EMPIRICAL CONCEPTUALISATION OF RESIDENTIAL RENTAL VALUES IN GHANA – UNDERSTANDING LOCATION AND NEIGHBOURHOOD EFFECTS

Emmanuel Kofi GAVU[1] Dietwald GRUEHN[2]
[1]*Faculty of Spatial Planning, TU Dortmund University, Dortmund, Germany and Department of Land Economy, KNUST, Kumasi, Ghana*
Email: ekgavu@gmail.com
[2a]*Faculty of Spatial Planning, TU Dortmund University, Dortmund, Germany*

Abstract

Purpose – Based on empirical data, the purpose of this paper is to model the residential rental market in Ghana in order to examine the effects of location and neighbourhood attributes on rental values.

Design/ Methodology/ Approach – To situate the research in its proper context, an overview of the residential rental market dynamics are provided. Empirical testing of submarkets are performed based on *a priori* delineations. Based on hedonic modelling results, the effects of location and neighbourhood attributes on rental values are analysed.

Findings – The data gives credence tot the fact that in Ghana's residential rental housing market, structural attributes of properties have the greatest effect on rental value, than location and neighbourhood attributes.

Research limitations/ implications – Provides a macro overview into the determinants of rental value based on empirical data and offers property investors a better understanding of the rental housing to ensure profit maximisation.

Practical implications – The research provides property investors an overview of useful insights to maximise returns on their investments. This is achieved by providing an understanding of price movements based on submarket dynamics. More so the assumption of urban economic models that rental values decrease with increasing distance from the Central Business District (CBD) is tested.

Originality/ value – This research is one of the first attempts to quantify the effects of location and neighbourhood attributes in Ghana's residential rental housing market.

Keywords: *Submarket; Rental Value; Housing Market; Location; Neighbourhood; Ghana*

1. Introduction

In housing markets research it has been long established that stuctural, location and neighbourhood characteristics do matter and play a role in determining housing values. This begs the question, '*what determines the value of a reseidential rental unit?*' The usual mantra is *location, location, location* (Alonso 1964; Bourassa et al. 2003; Glaeser and Gyourko 2007; Predöhl 1928; Won and Lee 2018). This suggests that real estate goods and services place a premium on location and neighbourhood attributes in determining the value of real property. Although this may be the case, such characteristics are not traded explicitly and their contribution to value cannot be directly observed (Owusu-Ansah 2012). Basically the value of property is determined by market forces of demand and supply. However, the value placed on property is not only related to the physical property but also all the services associated with the property including accessibility, utilities and infrastructure, neighbourhood among others. In other words, the value of a house is made up of a bundle of characteristics that are not explicitly traded.

Neighbourhoods are discreet spatial entities that contain households and housing structures with similar characteristics. The importance of neighbourhood in the operations of housing markets are critical in understanding the market dynamics (See Goodman 1989). The exact location of each house is geographically fixed in space. The process of location choice leads to geographic segmentation of housing stock and markets (Can 1998). The housing market is a set of distinct but interrelated sub-markets encompassing dwellings. The various attributes of sub-market location features are essential ingredients that make up house prices (Adair et al. 1996). To determine the value placed on location and neighbourhoods, Goodman (1978) suggests the formation of house price indices and analysing variations using spatial statistics; whereas Anselin (1998) proposes the kind of infrastructure required to perform spatial analysis of real estate markets using econometrics and multiple regression analysis.

An analysis of the determinants of residential rental values in the housing market, offers various stakeholder groups a better understanding of the dynamics of the market for profit maximisation. An understanding of price movements based on sub(market) dynamics provides useful insights to whether location and neighbourhood characteristics (or attributes) constitutes key explanatory variables in price determination in the rental market. An effective model for adequate housing provision, advocates for market mechanisms to work efficiently, *i.e.* demand and supply forces interacting to fix prices of various real estate goods and services. This interaction process is however very complex.

In Ghana, a number of studies have analysed the dynamics of property markets in Accra, Kumasi and Tema (Anim-Odame et al. 2010a, 2010b; Owusu-Ansah 2012; Owusu-Ansah et al. 2017; Owusu-Ansah and Abdulai 2014). These studies only focused on residential property values and price dynamics. On the rental market, Gavu and Owusu-Ansah (2019) and Owusu-Ansah et al. (2018) have analysed the empirical conceptualisation of submarket existence and the nature of rental contracts respectively. All these studies have not empirically tested the effects of location and neighbourhood characteristics on housing or rental value. Although anecdotal evidence suggests that location and neighbourhood characteristics determine rental values to a large extent in the Ghanaian housing market, the quantum of these effects have not been empirically confirmed. There is little documented research on this subject in the Ghanaian literature.

We fill this knowledge gap by empirically quantifying the price premium of location and neighbourhood effects on residential rental values in Ghana. This is done using rental housing data collected during fieldwork (primary data collection) in Accra between March and October 2017.

The main aim of this research is to examine the price premium of location and neighbourhood attributes on rental values within the aggregate market and *a priori* delineated submarket groupings.

The remainder of the paper is structured in the following manner; the next section examines the theoretical framework including research problems and questions. Next, an overview of housing market features in Ghana are examined. Further the methodology, results of the modelling process and conclusions are discussed.

2. Theoretical framework – rental value determinants

A number of theoretical and econometric studies have examined determinants of house prices (Predöhl 1928; Tse 2002). Heinrich von Thünen's theory of location of agricultural land uses in his book "*Der isolierte Staat*" and Alfred Weber's theory of location of manufacturing industries provide useful insights with regards to the classical theories of location.

The initial focus of the theory of land rent was on agriculture and the value placed on the produce. The discussions as to whether the theory of land rent is still relevant and can be applied in current urban contexts has been examined by a number of scholars (Harvey 1973; Ball 1977; Ball 1985b; Ball 1985a; Lipietz 1985; as cited in Haila 2016). There seems to be no clear end in sight. However, one assumption of urban economic models has been that rents decrease with distance from the city centre. However Haila (2016, 59) posits that, "empirical research has neither verified nor disproved this". When rents increase with distance it is explained that perhaps the neighbourhood and quality of the environment is superior compared to others.

Ozanne and Thibodeau (1983) posit that the quality of a location has a ripple effect on house prices within that particular neighbourhood. They depict that in a particular neighbourhood, quality of a property can be mimicked or duplicated over a set period. Resulting in every property having similar qualities over time. *Vice versa* will hold true for low quality properties in a particular neighbourhood. It is worth noting that better quality property could reflect quality of location, which will in turn have a ripple effect to induce more quality housing in that particular neighbourhood or geographical area. Higher income metropolitan areas will generally have more new houses of better quality and a large size. Where there are inter metropolitan variations, it will contribute to house price variations.

A house is composed of characteristics which together affect its rental value. These include physical (structural), locational, neighbourhood and environmental characteristics. There is disagreement as to how much each of these attributes influence rental values (Arimah 1992; De and Vupru 2017; Harrison and Rubinfeld 1978; Roubi and Ghazaly 2007; Sirmans et al. 2005). Ideally in the rental market, the basis of value in an arm's length transaction should be market rent; defined as, "*the estimated amount for* *which an interest in real property should be leased on the valuation date between a willing lessor and a willing lessee on appropriate lease terms in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion*" (International Valuation Standards Council 2017, 21).

