# Understanding location and neighbourhood effects: An analysis of the housing submarkets in Accra – Ghana

by

**Emmanuel Kofi Gavu,** *MSc. BSc.*

A thesis submitted to the School of Spatial Planning at TU Dortmund University in fulfilment of the requirements for the award of a degree of Doktor Ingenieur – Dr. -Ing. (Doctor of Engineering)

**Fakultät Raumplanung**
**Technische Universität Dortmund**

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**Emmanuel Kofi Gavu**
*MSc. Geo-Information Science and Earth Observation (Urban Planning and Management*),
University of Twente, The Netherlands

*BSc. (Hons) Land Economy*,
Kwame Nkrumah Univ. of Science and Technology (KNUST), Ghana

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|---|---|
| 1st Supervisor: | Univ-. Prof. Dr. -Ing. Dietwald Gruehn, Technische Universität Dortmund |
| 2nd Supervisor: | Univ-. Prof. Dr. rer.pol. Karl-Werner Schulte, Universität Regensburg |

*Dedicated to*

*my mother,* **Patience Sarkubea Brempong** *(of blessed memory),*

*my father,* **Winnard Kwesi Gavu**

*and*

*aunt,* **Annie Asigbey Asante**

*for being an inspiration to achieve greater heights*

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Emmanuel Kofi Gavu

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# Abstract

Housing is a global phenomenon and is the heartbeat of almost everyone. It is seen as one of the fundamental needs of mankind and the long term focus of many developments across the world. In housing markets research it has been long established that location does matter. That suggests that real estate goods and services place a premium on location. Although this is the case, such location and neighbourhood characteristics are not traded explicitly and their contribution cannot be directly observed. However the contribution of location characteristics on housing markets research to professionals both in Valuation practice and planning authorities cannot be over-emphasised.

This research focuses on analysing rental values at the neighbourhood level which has been neglected by researchers. The main goal of this thesis was to develop a model that could be used to disaggregate residential rental housing values and use it to explain location and neighbourhood effects of housing sub-markets in Accra. The thesis empirically highlights the perception of stakeholders in Accra's housing market in order to identify and conceptualise commonalities and differences in variables that determine Residential Rental Values (RRVs); the empirical conceptualisation of rental values in Accra; determinants of RRVs; empirical examination of submarket existence; and the determination of the price premium of location and neighbourhood attributes on rental values.

The thesis adopts a mixed research approach. Two approaches are broadly operationalised in achieving objectives in this thesis. The first is a perception survey to understand stakeholder views on the rental housing market, and the second was an empirical survey to understand price movements within the market.

The dataset for the perception survey adopted a relative importance index to rank 38 different variables that have been utilised in the extant literature to determine RRVs. Using the stratified sampling technique, the population of experts and stakeholders with knowledge in the rental market space were identified and categorised into six distinct strata. The sample frame was drawn from landlords; tenants; real estate agents; academic staff from real estate teaching departments in universities; valuation and estate surveyors; and a group labelled as 'others'. Purposive sampling was then used to identify respondents within each stratum.

The findings of the perception survey suggest that electricity and piped water connection, type of house, property condition and number of bedrooms are the most significant determinants of RRVs in Accra. Contrariwise, the least significant variables include storeroom availability, proximity to recreational facilities, proximity to place of worship, landscape quality and number of storeys. The first part of the thesis contextualises RRVs by identifying variables that reflect characteristics of the rental housing market in Accra. This serves as a guide in understanding rental market dynamics in a typical African city where access to data remains a challenge.

The dataset for the empirical study is based on 536 rental transaction data collected during field study in Accra. 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. 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 a priori submarket group during the field work.

The thesis finds that submarket definition is a critical aspect in housing market analysis, and this is very useful in understanding market dynamics and making market predictions at a lower level of disaggregation. Using spatial, structural and nested definitions, submarket existence was tested using the Kruskal-Wallis H test (non-parametric), the Jonckheere-Terpstra test (non-parametric) and the

hedonic pricing model (parametric). The results suggests that when pairwise comparisons are analysed, distinct submarkets existed within the aggregate market.

The thesis further finds that variables such as electricity availability, real estate type, water availability, physical condition of property and number of bedrooms, are the top five determinants of rental value as perceived by market stakeholders; while on the other side, properties in high income neighbourhood, landscape quality, construction quality, bus stop availability and total floor area, are the highest contributors (51.85%) to rental value per empirical results. There seem to be a disconnect between these two groups of variables. The results suggests that the five highly ranked variables as perceived by market stakeholders was not confirmed by empirical analysis.

The thesis also tested the hypothesis that, location and neighbourhood attributes determine to a larger extent residential rental values in Ghana than structural attributes does. Separate hedonic models were computed for both the aggregate market and submarket constructs. Using statistically significant model coefficients and the adjusted $R^2$, the effects of location and neighbourhood are specifically analysed. The empirical results suggest that statistically significant structural variables contribute 43% to rental values, whereas location and neighbourhood variables contribute 20% and 25% respectively within the aggregate market. Similar trends are observed within submarket constructs.

The findings have practical and policy implications; and methods utilised in this thesis can be replicated in similar cities in a developing country context where access to reliable data is a challenge. Findings also provide stakeholder investors in the rental space an understanding of market dynamics for profit maximisation, and end-users to maximise utility in deciding where to live – and as such households could benefit from making informed investment decisions on housing.

The thesis finds that there exists several potential applications of quantifying the specific contributions of variables within the aggregate market as well as submarket constructs. The results of the quantification is influenced by the quality of data. It is further recommended that a national housing data bank is established by real estate teaching and research institutions of higher learning in Ghana to facilitate the acquisition of housing related data for research purposes. This thesis is one of the first attempts to empirically identify and test for submarkets existence; and to quantify the price premiums of structural, location and neighbourhood attributes in Ghana's residential rental housing market.

# Zusammenfassung

Wohnen ist ein globales Phänomen und von zentraler Bedeutung für alle Menschen. Es wird als eines der Grundbedürfnisse der Menschheit angesehen und ist der langfristige Fokus vieler Entwicklungen auf der ganzen Welt. In der Wohnungsmarktforschung hat sich längst herausgestellt, dass der Standort eine bedeutsame Rolle spielen kann. Das deutet darauf hin, dass Immobilienwaren und -dienstleistungen eine Prämie einbringen (oder Wert) vor Ort. Obwohl dies der Fall ist, werden solche Standort- und Nachbarschaftsmerkmale nicht explizit behandelt und ihr Beitrag kann nicht direkt beobachtet werden. Der Beitrag von Standortmerkmalen zur Wohnungsmarktforschung ist für Fachleute in der Bewertungspraxis und in Planungsbehörden von hoher Relevanz.

Diese Forschungsarbeit konzentriert sich auf die Analyse von Mietwerten auf Nachbarschaftsebene, die von Forschern bislang vernachlässigt wurden. Das Hauptziel dieser Arbeit war es, ein Modell zu entwickeln, mit dem die Werte von Mietwohnungen aufgeschlüsselt und die Standort- und Nachbarschaftseffekte von Teilmärkten in Accra erklärt werden können. Die Arbeit beleuchtet empirisch die Wahrnehmung von Stakeholdern auf dem Immobilienmarkt von Accra, um Gemeinsamkeiten und Unterschiede in Variablen zu identifizieren und zu konzeptualisieren, die die Wohnungsmietwerte (Residential Rental Values, RRVs) bestimmen. Die empirische Konzeptualisierung von Mietwerten in Accra; Determinanten von RRVs; empirische Untersuchung der Existenz von Teilmärkten; und die Bestimmung der Preisprämie von Standort- und Nachbarschaftsattributen auf Mietwerten.

Die Dissertation verfolgt einen gemischten Forschungsansatz. In dieser Arbeit werden zwei Ansätze zur Erreichung der Ziele verfolgt. Der erste ist eine Wahrnehmungsumfrage, um die Ansichten der Stakeholder zum Mietwohnungsmarkt zu verstehen, und die zweite war eine empirische Umfrage, um die Preisbewegungen innerhalb des Marktes zu erheben.

Der Datensatz für die Wahrnehmungsumfrage beinhaltet einen relativen Wichtigkeitsindex, um 38 verschiedene Variablen zu bewerten, die in der vorhandenen Literatur zur Bestimmung von RRVs verwendet wurden. Mit Hilfe einer stratifizierten Stichprobe wurde die Population von Experten und Stakeholdern mit Kenntnissen im Mietmarktbereich identifiziert und in sechs verschiedene Schichten eingeteilt. Der Musterrahmen wurde von Vermietern, Mietern, Immobilienmaklern, wissenschaftlichen Mitarbeitern aus den Lehrstühlen für Immobilien an Universitäten, Bewertungs- und Gutachtern und einer Gruppe mit der Bezeichnung „Andere“ erstellt. Anschließend wurden die Befragten in jeder Schicht anhand einer gezielten Stichprobe identifiziert.

Die Ergebnisse der Wahrnehmungsumfrage legen nahe, dass Strom- und Wasseranschluss, Haustyp, Zustand des Grundstücks und die Anzahl der Schlafzimmer die wichtigsten Determinanten für RRVs in Accra sind. Im Gegensatz dazu zählen zu den am wenigsten bedeutsamen Variablen die Verfügbarkeit von Lagerräumen, die Nähe zu Freizeiteinrichtungen, die Nähe zu Gebetsstätten, die Landschaftsqualität (auf dem Grundstück) und die Anzahl der Stockwerke. Im ersten Teil der Arbeit werden RRVs kontextualisiert, indem Variablen identifiziert werden, die die Merkmale des Mietwohnungsmarktes in Accra widerspiegeln. Dies dient als Leitfaden für das Verständnis der Dynamik des Wohnungmietmarktes in einer typischen afrikanischen Stadt, in der der Zugang zu Daten nach wie vor oft eine Herausforderung darstellt.

Der Datensatz für die empirische Studie basiert auf 536 Miettransaktionen, die während einer Feldstudie in Accra erhoben wurden. Solche Daten sind nicht ohne weiteres verfügbar, da auf dem ghanaischen Wohnungsmarkt keine institutionalisierte Datenerhebung durchgeführt wird, in der entsprechende Informationen – notfalls auch gegen Gebühr - erhältlich wären. Einige Institute verfügen möglicherweise über einen Teil der Informationen (wie die Lands Commission), aber solche Datenbanken verfügen nicht über alle erforderlichen Variablen, um den Markt umfassend zu modellieren, wie dies in der hier vorliegenden Untersuchung versucht wurde. Darüber hinaus gibt es keine Liste von Mietwohnhäusern, aus denen Teilproben entnommen werden können. Daher war die Schneeballtechnik das praktischste Mittel, um während der Feldarbeit Miethäuser innerhalb jeder A-priori-Untermarktgruppe auszuwählen.

In der Dissertation kann festegstellt werden, dass die Definition von Teilmärkten ein kritischer Aspekt bei der Analyse von Immobilienmärkten ist. Dies ist sehr nützlich, um die Marktdynamik zu verstehen und Marktvorhersagen auf einer niedrigeren Disaggregationsebene zu treffen. Unter Verwendung räumlicher, struktureller und verschachtelter Definitionen wurde die Existenz von Teilmärkten mit dem Kruskal-Wallis-H-Test (nicht parametrisch), dem Jonckheere-Terpstra Test (nicht parametrisch) und dem hedonischen Preismodell (parametrisch) getestet. Die Ergebnisse legen nahe, dass bei der Analyse paarweiser Vergleiche auf dem Gesamtmarkt unterschiedliche Teilmärkte bestanden.

Es wird ferner festgestellt, dass Variablen wie die Verfügbarkeit von Strom, die Art der Immobilie, die Verfügbarkeit von Wasser, der physische Zustand der Immobilie und die Anzahl der Schlafzimmer die fünf wichtigsten Determinanten des Mietwerts sind, die von den Marktakteuren wahrgenommen werden. Auf der anderen Seite tragen Immobilien in Wohngegenden mit hohem Einkommen, Landschaftsqualität, Bauqualität, Verfügbarkeit von Bushaltestellen und Gesamtnutzfläche am meisten (51,85%) zum Mietwert je empirischem Ergebnis bei. Es scheint eine Trennung zwischen diesen beiden Gruppen von Variablen zu geben. Die Ergebnisse legen nahe, dass die fünf hochrangigen Variablen, die von den Marktakteuren wahrgenommen wurden, durch empirische Analysen nicht bestätigt wurden.

In der Dissertation wurde auch die Hypothese geprüft, ob Standort- und Nachbarschaftsattribute in Ghana in größerem Maße die Wohnungsmietwerte bestimmen als strukturelle Attribute. Separate hedonische Modelle wurden sowohl für den Gesamtmarkt als auch für Teilmarktkonstrukte berechnet. Anhand statistisch signifikanter Modellkoeffizienten und des angepassten $R^2$ werden die Auswirkungen von Standort und Nachbarschaft gezielt analysiert. Die empirischen Ergebnisse legen nahe, dass statistisch signifikante Strukturvariablen 43% zu den Mietwerten beitragen, während Standort- und Nachbarschaftsvariablen 20% bzw. 25% zum Gesamtmarkt beitragen. Ähnliche Trends sind bei Teilmarktkonstrukten zu beobachten.

Die Ergebnisse haben praktische und politische Auswirkungen. Die in dieser Dissertation verwendeten Methoden können in ähnlichen Städten in Entwicklungsländern repliziert werden, in denen der Zugriff auf zuverlässige Daten eine den ghanaischen Verhältnissen vergleichbare Herausforderung darstellt. Die Ergebnisse vermitteln den Investoren hinsichtlich der Mietflächen ein Verständnis der Marktdynamik zur Gewinnmaximierung und den Endnutzern die Möglichkeit, bei der Entscheidung, wo sie wohnen möchten, den größtmöglichen Nutzen zu erzielen. Daher könnten Haushalte von fundierten Investitionsentscheidungen in Bezug auf Wohnimmobilien profitieren.

Die Dissertation stellt fest, dass es mehrere mögliche Anwendungen zur Quantifizierung der spezifischen Beiträge von Variablen innerhalb des aggregierten Marktes sowie von Teilmarktkonstrukten gibt. Die Ergebnisse der Quantifizierung werden von der Datenqualität beeinflusst. Es wird ferner empfohlen, dass von Lehr- und Forschungseinrichtungen für Immobilien in Ghana eine nationale Wohnungsdatenbank eingerichtet wird, um die Erfassung wohnungsbezogener Daten für Forschungszwecke zu erleichtern. Diese These ist einer der ersten Versuche, die Existenz von Teilmärkten empirisch zu identifizieren und zu testen und zur Quantifizierung der Preisprämien für Struktur-, Standort- und Nachbarschaftsattribute auf dem Markt für Mietwohnimmobilien in Ghana beizutragen.

# Abstrait / Résumé

Le logement est un phénomène mondial et fait battre le cœur de presque tout le monde. Il est considéré comme l'un des besoins fondamentaux de l'humanité et l'objectif à long terme de nombreux développements à travers le monde. Dans la recherche sur les marchés du logement, il est établi depuis longtemps que l'emplacement joue un rôle important. Cela suggère que les biens immobiliers et les services immobiliers accordent une grande importance à l'emplacement. Bien que ce soit le cas, ces caractéristiques de localisation et de quartier ne sont pas négociées de manière explicite et leur contribution ne peut pas être directement observée. Toutefois, on ne saurait trop insister sur la contribution des caractéristiques de localisation des recherches sur les marchés du logement aux professionnels de la pratique de l'évaluation et des autorités de planification.

Cette recherche porte sur l'analyse des valeurs locatives au niveau du quartier, négligées par les chercheurs. L'objectif principal de cette thèse était de développer un modèle qui pourrait être utilisé pour désagréger les valeurs du logement locatif résidentiel et l'utiliser pour expliquer les effets des sous-marchés du logement à Accra sur l'emplacement et les quartiers. La thèse met en évidence de manière empirique la perception des parties prenantes du marché du logement à Accra afin d'identifier et de conceptualiser les points communs et les différences de variables qui déterminent les Valeurs Locatives Résidentielles (VLR); la conceptualisation empirique des valeurs locatives à Accra; déterminants des VLR; l'examen empirique de l'existence du sous-marché; et la détermination de la prime de prix des caractéristiques du quartier et de voisinage sur les valeurs locatives.

La thèse adopte une approche de recherche mixte. Deux approches sont largement opérationnalisées dans la réalisation des objectifs de cette thèse. La première est une enquête de perception visant à comprendre le point de vue des parties prenantes sur le marché du logement locatif et la seconde consiste en une enquête empirique destinée à comprendre les fluctuations des prix sur le marché.

L'ensemble de données de l'enquête de perception a adopté un indice d'importance relative pour classer 38 variables différentes qui ont été utilisées dans la littérature existante pour déterminer les VLRs. En utilisant la technique d'échantillonnage stratifié, la population d'experts et de parties prenantes ayant des connaissances dans le marché de la location a été identifiée et classée en six strates distinctes. La base de sondage a été tirée des propriétaires; les locataires; les agents immobiliers; le personnel académique des départements d'enseignement de l'immobilier dans les universités; les experts en évaluation et en succession; et un groupe appelé «autres». Un échantillonnage raisonné a ensuite été utilisé pour identifier les répondants dans chaque strate.

Les résultats de l'enquête de perception suggèrent que le raccordement à l'électricité et à l'eau courante, le type de maison, l'état de la propriété et le nombre de chambres à coucher sont les déterminants les plus importants des VLR à Accra. Au contraire, les variables les moins significatives incluent la disponibilité des magasins, la proximité d'installations de loisirs, la proximité d'un lieu de culte, la qualité du paysage et le nombre d'étages. La première partie de la thèse contextualise les VLR en identifiant des variables qui reflètent les caractéristiques du marché du logement locatif à Accra. Cela sert de guide pour comprendre la dynamique du marché locatif dans une ville Africaine typique où l'accès aux données reste un défi.

