units provides valuable information which is not available at the aggregate level (Bangura & Lee, 2020). The models for pricing real estate properties involve a variety of factors including spatial characteristics (Moralı & Yılmaz, 2020). The property market is unique by nature, as local elements including local schools, markets, hospitals, public infrastructure and demographics are inextricably linked to the rental values of properties inside a given locality (Baum-Snow & Hartley, 2016). An address in a city district, particularly one located inside or outside the CBD, can serve as an indicator of the property's proximity to the city center (Kopczewska & Lewandowska, 2018). The distance to the CBD is therefore considered relevant in determining the property prices in such

a way that Monocentric models illustrate rents and property values decline as the distance to the CBD increases (Meen, 2016).

The Hedonic Pricing Theory (HPT) provides a basic idea that individual neighbourhood specific characteristics and property characteristics each contribute to the overall value of real estate properties (Belke & Keil, 2018). Property rental values therefore give a reflection of hedonic characteristics of the fundamental property but also provide the dynamics associated with neighboring property transactions hence accounting for local dynamics (Milcheva & Zhu, 2020). The presence of spatial effects is also a unique aspect among geographical areas that is considered in deriving property rental values within neighboring cities and suburban areas (Morley, et al., 2018). Spatial effects on rental values can be attributed to both property characteristics and neighbourhood specific characteristics. Spatial amenities such as greenways, open spaces, sea breeze, distance from the beach and scenic spots provide residents with a diversity of ecosystem services beneficial for improving the quality of life (Bucaram & Fernandez, 2019). Due to the limited land supply in high-density cities like Dar es Salam, these spatial amenities are relatively scarce thus, people are more willing to pay a rental premium to live in (Su, et al., 2021).

Space is unique to a property and each property has its unique pricing dynamics that may not be solely influenced by its spatial features (Moralı & Yılmaz, 2020). The characteristics of spatial location are connected to the non-random spatial nature of property rental values. Location rent, which is seen as a premium for prime sites, is a result of the neighborhood's global and local externalities as well as the effects of the relative and absolute location (Kopczewska, et al., 2021). The spatial features that are inherited in property rental values can be addressed in a few different ways. However, when conventional models seek to evaluate commercial property rental values without accounting for spatial dependence, they may fail to accurately represent the extent to which property rental values of different buildings are already correlated (Anselin, 1988; LeSage & Pace, 2010). This may be the case as to why some properties located in the CBDs have similar rental values despite the difference in their proximity to the ocean and open space amenities which do not reflect their prime spatial location. Thus, the impact of spatial features on property rental values in CBDs remains unclear. This raises important questions about the role that spatial factors and amenities play in influencing property rental values in the real estate market within the CBD. Understanding the role of spatial factors and amenities becomes pivotal in comprehending their influence on property rental values within prime locations.

This paper is structured into five sections. The first section has introduced the subject matter of the paper. The second section discusses the study's key variables using existing literature. In the third part, the method of study is presented. The fourth section includes the findings and results of the study, while the last section presents concluding remarks.

Previous Studies on the impact of Spatial amenities on Property Rental Values

In past research on housing markets, researchers have used various methods to determine the values which are associated with specific attributes that make a property more desirable. One crucial set of variables considered in these studies is related to spatial amenities being ocean scenic view, quality air/breeze, proximity to walkable areas/beach and proximity to open spaces.

In a study conducted Bourassa, Hamelink, Hoesli, & MacGregor (1999), they examined the impact of different types and qualities of views on residential property values in Bellingham, Washington using hedonic price model. The regression results of the particular study showed that a full ocean view adds about 60% to market price relative to a similar house with no views and the impact of water views on property values varies inversely with the distance to water. Seiler, Seiler, & Bond (2002) conducted a study which examines the impact of water views on property values. They estimated that a house with a view of Lake Erie has 56% higher value than a house with no view of the Lake. Jim and Chen (2007) investigated property buyers' preferences in relation to spatial/environmental amenities and also assessed the monetary values attributed to spatial amenities by using an HPM. The study discovered that the view of green space had the most significant positive influence on house prices in the study area. Furthermore, the study revealed that individuals demonstrated a willingness to pay a premium amount to enjoy the convenience of having easy access to water bodies located within a 500-meter radius of their property location. Simons and Saginor (2006) examined how environmental amenities can influence property values. They employed regression analyses to assess the impact of contamination and amenity variables on property values. The amenities considered included beach frontage, water views, parks, golf courses, and new housing construction. The researchers discovered that the distribution of positive amenities was not as widespread as that of negative amenities, indicating that certain regions were rich in amenities while others lacked them. Moreover, the study revealed that proximity to these positive features had a positive effect on property prices rather than a negative one.

Paterson and Boyle (2002) used a hedonic pricing model to estimate the impact of different types of views on residential property values in Connecticut. They found that the impact of a water view on house price was negative, suggesting that a house with a water view was valued less than a house without a water view, and however this impact was found to be statistically insignificant. They have suggested that the insignificant negative coefficient on visibility of water was due to lack of observations with water views. In New Zealand context, Bourassa, Hoesli, and Sun (2005) investigated the impact of different types and qualities of a view on the sale prices of residential properties in Auckland using a standard hedonic price model. Utilizing GIS data, it was estimated that at the coastline a wide view commands a premium of 59% compared with a premium of 33% for a medium scope of view on average, whereas the premiums were 18% and 13% respectively when 1,000 metres away from the coast. It was also found a 4.6%–13.3% premium for ocean water views in New Zealand, even when views are distant views. A study by Morancho (2003) on the hedonic price function of dwellings, found that there exists an inverse relationship between the 27 price of dwellings and their distance from urban green areas in the city. The study estimated that for every 100m away a dwelling is located from a green area, the housing price decreases by approximately 300,000 pesetas which is approximately 1,800 USD. Henderson and Song (2008) assessed the additional value of various types of open spaces in a residential market using the hedonic pricing model. The research findings revealed that property values tend to rise as the proximity to open spaces increases. Furthermore, the size of nearby open spaces was found to have an impact on property values. The study also found that the value of being adjacent to public open spaces within walking distance, as well as being close to the nearest open space, was particularly significant for properties with smaller private yards.