The hedonic pricing model (HPM) is the widely used model to analyse the implicit contribution of housing characteristics on value. The HPM tends to utilise all available evidence of transactions in order to model the market. The selection of the appropriate method is dependent on the market structure, the availability and quality data, objectives of the study. The hedonic equation regresses rent (or price) on housing characteristics. The assumption here is that the determinants of these rents are known and can be disaggregated. Rent as a function of housing charcteristics is given by;

$$R = f(S, N, L, C, T) \qquad (1)$$

Where:
R – Rent
S – Structural characteristics
N – Neighbourhood characteristics
L – Location characteristics within market
C – Contract conditions
T – Time value

For convenience sake the *S, N, L, C, T* characteristics are reduced to a larger *X* factor. Therefore the equation then becomes:

$$R = e^{x\beta\varepsilon} \qquad (2)$$

Equation (2) interprets as:

$$lnR = \mathrm{X}\beta + \varepsilon \qquad (3)$$

Since β and ε are not known, we therefore estimate,

$$lnR = \mathrm{Xb} + \mathrm{e} \qquad (4)$$

Where *b* and *e* are actual estimates. Using properties of logarithms, the predicted rent of a given unit can be computed as $R = e^{xb}$. The value of an individual characteristic can be estimated X_1, at a given level of X_1 as:

$$R = e^{xb} \tag{5}$$

The price of X_1, or any other single attribute varies with the level of X_1, as well as with the level of other X_i. The rent of real estate assets therefore are non-linear. The rent model is represented by the equation:

$$lnR(x_j) = \beta_0 + \sum_{i=1}^{n} \beta_i \ln(x_{ij}) + \sum_{k=1}^{n} \beta_k D_{kj} + \varepsilon \tag{6}$$

Where $lnR\ (x_j)$ is the natural logarithm of rent, β_i and β_k are coefficients, lnX_{ij} are the natural logarithms of continuous independent variables, D_{kj} are dummy variables and ε_j represent random errors.

The log linear model is the most widely used and tested for housing market analysis (Malpezzi 2002). In this work we adopt a modified form of the hedonic equation from Büchel and Hoesli (1995 p.1203). The functional form adopted is the multiplicative form because as in this peculiar circumstance, several variables are non-normal and also because of heteroscedasticity.

The adopted model is:

$$R = \alpha_1\, S^{\beta 1}\, L^{\beta 2} \tag{7}$$

Where *R* is a vector of rental values; *S* is a vector of structural characteristics and *L* is a vector of locational and neighbourhood characteristics. Some variables are dummy which do not transform because the natural logarithm of 0 is not defined. 1 is used to represent when a dummy characteristic is present and 0 when the characteristic is not. Therefore the model to be estimated is:

$$lnR = \beta_0 + \beta_1 lnS_1 + \beta_2\, lnS_2 + \beta_3\, lnL_1 + \beta_4\, lnL_2 + \varepsilon \tag{8}$$

Where S_1 is a vector of continuous structural variables; S_2 is a vector of structural dummy variables; L_1 is a vector of continuous locational and neighbourhood variables; L_2 is a vector of locational and neighbourhood dummy variables and ε is an error term.

Estimated vectors of coefficients of transformed continuous variables (i.e., β_1 and β_3) represent the relative variation of rent after a 1 *per cent* change in the quality of the characteristic, which represents elasticities. β_2 and β_4 are semi-elasiticities where ecoefficient represents the percentage change in rent after the dummy changes its state (ie from 0 to 1 or vice versa). The intercept in this case could be defined as the mean effect of all excluded explanatory variables.

3. Overview of the residential housing market in Ghana

The housing market in Ghana has similar features compared to others within the Sub-Saharan Africa (SSA) region. These markets are mostly characterised by demand excesses over supply. In Ghana, the policy focus of the government has been on home ownership with less attention given to rental housing. This seems to be a paradox as majority of the population are within the low income bracket. They cannot affort to buy homes, but may be able to rent one within their life time. The UNESCAP and UN-HABITAT (2008) make the point that not everyone can own property when they argue that, "it is a common misperception that everyone wants to own a house. For many people, rental housing is a better option" (2008, 1). The housing market in Ghana can be described as a free-market model with the main suppliers of new buildings being the private sector (Arku 2009a, 2009b; Tipple and Korboe 1998).

Ghana's housing policy aims at '*creating viable and sustainable communities through the provision of adequate, decent and affordable housing that is accessible and sustainable to satisfy the needs of Ghanaians'* (Government of Ghana, 2015, 14). The government's main approach in reducing the over 1.7 million housing deficit (Salifu Osumanu et al. 2018) is to provide an enabling environment (in terms of extension of key infrastructure) for the private sector to lead the way in housing supply.

The residential housing market is made up of the formal and informal markets (see figure 1). The formal market (modern housing) is more structured and consists of gated communities, apartments and estate buildings. These properties have better access to basic infrastructure and the buildings conform to planning and building standards. Anecdotal evidence suggests that majority of properties within the formal market are for sale (Arku et al. 2012) and priced in foreign currency (the United States Dollar).

The informal market (traditional housing) is typified by the phenomenon of urban sprawl. This market consists of a fair mix of all types of properties (in terms of good and bad access to basic infrastructure). Those who patronise this market are predominantly low income earners who also form the majority of the population. The properties here generally are of low quality and lack basic amenities (like good access to water, good roads, drainage among others). The usual trend is that development always precedes planning. Most landlords are believed to exploit tenants because of housing shortages. Thus tenants are made to pay between one and three years rent in advance. Further, most of these houses are overcrowded, without the requisite planning permits, poorly cited and do not have access for emergency services because of crowding (Arku et al. 2012). The informal market is dominated by compound houses (see figure 2); which is a single or multi-storey semi-detached building, where occupants share a common compound. Two main types of houses are available for low-income earners in compound houses; 'single rooms' and 'hall-and-chamber units'. The 'single rooms' consist of one room that serves as both a living area and bedroom for an occupant. 'Hall-and- chamber' units have two rooms, one used as a living room (which can be converted to a bedroom based on family size) and the other as a bedroom.

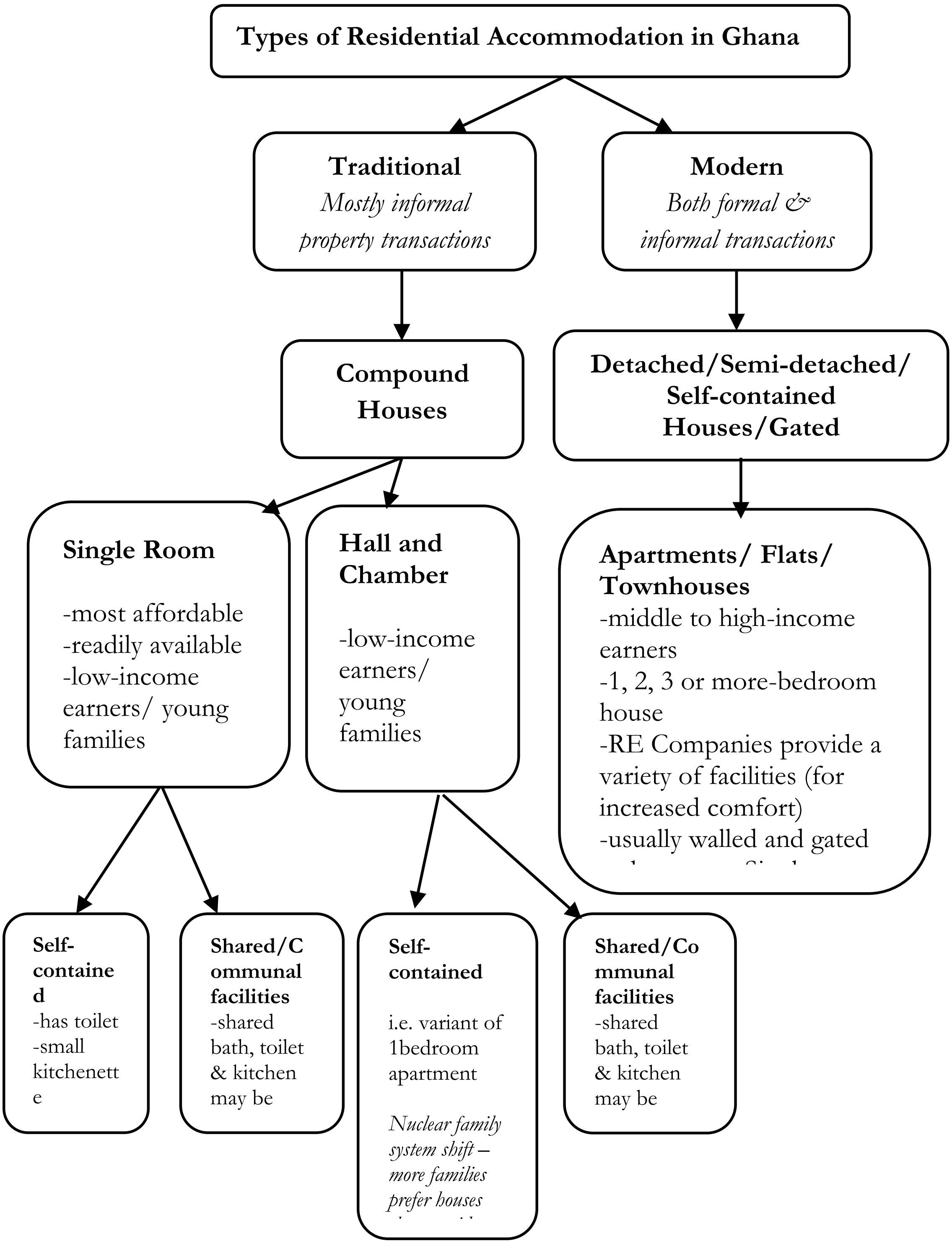

Figure 1: Residential Rental Accommodation Types in Ghana
Source: (Gavu and Owusu-Ansah 2019)