L'ensemble de données pour l'étude empirique est basé sur 536 données de transaction de location collectées lors d'une étude sur le terrain à Accra. De telles données ne sont pas facilement disponibles, car le marché de l'habitat Ghanéen n'existe pas en l'absence d'une banque de données bien établie, où de telles informations pourraient être obtenues même moyennant des frais. Certaines institutions peuvent disposer de certaines informations (par exemple, la Commission de la Terre), mais ces bases de données ne disposent pas de toutes les variables requises pour modéliser le marché de manière exhaustive, comme cela a été tenté dans cette étude. De plus, il n'existe aucune liste de bases de sondage des maisons de location résidentielle dans lesquelles puiser des sous-échantilluyons. La technique de la boule de neige a donc été le moyen le plus pratique de sélectionner des maisons de location au sein de chaque groupe de sous-marchés a priori pendant le travail sur le terrain.

La thèse conclut que la définition du sous-marché est un aspect essentiel de l'analyse du marché de l'habitation, ce qui est très utile pour comprendre la dynamique du marché et établir des prévisions de marché à un niveau de désagrégation inférieur. À l'aide de définitions spatiales, structurelles et imbriquées, l'existence du sous-marché a été testée à l'aide du test H de Kruskal-Wallis (non paramétrique), du test de Jonckheere-Terpstra (non paramétrique) et du modèle de tarification hédonique (paramétrique). Les résultats suggèrent que, lorsque les comparaisons par paires sont analysées, des sous-marchés distincts existaient sur le marché global.

La thèse conclut en outre que des variables telles que la disponibilité de l'électricité, le type d'immeuble, la disponibilité de l'eau, l'état physique de la propriété et le nombre de chambres à coucher constituent les cinq principaux déterminants de la valeur locative tels qu'ils sont perçus par les parties prenantes du marché; tandis que, de l'autre côté, les propriétés situées dans des quartiers à revenu élevé, la qualité du paysage, la qualité de la construction, la disponibilité des arrêts de bus et la surface de plancher totale, contribuent le plus (51,85%) à la valeur locative par résultat empirique. Il semble y avoir un décalage entre ces deux groupes de variables. Les résultats suggèrent que l'analyse empirique n'a pas confirmé les cinq variables hautement classées telles que perçues par les parties prenantes du marché.

La thèse a également testé l'hypothèse selon laquelle les caractéristiques d'emplacement et de voisinage déterminent dans une plus grande mesure les valeurs locatives résidentielles au Ghana que les caractéristiques structurelles. Des modèles hédoniques distincts ont été calculés pour les concepts de marché global et de sous-marché. En utilisant des coefficients de modèle statistiquement significatifs et le $R^2$ ajusté, les effets de la localisation et du voisinage sont spécifiquement analysés. Les résultats empiriques suggèrent que les variables structurelles statistiquement significatives contribuent pour 43% aux valeurs locatives, tandis que les variables d'emplacement et de voisinage contribuent respectivement pour 20% et 25% au sein du marché global. Des tendances similaires sont observées dans les constructions de sous-marchés.

Les résultats ont des implications pratiques et politiques; et les méthodes utilisées dans cette thèse peuvent être reproduites dans des villes similaires dans un pays en développement où l'accès à des données fiables constitue un défi. Les résultats fournissent également aux investisseurs parties prenantes de l'espace locatif une compréhension de la dynamique du marché pour maximiser les profits, et aux utilisateurs finaux de maximiser l'utilité en décidant du lieu de résidence. Les ménages pourraient ainsi bénéficier de prendre des décisions d'investissement éclairées en matière de logement.

La thèse montre qu'il existe plusieurs applications potentielles de la quantification des contributions spécifiques des variables au sein du marché global ainsi que des constructions de sous-marché. Les résultats de la quantification sont influencés par la qualité des données. Il est en outre recommandé de créer une banque de données nationale sur le logement créée par des établissements d'enseignement supérieur et de recherche en immobilier du Ghana afin de faciliter l'acquisition de données relatives au logement à des fins de recherche. Cette thèse est l'une des premières tentatives d'identification et de test empiriques de l'existence de sous-marchés; et pour quantifier les primes de prix les caractéristiques structurelles et de voisinage sur le marché du logement locatif au Ghana.

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| | |
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| AFTH | Apartment, Flat and Town houses |
| ANOVA | Analysis of Variance |
| BBU | Brand Beauty Utility |
| CBD | Central Business District |
| ETV | Explicit Time Variable |
| GhIS | Ghana Institution of Surveyors |
| GHS | Ghana Cedis |
| GSS | Ghana Statistical Service |
| HC | Hall and Chamber |
| HIN | High Income neighbourhood |
| HIN.AFTH | Apartment, Flat and Town houses within high income neighbourhoods |
| HIN.HC | Hall and chamber units within high income neighbourhoods |
| HIN.SR | Single rooms within high income neighbourhoods |
| HPM | Hedonic Pricing Model |
| LIN | Low Income neighbourhood |
| LIN.AFTH | Apartment, Flat and Town houses within low income neighbourhoods |
| LIN.HC | Hall and chamber units within low income neighbourhoods |
| LIN.SR | Single rooms within low income neighbourhoods |
| MIN | Middle Income neighbourhood |
| MIN.AFTH | Apartment, Flat and Town houses within middle income neighbourhoods |
| MIN.HC | Hall and chamber units within middle income neighbourhoods |
| MIN.SR | Single rooms within middle income neighbourhoods |
| MMDA | Metropolitan Municipal and District Assemblies |
| MSE | Mean Squared Error |
| RE | Real Estate |
| REA | Real Estate Agent |
| RII | Relative Importance Index |
| RRHM | Residential Rental Housing Market |
| RRVs | Residential Rental Values |
| SCS | Strictly Cross-Sectional |
| SR | Single Rooms |
| SSA | Sub Saharan Africa |
| UNESCAP | United Nations Economic and Social Commission for Asia and the Pacific |
| USD | United States Dollars |
| VES | Valuation and Estate Surveyor |

# 1. Ontology of key concepts in rental housing market modelling: A literature review

*"Everything is related to everything else, but near things are more related than distant things"*
*– So called first law of Geography*

*"The phenomenon external to an area of interest affects what goes on inside"*
*– So called second law of Geography*

(Tobler, 1979)

## 1.1. Introduction

This chapter provides a broad overview of key concepts, definitions and central themes that come up in rental housing market modelling. We begin this chapter by defining concepts such as market, housing market, neighbourhood and submarket definition. The residential rental market in Ghana and its structure is discussed to situate the research in its local setting so that we can better appreciate the peculiar rental housing market under study. More so, we analyse how the rental market generally works and examine some explanatory variables that are used to model same. We conclude the chapter by discussing the theoretical underpinnings to consider in terms of explanatory variables to include in an empirical study. We emphasize that location and neighbourhood factors play a critical role in determining residential rental values and as such the need to consider these effects and contribution of same on rental values. This in our opinion situates the research within its appropriate theoretical perspective for a more detailed analysis to proceed.

Ontology as a concept has its roots in Philosophy and is a science that relates to the theory of objects and their (inter) dependencies. Ontology is concerned with the form and nature of reality. It accordingly focuses on theory of what exists and how it exists. This concept is gaining some attention in housing markets research (Kohli, Sliuzas, Kerle, & Stein, 2012; La Grange & Pretorius, 2000; Ley & Teo, 2014; Malczewski & Jelokhani-Niaraki, 2012). Housing is defined by a bundle of site and locational attributes. In more general and theoretical terms, there exists a lot of explanatory variables that could be utilised to explain value differentials between properties in the residential housing market. In this research however, these explanatory variables are discussed holistically and in a much broader perspective. A number of research conducted into this field has not been conclusive as to what explanatory variables are critical and could be used to explain rental value differentials across neighbourhoods (or submarket constructs) (Abidoye & Chan, 2016; Choumert, Kere, & Laré, 2015; Owusu-Ansah, 2012a). However the common ground is that the structural characteristics of the property, locational, neighbourhood as well as environmental characteristics have influence on prices (Baranzini, Ramirez, Schaerer, & Thalmann, 2008). It is therefore important to take note that because of locational differentials these characteristics may differ from place to place. What accounts for value at a particular location may not necessarily be deemed important in another. As such these variables must be carefully chosen to represent what the market ideally represents in each location.

The subsequent sections are organised as follows. The main concepts of market; housing market; sub-market construction and theories to model same are discussed; a brief overview of the residential rental market in Ghana is provided; the concept of neighbourhoods and what distinguishes one from another; submarket definition and how to identify same; how the housing market works; discuss theoretical considerations in modelling housing markets and finally discuss explanatory variables that could be considered in a developing country context. Initially, it may sound pedantic to start by defining concepts as this may seem common knowledge. However the definitions put the research in its proper perspective and context. This will set the stage for deeper understanding on emerging issues and also a literature review. The chapter concludes by offering some concluding remarks and suggesting the way forward.

## 1.2. Market

A market in general terms connotes a system or institutional device for exchange (Maclennan, 2012). The concept of market also facilitates information flow between buyers and sellers – not necessarily single points or places, but rather connected information networks (Maclennan, 2012). Market could also be defined generally as an arrangement between buyers and sellers for the exchange of goods and services. Other definitions of a market restricted it to a location where goods and services were exchanged.

In the context of this research we have to make a clear distinction of the kind of product we have in order to define the kind of market. A clear distinction between this product (house) and other products is that a house is fixed in location; for housing the consumer moves and not the product. Hence in keeping to a locational definition, a market for a good is the area within which the price of a good tends to uniformity (Jones, 2002; Stigler & Sherwin, 1985). The reason for adopting this definition is that in

real estate analysis there is a locational attribute to the product which makes the definition valid. The concept of housing does not only encapsulate the notion of a structure where we live, but also services that run with the enjoyment of these spaces.

## 1.3. Housing market

Maclennan (2012, p.12) explains that, from an

> "*economic perspective, a house (or 'housing') consists of a designed physical structure of connected and sheltered spaces and systems, constructed of materials and components (pipes, wires, etc.) through the use of capital (e.g. developers' ingenuity and equipment), labour (from designers to bricklayers) and land or existing property*. Further we note that *houses are complex, durable, locationally fixed structures with multiple attributes that are invariably purchased and consumed jointly with the neighbourhood characteristics that surround them"* (*ibid*).

By definition, a housing market is an arrangement or a mechanism for the exchange of real estate goods and services between market participants. The market may be segmented by property type, geographic location, and income among others. To make effective decisions concerning real estate one needs to understand how real estate prices are determined in real estate markets. Demand and supply models may be used to explain how the market works and the dynamics associated with them. In this section we focus our attention on real estate markets where the properties are intended to generate rental income. Thus we are concerned with transactions over rights to the use space (real estate space markets).

There are various types of housing that one can occupy to satisfy their specific housing needs. This variation will come about as a result of taste and preferences of consumers or disposable income available for housing. In the housing ladder system (it is expected that) a household will normally move from poor quality housing to a better quality one, as household income improves. This potentially further segments the market by housing type. For example in Ghana, this hierarchical move from poor quality housing to a better quality one can take the form of moving from a compound house (where all rooms share common areas such as bathroom, toilet, drying lines) to a rental house; then to a condominium; to a rented single family home; then finally to an owner occupied house of better quality.

The housing market differs from place to place even between cities in the same country (Malpezzi, 1999) and it is segmented (Goodman & Thibodeau, 1998). This is because of the complexity of interactions and the spatiality of housing markets (Paterson & Boyle, 2002; Sirmans, Macpherson, & Zietz, 2005). Standards and quality of various housing may differ from locality to locality; likewise value may differ respectively. The import is that housing attributes that influence value may differ from one geographical region to another. Generalisations will therefore not be possible (in many instances) and thus such arguments will not be sustained.

There is the need to understand the complexities of rental markets to be able to model the process. Rental housing is an important part of urban housing markets. Rural areas tend not to be the focus of rental housing developers. This is because of the lack of effective demand especially in developing countries. One thing worth noting is that the rental markets respond to a variety of needs in a particular city; whether rich or poor. Furthermore, changes in rental value affects individual expenditure and as such aggregate consumption expenditure (Tsatsaronis & Zhu, 2004).

Housing is a composite good and it is let or sold wholly as one unit. Every house is highly heterogonous and that is the main reason why we say each is different. No two properties can be the same. The land economics literature suggests that the key determinant of house price is location. There are also other factors which include structural composition, neighbourhood and environmental quality that affect rental value.

## 1.4. Rental housing overview in Accra – Ghana

Accra is located on the south-eastern coast of Ghana, with a total land area of 3,245 square kilometres. It has been Ghana's capital and seat of government since 1877, prior to that was Cape Coast. With a population of about 4 million people, the region accounts for about 16.3 *per cent* of the total national population. It is currently the second most populous region in Ghana (most populous being Ashanti region) according to the 2010 population and housing census. It is the most urbanized region in Ghana accounting for over 90.5 *per cent* of all built up areas within the region. Accra typically connotes 3 different geographical areas – Accra Central; Accra Metropolitan Area and the Greater Accra Region. In this research we refer to the latter when we mention Accra.

According to the 2010 Population and Housing Census the Greater Accra region has the following characteristics;

Total land area: 3,245 square kilometres
Total population: 4,010,054
Population density: 1,235.8
Urban population: 90.5 *per cent*
Total household population: 3,888,512
Number of houses: 474,621
Percentage contribution to national housing stock: 14 *per cent*
Number of households: 1,036,370
Average household per house: 2.2
Population per house: 8.4
Average household size: 3.4
Percentage of compound houses: 57.4 *per cent*

In terms of land tenure system, majority of land is held by the Stools[1]. Ghana operates a pluralistic land tenure regime; statutory and customary land tenures. Customary land tenure accounts for between 80 to 90% of all undeveloped land (Kasanga & Kotey, 2001).

In Ghana rental housing has evolved with the government's implementation of the structural adjustment programme of the 1980s which saw more private sector involvement in housing provision. The majority of housing in the private sector is provided by private landlords who offer rental units in compound houses to tenants. The arrangement is such that tenants pay between 6 to 24 months' rent in advance to landlords in lieu of occupation (this is the current situation although the Rent Act of 1963, Act 220 only stipulates a maximum of 6 months' rent to be paid in advance). Tenants pay rents up to over 2 years in advance and in most cases they have to borrow such colossal amounts to make rent payments. This provision in the Act has been flagrantly ignored because of excess demand over supply and also a lack of enforcement of laws in the housing market in general.

Although Ghana has a multiplicity of laws governing rental housing tenure, its implementation has not seen any major successes. The Rent Control mechanism is not effective as such the rules are flouted with impunity. Anecdotal evidence suggests that the rent control department (a creation of Act 220) is riddled with corruption and thus renders their service only to clients who pay more (in terms of bribe). Complaints are either made by a landlord or tenant to the department and they make a ruling or determination to that effect. There is basically no centralized coordination between and among government organisations tasked with housing. Although rental housing shows more promising hope to house majority of the population, government approach has been to rather promote home ownership and

[1] Kasanga and Kotey (2001) sum up the definition of stool in this manner – *"a stool means the seat of a chief of an indigenous state (sometimes of a head of family) which represents the source of authority of the chief (or head of family). It is a symbol of unity and its responsibilities devolve upon its living representatives, the chief and his councillors. Land owned by such a state is referred to as stool land (National Land Policy, Ministry of Lands, Accra 1999). Note: A skin in Northern Ghana is the equivalent of a stool in Southern Ghana*".
Chiefs hold and administer these lands on behalf of their subjects. They will normally grant a lease of 99 years or less (to Ghanaians) or 45 years or less (to foreigners). These leases can however be renewed subject to landlord and tenant arrangements. For further discussions on land tenure arrangements in Ghana see Kasanga and Kotey (2001).

'affordable housing' policies (which in actual sense is only affordable to a few in the high income bracket).

Rental housing has become a common feature in terms of alternatives or options that are available to residents in the country. Rental housing is common among low and middle income earners who may not have enough capital to purchase or build their own homes. Most of the housing units in the rental market are unfurnished, implying that tenants spend additional monies furnishing rented units before they move in. Owing to the exploitative nature of the rental market in Ghana, most tenants desire and are actually working towards building and moving into their own houses. By so doing, they combine renting and building a house for several years till they become owner-occupiers (Asante, Gavu, Quansah, & Osei Tutu, 2018). Building one's own house is also a very challenging task in Ghana, as individuals have to surmount the hurdle of high interest rates on home financing, high cost of building materials and high prices of residential lands. It is important to note that majority of this population may not be able to buy a house in their entire lifetime.

The housing stock is mostly characterized by crowding and shortages, this is as a result of excess demand over supply. The rental market is a mix of low and high end properties depending on what is affordable to a particular tenant. The informal rental market (made up of mostly small scale developers) accounts for majority of rental housing provision across the country. To increase the stock a number of options are available to landlords, among these include; pre-financing or co-financing by tenants (so that uncompleted structures can be completed by landlords and let to tenants); reduction in the rooms occupied by landlords (so that these rooms can be made available to the market for rental); building of new houses; and renovating deteriorated structures (Yankson, 2012).

## 1.5. The residential rental market in Ghana

The world over, rental housing has a fair proportion of the housing market. Currently about 1.2 billion of the world's population live in rented accommodation and this constitutes a large share of the market in many countries (Gilbert, 2003, 2016). It is well established and documented in literature that two tenure regimes exists for housing, owner-occupier and rental (Gough & Yankson, 2011); however there exists a third group who are neither owner-occupiers nor renters and constitute a group known as "*rent-free occupiers".* Examples of persons who may constitute this third group are children living in parent's house, occupants of social housing, "*sharers*", *"squatters"* and "*perchers*" (Yankson, 2012). 31.1 *per cent* of residential units in Ghana are occupied on a rental basis, whereas in the Greater Accra region 47 *per cent* of these units are rented (Ghana Statistical Service, 2013). Figure 1.1 provides a snapshot of the residential rental housing market structure in Ghana. The rental housing structure is explained in subsequent paragraphs below.