According to Benson et al. (1998), the amenity of a view is not consistent and can vary depending on the type (such as water view, mountain view, or valley view) and quality (including full view, partial view, or poor partial view). By categorizing views as ocean front, ocean view, partial ocean view, and no view, the researchers found that compared to having no view, having an oceanfront view increases a property's rental value by 147%, an ocean view increases it by 32%, and a partial ocean view increases it by 10%. Landry and Hindsley (2011) studied beach nearing homes in Tybee Island, Georgia and Using spatial lag hedonic pricing regression models concluded that moving away by 100 meters from a quality beach, home values decline by 21%, and it declines 39% if 200 meters away, and 50% if 300 meters away. The quality of beaches is important for fetching higher price premiums. Gopalakrishnan, Smith, Slott, and Murray (2011) studied coastal properties within 550 yards of the ocean in 10 towns in North Carolina using a hedonic pricing model and found an $8,800 premium for every unit increase in the beach width (in feet) for ocean front homes. Bark, Osgood, Colby and Halper (2011) using hedonic pricing model studied arid Tucson Arizona, conclusion from the regression analysis results provided that green open spaces proximal to the property create a 21.4% premium $45,729 for houses with greenness in their neighborhood and 8.4% premium $17,860 for houses with lot-level greenness. Bowman, Thompson, and Colletti (2009) Studied homes in Cedar Rapids, Iowa, using hedonic pricing models and concluded there is a 3.9% ($8,688) price premium for homes in the subdivision with more conservation features in the subdivision.

All the reviewed studies above share a common finding which highlight the significant influence of spatial amenities on property rental values. Building upon this existing knowledge, this study adds to existing knowledge by examining the influence of spatial amenities on rental values in the CBD wards of Kisutu, Kivukoni, and Mchafukoge in Dar es Salaam. The research highlights the consistent impact of spatial amenities on property rental values in these specific areas.

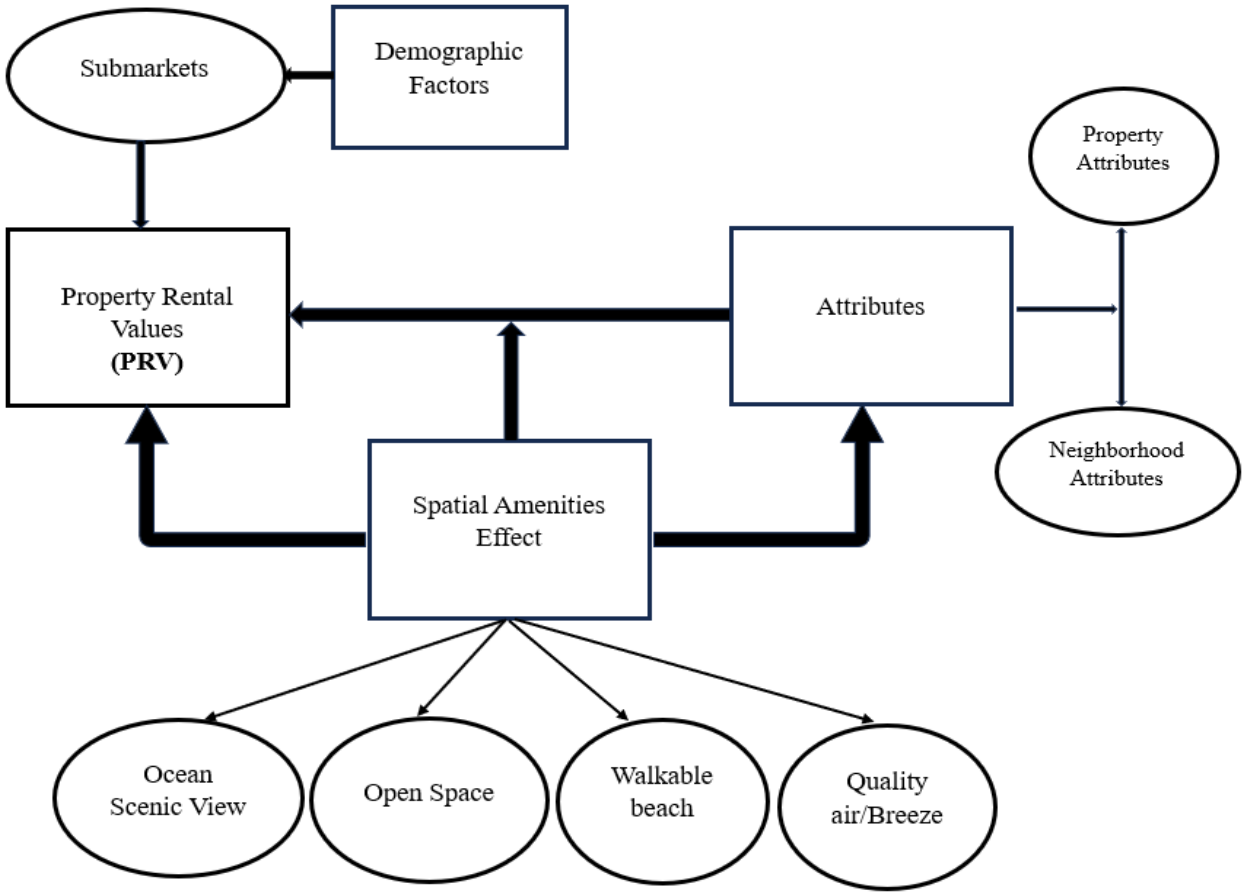

Figure 1: Conceptual framework

Source: Authors Own Construct (2023)

Study Area and Research Methods

The geographical scope of the research was limited to the central business district (CBD) specifically for commercial buildings located in Kisutu, Mchafukoge and Kivukoni areas, located within the Ilala district, surrounded by good spatial amenities such as proximity to ocean, good view, quality air, and open space. Ilala Municipality is situated in the eastern part of the Dar es Salaam region, serving as an administrative district within the region. It spans a geographical area between longitude 39^{o} and 40^{o} east and latitude 6^{o} and 7^{o} south of the equator. As part of Dar es Salaam city, it is positioned in the far eastern corner of the region, with a coastline along the Indian ocean extending approximately 10 kilometers to the east. The municipality comprises 26 wards, including notable ones such as Ukonga, Tabata, Ilala, Buguruni, Jangwani, Kisutu, Mchafukoge, Kivukoni, East and West Upanga, and Kariakoo. These wards contribute to the social fabric and diversity within Ilala Municipality.

Kisutu, Kivukoni, and Mchafukoge wards are specific administrative divisions within the larger Ilala Municipality in the Dar es Salaam Region of Tanzania. Kisutu ward is centrally located and

serves as a significant commercial and administrative hub with vibrant markets and active commercial activities. It shares borders with Upanga east ward and Kivukoni ward to the north and northeast, Mchafukoge ward to the south, and Jangwani ward to the west. The population of Kisutu Ward has been growing, reaching 10,404 individuals in 2016, compared to 8,308 individuals in 2012. Kivukoni ward is situated in the northeastern part of Ilala Municipality near the Indian ocean. Its coastal location, with an area of 2.387 square kilometers, makes it a significant ward in the country. The ward is known for its "crossing place" (Kivukoni) due to its proximity to the ocean. It shares borders with Upanga East ward to the west, Kisutu ward to the southwest, and Kigamboni ward across the Kivukoni channel. Kivukoni Ward is home to the Ikulu, the official residence of the President of Tanzania, as well as the National Museum of Tanzania. The 2012 census recorded a total population of 6,742 individuals in Kivukoni ward. Mchafukoge ward serves as the district capital within the Ilala district of Dar es Salaam region. It is located in the southwestern part of the Ilala Municipality, offering a mix of residential and commercial areas. The ward shares borders with Kisutu and Kivukoni wards to the north, the Dar es Salaam Harbor to the east, Kurasini and Keko wards to the south, and Kariakoo and Jangwani wards to the west. With its dynamic nature, Mchafukoge Ward has seen a population increase, reaching 13,384 individuals in 2016 compared to 10,688 individuals in 2012.