Figure 2: Compound houses in Ghana

4. Data and Methodology

Rental housing data were collected for all neighbourhood classes within Accra. *A priori* delineations of submarkets are defined theoretically and empirically tested based on spatial, structural and nested segmentations of the market. By spatial segmentation we test whether rental values are significantly different for the three neighbourhood groups (*i.e.* low-income, middle-income and high-income neighbourhoods). By structural segmentation, we test whether rental values are significantly different based on real estate type (*i.e.* single room; chamber and hall; and apartment, flat, house and town house). Finally, by a nested segmentation of the rental market, we test whether submarket exists based on a combined definition based on spatial and structural characteristics (*i.e.* low-income neighbourhood single rooms, middle-income neighbourhood apartments, high income neighbourhood apartments among others).

Four administrative districts within the Greater Accra region were selected as study areas based on discussions with real estate experts. These are;

(1) La-Nkwantanang-Madina Municipal Assembly;
(2) Adentan Municipal Assembly;
(3) La-Dadekotopon Municipal Assembly; and
(4) Ayawaso West Submetropolitan District Assembly under the Accra Metropolitan Assembly.

These districts encompass all neighbourhood classes to make the study thorough. Accra was chosen as study area for a number of reasons – it is the capital and has the most vibrant real estate market in Ghana (Baffour Awuah et al. 2014; Viruly and Hopkins 2014); has an active residential rental market; Accra's population represents a cosmopolitan mix from all parts of the country making it suitable for these studies; and the region provides a true mix of different socio-economic conditions that can effectively mimic other cities within Sub Saharan Africa (SSA).

The data consisted of 536 rental transaction data collected during fieldwork in Accra between March and October 2017. Such data is not readily available, as Ghana's housing market lacks the existence of an established data bank where such information could be obtained even at a fee (Baffour Awuah et al. 2016). Some institutions may have some of the information (*i.e*. the Lands Commission), but such databases do not have all the required variables to model the market comprehensively as was attempted in this research. Moreover, there is no list of residential rental houses sample frame to draw sub-samples from. So the snowball technique served as the most practical means to select rental houses within each district during the field work.

Table 1 provides the number of observations for the aggregate market as well as for *a priori* submarket groups theoretically identified. It can be observed that among the spatial submarkets identified, LIN and HIN dominate observations with about 86% of observations. MIN are more of transition zones between LIN and HIN, and has characteristics of both neighbourhoods.

Table 1: Aggregate market and submarket classifications

Market type	**Submarket**	**Definition**	**N**	**%**
Aggregate		Aggregate market	536	100.0
Spatial	LIN	Low Income Neighbourhood	211	39.4
	MIN	Middle Income Neighbourhood	77	14.4
	HIN	High Income Neighbourhood	248	46.3
Structural	SR	Single Rooms	73	13.6
	HC	Hall and Chamber	85	15.8

Market type	**Submarket**	**Definition**	**N**	**%**
	AFTH	Apartment, Flat and Town Houses	378	70.5
Nested	LIN.SR	Single Rooms within Low Income Neighbourhoods	71	13.2
	LIN.HC	Hall and Chamber units within Low Income Neighbourhoods	81	15.1
	LIN.AFTH	Apartment, Flat and Town Houses within Low Income Neighbourhoods	59	11.0
	MIN.SR	Single Rooms within Middle Income Neighbourhoods	0	0.0
	MIN.HC	Hall and Chamber units within Middle Income Neighbourhoods	4	0.7
	MIN.AFTH	Apartment, Flat and Town Houses within Middle Income Neighbourhoods	73	13.6
	HIN.SR	Single Rooms within High Income Neighbourhoods	2	0.4
	HIN.HC	Hall and Chamber units within High Income Neighbourhoods	0	0.0
	HIN.AFTH	Apartment, Flat and Town Houses within High Income Neighbourhoods	246	45.9

Source: Field work in Accra, 2017

More so, AFTH also dominates observations within the structural submarket with 71% of observations. In the structural submarket for instance, most of the properties are within compound houses (which may comprise more than 5 units), as such the attribute data for one unit is similar or the same for all other units within the compound. And finally, HIN.AFTH dominates observations within the nested submarkets with 46% of observations. It must be noted that the transaction frequency of properties within the LIN, HIN and AFTH markets are generally high and that accounts for availability of such observations collected.

Table 2 shows that the mean rent paid per month is USD 1,450 over the period, with the median, minimum and maximum rental values given as USD 341, USD 8 and USD 7,091 respectively. The wide range between the minimum and maximum rental values (USD 8 to USD 7,091)) shows the diverse property types available for rent in the market. The median floor area, number of bedrooms, number of wc, number of bathrooms and number of floors are 105, 2, 2, 2, and 1 respectively.

Table 2: Descriptive statistics of rental observations in aggregate market

		Rent paid per month (USD)	Total floor area (of rental unit) - sq.m	Number of bedrooms	Number of wc/ toilet	Number of bathrooms	Number of floors/ storeys
N	Valid	536	536	536	536	536	536
	Missing	0	0	0	0	0	0
Mean		1,450.25	133.32	2.38	2.51	2.24	1.46
Median		340.91	105.00	2.00	2.00	2.00	1.00
Mode		3,500.00	100.00	1	1	1	1
Std. Deviation		1,692.62	108.17	1.44	1.60	1.28	1.21
Minimum		8.00	9.00	1	0	0	1
Maximum		7,091.00	652.00	10	11	10	19

Source: Field work in Accra, 2017

Figure 3, shows the study area and the specific locations of rental data collected during the fieldwork. This was generated by plotting the *XY* locations (geographic coordinates) of various rental units.