Ghana's housing market follows a free market economy model. The initial policy focus of government was direct state provision in the 1990s; however this role has shifted and taken over by an active private sector comprising individual developers, private real estate firms and developers (Arku, 2009b, 2009a; Tipple & Korboe, 1998). The government's current role is a regulator and also to provide an 'enabling environment' for developers to provide housing needs. In some instances there are Public Private Partnership (PPPs) arrangements (for example the Appolonia City in Accra, a project of Rendeavour – Africa's largest urban land developer). In the recent past the attempts at improving housing supply has been to either sub-divide new land, extend infrastructure, make housing finance easier to access and also making it easier for private developers to develop new housing stock. All these attempts by the government were to encourage home ownership. In many countries however, home ownership has become the norm and the most desired option. There is the need for the populace to embrace rental housing as a viable option especially in developing countries where incomes are generally low and demand for housing always exceeds available supply. Thus resulting in increasing prices for accommodation.

Rakodi (1995) discusses policies that are relevant for the rental housing market to thrive. These include regulating private sector rental housing (through rent control; regulating relationships between landlord and tenant; development, building and health regulations); management of public sector stock (through

allocation and maintenance arrangements and divestments); and aim to increase supply of rental housing (through policies to increase both public and private sector supply of rental housing).

The national housing policy of Ghana 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). To reduce the over 1.7 million housing deficit (Salifu Osumanu, Aigbavboa, & Thwala, 2018), government's main approach is to create an "enabling environment" for private sector investment and accelerate upgrading of the existing housing. The efforts to address the housing deficit have been a piecemeal approach (or on a small scale) as compared to the scope of the problem.

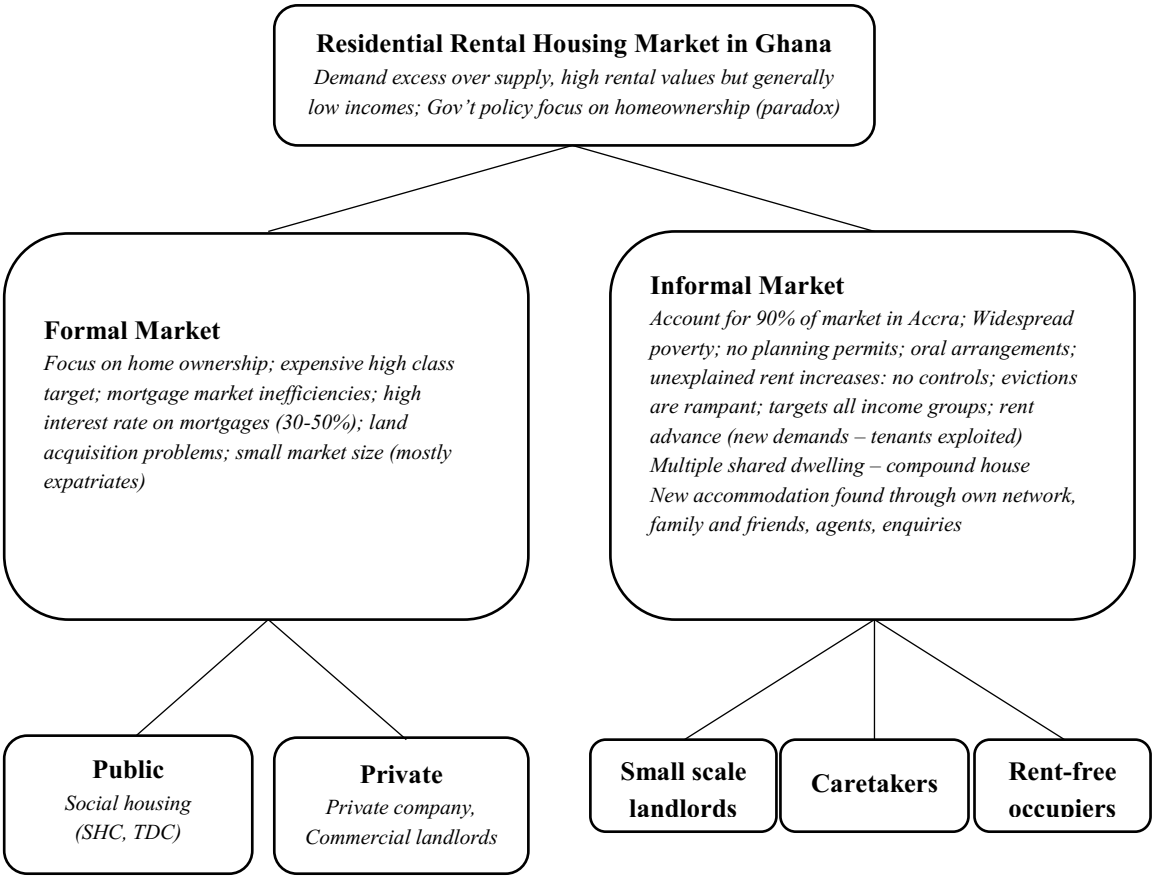



Figure 1.1: Residential Rental Market structure in Ghana (adapted from Arku et al. 2012)

Source: Author's construct

The paradox here is that although many attempts have been made by successive governments to increase homeownership through various policy directives, rental housing has rather been on the ascendancy (Asante et al., 2018; Gilbert, 2003, 2016). Indeed the frequency of rental housing transactions compared to sales is high and increased in many countries especially the developing ones (see tables 1.1a and 1.1b). More so, the bulk of (ineffective) demand for housing has been at the lower end of the market generally because of low incomes (poverty). For example in Ghana rental housing accounts for about 31 *per cent* of all households while Accra accounts for about 37.5 *per cent* (Ghana Statistical Service, 2012). It can be appreciated that a well-functioning housing market provides for a variety of housing options to the population. In a well-functioning rental housing market (in developed markets), the value of rental housing is linked to the quality of the housing, access to jobs and other public services, and access to basic infrastructure; which are all location specific. However in undeveloped markets for example, where government or employers provide accommodation (or pay rent) on behalf of employees,

these employees tend to pay less than what the market supports and will not reflect market-location specific rents. Supply in the market is from new constructions as well as modifications (and renovation) of the existing stock. And these changes to the stock is through the determinants of supply and demand forces.

Ghana as a lower middle income country is grappled with the problem affordability. A cursory examination of table 1.1a (in GHS) and 1.1b (in USD) shows that about 85 *per cent* of the population are unable to afford to buy a house that costs more than USD32,000 (about GHS72,000) and as such consider other tenure options based on household income.

Rental housing is an important component of housing supply provision. There are lots of constraints on the supply side (including high cost in building, high financing costs, high cost of building materials among others) and as such housing options range from those that lack basic facilities (in some cases are shared) to the other extreme. *Ceteris paribus*, household income plays a key role in determining options available to renters. Osumanu (2010) found out that a significant proportion of urban households cannot afford ownership due to low incomes, hence rental housing becomes the most logical solution to consider. Low income households predominantly rent in the informal sector where basic facilities may be lacking (while some are in deplorable conditions) and as household incomes rise they tend to consider more decent rental accommodation in the formal sector or become homeowners.

Table 1.1a: Housing affordability pyramid for Ghana (in Ghana Cedis – GHS)

| **Income Range** | **Income GHS/ month** | **Percentages of all Households** | **Maximum affordability (in GHS) assuming 3 times annual income** | **Housing cost (GHS) aimed at the thresholds*** | **Monthly maximum rent levels (GHS) affordable at R:Y of 10%** |
|---|---|---|---|---|---|
| Very High | >4,000 | 5% | 180,000 | 476,000 & 204,000 | 500+ |
| High | 3,001 – 4,000 | 10% | 144,000 | 163,200 | 400 |
| Mid-high | 2,001 – 3,000 | 50% of households can afford housing costing between GHS12,001 and GHS72,000 | 108,000 | 95,200 | 300 |
| Middle | 1,001 – 2,000 | | 72,000 | Up to 54,000 | 200 |
| Moderate | 501 – 1,000 | | 36,000 | | 100 |
| Low income | 101 – 500 | | 18,000 | | 50 |
| | 51 – 100 | 35% of households can afford housing costing USD2,276 or less | 12,000 | | 10 |
| No wage income | 0 – 50 | | | | |

**Assuming one-third of income as housing payments*

Source: (UN-Habitat, 2011)

Table 1.1b: Housing affordability pyramid for Ghana (in United States Dollars – USD)

| Income Range | Income USD/ month | Percentages of all Households | Maximum affordability (in USD) assuming 3 times annual income | Housing cost (USD) aimed at the thresholds* | Monthly maximum rent levels (USD) affordable at R:Y of 10% |
|---|---|---|---|---|---|
| Very High | >909 | 5% | 40,901 | 108,160 & 46,354 | 114+ |
| High | 682 – 909 | 10% | 32,721 | 37,083 | 91 |
| Mid-high | 455 – 681 | 50% of households can afford housing costing between USD2,727 and USD16,360 | 24,540 | 21,632 | 68 |
| Middle | 227 – 454 | | 16,360 | Up to 12,270 | 45 |
| Moderate | 114 – 226 | | 8,180 | | 23 |
| Low income | 23 – 113 | | 4,090 | | 11 |
| | 12 – 22 | 35% of households can afford housing costing USD2,276 or less | 2,727 | | 2 |
| No wage income | 0 – 11 | | | | |

**Assuming one-third of income as housing payments*

*Note: The exchange rate used is USD1.000 = GHS4.4009 as at August 27, 2017*

Source: (adapted from UN-Habitat, 2011)

Households make critical decisions as to which accommodation they prefer to rent based on whether the property in question fits their lifestyle or not. Typically a landlord makes an offer and a prospective tenant decides whether this is worth taking. When price is agreed between both parties, it reflects a lot of considerations both implicit and explicit. A rental tenancy may take any of these forms; (1) move to a newly completed house ready for occupation, (2) move to previously occupied house when a place becomes vacant, (3) move to already occupied rooms as a "*percher*" or "*shared tenant*" or to an overcrowded house – this puts pressure on few amenities available, (4) move to substandard housing where basic infrastructure is lacking, (5) move to a property that has been converted from another use type to residential accommodation, (6) move away from the city centre to the outskirts to occupy uncompleted structures or houses as caretakers or temporary occupants, among others.

The typology of accommodation types in the rental housing market in Ghana is of two typologies; the formal and informal sectors. In figure 1.2 the residential rental accommodation types in Ghana are depicted. The formal housing sector is usually characterised by valid legal title; structurally sound and complies with local planning standards and building codes; and the property can be pledged as collateral. It is much more organised and comprises of gated communities and estate buildings. It is well served with basic infrastructure and buildings conform to planning standards. Supply is mostly by government and the private sector (real estate developers). About ninety *per cent* of the housing stock is exclusively for sale. The few available for rent are mostly affordable to those in the higher income brackets and serves those in the middle and especially those in the high income brackets. Rental prices are mostly quoted in United States Dollars (USD). Low income households are unable to afford the rents in least expensive high income market.

The informal housing market is defined by deviations from laws and regulations that govern formal access. This is not necessarily slum development but a continuum of housing conditions relating to the lack or inadequate housing standards (and often linked to poverty). In Ghana the informal rental market is generally of poor quality. It often lacks access to basic water and sanitation. Landlords in this informal subsector operate outside the legal regime because of housing shortages and evictions are rampant. They use this phenomena as a basis to (most often) exploit tenants who are at their mercy. However these private sector informal landlords have contributed in curbing the housing problem. Without them the situation may have been worse. Informal rental housing market is yet to receive the needed attention from policy makers. However it must be noted that most of these houses in the informal market are overcrowded, poorly sited (for example very close to public toilets, dump sites) and do not have building permit. These buildings are more or less randomly sited. When disaster strikes, access routes for

emergency services like fire and ambulance are virtually non-existent; leading to 'needless' loss of lives and property.

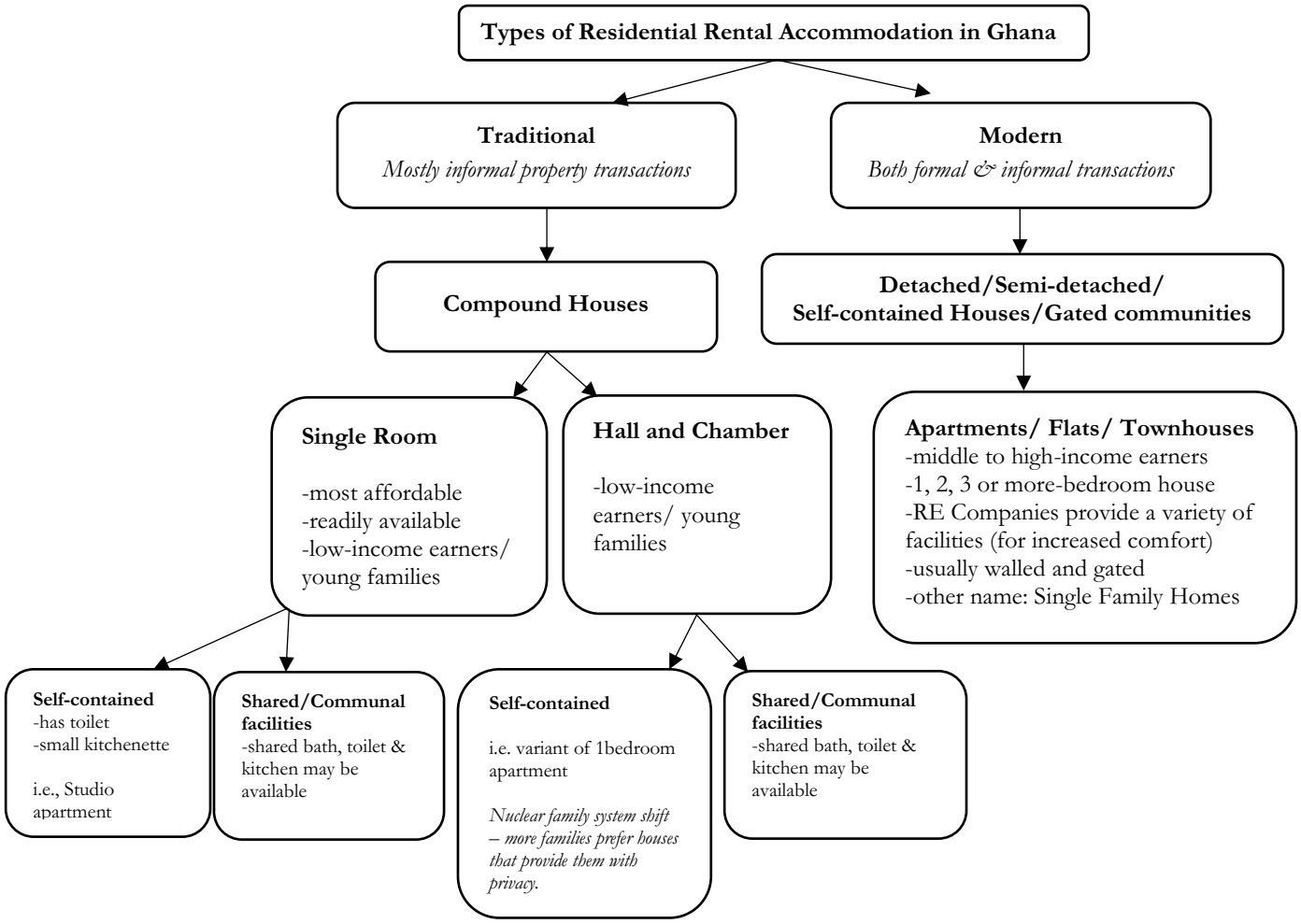



Figure 1.2: Residential Rental accommodation types in Ghana

Source: Author's construct

The rental market mainly favours the landlord. The rents that are however fixed are agreed between landlord and tenant. The Rent Act (Act 220) 1963 regulates transactions in this market but these provisions are hardly enforced. The Act specifies that landlords can only receive 6 months of rent in advance, however in practice tenants pay between 1 – 3 years rent in advance. The usual covenants apply which require that a tenant informs the landlord if s/he wants to pre-terminate the contract 3 months in advance before the lease expires; otherwise on expiry of the lease (or rental contract) it determines.

The informal rental market is dominated by what is known as the traditional compound houses (Osumanu, 2010) which is home to majority of the population (see figures 1.3 a, b and c). These are mostly communal single storey structures (with one or two rooms that serves a household), with a courtyard where multiple households share common bathroom and toilet facilities. They are normally occupied by low income earners. Basic infrastructural facilities around these houses are either non-existent or inadequate. About 50 *per cent* of households in Ghana live in one room dwellings and Accra is no exception.

Other housing options available in the rental market include semi-detached houses, detached houses, apartments and bungalows. Three main types of accommodation are available for the low income tenants

for renting in compound houses. These are the so-called *'single-rooms'*, '*hall-and-chamber units*' and the '*hall-and-chamber self-contain units'*[2].

One common feature in rental housing in Ghana is the use of estate agents (or 'agents' as they are known in the local parlance) in the house search process. Moving to a new accommodation has always been a daunting task (in terms of its risks and returns) and requires the services of professionals to make the right decisions. As discussed earlier housing is a complex good. Most of these estate agents are said to be quacks (not professionals and are not regulated by any professional association), though not all, who are mostly concerned with their commissions and not the satisfaction of clients. In some cases there are significant information asymmetries about true condition of the house that goes to the detriment of especially tenants. Problems are only realised by clients after they have moved into the house. There are plans to regulate estate agents through the 'Estate Agency Bill' by the Ghana Institution of Surveyors – GhIS; to ensure some sanity in the housing market.