This study employed a quantitative approach and utilized the survey method to investigate the behaviors of properties and households in the Kisutu, Mchafukoge, and Kivukoni areas within the Ilala Municipality. Data collection involved households and property managers, with the main research instrument being a structured questionnaire. The sample selection followed a two-stage sampling technique, where geographically defined clusters were randomly chosen, and individual sampling units were then selected by random sampling to achieve a two-stage cluster study (Famuyiwa, 2018). The sample size of 120 properties was considered, allowing for a representative of the real estate market in the study areas and providing data for meaningful analysis.

The sample encompassed various types of properties, such as residential, mixed-use, and commercial properties, ensuring a diverse representation of the market. A total of 130 questionnaire was administered but because of different challenges from the respondents, only 120 questionnaires were received back, 27 for Kisutu, 43 for Kivukoni and 50 for Mchafukoge which were later analyzed to provide the results of the study.

The collected data was subjected to both descriptive and inferential statistical analyses. The hedonic pricing model (HPM) model was utilized to discern meaningful value inferences pertaining to the variables considered in the study. The hedonic pricing model describes the functional relationship that exists between property rental value as well as associated relationships that exists between physical characteristics and neighbourhood characteristics (Sirmans, et al., 2005).

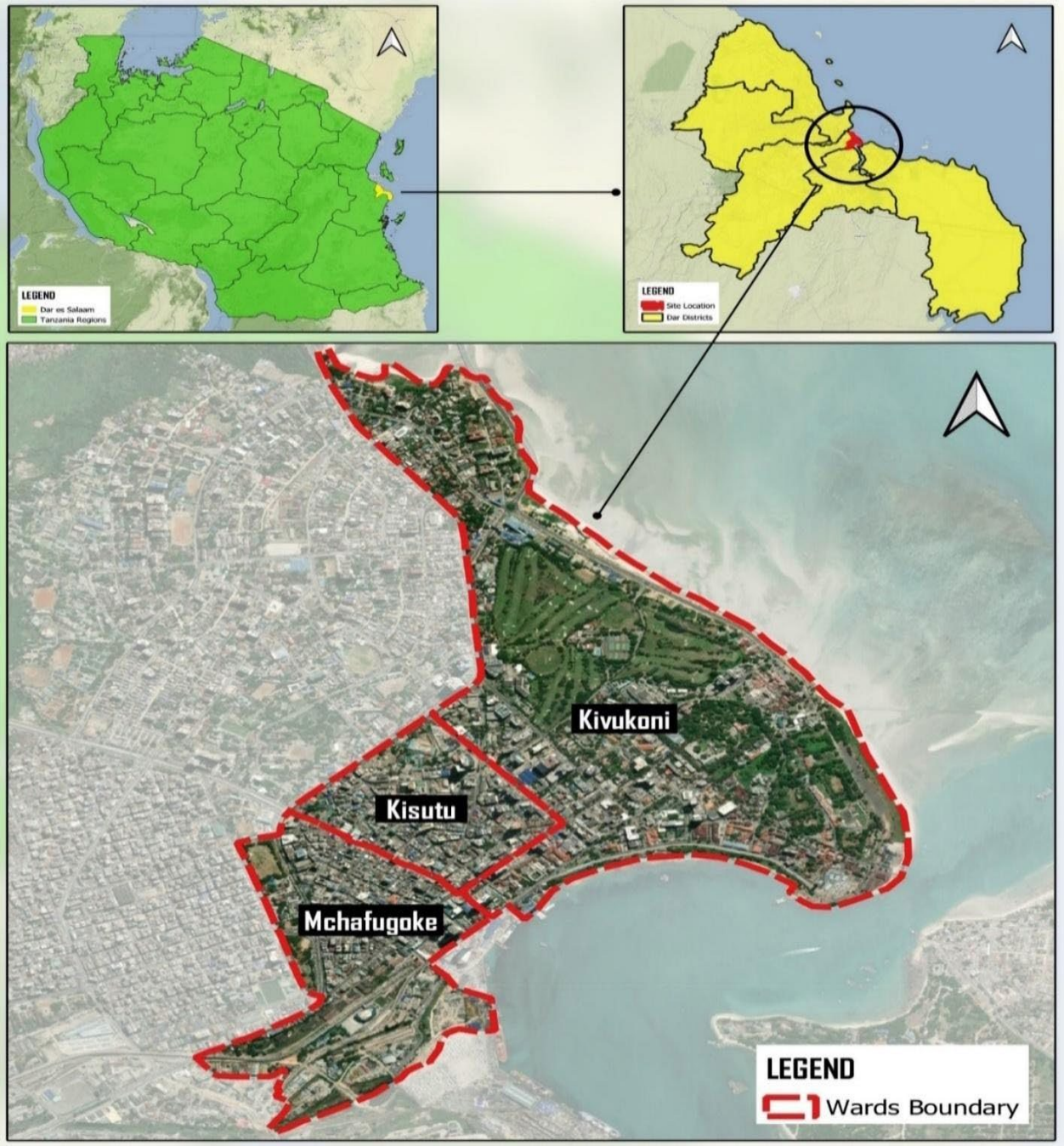

Figure 2: Study Area – Kivukoni, Mchafukoge and Kisutu, Ilala, Dar es Salaam, Tanzania

The analysis of the data collected from the tenants was done using multiple regression model to determine the interrelationships between (Independent Variables) Property attributes (Chau, et al., 2001), house hold characteristics property attributes (Chau, et al., 2001), house hold characteristics (Lim & Lee, 2013), neighborhood attributes (Abidoye & Chan, 2016), and the presence of specific spatial amenities (Simons & Saginor, 2006), which have a significant effect on property rental values (dependent variable). The model is not only capable of handling the problem of interactions amongst the independent variables but also it enables us to know the contributions or the

importance of each variable to the explanation of variation in the dependent variable (Property rental value). It also allows for the prediction of value of the dependent variable.