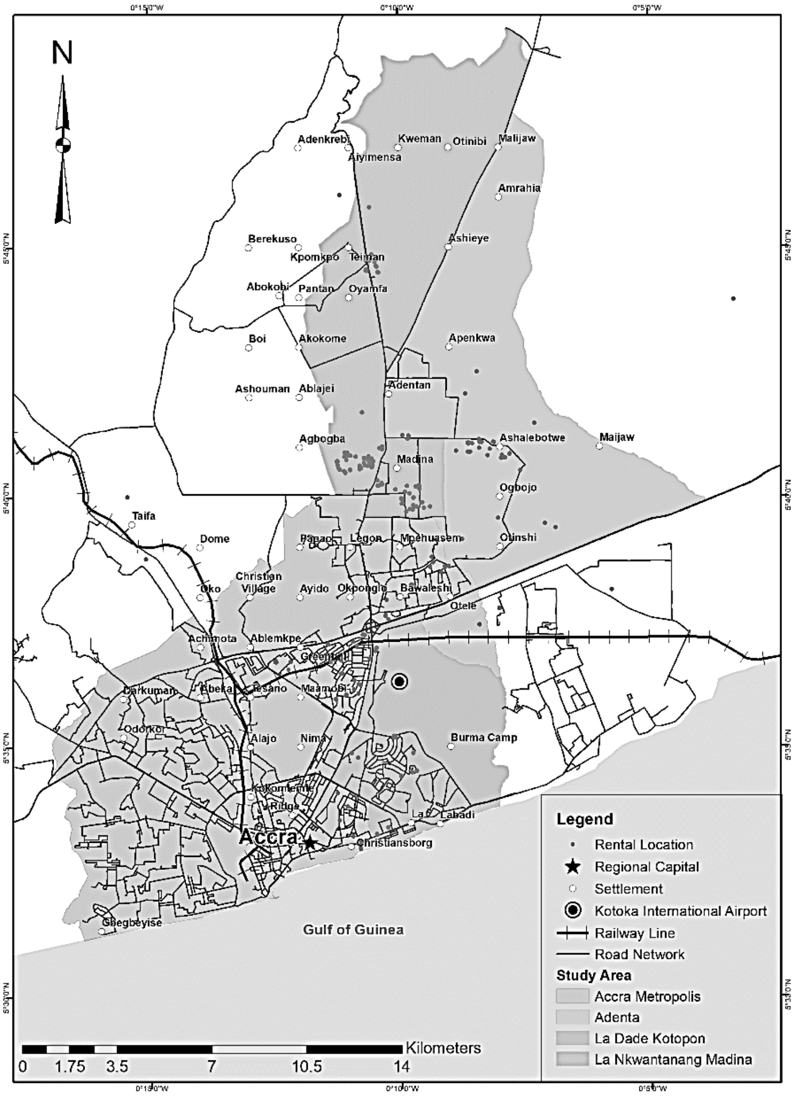

Figure 3: Study area
Source: Field work in Accra, 2017

The hedonic modelling technique is used to empirically test for submarket existence as well as effects of location and neighbourhood characteristics. Table 3 provides the list of all variables used in the modeling process.

Table 3: Variable names and definitions

Category	Variable	Definition
	lnRENT	Dependent variable; Natural log of Rental value per month in US Dollars
Structural	lnAREA	Natural log of total floor area of property (compound excluded)
	lnNoFl	Natural log of number of floors or storeys of property
	lnBRM	Natural log of number of bedrooms
	lnWC	Natural log of number of WC or toilet available
	lnBATH	Natural log of number of bathrooms
	TBATH	Type of bathroom – i.e., shared or separate
	KIT	Dummy equal to 1 if kitchen available, 0 if otherwise
	TKIT	Type of kitchen - i.e., shared or separate
	STO	Dummy equal to 1 if storeroom available, 0 if otherwise
	FLO	Floor finish (dominant) - i.e., cement sand screed, terazzo, tiled
	FEN	Dummy equal to 1 if fence wall available, 0 if otherwise
	PAR	Dummy equal to 1 if parking space (garage or outhouse) available, 0 if otherwise
	CQual	Dummy equal to 1 if construction quality is good, 0 if bad
	LQual	Dummy equal to 1 if landscaping is available, 0 if otherwise
	DET	Dummy equal to 1 if physical condition of property is good, 0 if otherwise
	RET_1	Dummy equal to 1 if property is Single Room
	RET_2	Dummy equal to 1 if property is Hall and Chamber
	RET_3	Dummy equal to 1 if property is Apartment, Flat or Town house
Locational	ACC	Dummy equal to 1 if property has suitable vehicular access available, 0 if otherwise

Category	Variable	Definition
	lnRENT	Dependent variable; Natural log of Rental value per month in US Dollars
	TRFC	Dummy equal to 1 if property is close to traffic congestion area, 0 if otherwise
	GAB	Dummy equal to 1 if waste disposal or garbage collection is available, 0 if otherwise
	MKT	Dummy equal to 1 if property is close to market or shopping centre (within 1km), 0 if otherwise
	CBD	Dummy equal to 1 if property is near to the CBD (within 1km), 0 if otherwise
	JOB	Dummy equal to 1 if property is near job opportunities, 0 if otherwise
	EDU	Dummy equal to 1 if property is near educational facilities, 0 if otherwise
	HLTH	Dummy equal to 1 if property is near to health facilities, 0 if otherwise
	REC	Dummy equal to 1 if property is near recreational facilities, 0 if otherwise
	INF	Dummy equal to 1 if property is near squatter or informal settlements, 0 if otherwise
	SEC	Dummy equal to 1 if property is near police station or police post, 0 if otherwise
	WOR	Dummy equal to 1 if property is near place of worship, 0 if otherwise
	BUS	Dummy equal to 1 if property is near bus stop, 0 if otherwise
	VQual	Dummy equal to 1 if quality of property view is good, 0 if otherwise
Neighbourhood	ELEC	Dummy equal to 1 if property has electricity available, 0 if otherwise
	WAT	Dummy equal to 1 if property has pipe or well available, 0 if otherwise
	SLT	Dummy equal to 1 if streetlighting available, 0 if otherwise
	DRN	Dummy equal to 1 if suitable surface drainange available, 0 if otherwise

Category	Variable	Definition
	lnRENT	Dependent variable; Natural log of Rental value per month in US Dollars
	LOC_1	Dummy equal to 1 if property is in low income neighbourhood
	LOC_2	Dummy equal to 1 if property is in middle income neighbourhood
	LOC_3	Dummy equal to 1 if property is in high income neighbourhood

Source: Field work in Accra, 2017

Modelling process

49 different variables comprising structural, location and neighbourhood characteristics are utilised. For variable inclusion into the aggregate market model, a step-wise regression to determine statistically significant variables at an α level of 0.10 are run. Out of these variables, a total of 16 better explains the data (see table 4).

A market-wide residential rental market model based on equation 8 is estimated. To capture non-linearity continuous variables are expressed as natural logarithms (Colwell 1990). The model is fairly consistent with similar results presented in the literature (see Anim-Odame et al., 2010a, 2010b). The explanatory power of the model is similar to other models used in the Ghanaian market (ibid). The strongest effect is when rental unit is located in a high income area (LOC_3). This is followed by the total floor area of the property (lnAREA). The estimated coefficients of transformed variables represent the relative variation of rent after a 1 *per cent* change in the quality of the characteristic. Dichotomous variables represent percentage change in rent after the dummy changes its state (from say 0 to 1). The intercept represents the value of all exluded variables.

To ensure that variable coefficients are robust, a multicollinearity test is performed. The rule of thumb is that when the tolerance statistic is less than 0.10 or the variance inflation factor (VIF) is greater than 5, it indicates high multicollinearity (Mansfield and Helms 1982). For the aggregate model, the tolerance statistic ranges from 0.172 to 0.901, and VIFs are all below 5. Hence, based on the VIFs of independent variables used in this model, multicollinearity is not present.

Table 4: Hedonic price estimate for Accra (aggregate rental market)

Variables	Coefficients	t-values	
Constant	0.272	0.786	
LOC_3	1.53	15.428*	
lnAREA	0.401	6.002*	
LQual	0.677	7.41*	
MKT	0.364	4.952*	
FEN	0.274	3.362*	
STO	0.229	3.029*	
FLO_4	0.195	1.888***	
lnNoFl	0.277	4.424*	
REC	0.261	3.751*	
LOC_2	0.34	3.349*	
CBD	0.332	3.723*	
BUS	0.53	3.504*	
lnBATH	0.385	4.871*	
RET_1	-0.367	-3.484*	
TBATH_2	0.382	3.601*	
CQual	0.674	2.997*	
Standard error	0.5817		
R^2	0.9220	**Adjusted R^2**	0.9190
F-value	364.2400	**Sample size**	532

Note: 1% (*), 5% (**) and 10% (***) levels of significance. Variable definitions are given in table 3 (includes all variables collected during fieldwork).

Source: Field work in Accra, 2017

The modelling procedure is repeated for the spatial, structural and nested submarkets. The basis is grounded in the assumptions that:

- [. . .] all dwellings within a submarket are relatively close substitutes and are within the same market; and

- [. . .] if differential prices exists then there is good reason to believe that [. .] these operate in different submarkets (Watkins, 2001, p.2241).