Various taxes are applicable in the Ghanaian rental market. These include rental income tax and property tax. The collection of these taxes are always low due to non-enforcement coupled with a bad property referencing system. Rental transactions are mostly private and not recorded especially in the informal sector. Most of these transactions are also shrouded in secrecy. Rental income received by non-residents attracts a withholding tax of 10 *per cent* on gross income, while property tax is based on the estimated value of the subject property and residential neighbourhood class. This tax ranges from 0.5 to 3 *per cent*.

**a.**

Photo credit © G Tipple
Source: (UN-Habitat, 2011)

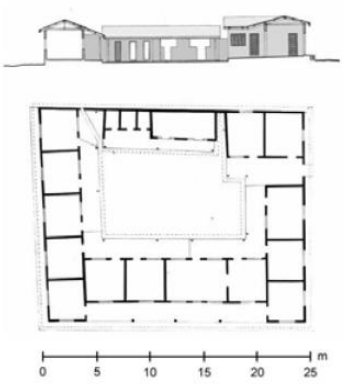



Photo credit © Royal Danish Academy of Fine Arts

**b.**


**c.**

Figure 1.3 a, b, c: Traditional compound house

[2] The '*single-room'* consists of just one room that serves as both living and bedroom for the tenant. The '*hall-and-chamber'* unit has two rooms; one used as living room (which can also be converted to a bed room space) and the other as a bedroom. In the first two scenarios all other facilities are shared by other households on the same compound. With the '*hall-and-chamber self-contain'* units the tenant may have a private space for kitchen, a toilet and bath. However because of crowding other spaces like kitchen and toilet facilities can be converted to rooms for rental purposes.

## 1.6. Neighbourhood

We now turn to one of the key concepts of the housing market discourse; neighbourhood. A neighbourhood can be defined in several ways; it can be construed in a social setting, geographic setting, in mathematics among others. A neighbourhood could be defined as a geographic area where there is a high degree of homogeneity among parcels (Owusu-Ansah, 2012b) or an area with relatively homogenous (or similar trend of prices) for similar units of real estate (RE). And as Meen (2001) further emphasises, analysis based on homogeneity relies on two aggregation conditions. He mentions that "*either all households (and spatial areas) must behave in an identical manner, i.e. coefficient homogeneity must hold, or the factors affecting housing demand … must grow at the same rate (or exhibit common stochastic trends)" (p.81).*

In a mobility decision there are basically two choices to make; the decision to leave or make a choice of destination if a house is available (Brown & Moore, 1970). These choices are made by considering needs, demand, preferences and constraints of each individual household (Hedman & Van Ham, 2012). Cities are mostly segregated based on economic lines and purchasing power. A particular household choice could be cheap in less attractive areas or *vice versa*. The more income a household has at their disposal, the more their options in terms of neighbourhood and dwelling type. These individual choices may be correlated with other neighbours' choices. Choice is basically the financial means; it is either a particular location is above the household financial means or location does not offer suitable housing type. It must be however acknowledged that some households do not have a choice, they are "captives" and as such may keep to particular neighbourhoods because of reasons of available disposable income.

Lupton (2003) argues that in generalizing results, researchers need to understand that neighbourhoods are not fixed, cannot be seen in isolation, and that it connotes people and place (social relations). Neighbourhoods interact with other neighbourhood and this must be noted. Moreover, neighbourhoods can be construed in three (3) distinct conceptual sense; the home area, immediate surroundings, and urban region or district. There is not a consensus on the geographical extent of neighbourhoods. There exists different neighbourhood extents for different research on housing markets. We explore this in detail in the next paragraphs.

There is no accepted typology of what constitutes a standard set of critical neighbourhood factors that affect rental value (Bates, 2006; De & Vupru, 2017; Galster, 2012). Each market (or market players) determines what is relevant to value. However there needs to be an agreement as to what the market basically considers when neighbourhood is considered. Neighbourhood characteristics has to do with housing type (low rise, high rise structures), crowding, noise, neighbourhood quality (derelict buildings, green spaces, crime rate, etc). According to Brown and Moore (1970) the factors to consider in neighbourhood studies include the following;

1. Access (to the Central Business District, green areas, services);
2. Physical characteristics of neighbourhood (cleanness, condition of street, aesthetic beauty);
3. Services and facilities (quality and access to green areas, safety);
4. Social environment (demographic composition, friendliness) and
5. Individual site and dwelling characteristics (size, costs).

What households consider as important and critical to consider in their choice of a neighbourhood may vary and eventually change over time.

There is vast empirical literature that confirms that neighbourhood factors play a role in determining rental value (Anim-Odame, Key, & Stevenson, 2010a, 2010b; Bates, 2006; Wu & Sharma, 2012). But to what extent this is analysed differs from many researchers. How do developed country housing market models typically apply in a developing country context? One of the few studies on Sub-Saharan housing markets (Megbolugbe, 1989) concluded that common assumptions that are applicable in a developed country context are not directly applicable in a developing country context.

Various neighbourhood amenities like schools, police station, health facilities, easy access to public transportation, convenient access to places of interest and good views, are attractions that make inhabitants prefer one location to another. These pool factors are very critical in making a choice as to how much to pay for a RE unit or even to price such.

A neighbourhood simply defines the surroundings of the property. Most empirical studies on neighbourhoods have produced useful reviews of what neighbourhoods are and what they are not. Factors used to measure a neighbourhood include environment, amenities and perceived security levels (Galster, Andersson, Musterd, & Kauppinen, 2008). Neighbourhoods have been classified as good or bad. A good neighbourhood is one whose public schools are effective, streets and parks are safe, where adults reinforce values of responsibility and work, and children are not lured into illegal activities. Moreover a bad neighbourhood puts inhabitants at risk to all bad elements. Perceived security levels within a neighbourhood is also an issue to consider. This can be measured using recorded crime and theft cases from the police to determine whether an area is suitable or otherwise not suitable. If perceived crime rates are low, then in effect it is expected that the price of various RE units within that neighbourhood will be high and *vice versa*.

Studies have focused on a number of issues in the social context (Galster et al., 2008), for example Galster and Killen (1995) model individual decision to choose to live in a particular neighbourhood. In terms of housing, the focus has been housing price appreciation in disadvantaged neighbourhoods (Galster & Tatian, 2009); endogenous and contextual effects on the demand for housing (Ioannides & Zabel, 2003); determinants of neighbourhood housing markets at the micro level (Bramley, Leishman, & Watkins, 2008); what constitutes neighbourhood factors and satisfaction of housing facilities (Salleh, 2008); causal relationships between neighbourhoods (Galster et al., 2008); neighbourhood tenure mix on employment and labour market performance (Maarten van Ham & Manley, 2010); housing markets and the macro economy (Leung, 2004). Others have considered the need for spatial context in housing studies since it is missing in most studies (Glaeser & Gyourko, 2007); provision of affordable housing for low income earners (Carter, 2012).

Accessibility to a large extent is a determinant of price in a RE unit. This is measured by the RE unit's proximity to neighbourhood amenities including market, transport facilities and terminals, recreational facilities, among others. If a neighbourhood has easy access to such amenities high RE values are expected than areas with undesirable access. Easy access means convenience to inhabitants in terms of travel time and costs. Ideally an access which provides for reduction in both travel time and costs is the preferred option. In this context a distance of say 500 meters to places of attraction (from a rental unit) can be construed as easy or near access.

In the neighbourhood effects discourse, both positive and negative external factors associated with neighbourhoods that affect rental pricing are considered. For example my neighbour remodels their house, or keep it well kept in ways that shame me. How do I react? Do I keep up or move out of the neighbourhood? If the remodelling motivates me to keep up, then these are endogenous effects that has an implication on rental value. Neighbourhood conditions have an effect on location which in effect affects rental pricing (see figure 1.4). Neighbourhood conditions are proxies that are linked to our objectives of interest. The concept of neighbourhood is multifaceted and we ask these two questions in order to keep research in focus.

1. How can neighbourhood effects be detected and priced in residential rental housing markets?
2. How can neighbourhood effects be capitalised into residential rental values?

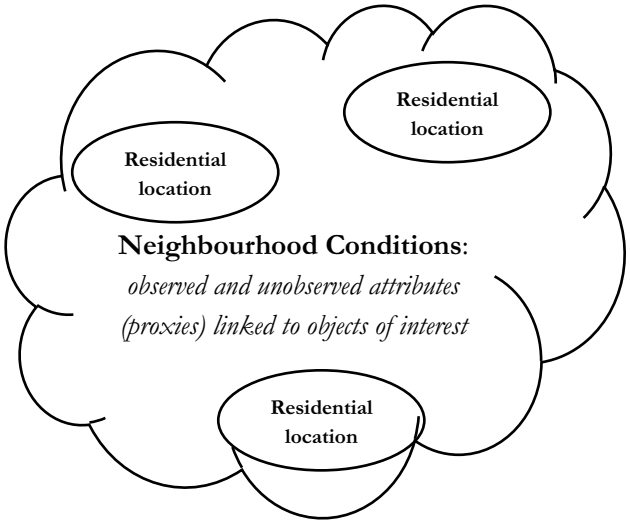



Figure 1.4: Relationship between residential location and neighbourhood conditions

Source: Author's construct

## 1.7. How do rental housing markets work?

Rental housing is an important component in housing markets and must be encouraged to function appropriately as a tenure option. The rental market provides a broad spectrum of opportunities to market participants from the bottom end to the top end (both poor and rich households alike). Housing is defined as a *"bundle of attributes which cover not only the physical aspects of a house, but all other services which a person purchases or gains access to by buying or renting a house. The price that a buyer or renter is willing to pay is an indication of how much value that person places on the attributes of the house they occupy"* (Leaf 1993, p.1).

Rent (or rental value) can be defined as a periodic amount that is paid (by a tenant) or received (by a landlord or his assigns) for the occupation and or use of property. This mostly stem from a contractual arrangement for the occupation and or use of property, known as a Landlord-Tenant relationship. From Leaf's (1993) definition it is to be expected that a set of attributes or variables (which include physical characteristics of the subject property, neighbourhood characteristics and locational characteristics) contribute to explain the constituents of rental value. From a purely theoretical perspective, it is thus expected that a number of variables are analyzed before rental value is fixed. These can be considered as key determinants of rental value. Housing is a heterogeneous good (and its constituents are not individually traded on the market) and the hedonic theory argues that the price of a house is determined by implicit prices of individual physical and spatial characteristics (Rosen, 1974; Watkins, 2001).

Various techniques are available in the modelling of housing submarkets. Some of the models focus on the supply side while others on the demand side. Supply side determinants of sub-market construction use characteristics of the housing stock (i.e. type of dwelling, square feet of living area, and age of dwelling) and characteristics of the neighbourhood (i.e. quality of neighbourhood schools, quality of local police) to determine sub-market constituents in the market (Goodman & Thibodeau, 2007). Demand side determinants model sub-markets based on household incomes or socioeconomic and demographic characteristics.

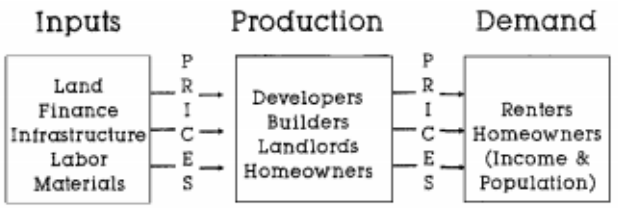



Figure 1.5: How housing markets work, adapted from Malpezzi (1999)

Figure 1.5 shows schematically how housing markets work. The haggling of demand and supply forces normally fixes the prices of real estate goods and services. For the supply side, those inputs of land,

labour, and infrastructure are combined with agents such as landlords, builders and the rest, to fix various prices of housing services. To understand housing markets requires analysis of key input markets and regulatory framework as well as the market behaviour (Malpezzi, 1999). On the supply side there is inelastic supply (in the short run) and slow adjustment to demand changes. It stands to reason that it takes time to increase supply even in the era of pre-cast materials. On the demand side, the taste and preference structure of consumers, imperfect knowledge of market vacancies, issues of other competing housing among others makes the market far from achieving equilibrium. All these market issues have an effect on housing prices in different parts of the market. According to Watkins (2001, p.2237), '*the presence of this friction leads us back to a conceptual framework based on submarket existence'*.

The market rent of a house (as estimated by the transaction price) is a function of the property's site, structural, location and neighbourhood characteristics. The immediate surroundings of a house (location factors) are also key determinants of price. Hedonic and other semi-parametric and non-parametric house price modelling techniques have been used to examine the influence that site and structural characteristics have on house price. Incorporating the influence of neighbourhood and location characteristics is more challenging (Goodman & Thibodeau, 2007) in the modelling process.

However, the influence of location on housing prices has been analysed differently by researchers. Although a challenging task it can be modelled to understand how location and neighbourhood play a role in determining rental value. Kain and Quigley (1970) considered factors such as adjacent parcel's quality, percentage of neighbourhood dedicated to commercial use, amount of local commercial traffic, quality of neighbourhood structures among others. These factors are regressed and their various contribution to price analysed. The idea is to group similar neighbourhood and location characteristics as one sub-market, so as to control for neighbourhood and location attributes on house prices.

In terms of housing market analysis, it is worth noting that few studies have been undertaken in the Ghanaian context. One of the early works on housing in an informal low income neighbourhood was by Asiama (1984), who showed evidence that renters were on the increase and concluded that the main solution to urban housing problem was in the provision of easy access to land for low income settlers. This was in a more social context and informal housing market context. Another in this same context was Antwi and Omirin (2006) that did a comparative study between Accra and Lagos. Karikari *et al.* (2005) argues about the need for incorporating GIS in land management in Ghana and the need for reliable datasets.

Buckley and Mathema (2007) estimate elasticity of housing supply and discuss the implications on growth. With the usual lack of required data, as is common with developing countries, the authors estimate a number of demand equations. Anim-Odame *et al.* (2010a) analysed residential locations in Accra and Tema, and examined the existence and performance of the housing submarket. This was one of the first attempts to develop a residential housing index for Accra.

Asabere (2004) develops hedonic analyses of the pricing of leaseholds and freehold estates for the land market. Asabere concludes that the estimated coefficients on all the variables representing services to the site like water, electricity and access roads are significantly positive, this indicates that these services are in high demand. He discusses that freeholds tend to attract premium prices compared to leaseholds. Asabere (2007) uses data from the Tema Development Corporation (TDC) and hedonic techniques to model rents. The paper concludes by suggesting a public policy towards renting of all public housing in Ghana. Anim-Odame et al (2010b) focused on the formal housing market and models the performance of investments in the Ghanaian residential real estate using hedonic modelling technique.

In a more recent work Owusu-Ansah and Abdulai (2014) used the Mean Square Error (MSE) technique to evaluate and compare accuracy of the Explicit Time Variable (ETV) and the Strictly Cross-Sectional (SCS) Hedonic Models using data from Accra and Tema. ETV hedonic models assumes a single regression equation from all time periods while the SCS controls for biases as a result of potential changes to implicit prices over time by estimating a separate hedonic model for each time period.

## 1.8. Towards the implementation of a theoretical model

### 1.8.1. Theoretical model construct

So far the discussion has focused on defining the housing market and submarket formation. We turn the focus now to how to implement a framework to theoretically model the (sub) market. To understand the theoretical underpinnings surrounding housing and observed rental prices (or values) in the market, we need to briefly discuss the concept of traditional location theory. Location theory examines the effect of access to central locations (i.e., to the Central Business District - CBD, job opportunities). The assumption here is that there is a desired residential location, which is within the CBD or areas close to it. The advantage of being close to the CBD is better access, however one pays higher rental prices because of excess demand over supply. As prices continue to increase some households move out to alternative locations further away from the CBD, which has inferior access, however rental prices are presumably lower. So there is a trade-off between access and how much one is willing to pay for housing. By this explanation there exists a relationship between observed rental prices and location factors. There is the need to understand that this relationship is as a result of unobservable variation in location across properties coupled with a heterogeneous market (Tse, 2002).

Meen and Meen (2003) mention three distinctive features of sub or local housing markets. These features are; Interactions between agents are extremely strong; Non-linear behaviour may be observed; Segregation and social exclusion are central. Areas with similar implicit prices of rental characteristics may be aggregated into same sub-markets. The question is whether these sub-markets are self-organizing? This accounts for the reasoning that lays the general principle for the construction of a bottom-up housing market model. Consumers or in this case tenants, trade-off a number of attributes that they desire to consume in the rental market. For example physical characteristics of subject property, distance to the CBD, number of rooms, nearness to services (i.e., Police Station), clean streets and so on. Some housing units may have more or superior of these attributes than other units and as such price differentials. Physical characteristics of the house define the state of the property and neighbourhood characteristics define the surroundings of the property.

However, in analysing housing markets there is the need to consider the following; the effect of market regulations (quotas, subsidies, rent control) on estimated rent; distortions by financing features of transactions is critical to free model construct of any unrealistic predictions; and also determine correct specification of model relationship (Meen & Meen, 2003). There is the need to optimize the explanatory power of variables used (Merrill, 1980). Thus choosing significant variables with the 'usual signs' (coefficients estimates) is the way to go. In selecting independent variables to analyse, one goal is to take out superfluous variables (whose inclusion or exclusion does not 'seriously' alter other coefficient estimates or standard error terms (Rao & Miller, 1971). This has to do with multicollinearity which we explain later in this research.

Let us now consider this hypothetical situation: If one lives some distance away from the CBD, normally one expects low rents to prevail and vice versa. The idea is that the farther away from the CBD, the lower the rent one pays. Monocentric models including the Bid-Rent Theory have been used to explain how price/ rent changes with distance from the CBD. The critique with the monocentric models is their relevance in the era of multiple centres for job opportunity not necessarily in the CBD. The explanation on classical location theory models (Alonso, 1964; Muth, 1969) have however lost some of their appeal in recent economic theory arguments. Neighbourhood quality is brought into the equation to attempt an explanation which has become quite relevant in modern times. This has seen the introduction of what is known as the hedonic pricing model (HPM). The HPM generalises space-access discourse to include to include a number of explanatory variables.