According to (Olujimi & Bello , 2009), Property rental values (dependent variable) is considered as a function of various factors. This can be presented in a formula for a multiple linear regression as:

$Y=\beta O+ \Sigma\beta_1 x_1+\ldots\ldots \Sigma\beta_n X_n + \varepsilon$……. equation (1)

Whereby,

Y= Predicted value of dependent variable

βo= The y-intercept (value of y when all parameters are set to 0)

$\beta_1 x_1$= Regression coefficient (B_1) of the first independent variable (X_1)

$\beta_n X_n$= The regression coefficient of the last independent variable

ε = Model error

For the case of this stud, the model can be termed as below

R= f (PA, PNA, SD, PNA*SD, PA*SD) ……..……..…equation (2)

However, the application of the model to our case study depicts the rent function to be theoretically formulated as;

$R_i = \beta o + \beta_{1i} \sum_{i=1}^{6} PA + \beta_{2i} \sum_{i=1}^{11} PNA_i + \beta_{3i} \sum_{i=1}^{4} SD_i + \beta_{4i} \sum_{i=1}^{1} SD_i * PNA_i + \beta_{5i} \sum_{i=1}^{1} SD_i * PA_i + E_i$……equation (3)

This is estimated as

$R_i = \hat{\beta} o + \hat{\beta}_{1i} \sum_{i=1}^{6} PA + \hat{\beta}_{2i} \sum_{i=1}^{11} PNA_i + \hat{\beta}_{3i} \sum_{i=1}^{4} SD_i + \hat{\beta}_{4i} \sum_{i=1}^{1} SD_i * PNA_i + \hat{\beta}_{5i} \sum_{i=1}^{1} SD_i * PA_i$……equation (4)

Where,

PNA= Property Neighborhood Attributes

PA= Property Attributes

PNA=Property Neighborhood Attributes

SD= Spatial dependence/Spatial amenities attributes

3.1 Description of Regression variables

This part enlists and describes the variables related to the study, the abbreviation of those variables and description based on each variable.

Table 1. Description of property attributes variables

Property Attributes			
S/n	**Variable Name**	**Description**	**Abbreviation**
1	Parking Space	Parking available = 1, Otherwise = 0	PS
2	Number of floors	Number	NF
3	Toilets	Number	TLS
4	Bathrooms	Number	BRM
5	Security systems (Cameras, Alarm system)	Security systems present = 1, Otherwise = 0	SCS
6	Lifts/Elevators	Lifts present = 1, Otherwise = 0	LE
7	Wi-Fi hotspot	Wi-Fi available = 1, Otherwise = 0	WH
8	Swimming pool	Property has swimming pool (1=Yes, 0 =No)	SP
9	Sewage disposal	Sewage disposal present (1=Yes, 0= No)	SD
10	Garden	Property has Garden (1=Yes, 0= No)	GDN
11	Property management service	Management present (1=Yes, 0=No)	PMS
12	Wall fences	Has wall fence (1=Yes, 0=No)	WF
13	Heaters	Has heater (1=Yes, 0=No)	HT
14	Cooling systems (Fans and ACs)	Has cooling systems (1=Yes, 0=No)	CS
15	Automatic Standby generators	Has generator (1=Yes, 0=No)	ASG
16	Availability of electricity	Has electricity (1=Yes, 0=No)	ELT
17	Availability of water services	Has Water (1=Yes, 0=No)	WTS

The table 1 provides a list of property attributes along with their corresponding measurement scales and abbreviations. These attributes represent various features and amenities that can be found in properties. These attributes provide information about various aspects of a property's amenities, facilities, and services, which can influence its desirability and potentially impact rental values.

Table 2. Description of property neighborhood attributes variables

Neighborhood Attributes			
S/n	**Variable Name**	**Description**	**Abbreviation**
1	Security services	Has Security service (1=Yes, 0=No)	SVS
2	Quietness and Privacy	Has Privacy (1=Yes, 0=No)	QP
3	Accessibility to major roads	Has access to road (1=Yes, 0=No)	MJR
4	Restaurants/Hotels	Restaurants nearby (1=Yes, 0=No)	RST
5	Hospital	Proximity to nearby hospital (1=Yes, 0=No)	HOSP
6	Banks	Access to banks nearby (1=Yes, 0=No)	BNK
7	Educational facilities (Universities, Colleges, Schools)	Access to Education facilities (1=Yes, 0=No)	EDU
8	Markets/Shopping centres	Markets nearby (1=Yes, 0=No)	SHP
9	Police station	Police station nearby (1=Yes, 0=No)	PLS
10	Fire station	Fire station nearby (1=Yes, 0=No)	FST

The table 2. provides a list of neighborhood attributes and their corresponding measurement scales and abbreviations. These attributes are factors that can influence the desirability and quality of a neighborhood. These neighborhood attributes provide important insights into the amenities and

services available in a particular neighborhood, which can influence the desirability and rental values of properties in the area.

Table 3. Description of household attributes variables

Household Characteristics			
S/n	**Variable Name**	**Description**	**Abbreviation**
1	Age of household	Number (In Years)	AG
2	Income level	Exact amount in TZS and US$ (Scale)	INC
3	Nationality	Exact response (Nominal)	NTN
4	Expenditure level	Exact amount in TZS (Scale)	EXP
5	Gender	Dummy (1=Male, 0=Female)	GEN
6	Employment status	Dummy (1=Employed, 0=Unemployed)	EMP
7	Education level category	Primary education is 1, secondary 2, 3 Diploma and 4 is higher education, (Ordinal)	EDL
8	Marital status	Single 1, Married 2 and otherwise 3, (Nominal)	MRS
9	Household occupation	Business 1, Employee 2 and otherwise 3, (Nominal)	OCC

The table 3. provides a list of household characteristics variables and their corresponding measurement scales and abbreviations. These household characteristics variables provide valuable information about the demographic, economic, and social aspects of the households under study. They can be used to analyze and understand the relationships between these variables and other factors of interest in the research or study.

Table 4. Description of spatial amenities variables

Spatial amenities features			
S/n	**Variable Name**	**Description**	**Abbreviation**
1	Scenic view	Access to scenic view (1=Yes, 0=No)	SCV
2	Wind (Ocean breeze)	Enjoy wind from the ocean (1=Yes, 0=No)	WIN
3	Open space	Proximity to open space (1=Yes, 0=No)	OPS
4	Walking ground (Ocean beach)	Proximity to ocean beach (1=Yes, 0=No)	WGR
5.	Spatial amenities and Property characteristics interaction	Interaction effect between spatial amenities and property characteristics	SPPC
6.	Spatial amenities and Property neighborhood characteristics interaction	Interaction effect between spatial amenities and property neighborhood characteristics	SPNC

The table 4. provides a list of spatial amenity features and their corresponding measurement scales and abbreviations. These spatial amenity features highlight specific attributes of the property's surroundings that can contribute to its desirability and potentially impact rental values.