Submarket analysis reflects the spatial heterogeneity of housing prices, improves predictive accuracy of house price models, and increases the understanding of location and neighbourhood effects (Wu et al. 2018). The most common procedure to test submarket existence at a static point in time was adopted (Dale-Johnson 1982; Schnare and Struyk 1976; Watkins 2001). The existence of submarkets within the aggregate market involves these steps. First the hedonic function for each of the *a priori* submarkets were computed. further a chow test to determine significant differences between pair-wise comparisons of hedonic estimates were also computed. Finally, a weighted standard error test was computed to examine the significance of price differentials within the submarkets. For a more detailed discussion on how the submarket existence were empirically tested and analysed, see Gavu and Owusu-Ansah (2019).

The results of each of the submarkets modelled suggested that when pairwise comparisons are analysed based on the three-step procedure (as already explained), distinct submarkets existed within the aggregate market. Submarkets exists for all theoretical submarket constructs apart from between 'single rooms' and 'hall and chamber units' (table 5).

Table 5: Modelling results of submarkets existence

Submarket	**N**	***Chow Test***	***Submarket existence***
Spatial Submarkets			
Omnibus test – all 3 spatial submarkets	536	-	-
LIN with MIN	288	3.93*	Yes
LIN with HIN	459	35.17*	Yes
MIN with HIN	325	17.38*	Yes
Structural submarkets			
Omnibus test – all 3 structural submarkets	536	-	-
SR with HC	158	1.64	No
SR with AFTH	451	4.31*	Yes
HC with AFTH	463	3.12*	Yes
Nested Submarkets			
Omnibus test – all 5 nested submarkets	530	-	-
LIN.SR with LIN.HC	152	2.14**	Yes

Submarket	N	*Chow Test*	*Submarket existence*
LIN.SR with LIN.AFTH	130	7.12*	Yes
LIN.SR with MIN.AFTH	144	2.46**	Yes
LIN.SR with HIN.AFTH	317	24.60*	Yes
LIN.HC with LIN.AFTH	140	1.77***	Yes
LIN.HC with MIN.AFTH	154	2.25**	Yes
LIN.HC with HIN.AFTH	327	11.37*	Yes
LIN.AFTH with MIN.AFTH	132	3.56*	Yes
LIN.AFTH with HIN.AFTH	305	32.44*	Yes
MIN.AFTH with HIN.AFTH	319	18.29*	Yes

Source: Field work in Accra, 2017

Table 6 shows statistically significant variables (at an α of ≤10%) within the aggregate market and submarkets. This provides an overview of statistically significant variables utilised in quantifying location and neighbourhood effects on rental values.

In the next section, the percentage contribution of variables are computed for the aggregate market as well as for submarket constructs. The aggregate market model provides statistically significant variables to use for submarket modelling. Each of these variables contribute to model fit and give an indication as to which variables determine rental values in these submarkets.

Table 6: Statistically significant variables within aggregate market and submarkets

Submarket category	Submarket	LOC_3	lnAREA	LQual	MKT	FEN	STO	FLO_4	lnNoFl	REC	LOC_2	CBD	BUS	lnBATH	RET_1	TBATH_2	CQual
Aggregate market		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Spatial	LIN		*		*		*	*	*	*		*		*	*	*	*
	MIN			*					*	*			*	*			
	HIN		*	*	*	*	*		*	*		*		*	*		
	LIN+MIN		*	*	*	*	*	*	*			*	*	*	*	*	*
	MIN+HIN			*	*	*			*	*		*	*	*		*	
Structural	SR	*	*			*										*	*
	HC		*		*			*	*			*		*		*	*
	AFTH	*	*	*	*	*	*	*	*	*	*	*	*	*			*
	SR+HC		*			*		*	*		*			*		*	*
	HC+AFTH	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*
Nested	LIN.SR		*													*	*
	LIN.HC		*		*			*	*					*		*	*
	LIN.AFTH							*	*	*		*		*		*	
	MIN.AFTH			*		*			*	*		*	*				

Submarket category	Submarket	LOC_3	lnAREA	LQual	MKT	FEN	STO	FLO_4	lnNoFl	REC	LOC_2	CBD	BUS	lnBATH	RET_1	TBATH_2	CQual
	HIN.AFTH		*	*	*	*	*		*	*		*		*			
	LIN.SR+LIN.HC		*			*		*	*					*		*	*
	LIN.HC+LIN.AFTH		*		*		*	*	*	*		*		*		*	*
	LIN.AFTH+MIN.AFTH		*	*	*	*		*				*	*	*			
	MIN.AFTH+HIN.AFTH			*	*	*			*	*		*	*	*		*	
	Total	4	15	11	13	13	8	12	17	12	4	14	9	17	4	14	12

N.B. – * represents statistically significant variable and within which (sub)market construct it occurs.
Source: Field work in Accra, 2017

5. Quantifying effects of location and neighbourhood variables on rental values

The hedonic equation for the aggregate as well as for each of the submarket constructs helps to identify the utility-bearing attributes (variables) inherent in the rental values which are implicitly priced. The utility-bearing attributes subsists of structural characteristics of the property (including size, number of bathrooms, type of real estate, among others), location characteristics of the property that relates to access and proximity to services, and neighbourhood characteristics related to presence of amenities or dis-amenities. The details of the various models are the focus for the next set of analysis.

The percentage contribution of each variable to rental value is computed as follows:

$$\%\text{ contribution } X_i = \frac{coefficient\ X_i}{\sum_{k=1}^{n} coefficient\ X_{i-n}} * \text{adj. } R^2 * 100\% \qquad (9)$$

Where;

- Coefficient X_i represents variable coefficient;
- % contribution X_i, represents the percentage contribution of variable X_i to rental value;
- $\sum_{k=1}^{n} coefficient\ X_{i-n}$, represents the summation of all coefficients in a particular submarket including the constant; and
- adj. R^2 represents the adjusted R^2 value in that particular submarket.

The percentage contribution of variable X_i is computed by dividing variable X_i by the sum of all coefficients in a particular (sub)market (including the constant term), then multiply by the adjusted R^2 value and then multiply the result by 100 *per cent*. This represents the percentage impact of that particular variale on rental value in a particular (sub)market.

To interpret results of the percentage contribution of variables, 3 factors are important to enable proper interpretation. The first is the statistical significance of the variable. It must be noted that only variables that are statistically significant were interpreted (although the percentage contribution for all variables are provided). In this case variables that are significant to the 10% significant level and below are considered. The second is to consider the sign of the variable (ie, positive or negative). The dependent variable (RENTusd) is a continuous variable and as such a positive independent variable sign will have a positive effect or impact on monthly rent and a negative variable sign will likewise have a negative impact on monthly rent. The last factor to consider in the interpretation is the magnitude of the variable. A larger value indicates a large effect on rental value and *vice versa* for a smaller value.

Since the interpretation of results follow similar procedure, only the results of the aggregate market and spatial submarkets will be discused here (table 7a). The results of the structural and nested submarket groups are provided but not discussed (table 7b and 7c). Tables 7a – c shows the model coefficients, the p-values (in asterisk – *) and the corresponding percentage contribution of variables.

Aggregate Market

Results from table 7a suggests that a rental unit located in neighbourhood type LOC_3 and LOC_2 contributes 21% and 5% respectively to rental value in the aggregate market. This supports the assertion that such neighbourhoods attract a rent premium because of superior neighbourhood and quality of the built environment as compared to other areas. Proximity to locations such as market, recreational facilities, CBD and bus stops together contribute 20% to rental value. All structural variables contribute 43% to rental value.

The aggregate market model although useful in market analysis, hides the differences within various submarket groups and treats the market as if all rental units are homogeneous. This is clearly illustrated by the percentage contribution of variables within each submarket construct.