There are two main real estate price index construction models. These are the Hedonic and the Repeat-Sales Methods. We explain further the theoretical underpinnings of the hedonic model.

### 1.8.2. The Hedonic Model

The hedonic model is considered as the most preferred model in terms of housing market analysis because of its sound logic (Owusu-Ansah, 2013). The theoretical basis of the Hedonic Method stems

from Rosen's (1974) pioneering work, which posits that it is not the good itself that creates utility, but rather individual characteristics that have an effect on price (Lancaster, 1966). Rosen's technique allows for implicit characteristics of the housing market to be modelled or uncovered in a hedonic equation (Büchel & Hoesli, 1995; Cassel & Mendelsohn, 1985). A house is priced based on its utility-bearing characteristics with implicit prices. This therefore enables the estimation of the implicit price of each utility-bearing attributes or characteristics by relating rental value to these individual characteristics. This model assumes that all these utility-bearing attributes are known, can be identified and modelled. Therefore each characteristic identified (and used in the model estimation) contributes to the observed rental price in the market. However, a house is a heterogeneous good and as such each characteristic cannot be traded separately in the market (but only as one unit). The relative importance of each of these characteristics and their contribution to rental value can be determined through regression analysis. One of the first known applications of the hedonic method is the work of Frederick Waugh (1928) who applied this technique to help farmers produce quality asparagus as demanded in the market.

Helbich et al. (2013) mention that the price function of a hedonic pricing model *f,* describes the functional relationship that exists between real estate prices *P* as well as associated relationships that exists between physical characteristics $X_{p1}, \ldots, X_{pn}$ and neighbourhood characteristics $X_{n1}, \ldots, X_{nm}$ of same. In a typical hedonic model, the observed rental price of a housing unit is regressed on a number of attributes which have an effect on price. This is usually estimated using multiple regression analysis. These broader characteristics can again be broken down into smaller and specific utility-bearing characteristics. Implicit here is that some characteristics can be continuous whiles others are discrete (for example the availability of a road in front of the house). To appreciate the effect of say location and neighbourhood characteristics on the observed rental price, there is the need to first examine the separate influences of the various utility-bearing attributes. Tse (2002) observes that a good hedonic study includes neighbourhood quality measures at a much lower level of disaggregation.

The basic form of the hedonic model is given as a functional relationship between a heterogeneous good (in this case the rental value of a house) *P* and its characteristics that affect value represented by vector $x_i$. This is denoted by the relationship below;

$$P_i = f(\mathbf{x_i}; \boldsymbol{\beta}) + \mu_i \qquad (1.1)$$

$x_i$ represents locational characteristics, structural characteristics, vector of neighbourhood characteristics and environmental attributes. $\beta$ represents the coefficients that are estimated by the characteristics and the error term $\mu$ of unexplained variables.

Theoretically, once this equation has been estimated, it can be used to predict the implicit prices of rental value of a property *i* with characteristics *x*.

$$\hat{P}_i = f(\mathbf{x_i}; \hat{\boldsymbol{\beta}}) + \mu_i \qquad (1.2)$$

The lessee's (tenant's) problem will then be to maximise his utility subject to income available. Therefore rental value would theoretically be based on utility-bearing characteristics implicitly traded as one unit. A household then has to maximise the utility derived from this heterogeneous good in order to make a decision to pay or not to pay the asking rent. Households usually make a choice by first considering their social and economic standing.

In the modelling process, it is sometimes necessary to proceed on an entirely empirical approach to the choice of relations that may exist between independent variables. This position, as supported by Box and Cox (1964), avoids the initial bias of assuming a functional form of a regression when empirical data or evidence may suggest otherwise. For ease of understanding and efficiency it is best to 'allow the data to speak for themselves'. Halvorsen and Pollakowski (1981, p.1) argue that *'the appropriate functional form for a hedonic equation cannot be specified on theoretical grounds'*. Rosen's (1974) equation however assumes a normal linear form for simplicity. Heteroscedasticity could be occasioned if the inappropriate functional form is used. For further discussions on functional forms see Box & Cox, 1964; Cassel & Mendelsohn, 1985; Halvorsen & Pollakowski, 1981.

In most empirical research however a semi-log or log-log specification in terms of functional form is utilised (Helbich et al., 2013). The relative rent reflects housing services that the unit provides. There is

the need to take note that attributes that may affect market rent may not have any value when market value is analysed (Merrill, 1980). In deciding on a model, some attributes may be highly correlated than others. Merrill (1980) posits that the suitability of using hedonic modelling in housing market analysis rests on the assumption that cost does reflect the amount and quality of housing services offered by the unit. More expensive units generally reflect a common consensus that they are better.

Hedonic equations usually take either a linear or a semi-logarithmic form. The coefficient of the variables in the equation are interpreted as the percentage of change in rent that results from a unit change in the independent variable. The constant term in the hedonic model is said to represent to a large extent some aspects of omitted variables. This interpretation could be ambiguous as it can also represent the basic rent that needs to be paid for a house irrespective of the unique features of the unit in terms of its physical, neighbourhood, locational and services it provides (Merrill, 1980).

Linear equation forms, allows explicit introduction of appropriate interdependencies (Box & Cox, 1964) to be modelled. In deciding on any of the forms to adopt (i.e., linear, semi-log, log-log) there is the need to consider the explanatory power of attributes used and critically examine the error terms. More so there is the need to test for heteroscedasticity by regressing the residuals on predicted values of the dependent variable – the predicted Rent Values. The presence of heteroscedasticity (where the error variance is not constant; $Var(u_i) \neq \delta^2$) is indicative of what we must add to the model to improve its explanatory power. The reasons that a model may test positive for heteroscedasticity may be as a result of error learning models, the elimination of an important variable, skewdness in data, and functional mis-specification among others.

There is the need to test whether regressions are significant using a *t*-statistic, one-tailed and two-tailed tests. Adjusted $R^2$ is improved when any variable that has a *t*-statistic of greater than 1 is retained (Haitovsky, 1969). The formula for adjusted $R^2$ is given as;

$$Adjusted\ R^2 = \frac{1-(1-R^2)(\mathrm{N}-1)}{\mathrm{N}-\mathrm{K}} \qquad (1.3)$$

Where *N* is the total number of observations and *K*, the total number of parameters used.

## 1.9. Rental housing modelling for a developing country context

### 1.9.1. Explanatory variables for rental housing modelling

As discussed earlier a house is composed of a number of intrinsic and extrinsic attributes which together determine its rental value. These include physical, locational, neighbourhood and environmental characteristics. The hedonic model is usually the preferred option used to analyse the correlation (relationship) between housing characteristics that affect value to the rental value in housing market analysis. Some of these characteristics may make significant impact on the rental value or otherwise. The marginal contribution of each of these individual characteristics will enable us understand how the market works and how rental value is priced. The coefficients that are estimated are termed hedonic prices which is interpreted as the implicit prices of the modelled attributes or characteristics.

Sirmans *et al.* (2005) mention that research conducted on explanatory variables that explain the price build-up of real estate units show a particular trend. The direction and trend of the impact of these studies show that such analysis cannot be generalised but location specific. Sirmans *et al.* also identify a list of twenty housing characteristics appearing most often in hedonic pricing model studies. Table 1.2 as adopted from Sirmans *et al*. (2005) asserts that bathrooms, bedrooms, public rooms, garages, fireplace, pool, area of the RE unit are key explanatory variables that consistently show a positive sign across various regions when a hedonic pricing model is adopted.

Table 1.2: The 20 characteristics appearing most often in hedonic pricing model studies

| Variable* | Appearances | # Times Positive | # Times Negative | # Times Not significant |
|---|---|---|---|---|
| Lot Size | 52 | 45 | 0 | 7 |
| Ln Lot Size | 12 | 9 | 0 | 3 |
| Square Feet | 69 | 62 | 4 | 3 |
| Ln Square Feet | 12 | 12 | 0 | 0 |
| Brick | 13 | 9 | 0 | 4 |
| Age | 78 | 7 | 63 | 8 |
| # Stories | 13 | 4 | 7 | 2 |
| # Of Bathrooms | 40 | 34 | 1 | 5 |
| # Rooms | 14 | 10 | 1 | 3 |
| Bedrooms | 40 | 21 | 9 | 10 |
| Full Baths | 37 | 31 | 1 | 5 |
| Fireplace | 57 | 43 | 3 | 11 |
| Air-Conditioning | 37 | 34 | 1 | 2 |
| Basement | 21 | 15 | 1 | 5 |
| Garage Spaces | 61 | 48 | 0 | 13 |
| Deck | 12 | 10 | 0 | 2 |
| Pool | 31 | 27 | 0 | 4 |
| Distance | 15 | 5 | 5 | 5 |
| Time On Market | 18 | 1 | 8 | 9 |
| Time Trend | 13 | 2 | 3 | 8 |

*Note: Although some of these variables are the same and just measured differently, they are presented separately so readers can see how they are typically measured.

Source: Adapted from Sirmans *et al*. (2005)

A careful consideration of variables given by Sirmans *et al*. suggests that structural variables appear to be dominant in the discourse. This is rather interesting and gives a one sided picture. Locational and neighbourhood variables are invariably missing on this list; although there is anecdotal evidence and empirical research to support locational and neighbourhood variables do affect rental values. In a developing country context like Ghana variables like fireplace, air-conditioning and pool which are absent in most homes may not be relevant. What explanatory variables have been used in a developing country context? Are there any trends that could be realised? By developing country context the focus will be on the Ghanaian rental housing market.

Buckley and Mathema (2007) use household income and household size to model housing demand. Asabere (2004) considers lot size, distance to CBD, neighbourhood class, electricity and water availability, type of tenure, access and time variables to price leasehold and freehold interests using hedonic analysis. In another study Asabere (2007) utilises number of storeys, plot size, age and location to model the housing market in Tema.

Anim-Odame *et al.* (2010a; 2010b) and Owusu-Ansah and Abdulai (2014) used similar datasets from the Land Valuation Division of the Lands Commission of Ghana to develop housing price indices for Accra. Explanatory variables used were sale price/ rent, number of bedrooms, number of storeys, plot size, floor area, tenure or tenancy term certain, presence of garage or outhouse, quality of landscaping, real estate type (detached or semi-detached), security of tenure. Anim-Odame *et al.* used a hedonic model to analyse the influence of residential attributes on price and rent and also to test submarket performance. They concluded that the number of bedrooms and unexpired term were not statistically significant, while all other variables showed expected signs for the rental market and were statistically significant at 1 *per cent* level of rental analysis. The explanatory variables explained 88 and 93 *per cent* of the variances in price and rent (adjusted $R^2$) respectively, which suggests best fit for the data used. Using the same dataset Owusu-Ansah and Abdulai (2014) recommend the use of the Explicit Time

Variable hedonic model as more accurate to analyse real estate price indices than using the Strictly Cross Sectional hedonic model. They come to this conclusion by analysing the Mean Square Errors of both models constructed.

Using cross sectional data Owusu-Ansah (2012) establishes that the "number of bedrooms, bathrooms, public rooms, age of property, location of the property, availability of garage, fence wall, swimming pool, and land registration influence real estate values in urban Ghana". The number of floors was found to have the least impact on price.

It can be appreciated that different variables have been used but consistent ones as have been used in developed country studies include bedrooms, plot size, location attributes, age and presence of garage. As such this will be a guide to determine what will be relevant to determine rental value in this context.

There is however another construct that has been developed to model explanatory variables in housing market analysis; this is discussed further in the next section.

### 1.9.2. Concept of Brand, Beauty and Utility in determining property value

This concept examines the role that brand, beauty and utility (Roulac, 2001) play in defining property value with a place construct. On the broader conceptual level, the value of a property is determined by its use. This concept is amplified when explained using the laws of demand and supply in basic economics. On one side demand for property is what people are willing and able to pay for the right to use a given space in a property that manifests attributes similar to the subject property; whereas supply of property can be defined as the similar or aggregate of space that would be available or that is available for consideration by a user who is considering that subject property of interest.

What explains the differences in prices of spaces within the built environment? What attributes do people seek from the use of a particular space? This concept builds on the location theory and articulates this concept from an angle that sheds more light on what real estate practitioners mean when they say location determines value of property.

Roulac (2001; 2007) explains that, "*the price that a property commands in the market place effectively is a payment for the right to rent and control the sensory experiences of utility, brand and beauty".* For rental property a (prospective) tenant assesses the worth of the whole value package of brand, beauty and utility (BBU). For any property interest the three resources of BBU is aggregated and this aggregation represents the property's uniqueness which determines value. Making this decision is implicit in how much a tenant is willing to pay for a subject property. Roulac's construct is a significant advance in the property value theory. The BBU model is defined as;

$$Brand + Beauty + Utility = Property\ Value \qquad (1.4)$$

*Brand* – Certain places have greater appeal and popularity over time than others. For example properties along the Osu Oxford Street, East Legon, Airport Residential Area all in Accra have a place brand. Place brand is an integral component of value. People will pay for a more known desired and distinctive brand than one that is not.

*Beauty* – is the sensory experience derived from the beauty of the property and its environment. It comprises both interior and exterior improvement, site, natural features and improvements (i.e. landscaping, trees, topography, views of both natural and built environment). Beauty has to do with the aesthetic appeal of the property (Gruehn & Roth, 2010; Roth & Gruehn, 2005).

*Utility* – is the particular function and features desired of a property. The utility is a function of its design, interior and exterior functionality, structural quality, access, proximity and quality of resources and opportunity. One important aspect to consider is the degree to which a property enjoys connectivity with others (access to economic opportunity).

The BBU model considers that if location is identical then value differential is due to non-location factors.

To sum up, this chapter attempted to bring to the fore concepts in housing market analysis that needed to be considered in order to model the market effectively. We concluded on explanatory variables that could be utilised in a developing country context and what can work. A number of methods have been utilised to analyse the housing market but mainly in a developed country context. Data paucity and secrecy of transactions in a developing context like Ghana have not helped the situation. It is recommended that to improve the consistency of explanatory variables used in modelling housing (sub) markets in the Ghanaian residential housing market, an expert survey of professionals who are familiar with the rental housing market in Ghana should be administered. Then based on the responses key variables can be relied upon for empirical data to be collected to test reliability of same. Relying on variables based on empirical results from developed country perspective may not yield the desired results applicable in a developing country context. This in our opinion will help to improve transparency in the sector as analysed by the Jones Lang LaSalle Global Real Estate Transparency Index that identifies Ghana's real estate market in terms of transparency as low. In 2018 Ghana slipped to 3.99 from a rank of 3.86 in 2016 (Jones Lang LaSalle, 2016, 2018).

Rental values/ prices affect household expenditure and spending patterns through the wealth effect in the broader macro economy. When we are able to uncover factors that causes changes in value from one location to another, it supports housing market stakeholders to understand the underlying constituents of differential rents. When effects of location or locational attributes are separated from rental values, two effects are envisaged. Firstly, rental values can be analysed on a standardised basis. Secondly, the contribution of locational attributes can be analysed to estimate its effects on rental values.

## 1.10. Conclusion

The residential rental market in Ghana accounts for 31 *per cent* of households with compound houses (with shared facilities) as main housing option to most of the population. This chapter has reviewed literature in the housing market discourse and highlighting key concepts. It is realised that there exists several statistical approaches to model housing market mostly in developed market context. Submarkets exist and there are different definitions used to analyse this phenomenon. Three main approaches are identified in the literature to define segmentation in the market; spatial, structural, or nested spatial/ structural segmentations. There appears not to be a clear direction in these classifications, however Jones and Watkins (2009) suggest a procedure to adopt. The market rent of a house is a function of the property's site, structural, neighbourhood and locational characteristics. Hedonic models appear to be the most utilised method to disaggregate value based on implicit assumptions of value attributes.

It is further argued that in a theoretical model that may be utilised in a developing country context, there is the need to optimise explanatory power of variables used. Studies conducted in the Ghanaian context suggest that consistent explanatory variables used in this regard include number of bedrooms, age, plot size, presence of a garage and location attributes.

Neighbourhood level information is envisaged as more reliable and expedient to use if the housing market is not characterised as a single homogenous one. But as earlier highlighted, theoretically, the housing market is a series of different submarkets that may interlinked. When submarket data is aggregated there is the tendency that it hides or masks variations in the housing market outlook. Thus, resulting analysis and findings could be flawed and may not be reliable or consistent.

Further, this thesis agrees with Meen's (2001) economic theory argument that housing markets are not independent; the economic theory underpinning housing market models suggests that coefficients will vary over space and individuals; the aggregation conditions that allows housing to be treated as a single national market do not hold; and spatial models must explicitly allow for a heterogeneous market.

In conclusion, there is some difficulty in identifying all relevant variables/ attributes that influence rental value and the correct functional form to model such data. To avoid biases in choosing variables for housing market analysis we recommend a survey of experts (professionals) who are conversant with the Ghanaian rental housing market to first identify these key variables that may be relevant and affects

rental value. Based on this approach a relative importance index was developed and theorised for further analysis based on empirical data.

# 2. Setting the Stage

*"It is a common misperception that everyone wants to own a house.*
*For many people, rental housing is a better option"*
(UNESCAP & UN-HABITAT 2008, p.1)

## 2.1. Introduction

Housing is a global phenomenon and is the heartbeat of almost everyone. It is seen as one of the fundamental needs of mankind and the long term focus of many developments across the world. Housing is the largest share of every country's wealth and capital stock. The need for a shelter or roof over one's head predates current civilisations. The ability of governments to provide greater numbers of its citizens with decent housing is acknowledged as a step in the right direction. The housing agenda has long been on the discussion of many countries (Hott & Monnin, 2008), especially developing countries, who are trying very hard to build formalised institutions to cater for the growing housing need among the population. In the past while some (developed) countries have made good progress in terms of meeting the housing needs of their population, others are still grappling with issues of shortages and slum development. Provision of adequate housing is now an accepted phenomenon (Gough & Yankson, 2011). Developed countries have made a giant leap, but many developing countries still face numerous problems of even worsening housing conditions; if they do not curb and offer pragmatic solutions to the rising accommodation needs of their populations. Can developing countries leap-frog to meet this challenge?