Rental values trend in Dar es Salaam CBD

Real Estate in Dar es Salaam, Tanzania's commercial capital and Africa's fastest growing city, has a current population of about 4.3 million which is expected to rise about 20 million by 2050 (Nyangarika, 2020). It comprises of 35% of all households in Tanzania that are urban, over one-third (35 percent) reside in Dar es Salaam (approximately 2.7 million people, or 1.5 million households) (Gardner, et al., 2020). Real estate sector in Dar es Salaam has attractive rental yields with average yields of 5.2%, 6.4% and 9.3% for residential, office and retail sectors, respectively while a larger percentage of yield is derived along properties located in the CBD (Cytonn, 2018). Within Dar es Salaam, the high-end market comprises of developments CBD areas including Kisutu, Upanga, Kivukoni and other areas where this sector, detached units have the highest yields at 7.8% as they are relatively lower in supply thus able to charge rental premium due to the relatively low supply given the increasing land prices in their locations and available spatial amenities such as sea breeze, water view, open spaces and golf courses (Cytonn, 2018). The proximity and easy access to amenities such as leisure and recreational activities or scenic views lead to higher demand for properties in those locations, resulting in increased PRV in the surrounding areas. This creates a spatially clustered market, where investors and tenants who seek these amenities benefit the most from properties located on the edges of these amenities (Mittal & Byahut, 2016).

4.1 Descriptive statistics for the case study

In Table 5. the descriptive statistics of the sampled properties in the study area are displayed.

Table 5. Descriptive statistics summary for dependent variable and independent variables

Variable	Description	N	Min	Max	Mean	Std. Dev
	DEPENDENT VARIABLE					
	Rent Per Sqm	120	8.0	18.0	13.50	2.1420
	INDEPENDENT VARIABLES					
Gender	Male	120	0	1	.58	.495
	Female	120	0	1	.42	.495
Nationality	Tanzanian	120	0	1	.53	.501
	Other	120	0	1	.47	.501
Marital status	Single	120	0	1	.02	.129
	Married	120	0	1	.79	.408
	Widow/Widower	120	0	1	.18	.382
	Divorced	120	0	1	.02	.129
Age	Age 18-35	120	0	1	.13	.332
	Age 36-45	120	0	1	.50	.502
	Age 46-59	120	0	1	.29	.456
	Age 60-Above	120	0	1	.08	.278
Education Status	Prim Education	120	0	0	.00	.000
	Ordinary Level Education	120	0	1	.06	.235
	Advanced Sec Education	120	0	0	.00	.000
	Diploma	120	0	1	.22	.414
	Bachelor degree	120	0	1	.48	.501
	Masters degree	120	0	1	.24	.430
	PhD	120	0	1	.01	.091
Income	300K-500K	120	0	0	.00	.000

level	510K-1M	120	0	1	.20	.402
	1.1M-1.5M	120	0	1	.20	.402
	1.6M-2.5M	120	0	1	.33	.470
	2.6M-3M	120	0	1	.03	.180
	3.1M-Above	120	0	1	.23	.425
Property type	Office Building	120	0	1	.40	.492
	Retail Building	120	0	1	.17	.374
	Residential Building	120	0	1	.30	.460
	Industry Building	120	0	0	.00	.000
	Mixed Use Building	120	0	1	.13	.341
Occupancy rate	0-20%	120	0	1	.01	.091
	21%-50%	120	0	1	.26	.440
	51%-80%	120	0	1	.38	.488
	81%-100%	120	0	1	.34	.476
Rented area		120	18.00	160.00	50.54	29.69
Neighbourhood characteristics Index		120	.29	1.00	.69	.182
Property Characteristics Index		120	.24	.94	.63	.213
Proximity to Spatial Amenities Index		120	.00	1.00	.67	.285
Neighborhood characteristics*Spatial Amenities Index		120	.00	1.00	.49	.298
Property Characteristics* Spatial Amenities index		120	.00	.94	.44	.269
Valid N (listwise)		119				

The descriptive statistics results indicate that the rent per square meter has a mean value of USD 13.50. This suggests a moderate variability in the rental prices around the average. Demographically, the dataset encompasses a gender distribution of 58% male and 42% female respondents, while 53% of the subjects identify as Tanzanian nationals and 47% as belonging to other nationalities. Marital status profiles a predominant proportion of married participants at 79%. The category of household aged 36-45 years stands out as the most substantial segment, constituting 50% of the sample. The education level demonstrates the prevalence of bachelor's degrees at 48% while income distribution highlights a prominent concentration within the 1.6M-2.5M range, comprising 33% of the data. In terms of property type, the dataset comprises predominantly of office buildings (40%), and a prevailing majority of properties maintain occupancy rates ranging from 51% to 100%.

Regression results

4.2.1 Hedonic regression results

Table 6. Regression coefficients for property characteristics

Coefficients			
Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
(Constant)	6.939	0.862	0.000
Household Characteristics			
Gender category	-0.189	0.167	0.274
Nationality category	0.481	0.151	0.002

Marital Status category	0.252	0.235	0.117
Income category	0.058	0.074	0.436
Job Status category	0.073	0.249	0.771
Property Characteristics			
Parking Space	0.089	0.427	0.834
Good toilets	1.496	0.525	0.005
Good Bathrooms	0.397	0.451	0.004
Security Services	0.246	0.364	0.502
Security Systems	0.881	0.389	0.026
Lifts and Elevators	1.652	0.357	0.001
Water Services	1.022	0.725	0.162
Auto Standby Generator	-0.186	0.400	0.644
Fire alarm & Extinguisher	-0.303	0.413	0.465
Wi-Fi/Hotspot	1.418	0.384	0.001
Sewage disposal	0.078	0.373	0.834
Swimming pool	0.77	0.849	0.367
Garden	-0.064	0.346	0.854
Property management service	0.739	0.340	0.032
Cooling systems	1.242	0.405	0.003
Wall fences	0.742	0.275	0.008

In Table 6 above the regression analysis results indicate that the coefficient for parking space is 0.089, this indicates that for every unit increase in the presence of parking space, there is an expected increase of 0.089 in the rent per square meter, although the coefficient is not statistically significant ($p = 0.834$). The coefficient for good toilets is 1.496. It suggests that properties with better toilet facilities tend to have an expected increase of 1.496 in the rent per square meter ($p = 0.005$). Good Bathrooms, Security Services, Security Systems, Water Services, Auto Standby Generator, Fire Alarm and Extinguisher, Sewage disposal, Swimming pool, Garden, and Cooling systems, the coefficients for these variables indicate their respective impact on the rent per square meter, but none of them are statistically significant as their p-values are greater than 0.05. The coefficient for lifts and elevators is 1.652, indicating that properties with this feature are expected to have an increase of 1.652 in the rent per square meter ($p < 0.001$). The coefficient for Wi-Fi/Hotspot is 1.418, indicating that properties with this feature are expected to have an increase of 1.418 in the rent per square meter ($p < 0.001$). The coefficient for property management service is 0.739. It suggests that properties with property management services tend to have an expected increase of 0.739 in the rent per square meter ($p = 0.032$). The coefficient for wall fences is 0.742, suggesting that properties with wall fences tend to have an expected increase of 0.742 in the rent per square meter ($p = 0.008$). In general, these coefficients provide insights into the relationship between various property characteristics and the rent per square meter. Some features, such as good toilets, lifts and elevators, Wi-Fi/hotspot, and property management services, are found to have statistically significant effects on the rental values, while others do not show significant associations based on the results of analysis.