Spatial submarkets and percentage contribution of variables to rental value
LIN
The assumption with the LIN submarket is that all properties irrespective of the property type found in low income areas belong to this submarket group. From table 7a it can be observed that the greatest contribution to rental value are construction quality (CQual, 11%), nearness to the CBD (CBD, 10%), number of floors (lnNoFl, 10%) and the size of the rental unit (lnAREA, 8%). This suggests the better the construction quality, the higher the rental value will be and vice versa. Also of importance is the size of the rental unit which translates to value. It was striking to note that if the real estate type was a single room (-5%) it contributed negatively to rent. In most LIN, the quality of single room type of accommodation mostly with shared facilities attract low rents. It is this trend that has been confirmed in this modelling result. The least contributor to rental value is nearness to a bus stop (BUS, 3%). This is to be expected as properties mostly found in this submarket do not normally have good transportation routes. In terms of aggregate contribution to rent, it can be seen that structural characteristics of the properties within this submarket contribute 49%, whereas location variables contribute 24%. This suggests that almost half of the value of a rental unit within this submarket is determined based on structural characteristics of the property. Although location attributes contribute about one-fourth of total rent. Neighbourhood variables are not present here as they are control variables identifying submarket groups.

Table 7a: Spatial submarket coefficients and percentage contribution of hedonic model regressors (variables)

Variables	Aggr.	% Contr.	LIN	% Contribution	MIN	% Contribution	HIN	% Contribution	LIN + MIN	% Contribution	MIN + HIN	% Contribution
Constant	0.27	3.70	0.57	9.63	1.865	11.41	3.31*	43.45*	0.03	0.53	0.59	6.06
LOC_3	1.53*	20.81*										
lnAREA	0.40*	5.45*	0.47*	8.05*	0.10	0.58	0.17***	2.19***	0.54*	9.27*	0.14	1.42
LQual	0.68*	9.21*	0.04	0.63	0.64**	3.93**	0.77*	10.12*	0.48*	8.24*	1.28*	13.08*
MKT	0.36*	4.95*	0.24*	4.00*	0.28	1.71	0.44*	5.79*	0.28*	4.88*	0.24***	2.40***
FEN	0.27*	3.73*	0.09	1.55	0.40	2.47	1.38*	18.15*	0.18***	3.01***	0.87*	8.82*
STO	0.23*	3.12*	0.47*	7.91*	0.38	2.29	0.19*	2.53*	0.38*	6.60*	0.13	1.35
FLO_4	0.20***	2.65***	0.28*	4.78*	0.23	1.41	0.07	0.95	0.35*	6.04*	0.39	3.96
lnNoFl	0.28*	3.77*	0.56*	9.58*	0.93**	5.67**	0.10***	1.35***	0.43*	7.43*	0.34*	3.46*
REC	0.26*	3.55*	0.34*	5.84*	- 0.56***	-3.44***	0.39*	5.13*	-0.05	-0.81	0.38*	3.86*
LOC_2	0.34*	4.62*										
CBD	0.33*	4.52*	0.61*	10.31*	1.47	8.99	0.15**	2.02**	0.57*	9.73*	0.48*	4.93*
BUS	0.53*	7.21*	0.20	3.37	0.83	5.08	0.07	0.87	0.53*	9.06*	1.06*	10.81*
lnBATH	0.39*	5.24*	0.32*	5.39*	0.72***	4.42***	0.52*	6.80*	0.28*	4.81*	0.66*	6.70*
RET_1	-0.37*	-4.99*	-0.31*	-5.29*			-1.62	-21.25*	-0.33*	-5.67	-0.73	-7.49
TBATH_2	0.38*	5.20*	0.36*	6.07*	0.83	5.07			0.31*	5.35*	1.41*	14.35*
CQual	0.67*	9.17*	0.62*	10.48*					0.61*	10.52*		

Variables	Aggr.	% Contr.	LIN	% Contribution	MIN	% Contribution	HIN	% Contribution	LIN + MIN	% Contribution	MIN + HIN	% Contribution
Standard error	0.5817		0.4875		0.87		0.40		0.64		0.68	
R^2	0.922		0.835		0.58		0.79		0.80		0.75	
Adjusted R^2	0.919		0.823		0.50		0.78		0.79		0.74	
N	532		209		75		248		284		323	
Structural		**(42.54)**		**49.16 (46.98)**		**25.84 (14.42)**		**20.84 (19.89)**		**55.60 ((55.60)**		**45.65 (46.41)**
Neighbourhood		**(25.44)**										
Location		**(20.23)**		**23.51 (20.14)**		**12.35 (-3.44)**		**13.81 (12.94)**		**22.87 (23.67)**		**21.99 (21.99)**

Note: 1% (*), 5% (**) and 10% (***) levels of significance. Statistically significant contributions per group are in brackets
Source: Fieldwork data 2017

Table 7b: Structural submarket coefficients and percentage contribution of hedonic model regressors (variables)

Variables	SR	% Contribution	HC	% Contribution	AFTH	% Contribution	SR + HC	% Contribution	HC + AFTH	% Contribution
Constant	1.28*	17.79*	-0.35	-6.26	0.19	2.13	0.32	5.93	0.20	2.56
LOC_3	0.61***	8.41***			1.51*	16.65*	0.45	8.24	1.49*	18.77*
lnAREA	0.35*	4.82*	0.74*	13.26*	0.33*	3.59*	0.62*	11.48*	0.40*	5.07*
LQual	0.26	3.53			0.56*	6.15*	0.05	0.88	0.69*	8.69*
MKT	-0.04	-0.50	0.22**	3.86**	0.51*	5.65*	0.11	1.99	0.40*	5.02*
FEN	0.28**	3.81**	0.08	1.39	0.69*	7.60*	0.20*	3.68*	0.31*	3.92*
STO					0.16**	1.78**			0.21*	2.67*
FLO_4	0.18	2.42	0.31***	5.55***	0.25***	2.71***	0.27**	4.96**	0.28**	3.55**
lnNoFl			0.53**	9.51**	0.26*	2.89*	0.51**	9.45**	0.27*	3.35*
REC	-0.36	-4.93	-0.06	-0.98	0.26*	2.88*	-0.15	-2.67	0.27*	3.35*
LOC_2			-0.68**	-12.15**	0.39*	4.36*	-0.60**	-11.00**	0.31*	3.93*
CBD	-0.02	-0.28			0.41*	4.57*	-0.16	-2.93	0.42*	5.36*
BUS			0.30	5.39	0.56*	6.14*	0.17	3.04	0.54*	6.85*
lnBATH	-0.01	-0.08	0.30***	5.26***	0.41*	4.50*	0.19***	3.48***	0.37*	4.71*
RET_1										
TBATH_2	0.41*	5.64*	0.25***	4.41***	0.42	4.69	0.28*	5.07*	0.33*	4.18*

Variables	SR	% Contribution	HC	% Contribution	AFTH	% Contribution	SR + HC	% Contribution	HC + AFTH	% Contribution
CQual	**0.49*** **	**6.77*** **	**0.56** **	**10.07** **	**0.66*** **	**7.32*** **	**0.43***	**8.00***	**0.68***	**8.64***
Standard error	0.39		0.42		0.59		0.41		0.58	
R^2	0.56		0.47		0.84		0.54		0.91	
Adjusted R^2	0.47		0.39		0.84		0.50		0.91	
N	72		85		375		157		460	
Structural		**26.91 (21.04)**		**49.46 (48.07)**		**41.22 (36.53)**		**47.00 (46.12)**		**44.77 (44.77)**
Neighbourhood		**8.41 (8.41)**		**-12.15 (-12.15)**		**21.01 (21.01)**		**-2.76 (-11.00)**		**22.70 (22.70)**
Location		**-5.71 (0.00)**		**8.26 (3.86)**		**19.23 (19.23)**		**-0.57 (0.00)**		**20.57 (20.57)**

Note: 1% (*), 5% (**) and 10% (***) levels of significance. Statistically significant contributions per group are in brackets
Source: Fieldwork data 2017

Table 7c: Nested submarket coefficients and percentage contribution of hedonic model regressors (variables)