Types of real estate include commercial, corporate, residential and agricultural. Housing is the most important sub-sector of the real estate (RE) industry. This sub-sector (housing) serves as a critical portfolio in households' investment decisions. The awareness of value is thus very crucial not only to the owner, but also to investors and other decision makers. It is partially on the awareness of price that housing plays a crucial role in RE mortgage transactions (Owusu-Ansah, 2012b). It can be appreciated that the stock price of a house is large as compared to incomes of individuals, hence the need to finance. This financing would normally require a financial institution to provide a mortgage facility to individuals who may be interested.

It takes a period of time (to raise finances and construct) to increase supply on the market and hence in the intervening period some people may resort to sub-standard housing. Housing is a composite good and it is sold wholly as one unit. Every house is highly heterogonous and that is the main reason why we say each is different. No two properties can be the same. From an investment perspective housing is fixed in location and durable as compared to other investment assets.

In housing markets research it has been long established that location and neighbourhood do matter. That suggests that real estate goods and services place a premium on location and neighbourhood characteristics. Although this is the case, such location and neighbourhood characteristics are not traded explicitly and their contribution cannot be directly observed (Owusu-Ansah, 2012b). Their contribution to housing markets research and to professionals both in Valuation practice and planning authorities cannot be over-emphasised. It is therefore important to gain useful insights into determinants of residential rental values in the housing market. And more so, evaluate whether location and neighbourhood characteristics (or attributes) constitute key explanatory variables in price determination. An effective model for adequate housing, advocates for market mechanisms to work efficiently, i.e., demand and supply forces interacting to fix prices of various real estate goods and services.

## 2.2. Background and justification of research

### 2.2.1. Background

One of the most important factors to consider in housing markets analysis is location. Location is a crucial factor as the value of comparable properties tends to be the same within similar neighbourhoods. 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. There is the inability to generate effective demand in the housing market in most developing countries basically because of low incomes.

Neighbourhoods are discreet spatial entities that contain households and housing structures with similar characteristics. The importance of neighbourhood in the operations of housing markets cannot be over-

emphasized (See Goodman 1989). The 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 submarket location features are essential ingredients that make up house prices (Adair, Berry, & McGreal, 1996). To determine the value placed on location and neighbourhoods, a number of methods exist. For example, Goodman (1978) discusses formation of house price indices and analysing variations using spatial statistics; Anselin (1998) also outlines the kind of infrastructure required to perform spatial analysis of real estate markets using econometrics and multiple regression analysis.

### 2.2.2. Justification of research

Most theories to explain housing markets may have developed in developed countries, however they can be modified to fit the social, cultural, economic and institutional context in many developing countries (Gilbert, 2003). In real estate housing analysis observations on variables used tend to be spatial (Anselin, 1998); this coupled with the phenomenon that spatial data is dependant rather than independent has interesting implications for statistical analysis in the housing market. This results in observations that are spatially clustered or otherwise. In other words there may be spatial homogeneity or heterogeneity in housing market analysis. Can (1998) further asserts that neighbourhood effects can be examined in two interrelated ways. One is to consider localised externalities associated with the absolute location (adjacency effects) and the other is the overall effect of neighbourhood characteristics (situation).

Ghana's housing market follows a free market economy model. The initial policy focus of government was direct state provision in the 1990s; however this role has shifted and been taken over by an active private sector comprising individual developers, private real estate firms and developers (Arku, 2009b, 2009a; Tipple & Korboe, 1998). The government's current role is a regulator and also to provide an enabling environment for developers to provide housing needs. In the past the attempts at improving housing supply has been to either sub-divide new land, extend infrastructure, make housing finance easier to access and also making it easier for private developers to develop new housing stock. All these attempts by governments across the globe were to encourage home ownership. In many countries home ownership has become the norm and the most desired option. However, it is a stress on truism that not everyone can afford to own property. There is the need for others to consider rental housing as a viable option especially in developing countries where incomes are generally low.

It is well established and documented in literature that two tenure regimes exist, owner-occupier and rental (Gough & Yankson, 2011), however there exists a third group who are neither owner-occupiers nor renters. Examples of persons who may constitute this third group are relatives and children living in parent's house, and occupants of social housing. These tenure regimes have implications on rental values that are observed in the market. The world over, rental housing has a fair proportion of the market share of residential housing. Currently about 1.2 billion of the world's population live in rented accommodation (Gilbert, 2016). Table 2.1 depicts the housing tenure in some countries and cities and their share of the market. Rental housing constitutes a large share of the market in many countries. National data on rental housing could be misleading as it inadvertently hides local disparities within the market. A careful consideration of table 2.1 gives us a fair idea as to the situation. For example renters in Germany are about 60% however for Berlin alone the figure stands at 89%.

Although many attempts have been made by governments to increase home-ownership, rental housing has rather been on the ascendancy (Gilbert, 2003, 2016). Indeed the frequency of rental housing transactions compared to sales is high and increased in many countries especially the developing ones (see table 2.2). For example in Ghana rental housing accounts for about 31% of households (Ghana Statistical Service, 2012). Rental housing analysis has received marginal attention as the focus of most research has been on other areas such as homeownership (Adegoke, 2014; Yankson, 2012). It is generally believed that homeownership is accessible even if through informal means, and highly accessible. This research focuses on analysing rental values at the neighbourhood level which has been neglected. It can be appreciated that a well-functioning housing market provides for a variety of housing options to the population.

Table 2.1: Housing tenure in some countries and cities and their share of the market

| **Housing tenure in countries** | | | | **Housing tenure in cities** | | | |
|---|---|---|---|---|---|---|---|
| | **Owners** | **Renters** | **Other** | | **Owners** | **Renters** | **Other** |
| Germany | 40% | 60% | - | Berlin | 11% | 89% | - |
| Netherlands | 53% | 47% | - | Cairo | 37% | 63% | - |
| USA | 66% | 34% | - | Bangalore | 43% | 55% | 2% |
| UK | 69% | 31% | - | New York | 45% | 55% | - |
| South Africa | 69% | 31% | - | Rotterdam | 26% | 49% | 25% |
| Brazil | 74% | 25% | 11% | Johannesburg | 55% | 42% | 3% |
| Egypt | 77% | 22% | 2% | Bangkok | 54% | 41% | 5% |
| Bolivia | 60% | 18% | 22% | London | 58% | 41% | - |
| Thailand | 87% | 13% | - | Santa Cruz | 48% | 27% | 25% |
| India | 87% | 11% | 3% | Sao Paolo | 70% | 20% | 10% |

Source: Adapted from Gilbert (2003)

Table 2.2: Proportion of tenant household by country

| *Country* | *Year* | *% Tenants* | *Year* | *% Tenants* |
|---|---|---|---|---|
| **Advanced Capitalist countries** | | | | |
| Australia | 1981 | 26% | 2007-8 | 28% |
| Canada | 1981 | 36% | 2006 | 32% |
| Finland | 1989 | 23% | 2010 | 26% |
| France | 1978 | 43% | 2009 | 37% |
| Germany | 1981 | 63% | 2005 | 53% |
| Japan | 1978 | 34% | 2003 | 39% |
| Netherlands | 1981 | 56% | 2009 | 32% |
| New Zealand | 1976 | 27% | 2001 | 33% |
| Spain | 1980 | 23% | 2009 | 17% |
| Sweden | 1975 | 56% | 2009 | 30% |
| Switzerland | 1981 | 67% | 2000 | 65% |
| UK | 1981 | 43% | 2009 | 30% |
| USA | 1980 | 36% | 2010 | 33% |
| **Former Communist nations** | | | | |
| Bulgaria | | | 2009 | 13% |
| China | | | 2005 | 9% |
| Czech Republic | | | 2009 | 23% |
| Hungary | 1980 | 30% | 2010 | 10% |
| Poland | 1974 | 51% | 2009 | 31% |
| Romania | | | 2009 | 4% |
| Slovakia | | | 2009 | 11% |
| Slovenia | | | 2009 | 19% |
| **The South** | | | | |
| Argentina | 1980 | 16% | 2001 | 11% |
| Bolivia | 1976 | 15% | 2001 | 21% |
| Brazil | 1980 | 23% | 2010 | 18% |
| Chile | 1982 | 31% | 2002 | 18% |
| Colombia | 1985 | 24% | 2005 | 31% |
| Dominican Republic | 1981 | 22% | 2002 | 28% |
| Ecuador | 1982 | 23% | 2006 | 18% |
| Ghana | | | 2010 | 31% |
| India | 1981 | 16% | 2011 | 11% |
| Indonesia | | | 2010 | 21% |
| Korea | 1975 | 33% | 2010 | 42% |
| Mexico | 1980 | 21% | 2010 | 14% |
| Peru | 1981 | 15% | 2007 | 15% |
| South Africa | | | 1999 | 36% |
| Taiwan | 1976 | 20% | 2007 | 12% |
| Thailand | | | 2000 | 11% |
| Tunisia | 1975 | 14% | 2004 | 23% |
| Turkey | 1985 | 23% | 2006 | 39% |
| Uruguay | 1975 | 32% | 2006 | 15% |
| Venezuela | 1981 | 18% | 2007 | 10% |

Source: Respective national and housing population censuses as reported in Gilbert (2016)

In a well-functioning rental housing market (in developed markets), the value of rental housing is linked to the quality of the housing, access to jobs and other public services, and access to basic infrastructure; which are all location specific. However in undeveloped markets for example, where government or employers pay (or subsidise) rent on behalf of employees, these employees in some cases tend to pay less than what the market supports and will not reflect market-location specific rents.

More so in the property valuation spheres, there is the problem of paucity of information. Market data is difficult to access especially in a developing country context and as such the need to at least get base line data for analysis.

## 2.3. The research gap

The fixity in space and the spatial immobility of housing (which is absent in other goods) makes housing values extremely sensitive to the changes in geographical patterns of consumption (Gilbert, 2003). In other words there is a spatial dimension to housing markets analysis. The standards of housing may differ from locality to locality and from region to region; as such housing values may be expected to differ respectively.

It can be appreciated that a well-functioning housing market provides for a variety of housing options to the population. Supply in the market is from new constructions as well as modifications (and renovation) of the existing stock (Owusu-Ansah, 2014). These changes to the stock is through the determinants of supply and demand forces. Rental housing is on the ascendancy, and there exists no explicit policies to recognise rental housing as a credible tenure option.

It has been argued severally by housing market researchers that, housing markets are an aggregation of various interconnected sub-markets (Wilhelmsson, 2004) at the neighbourhood, local and regional levels that represent the national picture. Each property within a neighbourhood may have distinct characteristics that make its value differ from another. Submarket definition is an important aspect in housing market analysis and this is very useful in understanding market dynamics and making market predictions (Wheeler, Paez, Spinney, & Waller, 2014). Housing markets research continues to receive little attention from researchers especially in the developing countries (Adegoke, 2014; Yankson, 2012). In developing markets, data asymmetries and the lack of a consistent dataset have been cited as the hindrance for comprehensive housing market analysis to be conducted (see Owusu-Ansah 2012a). Most studies draw on the few 'available' data (mostly from aggregated census data (Hott & Monnin, 2008; Meen, 1996), data from land sector agencies and valuation reports) that are practically impossible to compare on a standardised basis. Ghana's housing market has no established data bank where such dataset can be obtained even at a fee (Baffour Awuah, Proverbs, Lamond, & Gyamfi-Yeboah, 2016). Some institutions may have some bits and pieces of information (e.g. the Lands Commission), but do not have all the requisite variables to comprehensively model the market.

In Ghana for instance, research by Owusu-Ansah (2012a), Owusu-Ansah and Abdulai (2014), Owusu-Ansah et al. (2017), Anim-Odame et al. (2010a) and Anim-Odame et al. (2010b) have examined the dynamics of the property markets in Kumasi, Accra and Tema. These studies however, were limited to residential property values and price dynamics. On the rental market, Owusu-Ansah et al., (2018) have examined the nature of rental contracts. All these studies, even though, appreciate that submarkets may exist in the Ghanaian rental market, have ignored the empirical testing for submarket existence. We fill this knowledge gap by identifying and empirically testing for submarket existence based on an understanding of the residential rental housing market in Ghana by using fieldwork data (primary data) collected between March and October 2017.

This research also analyses and explores the limitations in identifying relevant and critical variables in the "whole-sale" application of determinants of residential rental values (RRVs) in a developing country setting, while examining the effects of location and neighbourhood variables to RRVs. Different explanatory variables have been used by researchers to explain the constituents of rental value and this imposes some limitations when examining critical determinants of rent, especially in a rental markets in a developing country context because of paucity of data. This makes it practically impossible to compare analysis on rental value determinants on a standardised basis.

The literature suggests that in a developing country context, there is not an agreement as to the unique set of factors (value determinants) that can be used to model the rental market (see Adegoke, 2014;

Choumert, Kere and Laré, 2015; Abidoye and Chan, 2016). A house is composed of characteristics which together affect its rental value. These housing attributes cannot be untied and repackaged at all locations to produce an arbitrary set of attributes (Arimah, 1992; Harrison & Rubinfeld, 1978). This implies that since non-linear functional forms and relationships could exist between various attributes, differences in RVs observed are based on the quantity of attributes consumed. Hence the need to explore various attributes to confirm whether they apply to the particular housing market under analysis. Indeed an examination of literature of RRV determinants from Sub-Saharan Africa (SSA) shows that the focus has been on structural characteristics in the modelling process, although location and neighbourhood characteristics are also key determinants of value (see for example Arimah 1992; Asabere 2004; Asabere 2007; Knight et al. 2004; Gulyani & Talukdar 2008; Anim-Odame et al. 2010b; Anim-Odame et al. 2010a; Owusu-Ansah 2012; Adegoke 2014; Choumert et al. 2015; Abidoye & Chan 2016).

How can rental values be disaggregated to explain value determinants in the residential rental housing market? In answering this question, the first phase of the thesis takes an exploratory nature. Various methods that had been used to disaggregate rental values, and to analyse the effects of each explanatory variable are analysed. The thesis departs from the usual trend of adopting models in a developed country context and "forcing" these models to fit in a developing country context. In this thesis, the main drivers of RRVs by first analysing the perceptions of experts and stakeholders within the residential rental housing market (RRHM) space are explored. The conclusions here provide the basis for collection of fieldwork data specific to Ghana's RRHM. In the next phase, submarket existence is empirically tested, as this is critical in understanding how the market operates (Wheeler et al., 2014); either as a single market or an aggregation of submarkets.

The guiding principle in exploring the thesis further is to fill the research gap through the following aspects:

-A perception survey of experts and stakeholders within the rental market space. The idea is to link the perceptions of these critical market players to empirical results. The question is, do expert and stakeholder perceptions about value determinants have any empirical basis?

-Model submarket constructs based on literature and analyse how the rental market effectively mimics theoretical underpinnings. It is worth noting that studies across developing countries accept that submarkets exists, but researchers have ignored the empirical testing of same. We fill this knowledge gap by theoretically identifying and empirically testing for submarket existence based on an understanding of the residential rental housing market in Ghana by using the Kruskal-Wallis H-test, the Jonckheere-Terpstra test and hedonic modelling techniques.

-Based on results of submarket existence, analyse empirical effects of structural, locational and neighbourhood characteristics on RRVs. This bridges the knowledge gap in understanding the rental market in a developing country context, where due to data paucity such systematic analysis are seldom undertaken. This approach can then be replicated across cities in SSA in an attempt to link rental value determinants based on empirical analysis to market stakeholder perceptions.

These guiding principles drive the development of the hypothesis and research objectives to better understand the residential rental market in a developing country context.

The contribution of this research in this regard will be to provide base information that can assist valuers (and other market stakeholders) make informed decisions as to the rents that should pass on subject properties. In the absence of these, the basis of values that valuers will arrive at may be questionable. Also a number of models can be developed from this to improve property valuation practice.

## 2.4. Hypothesis and Goal of research

*Hypothesis*

$H_0$ – Location and neighbourhood related attributes (or variables) **are not key determinants** of residential rental values in the housing market in Ghana.

$H_1$ – Location and neighbourhood related attributes (or variables) **are key determinants** of residential rental values in the housing market in Ghana.

*Goal*
To develop a model that can be used to disaggregate residential rental housing values and use it to explain location and neighbourhood effects of housing sub-markets in Accra.

## 2.5. Research objectives

The main objective of this research is to quantify how location and neighbourhood characteristics affect residential rental values in housing submarkets. To operationalise this main objective, 4 sub-objectives are formulated. The more specific sub-objectives are:

1. **To evaluate the relative appeal of location and neighbourhood attributes to rental value and identify theories that explain effects of same on property value.** There are a number of methods and concepts that are available to model rental values in the residential rental market. A systematic review of the extant literature suggested that there is not a consensus on variables to model determinants of rental value, especially in a developing country context (Anim-Odame et al., 2010a; Owusu-Ansah, 2012a, 2012b; Owusu-Ansah et al., 2017). This sub-objective addresses this gap in the literature by providing among other things (i) a review of recent and regularly used approaches and methods, (ii) independent variables (attributes) used in the modelling process, (iii) data sources, (iv) the direction of both theoretical and empirical research, and (v) how location and neighbourhood variables have been incorporated in an attempt to understand how the rental housing market works. This provides the basis to build on a technique that could be replicated across cities in Sub Saharan Africa (SSA).