Table 7. Regression coefficients for neighborhood characteristics

Coefficients			
Model	Unstandardized coefficients		Sig.
	B	Std. Error	
(Constant)	5.294	0.801	0.000
Household characteristics			
Gender category	-0.178	0.165	0.296
Nationality category	0.481	0.151	0.002
Marital status category	0.379	0.231	0.105
Income category	0.058	0.074	0.436
Job status category	0.073	0.249	0.771
Neighborhood characteristics			
Security and safety	1.015	0.217	0.001
Absence of noises	0.837	0.211	0.001
Drainage systems	0.801	0.194	0.001
Accessibility to major roads	1.438	0.732	0.052
Restaurants/hotel	0.494	0.211	0.021
Health facilities	0.668	0.253	0.009
Bank/financial services	0.469	0.310	0.133
Bus stand/Public transport	1.096	0.207	0.001
Educational facilities	1.243	0.255	0.001
Market/Shopping	0.843	0.214	0.001
Local government	0.792	0.221	0.001
Major roads	0.668	0.217	0.003
Police station	0.456	0.194	0.021
a. Dependent variable: Rent per sqm			

The analysis in Table 7. reveals that several independent variables have statistically significant relationships with rental prices. Factors like privacy, security and safety, absence of noises, and drainage system quality have positive impacts on rent, with coefficients of 0.581, 1.015, 0.837, and 0.801, respectively. This means that an increase in these scores leads to estimated rent increases per square meter. Similarly, accessibility to major roads, restaurants/hotels, health facilities, bus stands/public transport, and educational facilities also show significant positive relationships with rental prices, with coefficients of 1.438, 0.494, 0.668, 1.096, and 1.243, respectively. On the other hand, the availability of bank/financial services does not significantly influence rental prices (coefficient of 0.469), and while major roads and police stations have statistically significant coefficients, their impacts are comparatively smaller. Overall, the analysis suggests that privacy, security and safety, absence of noises, drainage systems, and various amenities play significant roles in determining property rental values.

4.2.2 Multiple Regression results

Table 8. Regression coefficients for spatial amenities

Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
(Constant)	4.405	0.758	0.001
Property characteristics	4.268	1.558	0.007
Neighbourhood characteristics	9.032	1.932	0.001
Proximity to walkable area/beach	1.798	0.368	0.001
Ocean scenic view	0.042	0.435	0.092
Quality air/breeze	1.043	0.290	0.027
Proximity to open space	0.754	0.403	0.064

The findings of the study a show that proximity to walkable area/beach variable has a coefficient of 1.798, indicating that a one-unit increase in proximity to walkable areas or beaches is associated with an increase of 1.798 units in the rental value per square meter. The standardized coefficient (Beta) of 0.410 suggests that this variable has a relatively strong positive impact on rental values. Ocean scenic view variable has a coefficient of 0.042, which indicates a very small positive effect on rental values. The non-significant p-value (0.923) suggests that the relationship between ocean scenic view and rental values is not statistically significant in this model. Quality air/ ocean breeze variable has a coefficient of 1.043, indicating that a one-unit increase in the perceived quality of air or breeze is associated with an increase of 1.043 units in rental value per square meter.

The standardized coefficient (Beta) of 0.182 suggests a moderate positive impact on rental values. Proximity to Open Space variable has a coefficient of 0.754, indicating that a one-unit increase in proximity to open spaces is associated with an increase of 0.754 units in the rental value per square meter. The p-value (0.064) is close to the significance threshold of 0.05, suggesting a marginally significant relationship with rental values. Based on these regression results it can be concluded in summary that proximity to walkable areas/beaches and perceived quality of air/breeze have positive and statistically significant effects on property rental values. However, the presence of an ocean scenic view and proximity to open spaces have relatively weaker or marginally significant effects on rental values in this model. These findings are consistent with the studies by Simons and Saginor (2006), Jim and Chen (2007), and Cho, Lambert, Kim, Roberts, and Park (2011). These studies emphasized the positive influence of proximity to desirable amenities such as beaches, parks, and open spaces on property values. Also, the findings align with the study by Morancho (2003) which highlighted the negative impact of nearby open spaces on property values.