Variables	LIN.SR	% Contribution	LIN.HC	% Contribution	LIN.AFTH	% Contribution	MIN.AFTH	% Contribution	HIN.AFTH	% Contribution
Constant	1.29*	15.93*	-1.01	-21.20	1.34	14.96	2.01***	12.30***	3.31*	32.93*
LOC_3										
lnAREA	0.35*	4.31*	0.92*	19.34*	0.17	1.94	-0.01	-0.07	0.17***	1.66***
LQual	0.26	3.16			-0.29	-3.21	0.56**	3.40**	0.77*	7.67*
MKT	-0.04	-0.45	0.22**	4.53**	0.24	2.70	0.38	2.32	0.44*	4.39*
FEN	0.28**	3.41**	0.09	1.87	0.03	0.35	0.67**	4.12**	1.38*	13.76*
STO					0.26	2.91	0.30	1.86	0.19*	1.93*
FLO_4	0.18	2.17	0.30**	6.36**	0.33***	3.65***	0.19	1.15	0.07	0.72
lnNoFl			0.53**	11.21**	0.52*	5.74*	0.86**	5.24**	0.10***	1.02***
REC	-0.36	-4.41	-0.04	-0.92	0.53***	5.93***	-0.65**	-4.00**	0.39*	3.89*
LOC_2										
CBD	-0.02	-0.25			1.63*	18.20*	1.54***	9.41***	0.15**	1.53**
BUS			0.33	7.01	0.19	2.09	0.88***	5.38***	0.07	0.66
lnBATH	-0.01	-0.07	0.29**	5.98**	0.73*	8.09*	0.59	3.63	0.52*	5.15*
RET_1										
TBATH_2	0.41*	5.04*	0.21***	4.39***	1.10*	12.24*	1.19	7.28		
CQual	0.49***	6.06***	0.58*	12.13*	0.48	5.32				

Variables	LIN.SR	% Contribution	LIN.HC	% Contribution	LIN.AFTH	% Contribution	MIN.AFTH	% Contribution	HIN.AFTH	% Contribution
Standard error	0.39		0.37		0.50		0.80		0.40	
R^2	0.44		0.57		0.85		0.60		0.76	
Adjusted R^2	0.35		0.51		0.81		0.52		0.75	
N	70.00		81.00		58.00		71.00		246.00	
Structural		**24.08 (18.82)**		**61.28 (59.41)**		**37.02 (29.72)**		**26.60 (12.76)**		**31.91 (31.19)**
Neighbourhood										
Location		**-5.11 (0.00)**		**10.62 (4.53)**		**28.92 (24.13)**		**13.10 (10.79)**		**10.46 (9.81)**

Note: 1% (*), 5% (**) and 10% (***) levels of significance. Statistically significant contributions per group are in brackets
Source: Fieldwork data 2017

Table 7c (continuation): Nested submarket coefficients and percentage contribution of hedonic model regressors (variables)

Variables	LIN.SR + LIN.HC	% Contribution	LIN.HC + LIN.AFTH	% Contribution	LIN.AFTH + MIN.AFTH	% Contribution	MIN.AFTH + HIN.AFTH	% Contribution
Constant	0.20	3.63	0.49	7.30	0.91	7.88	0.60	5.42
LOC_3								
lnAREA	0.66*	12.23*	0.50*	7.34*	0.34***	2.97***	0.12	1.10
LQual	0.05	0.84	-0.01	-0.13	0.37**	3.18**	1.15*	10.37*
MKT	0.11	2.07	0.22**	3.24**	0.51**	4.41**	0.29**	2.60**
FEN	0.20*	3.71*	0.02	0.31	0.42**	3.61**	1.05*	9.54*
STO			0.23***	3.46***	0.22	1.86	0.10	0.92
FLO_4	0.27**	4.97**	0.28**	4.09**	0.43**	3.69**	0.37	3.35
lnNoFl	0.51**	9.40**	0.45*	6.65*	0.27	2.33	0.34*	3.09*
REC	-0.15	-2.72	0.29*	4.21*	-0.21	-1.82	0.34*	3.10*
LOC_2								
CBD	-0.15	-2.83	1.70*	25.12*	1.50*	12.92*	0.48*	4.30*
BUS	0.18***	3.37***	0.22	3.31	0.58**	5.02**	1.06*	9.62*
lnBATH	0.19	3.48	0.46*	6.83*	0.45**	3.92**	0.62*	5.58*
RET_1								
TBATH_2	0.27*	4.99*	0.45*	6.59*	0.27	2.31	1.50*	13.61*

Variables	LIN.SR + LIN.HC	% Contribution	LIN.HC + LIN.AFTH	% Contribution	LIN.AFTH + MIN.AFTH	% Contribution	MIN.AFTH + HIN.AFTH	% Contribution
CQual	**0.43***	**8.06***	**0.55***	**8.08***	**0.35**	**3.02**		
Standard error	0.39		0.44		0.78		0.66	
R^2	0.55		0.88		0.60		0.74	
Adjusted R^2	0.51		0.86		0.55		0.73	
N	151.00		139.00		129.00		317.00	
Structural		**47.68 (43.36)**		**43.22 (43.04)**		**26.88 (17.37)**		**47.56 (42.19)**
Neighbourhood								
Location		**-0.11 (3.37)**		**35.88 (32.57)**		**20.54 (22.35)**		**19.62 (19.62)**

Note: 1% (*), 5% (**) and 10% (***) levels of significance. Statistically significant contributions per group are in brackets
Source: Fieldwork data 2017

MIN

The Middle Income Neighbourhood (MIN) submarket relates to a submarket that is more of a transition zone between high and low income neighbourhoods. It is a transition zone in the sense that low income earners want to move to these areas when they can afford, and higher income earners want to move out to 'better' accommodation when financial conditions permit and housing is available. In other words, it is an area 'supposed to be' predominantly dominated by middle income earners (working class). The modelling results explains 50% of the variability of the data. The results present a different picture as only 4 variables are statistically significant. LQual contributes 4% to rental value, whereas lnNoFl and number of bathrooms (lnBATH) contributes 6% and 4% respectively. The magnitude of contribution suggests that these variables do not contribute much to rental value.

It should be noted that property near to a recreation facility (REC, -3%) attracts a negative contribution to rent. This is quite a deviation from the norm, as it is expected that nearness to a recreational facility should rather have a positive contribution to rental value. The variables lnAREA, MKT, FEN, STO, FLO_4, CBD, BUS and TBATH_2 were not significant.

HIN

The justification for this submarket classification is that all properties irrespective of type of rental unit, belong to one submarket. It should be noted that properties available here are predominantly apartments, flats and town houses (AFTH). The greatest variable effect on rental value is when the real estate type is a single room (RET_1). This contributes negatively (-21%) to rental value. In these HIN, *single room* type of rental apartments are perceived to be of low standard, especially if toilet, bathroom and kitchen facilities are not for exclusive use but a shared facility. This could be the possible reason why it has a large negative effect on rental value. Also, the availability of a fence wall (FEN) and the landscape quality (LQual) contribute 18% and 10% respectively to rental value. This is quite significant because the fence wall provides some sort of security and landscape quality in Ghana connotes the 'luxury' status of the occupant. Hence the presence of these, invariably should contribute positively to rental value as has been confirmed in this instance. It must be noted that the variables number of bathrooms (lnBATH) and and property near a recreational facility (REC) also has a relatively large contribution to rental value; contributing 7% and 5% respectively. Especially if a property is close to a REC, it makes that neighbourhood attractive for relaxation and as such contribute to rental pricing either explicitly or implicitly. This assertion is confirmed for the HIN submarket. Other variables which also have a positive contribution to rental value include lnAREA, STO, lnNoFl and CBD; which contribute 2%, 3%, 1% and 2% respectively. It is quite surprising that the size of the property only contributes 2% to the value. This could be as a results of the assumption used for this submarket formulation. However although it seems to have a small effect on rent it is statistically significant. It is interesting to note that the variable, property near to bus stop (BUS) is not significant. It is perceived that residents of HIN have a high car (or vehicle) ownership rate and would rather prefer to drive their own vehicles than to be in public transport. HIN are mostly not the focus of public transportation and as such this result reinforces that assumption.