2. **To apply an effective technique (as per objective 1) to estimate location and neighbourhood values, and use same in measuring and valuation of these effects.** In a market where paucity of data and data asymmetries are critical issues to deal with, there is the need to be innovative in data collection techniques to achieve results that are robust and can be relied on. We explore a mixed methods approach – where we specifically use both parametric and non-parametric techniques in analysing the rental housing market. The methodology explores modelling rental submarkets at various scales of submarket disaggregation based on theoretical definitions by using the Kruskal-Wallis H test, the Jonckheere-Terpstra test and hedonic modelling techniques. The hedonic modelling technique is further used to quantify the effects of value determinants on rental value pricing – with specific focus on location and neighbourhood attributes. A systematic approach is developed that examines which data is relevant and to be included in the model; how the modelling process should proceed at various scales of disaggregation; and how effects of location and neighbourhood can be analysed through regression models.

3. **To analyse estimated location and neighbourhood values and their impact on residential rental housing (sub)markets.** It is hypothesised that if submarkets exists, then effects of location and neighbourhood envisaged may not be homogeneous across submarket constructs. Hence this sub-objective analyses these effects based on methods developed in sub-objective 2. The percentage contribution of location and neighbourhood variables are computed for statistically significant submarkets identified. An attempt is made to discuss trends identified and why they may be so for particular submarket constructs.

4. **To empirically examine how location and neighbourhood characteristics contribute to residential rental housing value and the interrelationships that exist.** Considerable differences may exist within submarkets identified in the rental market. In order to address this, the thesis analyses interrelationships that may exist at both the aggregate market and submarket levels. In the end, this thesis concludes by linking perceptions of market stakeholders on rental value determinants to empirical results.

## 2.6. Research questions

In order to operationalise research objectives, research questions have been formulated and specific answers need to be obtained. The table 2.3 shows the research objectives with the specific questions to address them.

Table 2.3: Research objectives and questions

| No. | Research Objectives | Research Questions |
|---|---|---|
| 1 | To evaluate the relative appeal of location and neighbourhood attributes to rental value and identify theories that explain effects of same on property value. | Which theories of location and neighbourhood can affect value of residential properties?<br>Are there logical steps that can be identified in how we understand location and neighbourhood effects? |
| 2 | To apply an effective technique (as per objective 1) to estimate location and neighbourhood values, and use same in measuring and valuation of these effects. | Which location and neighbourhood factors are key determinants of residential rental value?<br>Can location and neighbourhood factors be quantified and analysed to deepen the understanding of residential rental housing markets in a developing country context? |
| 3 | To analyse estimated location and neighbourhood values and their impact on the residential housing (sub)market. | Based on an understanding of Ghana's residential housing market, how are submarkets theoretically modelled?<br>How can submarkets be empirically identified and tested in Ghana's residential housing market? |
| 4 | To empirically examine how location and neighbourhood characteristics contribute to residential rental housing value and the interrelationships that can potentially exist. | How do analysed submarkets compare with each other in terms of location and neighbourhood effects?<br>Are there interrelationships that can be analysed? |

Source: Author's construct

The next chapter discusses the methodology employed in the thesis.

# 3. Methodology and data collection

*"Research is to see what everybody else has seen,*
*and to think what nobody else has thought"*
(Albert Szent-Gyorgyi)

## 3.1. Introduction

This chapter is in two parts. The first part puts the research in its appropriate philosophical context. It engages in the debate surrounding qualitative and quantitative research methods and points out that none of them is superior to another. It concludes that they are not mutually exclusive and that these can be mixed to enhance a better analysis of data. Building on this, the second part of the chapter outlines the datasets used in the empirical research and their source(s). Activities performed during and after fieldwork are discussed; which includes administering expert/ stakeholder questionnaire, pre-fieldwork preparations, fieldwork data collection, and pre-processing of data are all discussed. The chapter provides specific rationales for adopting the mixed method approach, and concludes with a reflective consideration on the mixed data used and implications.

## 3.2. The research in a philosophical context

A research philosophy is a belief about the way in which data about a particular phenomenon should be gathered, analysed and presented in relation to a researcher's view of the real world. Dainty (2007) posits that it is pertinent to construct and align any empirical investigation to a philosophical position to ensure theoretical and philosophical consistency. It has therefore been strongly suggested that, the philosophical background and paradigm of inquiry should be clearly defined at the initial stages of the research (McCallin, 2003b, 2003a). Guba and Lincoln (1994, p.105) define a research paradigm as "*the basic belief system or worldview that should guide the investigator, not only in choices of method but in ontologically and epistemologically fundamental ways*".

A research paradigm encompasses a trilogy of ontology, epistemology and methodology. Ontology is concerned with the form and nature of reality. It accordingly focuses on theory of what exists and how it exists. In describing ontology two aspects become evident from a researcher's perspective; these are objectivism and subjectivism (Saunders et al. 2009 p.110). These views are how researchers will want to explore a particular social phenomenon of interest. Epistemology describes what is acceptable in a phenomenon under study. It is further concerned with the nature of knowledge and considers the relationship between the subject of the research (the researcher) and the object (which is the phenomena being investigated) (Guba & Lincoln, 1994). Methodology on the other hand seeks to unearth and rationalize "*research assumptions as far and as practicably as possible, and in doing so to locate the claims which the research makes within the traditions of enquiry which use it*" (Clough and Nutbrown, 2002 p.31). Research methodology describes the ways a researcher will gather information to illuminate a problem under study to meet set out objectives. This process may be simple or complex depending on the issues under study. In developing this thesis further there was the need to explore the extant literature, to understand the extent of housing submarket identification and value determination in a developing country context.

These three research paradigms are very important to the entire processes of knowledge development. Failure to effectively observe these issues may reduce a given piece of research to a mere data dredging exercise. Accordingly, Amaratunga and Baldry (2001) have cautioned that ignoring them can have a detrimental effect on the quality of the final output of the research.

The appropriate philosophical foundation upon which a study (epistemological issues) is undertaken is often confused with the appropriateness of one method or another (Bryman, 1984). This confusion has resulted in considering epistemology and methodology as synonyms which ought not to be so. Epistemology (logic justification) and method are not synonymous (Johnson & Onwuegbuzie, 2004). The logic of method does not dictate as to what specific data collection techniques and analytical methods a researcher must use. The philosophical debate about the methods has no end in sight. But clearly from literature the two classical or traditional approaches to research have either been to adopt quantitative or qualitative approaches.

## 3.3. Research paradigms

Saunders *et al.* (2009 p.118) define research paradigm as "*a way of examining social phenomena from which particular understandings of these phenomena can be gained and explanations attempted*". Three (3) paradigms of research stem out of this philosophical debate in literature; (i) the Positivist or Empiricist paradigm (linked to quantitative methodologies); (ii) Constructivist, Naturalistic, Ethnographic or Interpretivist research paradigm (linked to qualitative methodologies); and (iii) the Mixed research paradigm (a combination of qualitative and quantitative methodologies). Some schools of thought agree to similarities between the two traditional methods and hence the need to integrate (Bryman, 1984, 2012; Howe, 1988), others see sharp differences and thus advocate for a parallel use in research (Greene, Caracelli, & Graham, 1989). Both methods are very important and useful.

### 3.3.1. Quantitative Research paradigm

The quantitative research paradigm is premised on the belief that reality exists and thus the relationship between concepts, phenomena and variable can be accurately measured. Quantitative purists maintain that social science research should be objective, while qualitative purists reject the positivism point of view and rather prefer a detailed and rich description of research. Quantitative research methodology according to Bryman (2012 p.35) can be construed as a research strategy that emphasizes quantification in the collection and analysis of data while qualitative methodology emphasizes words (descriptions) rather in the collection and analysis of data. If the problem is identifying factors that influence an outcome, then the quantitative approach is better suited.

Quantitative research continues to remain popular due to some inherent strength in its usage. Sympathisers of the quantitative paradigm claim that the structured approach of gauging existing facts eliminates all forms of subjective judgement and prejudiced positions. Outcomes of quantitative research is thus seen as being 'hard evidence', scientifically more robust, more reliable and valid (Robson, 2002). With the quantitative research paradigm, data collected and analysed seeks to give a numerical weight to the phenomenon under study by using statistical procedures. Useful insights are provided to answering and analysing '*how much?'* and '*how many?'* questions. Thus requiring a measure of counting. Inferences are made about a sample to represent a general population. Quantitative methods enable the testing of hypothesis based on the principle of probability.

### 3.3.2. Qualitative Research paradigm

Qualitative research represents a direct contrast to the proposals of the quantitative paradigm. It is thus any kind of research that produces outcomes that are not arrived at by means of statistical procedures and methods, or other means of quantification. Qualitative implies an emphasis on processes and meanings that are not so strongly reliant on statistical analysis (Denzin & Lincoln, 1994). Thus, there are instances, particularly in the social sciences, where researchers are interested in insight, discovery, and interpretation rather than hypothesis testing (Merriam, 1988). Qualitative studies aim to provide useful insights into answering '*why*?' and '*how*?' questions.

The general underlying assumption of qualitative research rests on the belief that reality is a social construct. Accordingly, understanding the meaning of the dynamics of social interaction is a prerequisite to defining reality (Delanty, 2005). In turn, the actors and agencies within a given context constitute the principal focus when investigating any phenomena. Qualitative research primarily employs case-studies and social contexts instead of variables and hypotheses which are closely associated with the quantitative research paradigm. The qualitative research leans more towards to the logic and propositions of the interpretivist paradigm where investigations focus on describing meanings and understanding members' definition of situations (Gephart, 1999).

The key data collection tools employed for qualitative research include interviews, focus group discussion and observation. Qualitative data is usually analysed using content/textual analysis strategy. Qualitative research is useful for studies which are exploratory in nature. Such studies enable new discoveries of social phenomena and concepts owing to the flexible and iterative nature of this approach.

Critics of the qualitative paradigm are often quick to point to the fact that, this approach is usually small-scale and non-representative. Qualitative research is exploratory in nature. One key advantage of qualitative research is that, '*detailed and exact analysis of case studies can be produced*' (Creswell, 2003) and so it depends on the researcher to present what is relevant or not.

### 3.3.3. Mixed Research paradigm

Mixed method research methodology involves '*one in which the researcher tends to base knowledge claims on pragmatic grounds* (e.g. consequence-oriented, problem-centred and pluralistic (Creswell 2003, p.18). It involves both attributes of qualitative as well as quantitative. Johnson and Onwuegbuzie (2004b) define mixed methods research "*as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study*". This method is also becoming popular among researchers because of the blend between qualitative and quantitative methods. Johnson and Onwuegbuzie (2004) are of the view that mixed methods are a compliment to purely qualitative and quantitative research, as today's research is becoming more interdisciplinary. It draws from the strengths and minimises weaknesses that may be inherent in opting for a single method (Johnson & Onwuegbuzie, 2004). To many researchers opting for the qualitative or quantitative approach represents a commitment to either the positivist or interpretivst epistemological position. These two positions are therefore seen as mutually exclusive without any chance of convergence. The danger of strict allegiance to one paradigm means, researchers eventually pigeonhole themselves, a situation which results in lack of flexibility in the research process. Denscombe (2008) asserts that reviews of existing mixed methods show researchers opt for this approach to; (a) improve accuracy of data; (b) produce a more complete picture by combining information from complementary kinds of data or sources; (c) avoid biases intrinsic in using single approaches; (d) way of developing the analysis and building on initial findings using contrasting kinds of data or methods and (e) aid in sampling.

There are three strategies of the mixed research paradigm or the mixed research approach. These are the sequential mixed methods, concurrent (parallel) mixed methods and the transformative mixed methods (Creswell, 2003).

With the sequential mixed methods, the focus is to expand on the research findings of one method as against the other. The option here may be to begin the research based on qualitative underpinnings and continue with quantitative methods to generalise results. The researcher is free to begin with either methods.

The concurrent (parallel) mixed method however requires the researcher to collect both qualitative and quantitative data types and merge them for effective data interpretation based purely on research problem at hand. The degree of data integration depends on what phenomenon is under study.

The transformative mixed methods require that the researcher in analysing a particular phenomenon begins from a particular theoretical perspective and designs the research or data collection in such a way that these perspectives are taken into account. Within this broad framework data collection methods could make use of either the sequential or the concurrent mixed methods approaches.

### 3.3.4. Adopting the mixed research paradigm

Quantitative, qualitative and mixed researches are all superior under different circumstances. The choice of a method is not mainly about the advantages that a method has to offer, but basically on the research problem at hand and, the aims and objectives of the study (Bryman, 2012; Mackenzie & Knipe, 2006; Saunders et al., 2009; Somekh & Lewin, 2005). The key question to ask is not which of the paradigms is better in terms of technique, but rather whether one is the appropriate technique in terms of a set of epistemological premises (Bryman, 1984). Some techniques are more useful than another depending on the research problem at hand.

Against the background of inherent flaws associated with both methods, mixing the quantitative and qualitative will be adopted in this research. The mixed methods is a way to reject and avoid dogmatism

and is superior to mono-methods research (Greene et al., 1989; Johnson & Onwuegbuzie, 2004). The research problem basically is about ways to better understand the location and neighbourhood phenomenon in transaction prices in the residential rental market.

Based on the foregone discussions the concurrent (parallel) mixed methods approach is adopted for this research. The choice is based on research objectives and research questions. Research objectives as stated in section 2.6 of chapter 2 has 2 dimensions. Objectives 1 and 4 are explorative in nature and are addressed through the qualitative strategy. Objectives 2 and 3 explores the effects of location and neighbourhood factors on residential rental values which are addressed through quantitative strategies. Both the qualitative and the quantitative types of data are required for a comprehensive analysis. We collect both types of data and make interpretations based on assumptions made. The mixed approach helps to situate the research in a real life situation, i.e., residential rental housing market.

## 3.4. Research matrix

Table 3.1 shows the research matrix; it states the objectives, research questions, data required and sources of data, data acquisition tools, method of analysis and the time frame within which to achieve each objective. This matrix focuses on the what, when and how to achieve the overall objective of the research – which is to develop a model that can be used to disaggregate rental transaction prices and use it to understand the location and neighbourhood effects of the rental housing (sub)markets in Accra, Ghana.

Table 3.1: Research matrix

| No | Specific Research Objectives | Research Questions | Data Required | Data sources | Data acquisition tools | Time (when?) | Methods of analysis |
|---|---|---|---|---|---|---|---|
| 1 | To evaluate the relative appeal of location and neighbourhood attributes to rental value and identify theories that explain effects of same on property value. | Which theories of location and neighbourhood can affect value of residential properties? | Relevant literature on modelling housing (sub) markets | Primary/ secondary housing data | Literature search | Pre-field work/ field work | Literature review |
| | | Are there logical steps that can be identified in how we understand location and neighbourhood effects? | Relevant literature | Secondary data | Literature search | Pre-field work/ field work | Literature review |
| 2 | To apply an effective technique (as per objective 1) to estimate location and neighbourhood values, and use same in measuring and valuation of these effects. | Which location and neighbourhood factors are key determinants of rental value? | Relevant literature<br><br>Documentation on rental housing structure quantification<br><br>Rental housing transaction data | Primary/ secondary data | Literature search<br><br>Expert survey | Fieldwork/ post fieldwork | Literature review<br><br>Relative Importance Index<br><br>Thematic Content Analysis |
| | | Can location and neighbourhood factors be quantified and analysed to deepen the understanding of residential rental housing markets? | Documentation on rental housing structure quantification<br><br>Rental housing transaction data | Primary/ secondary data | Literature search<br><br>Expert survey<br><br>Field data collection | Fieldwork/ post fieldwork | Literature review<br><br>Relative Importance Index<br><br>Thematic Content Analysis |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | To analyse estimated location and neighbourhood values and their impact on the residential housing (sub)market. | Based on an understanding of Ghana's residential housing market, how are submarkets theoretically modelled?<br><br>How can submarkets be empirically identified and tested in Ghana's residential housing market? | Rental housing transaction data | Primary | Field data collection | Post fieldwork | Kruskal-Wallis H test<br><br>Jonckheere-Terpstra test<br><br>Hedonic modelling<br><br>Hypothesis testing |
| 4 | To empirically examine how location and neighbourhood characteristics contribute to residential rental housing value and the interrelationships that can potentially exist. | How do analysed submarkets compare with each other in terms of location and neighbourhood effects? | Data from previous analysis (3) | Primary | - | Post fieldwork | Analyse model results |
| | | Are there interrelationships that can be analysed? | Data from previous results (3) | Primary | - | Post fieldwork | Analyse model results |

The next section discusses the conceptual framework, research design and detailing the methods that were used to collect relevant data once the problem at stake had been clearly identified. Key explanatory variables that contribute to rental value are discussed in detail here.

## 3.5. Conceptual framework

Theories serve as the basis through which researchers observe and attempt to find answers to a particular phenomenon under study. We briefly discuss two of the classical location theories; the Homer Hoyt sector model and the multiple nuclei theory.

The Hommer Hoyt sector model (Hoyt, 1939, 1964) postulated that cities grow from important transportation nodes such as roads, canals, railways among others. Hoyt opines that areas with high levels of access command higher prices in terms of housing values and *vice versa*, lower housing values. Since affordability was key at the household level, the spatial trend which evolved was that similar households within a particular income range seemed to converge at particular locations to form a submarket.

Harris and Ullman developed the multiple nuclei theory since many cities did not emerge or fit the traditional concentric or sector theory models (Hoyt, 1964; Senior, 1973). They posit that several portions of a city developed from pull factors apart from the CBD. This creates several growth nodes that have an effect on various land uses; and in this instance housing from the market perspective. Harris and Ullman's model offer an interesting insight on the causes of house price differentials. The theory explains that these price differentials exist based on distance from the CBD as well as other growth sub–centres. It also suggests the notion that clusters of housing occur due to spatial distribution of various income groups.

In all these models, location is very critical in determining how much to pay for housing based on services available, especially transportation. These models help in the development of a conceptual framework and the methodological approach.

At this point we consider a hypothetical model of location differentials in rental value. It is hypothesised that as one moves from one neighbourhood location to another, rental value changes (see figure 3.1).