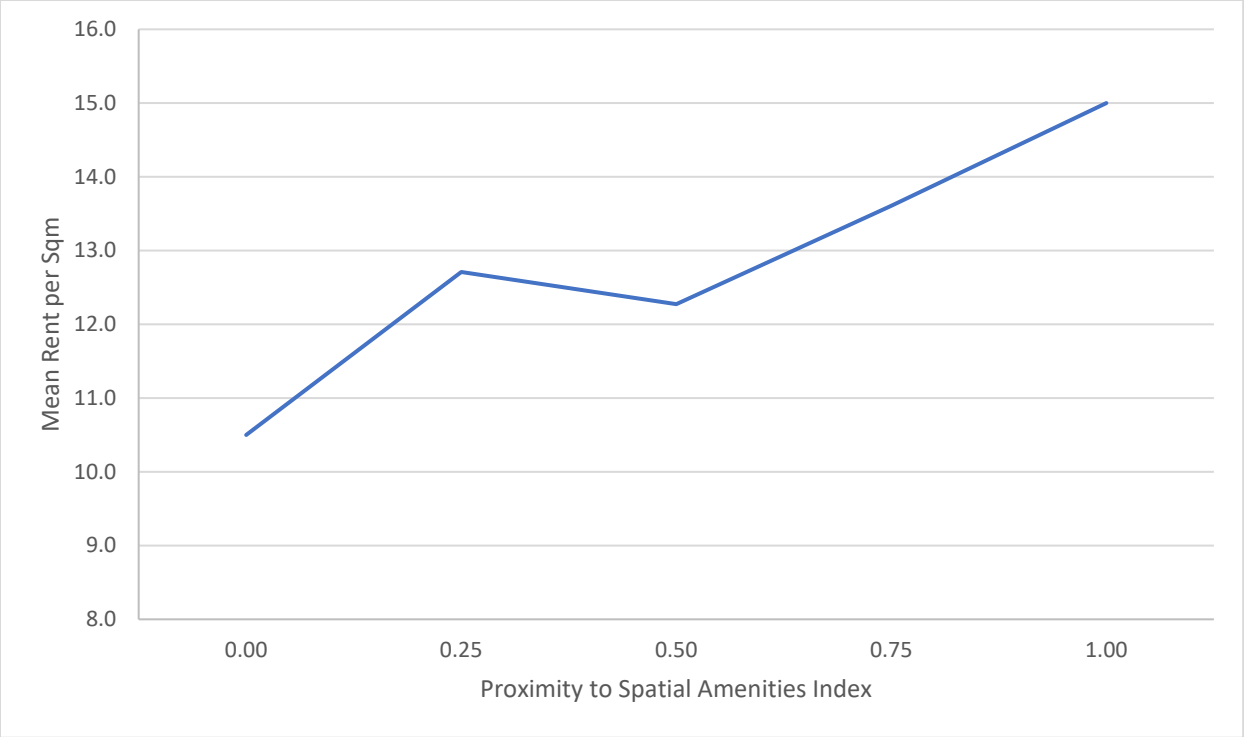

Figure 2. The relationship between spatial amenities effect on property rental values

Source: Authors Own Construct (2023)

Table 9. Regression coefficients for Property characteristics and Spatial amenities interaction

Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
(Constant)	6.384	.346	.001
Property characteristics	3.619	1.550	.021
eighbourhood characteristics	6.664	1.736	.001
Neighborhood characteristics and spatial amenities effect	5.372	.439	.001
Property characteristics and spatial amenities effect	6.052	.473	.001

The regression results indicate two models with the dependent variable "Rent Per Sqm" and two interaction predictor variables. In the first model, the "Property Characteristics* Spatial Amenities effect" has a significant positive effect on rent per square meter (coefficient of 6.052, $p < .001$). This suggests that the combined impact of property characteristics and spatial amenities has a strong influence on rental prices. The standardized coefficient (beta) of 0.762 shows the relative

importance of this predictor in explaining the variation in rent. Similarly, in the second model, the "Property neighborhood characteristics and spatial amenities" interaction also has a significant positive effect on rent per square meter (coefficient of 5.372, $p < .001$).

The standardized coefficient (beta) is 0.748, indicating its relative importance in explaining the variation in rent. Both models highlight the importance of considering the joint effects of property characteristics and spatial amenities in understanding rental prices. An increase in the combined effect of these variables leads to a higher rent per square meter in both cases. These findings align with several studies having explored the individual effects of property characteristics and spatial amenities on rental values. For example, Ozus (2009) found that factors like the number of floors in buildings and the presence of social facilities within the buildings significantly influenced office rents. Sirmans et al. (2005) highlighted the significant effect of bathrooms on property values. Jim and Chen (2007) demonstrated the impact of urban environmental elements on residential rental values. The graphs that illustrate the trends of simple line mean of neighbourhood characteristics and property characteristics interaction with spatial amenities index by rent per sqm is present are shown below;

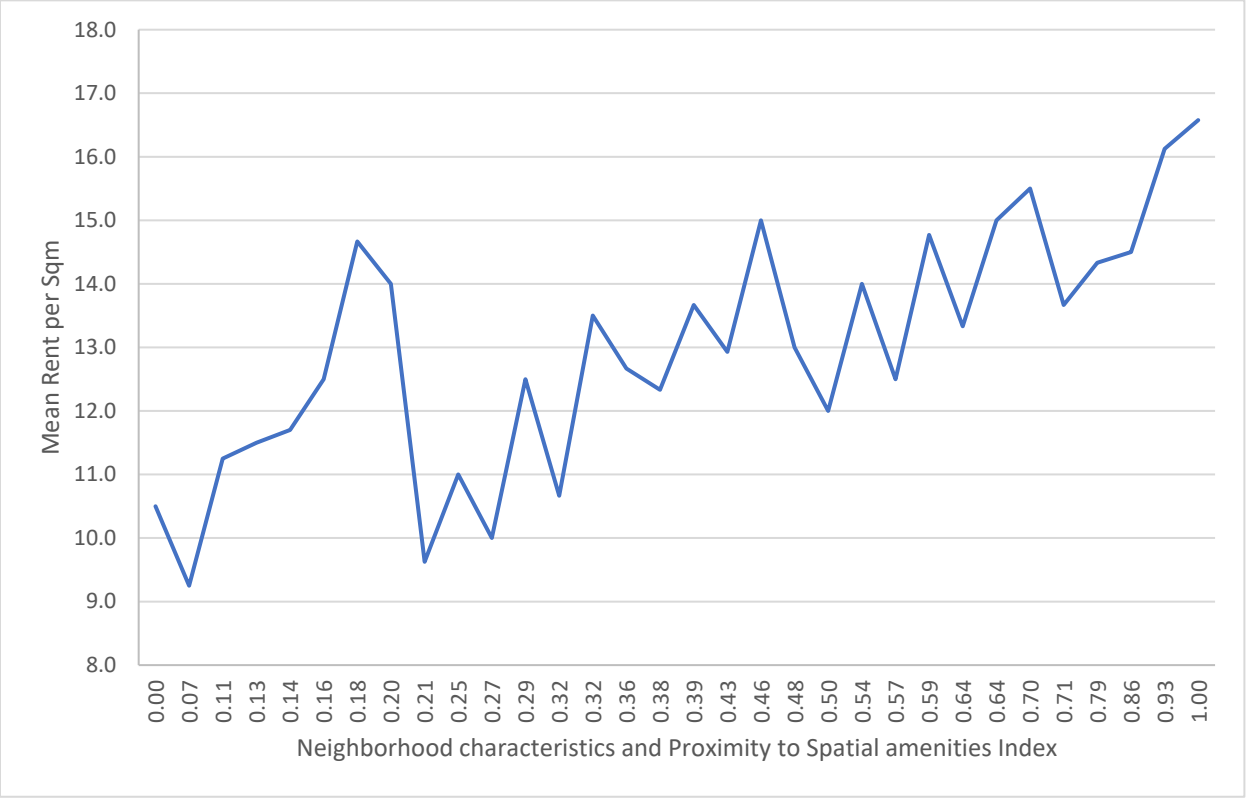

Figure 3. Mean of Neighborhood Characteristics and Spatial amenities effect on rent

Source: Authors Own Construct (2023)