Aside these spatial submarket combinations, this research also explored other plausible pairwise comparisons and analyse results. These pairwise combinations are LIN+MIN, which assume that the LIN and MIN submarkets are indeed one and of the same market and should not be separated. The other is the MIN+HIN submarket which also assume that these 2 should be captured within the same submarket. The modelled LIN+MIN submarket has an adjusted R^2 of 0.79 whereas the adjusted R^2 of the MIN+HIN submarket is 0.74. By comparing the modelling results and adjusted R^2 the LIN+MIN and MIN+HIN submarkets are a much improvement of the results of the MIN submarket.

LIN+MIN

The greatest contributor to rent in this submarket is the quality of construction (CQual), which contributes about 11% to rental value. This could be because it combines all rental properties in both LIN and MIN areas and what should intuitively make the biggest impression on how much rent to pay will be the CQual. Nearness to the CBD also contributes about 10% to rental value. It can be appreciated that with a combined submarket like this, many low income households and those at the lower end of the middle income class may prefer to live closer to the CBD to ensure easy access to work related activities. The reason will be to save same time and cost in commuting daily to the CBD and back. The variables BUS and lnAREA also has a large effect on rental value, contributing about 9% each to rental value. LQual, STO, tiled floor (FLO_4), lnNoFl, lnBATH, FEN, MKT and separate bathroom (TBATH_2) all make a relatively large and positive contribution to rental value. However it is still striking to note that the variable RET_1 has a negative effect on rental value, contributing -6% to rental value. Moreover the variable REC is not statistically significant. The reason could be that within the LIN+MIN submarket green areas, or recreational areas are not the focus of property developers (whether private or institutional) and as such the few properties which may be closer to these areas could attract a premium value. But in the generality of cases, these REC are non-existent or far from these areas because of pressure on available open spaces to be used for accommodation purposes. Recreational/ green areas are easily encroached for residential accommodation as building codes are regulations are hardly enforced; thus resulting in uncontrolled developments.

MIN+HIN

This submarket combines middle and high income neighbourhoods as one subgroup. It should be noted that at the lower end of the market may have characteristics of LIN and at the other end will be characteristic of HIN. As a result of this, it is realised that the greatest contributors to rental value are TBATH_2, LQual and BUS; contributing 14%, 13% and 11% respectively. Having a separate bathroom not shared with other tenants is critical for many middle to high income earners. It is perceived as an improvement in standard of living and as such may attract some premium on rent paid. Same with the quality of landscape which cost is passed on to tenants. The availability of a FEN is a common feature in this combined submarket. Renting a property with or without a fence wall in Accra attracts different pricing in both scenarios; which is a confirmation of what is already known in practice. Other variables like lnBATH, CBD, REC, lnNoFl and MKT all have the expected signs and contributes positively to rental value. It should be noted that RET_1, FLO_4, STO and lnAREA are all not statistically significant. In terms of the size of the rental unit, the reason could be that similar types of accommodation may have standard sizes and that is captured here as well. It is also not surprising that single rooms (RET_1) type of accommodation and tiled floors (FLO_4) are not statistically significant. RET_1 is rather predominant in LIN submarkets and not in this particular one. Also FLO_4 are a common feature of properties within MIN and HIN submarkets.

Table 8 provides a summary of the percentage contribution of statistically significant variables based on an aggregate measure of structural, neighbourhood and location variables. As has been discussed for the spatial submarkets, similar computations have been done for the structural and nested submarket constructs (tables 7b and 7c). The aggregated results are summarised in table 8. When read together with table 6, the specific variables that are statistically significant can be identified for further analysis. As can be observed from table 8, it was only in four instances that the constants were statistically significant and as such reported. Basically the constant represents the combined effects of all omitted variables. The results suggest that structural variables are the main determinants of value in the rental market followed by location variables. This could be attributable to the fact that majority of properties for rent are within the informal market. Therefore resulting in landlords or lessors implicitly placing a higher premium on structural attributes than location and neighbourhood attributes. This could also imply that submarkets within Ghana’s housing market may be homogeneous an thus the differences in rental value predominantly stem from structural attributes. The only exception to this observed trend is within the LIN.AFTH+MIN.AFTH submarket where location variables contribute more to rental values than structural variables.

To sum up, it can be realised that identifying relevant variables and quantifying effects of statistically significant variables are a daunting task. The analysis shows that within the aggregate market and submarket constructs, statistically significant variables modelled are consistent apart from LOC_3 and LOC_2 (which are neighbourhood related). As such their effects are better envisaged within the structural submarkets only. This is because they are controlled for in the other submarket groupings. The same is for RET_1, representing rental units that are single rooms. Here too the effects are seen within the spatial submarkets only and controlled for in the other submarkets.

6. Conclusion

The research analysed the the price premium of value determinants, but focusing on location and neighbourhood attributes and its effect on residential rental values in Ghana. The main aim was to test the hypothesis that differential rental values observed within submarket constructs are mainly due to location and neighbourhood variables or otherwise. Due to the lack of a consistent dataset, this research seldom receives the attention of resesarchers. This research fills the literature gap by providing empirical evidence to test the hypothesis and make far reaching conclusions.

The analysis is based on 536 rental transaction data collected during field study in Accra. *A priori* submarkets are selected based on theoretical definitions and empirically tested to examine the existence of same based on hedonic modelling techniques. Separate hedonic models are run for both the aggregate market and submarket constructs. Using statistically significant model coefficients and the adjusted R^2, the effects of location and and neighbourhood are specifically analysed.

The empirical results suggests that generally within the aggregate market and submarket constructs, structural variables consistently contribute more to rental values than location and neighbourhood variables. In terms of percentage contribution of variables within the aggregate market and submarket constructs, there is a consistent trend. Within the aggregate market, statistically significant structural attributes contribute 43% to rental values, whereas location and neighbourhood attributes contribute 20% and 25% respectively. Followed by location and then neighbourhood variables. In this research it is confirmed that although location and neighbourhood variables are important in determining rental values, structural variables contribute the most (see the summary table 8). The paper finds that the explanatory power of location and neighbourhood variables are improved when separate hedonic equations (models) are estimated based on submarket constructs in Accra.

Table 8: Percentage contribution of statistically significant variables (aggregate effect)

Submarket category	Submarket	Constant	Structural variables	Neighbourhood variables	Location variables	Total
Aggregate market			42.54	25.44	20.23	88.21
Spatial	LIN		46.98		20.14	67.12
	MIN		14.42		-3.44	10.98
	HIN		19.89		12.94	32.83
	LIN+MIN		55.60		23.67	79.27
	MIN+HIN		46.41		21.99	68.40
Structural	SR	17.79	21.04	8.41	0,00	29.45
	HC		48.07	-12.15	3.86	39.78
	AFTH		36.53	21.01	19.23	76.77
	SR+HC		46.12	-11.00	0,00	35.12
	HC+AFTH		44.77	22.70	20.57	88.04
Nested	LIN.SR	15.93	18.82		0,00	34.75
	LIN.HC		59.41		4.53	63.94
	LIN.AFTH		29.72		24.13	53.85
	MIN.AFTH	12.30	12.76		10.79	35.85
	HIN.AFTH	32.93	31.19		9.81	73.93
	LIN.SR+LIN.HC		43.36		3.37	46.73

Submarket category	Submarket	Constant	Structural variables	Neighbourhood variables	Location variables	Total
Aggregate market			42.54	25.44	20.23	88.21
	LIN.HC+LIN.AFTH		43.04		32.57	75.61
	LIN.AFTH+MIN.AFTH		17.37		22.35	39.72
	MIN.AFTH+HIN.AFTH		42.19		19.62	61.81

Source: Field work in Accra, 2017

This research is relevant to various stakeholders in a number of ways. It provides investors within the rental housing space empirical evidence to support the drivers of value to ensure profit maximisation. It also provides a macro overview of rental value determinants based on submarket analysis. It further provides useful insights in the understanding of price movements based on submarket dynamics.

Future research can consider expanding the spatial extent in terms of administrative districts used for these analyses. This will ensure more robust generalisations to be made in terms of understanding the effects of location and neighbourhood characteristics on value. This research is however an important step in this direction and makes significant contribution to the housing market literature in Ghana.

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