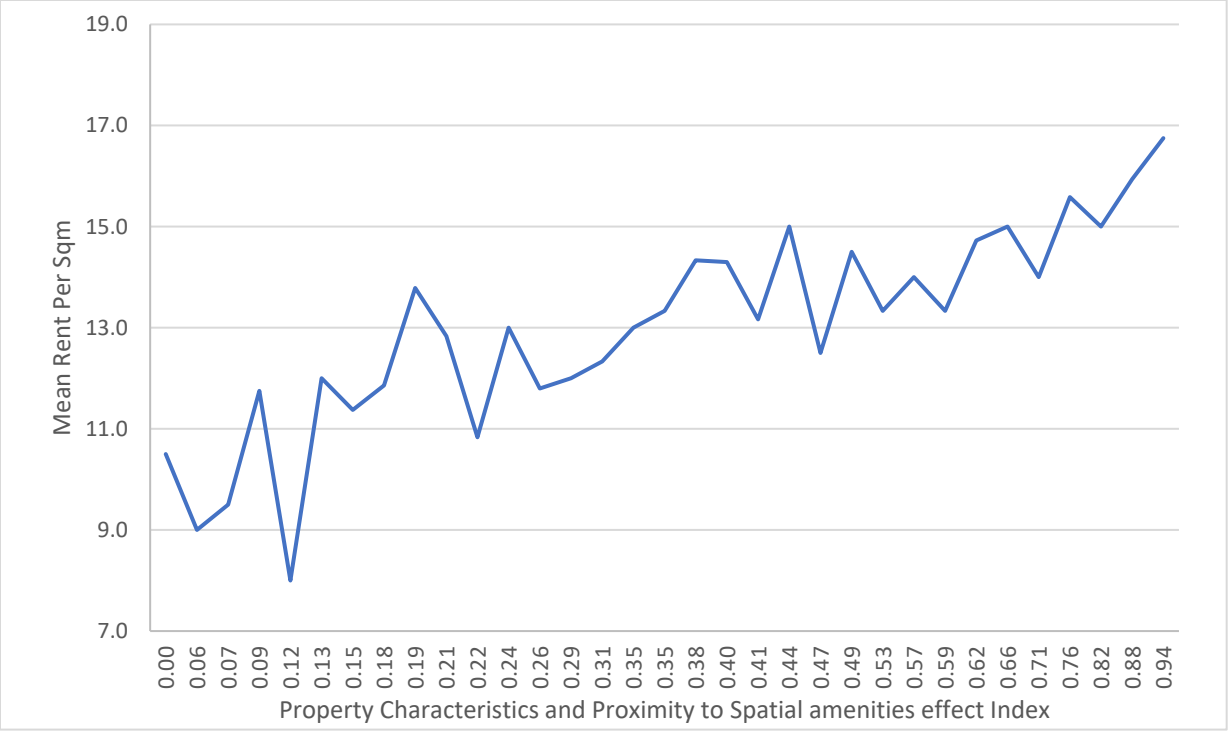

Figure 4. Mean of property characteristics and spatial amenities on rental values

Source: Authors Own Construct (2023)

4.2.3 Overall regression results

The research conducted an in-depth examination of the interplay between spatial amenities, property neighborhood attributes, property characteristics, and their combined effects on property rental values within the CBD. The findings underscored the multifaceted impacts of various spatial amenities on rental values. While ocean scenic views exhibited a minor positive effect, its statistical insignificance aligned with previous observations of negative ocean view influences on property prices. Air quality demonstrated a moderate positive impact, supporting the idea that favorable breeze/air quality significantly contributes to property values. Proximity to walkable areas and beaches emerged as a robust factor, consistently highlighted in earlier research. Conversely, proximity to open spaces showed a modest positive impact with marginal significance.

In terms of property neighborhood attributes, the study illuminated their substantial influence on rental values. Privacy, accessibility to essential facilities, security and safety measures, and noise levels exhibited meaningful correlations. The presence of property management services, advanced security systems, noise reduction, and quality drainage positively influenced rental values. Various amenities such as elevators, Wi-Fi availability, and property management services were identified as contributors to enhanced rental values. Moreover, the study explored the interactions between property characteristics, spatial amenities, and property neighborhood

attributes, revealing their combined effect on rental values. These interactions exhibited significant explanatory power, indicating that these factors collectively play a crucial role in shaping rental values.

4.3 Model fit and Robustness of the models

The assessment of model validity involved employing both White's test for heteroskedasticity and the Variance Inflation Factor (VIF) statistics to gauge the presence of multicollinearity. White's test as displayed in Table 10, characterized by an F-statistic of 1.682110 and an Observed R-squared value of 60.7, along with a corresponding p-value of 0.0414, supports the notion of consistent random error. This p-value signifies a probability below 5 percent, indicating the absence of significant heteroskedasticity within the random error. Moving to the VIF analysis in Table 11, the highest VIF value recorded is 2.818. This relatively low value aligns with the desired outcome, underscoring the absence of multicollinearity within the model. This analysis collectively underscores the favorable fit of the data to the regression line and affirms the model's proficiency in elucidating fluctuations in rental values for the specific property category in the case study.

Table 10. White's Test

F	1.053
P-Value	0.414
Observed R Square	60.7

Table 11. Collinearity Statistics

ABBR	VIF	ABBR	VIF
WGR	2.461	WLF	2.325
SCV	1.870	QAP	2.411
WIN	2.03	SVS	2.018
OPS	2.375	RST	2.250
PS	5.749	HSP	2.308
TLS	3.038	BNK	1.977
BRM	2.264	BST	1.915
SCS	5.551	EDU	2.256
LE	3.671	MKT	2.106
WTS	1.754	MJR	1.699
ASG	6.507	PLS	2.08
WFH	1.679	GEN	1.584
SWD	2.125	NTN	1.669
SWP	1.426	EXP	3.069
GDN	2.464	EDL	2.099
PMS	3.775	EMP	2.818
COS	3.744	INC	2.724

Conclusion

In conclusion, the research study on the spatial dimensions of real estate markets in the CBD has highlighted the importance of spatial amenities, property neighborhood attributes, and property characteristics in determining rental values. This research study provides valuable insights into the determinants of property rental values in the diverse locations of the Central Business District (CBD) in Dar es Salaam. The findings emphasize the positive impact of spatial amenities such as proximity to walkable areas, open spaces, and desirable features on rental values. Property neighborhood attributes and property characteristics were also found to significantly influence rental prices. Additionally, the study validates the substantial positive effect resulting from the interaction between property characteristics and spatial amenities on rental values. The study findings also underscore the importance of spatial amenities, property neighborhood attributes, and property characteristics in influencing rental prices. The study emphasizes the need to consider both the individual property features and the surrounding neighborhood and amenity context when assessing property rental values. These findings contribute to a deeper understanding of the factors driving rental values in the CBD and provide insights for decision-making in the real estate market and can inform real estate professionals, policymakers, and investors in making informed decisions regarding property investments and rental pricing strategies in the CBD.

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