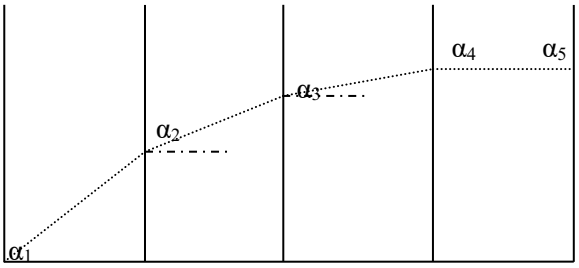



Figure 3.1: Hypothetical model of rental value differentials based on neighbourhood location

Source: Author's construct, 2018

From the hypothetical model in figure 3.1, the underlying assumption is that as one moves from an undesirable neighbourhood location (where basic infrastructure provision is lacking) to a more desirable neighbourhood location (where basic infrastructure provision is available), it is expected that rental value increases. The assumption is that when a house is located in an undesirable location a small change (or improvement) in location characteristics (i.e. improvement in basic infrastructure and related services) corresponds to a much larger change in price or rent paid. As can be seen in the figure; a change from say location $\alpha_1$ to location $\alpha_2$ corresponds to an increase in rental value. However if we take a look at a change from say location $\alpha_4$ to location $\alpha_5$, the change is marginal or negligible; the reason being that the two locations may be in a similar (desirable) neighbourhood and hence similar rental values are assumed to exist. It is assumed that properties here enjoy and have the same neighbourhood and building quality. The theory of location is able to describe the complex relations between property and their various influences on the market.

Rental value differentials may exist due to a number of reasons: (i) Economic conditions – the weights on variables differ in space which depends on the neighbourhood fabric; (ii) Differences in housing characteristics in the market (Meen, 2001); (iii) Probably because supply characteristics support the market for such differential housing types and rents, hence the observed trend.

Let us consider this situation: If one lives some distance away from the Central Business District (CBD), normally one expects low rents to prevail and *vice versa*. The assumption is that the further away from the CBD, the lower the rent one is expected to pay. Monocentric models, including the Bid-Rent Theory, have been used to explain how price/ rent changes with distance from the CBD. The critique with the monocentric models is their relevance in the era of multiple centres (or nuclei) for job opportunity not necessarily in the CBD. The CBD is obviously a pull factor but may not necessarily be the main factor for rent determination. The explanation on classical location theory models (Alonso, 1964; Muth, 1969) have however lost some of their appeal in recent economic theory arguments (Senior, 1973). Neighbourhood quality is brought into the equation to attempt an explanation which has become quite relevant in modern times. This has seen the introduction of what is known as the hedonic pricing model (HPM). The HPM generalises space-access discourse to include a number of explanatory variables that are relevant to price disaggregation. In this research however, we lean more towards the multiple nuclei theory to explain rent differentials.

## Hedonic Pricing Model

Hedonic models are based on the theory of consumer behaviour (Lancaster 1966) that suggests that commodities are valued for their individual "utility bearing" attributes or explanatory variables (Rosen, 1974). It is not the good itself that creates utility but rather individual characteristics that have an effect on price. This guides both consumer and producer on locational decisions in characteristic space as a problem in the economics and spatial equilibrium. Paterson and Boyle (2002) opine that the price of a property can be modelled as;

$$P = \mathrm{P}(\mathrm{L}, \mathrm{S}, \mathrm{N}, \mathrm{Q}) \qquad (3.1)$$

Where:
$P$ – Vector of sales price of property (in this case rental value)
$L$ – Locational characteristics
$S$ – Structural characteristics
$N$ – Vector of neighbourhood characteristics
$Q$ – Environmental attributes

The lessee's (tenant's) problem will then be to maximise his utility subject to income available. Therefore rental value is based on utility-bearing characteristics implicitly and traded as one unit. A household then has to maximise the utility derived from this heterogeneous good in order to make a decision to pay or not to pay for the asking price of rental value. Tenants evaluate their rental location choice by first considering their social and economic standing.

Helbich *et al*. (2013) mention that the price function of a hedonic pricing model *f* describes the functional relationship that exists between real estate prices *P* as well as associated relationships that exists between physical characteristics $X^p_1, \ldots, X^p_n$ and neighbourhood characteristics $X^n_1, \ldots, X^n_m$ of same. Sirmans *et al.* (2005) suggest that research conducted on explanatory variables that explain the price build-up of RE units show a particular trend. The direction and trend of the impact of these studies show that such analysis cannot be generalised but location specific. Table 3.2 as adopted from Sirmans *et al*. (2005) show that bathrooms, bedrooms, public rooms, garages, fireplace, pool, area of the RE unit are key explanatory variables that show a positive sign when a hedonic pricing model is adopted.

Table 3.2: Factors that determine RE property values

| **Housing Characteristics** | **Number of times it appears** | **Number of positive signs** | **Number of negative signs** | **Number of neutral signs** |
|---|---|---|---|---|
| Number of floors | 13 | 4 | 7 | 2 |
| Number of bathrooms | 40 | 34 | 1 | 5 |
| Number of public rooms | 14 | 10 | 1 | 3 |
| Number of bedrooms | 40 | 21 | 9 | 10 |
| Garage | 61 | 48 | 0 | 13 |
| Age | 78 | 7 | 63 | 8 |
| Square feet | 69 | 62 | 4 | 3 |
| Fireplace | 57 | 43 | 3 | 11 |
| Pool | 31 | 27 | 0 | 4 |

Source: adapted from Sirmans *et al.* (2005)

We summarise the foregone discussions into a framework to understand how to analyse the effects of location and neighbourhood characteristics on residential rental values. We conceptualise the market of residential rental housing by first analysing the main theories that explain price differentials on residential land uses. Thus we consider classical location theories, multiple nuclei theory and the hedonic pricing models. We situate this discussion in how to disaggregate residential rental values into structural, locational and neighbourhood factors by first measuring the perception of various stakeholders in the rental market space on what variables are relevant. The interrelationships between these factors and how it affects rental value are analysed. This aspect is very critical in understanding the influence of each of these factors based on empirical data.

The interaction between structural, locational and neighbourhood factors is influenced by how much weight is given to same in order to determine rental values. As a first step, an attempt is made to identify how experts and stakeholders in the rental market perceive this and discuss the results in the subsequent chapter. The concept of housing submarket and its definition is also discussed. Figure 3.2 provides an overview of the conceptual framework.

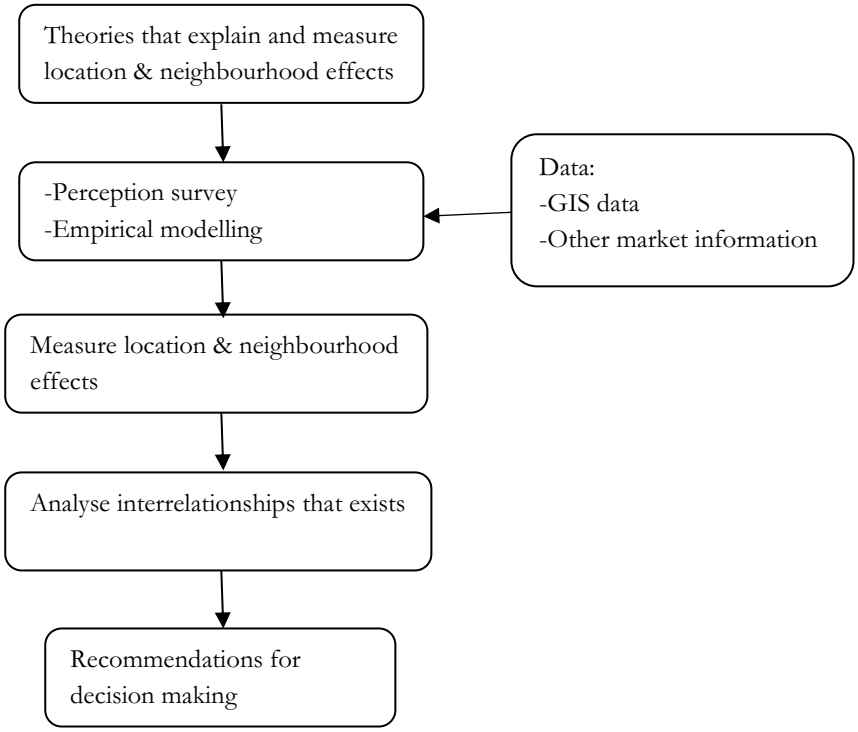



Figure 3.2: Conceptual framework

Source: Author's construct

The conceptual framework (figure 3.2) for analysing this research is organised into these steps:

1. Identifying theories and models that explain and measure neighbourhood effects. These include classical location theories and multiple nuclei theory.
2. Administration of a stakeholder perception survey. Then the selection, adaption and construction of model based on results of perception survey and empirical fieldwork data.
3. Measure these effects based on empirical data from fieldwork data.
4. Analyse interrelationships that exists between variables used and its impacts on local housing (sub) markets.

This conceptual framework emphasises how data on rental values are used to determine and extract location and neighbourhood effects within the context of the residential rental housing market at the neighbourhood level of analysis. This level of spatial analysis is known to affect individual expenditure and builds up to aggregate consumption expenditure (Tsatsaronis & Zhu, 2004). Housing is a composite good and let wholly as one unit. Sensitivity analysis is performed to ensure robustness of the model constructed. Further to this, various location and neighbourhood variables are analysed to gain a deeper insight as to the influence of these variables on rental values. To be able to understand how this works, a disaggregation of the composition of rental values are critically examined. The price build up consists of structural composition of the house, neighbourhood and environmental quality. When we are able to determine the factors that cause price differentials from transaction data, we can better understand the market dynamics. This however requires reliable datasets to make any meaningful analysis. Finally recommendations are formulated to aid in decision making and policy direction. It can be noted that the conceptual framework emphasises the selection, modifying and adapting a model. The emphasis in this thesis was to disaggregate the composition of residential rental values so that location and neighbourhood effects can be analysed and explored further.

As shown in figure 3.3, concepts were developed and operationalised based on literature review.

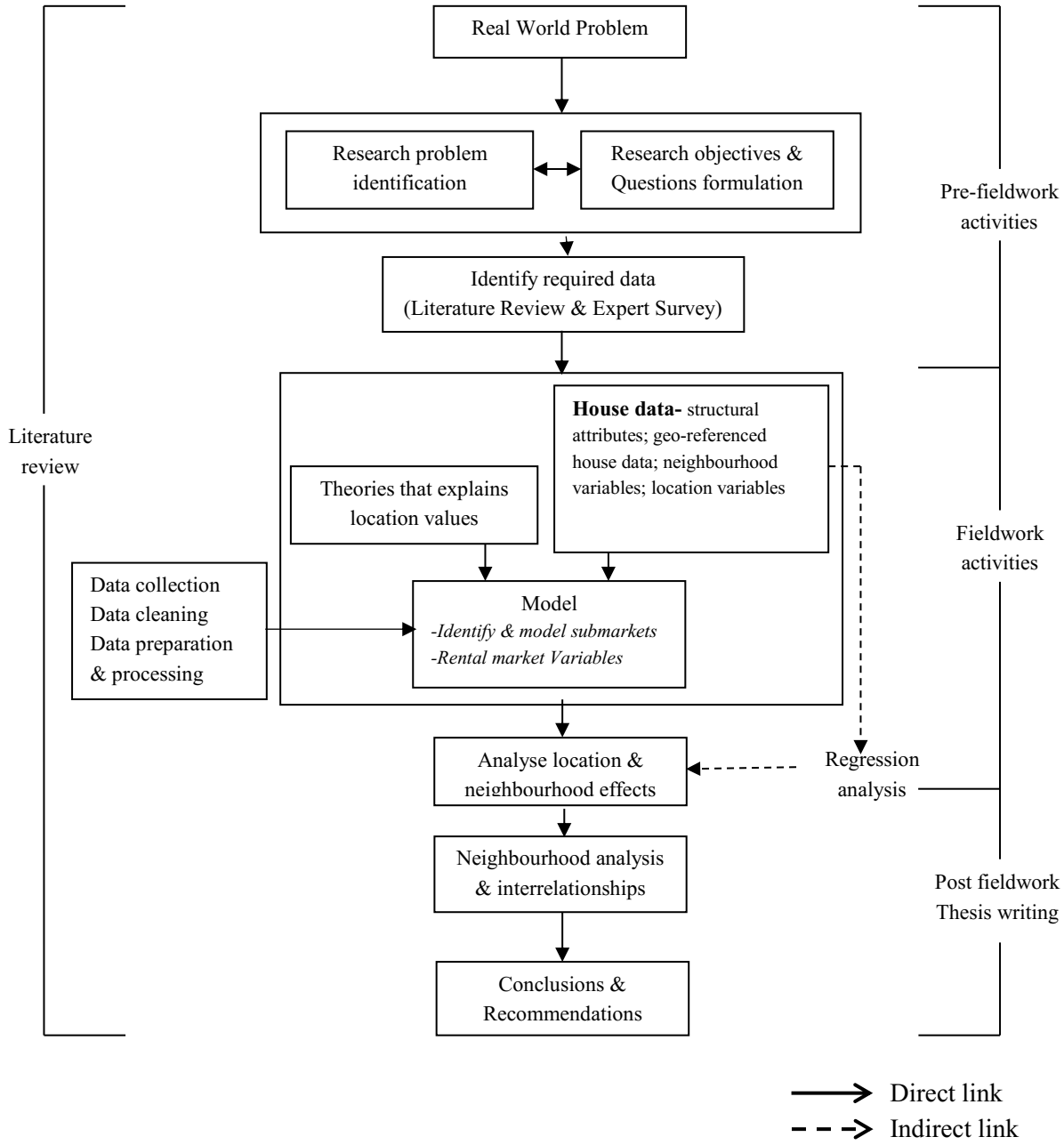



Figure 3.3: Research design

Source: Author's construct 2018

## 3.6. Survey methodology and design

The survey methodology comprised of selecting the area of study – four district assemblies within the Greater Accra region – which included all three classified neighbourhood income classes, housing characteristics and attribute data, selection of the survey method and the methods of analysis.

Both primary and secondary datasets are used for the research. The research adopts the mixed method for data collection and analysis. Existing secondary data are reviewed as base guideline, however empirical data is used to construct model to examine location and neighbourhood effects from rental transaction data.

Accra, the capital of Ghana is chosen as the fieldwork location because it has the most vibrant real estate market in Ghana (Baffour Awuah, Hammond, Lamond, & Booth, 2014; Viruly & Hopkins, 2014). It has also has the largest proportion of residential housing as compared to other cities in the country. Real estate investments in Accra over the past years has been on the ascendency.

This research as a first step developed an expert survey to elucidate responses from respondents who are knowledgeable in the activities of the rental market in Accra. Respondents were asked to select from a list of variables gleaned from literature, what the key components of residential rental values were. Respondents' task was to rank these variables from least important to very important (with each variable getting only one response). In the end a Relative Importance Index was constructed, which was the basis of the empirical field data collection in terms of selecting which information was to be sampled. This in the opinion of the researcher was to help answer the question, *what are the key variables that affect residential rental value in a developing country setting?* Other information that were elucidated from these stakeholders (respondents) was to define what a market, sub-market and neighbourhood were.

The case study approach was adopted since it afforded the opportunity to examine real life situations in their natural context. Emerging findings will then be easily applicable to other cities across Sub Saharan Africa with a similar residential rental market structure.

In the second step or procedure, we collected and documented attribute data that constitutes (or make up) residential rental values from selected district assemblies. This process involved the researcher and a number of research assistants who assisted in measuring the area of the subject properties, recording and imputing attribute data and translations. Three neighbourhood classes are targeted, i.e. Low, Middle and High income neighbourhoods. Data from the fieldwork formed the basis for empirical analyses.

Modelling and data analysis are performed using Hedonic Pricing techniques; GIS application tools including ArcView and Spatial Analyst. Step by step details of analytical steps undertaken are provided in relevant chapters.

## 3.7. Data collection: Approach and method

Data collection was basically done in two stages. During the first stage, questionnaires were administered to experts and stakeholders who are familiar with the rental market in Accra, Ghana. The questionnaire sort to elucidate from these experts and stakeholders which variables drive residential rental values. The questionnaire was based on earlier discussions about characteristics of physical, locational and neighbourhood characteristics of residential rental housing attributes. Based on the responses from this process, empirical survey was undertaken to sample key explanatory variables that have an impact on the residential rental housing market. Variables that were collected during empirical survey included structural, neighbourhood and locational characteristics on the rental housing market.

### 3.7.1. Expert survey/ questionnaire

Using the stratified sampling technique, the population of experts and stakeholders with a knowledge in the rental market space are identified and divided into six distinct homogeneous strata. Each respondent is assigned to only one stratum, which are mutually exclusive. Each stratum was identified based on their direct or indirect interaction with the rental housing market. The sample frame was drawn from landlords; tenants; real estate agents; real estate developers; academic staff and graduates from Universities (in the real estate and related sectors); and valuation and estate surveyors of the Ghana Institution of Surveyors (GhIS). This sample frame constitutes stakeholders who are actively involved with activities of the (rental) housing market in Ghana. Experts are potentially helpful in providing information that may not be easily assessed due to data asymmetries. The questionnaire made available an option known as 'others' for respondents who did not identify themselves with any of the above groupings. This group was envisaged to be sharers, perchers, and rent-free occupiers of rental property. The stratified technique has the advantage of providing a greater precision in terms of responses from each stratum, and as such can guard against an "unrepresentative" sample (Jewell, 1985; Thompson, 2012).

The purposive sampling technique was then employed to select and elucidate responses within each stratum. However every effort has been made to ensure that the downsides are mitigated. The snow-ball sampling technique is used to identify specific respondents within each stratum since identifying same through other means is not possible, as there exists no pre-existing reliable database of these

respondents. The snowball technique has the advantage of being able to utilise populations that may not have been included and is cost effective. These experts and stakeholders are believed to have good knowledge concerning the rental market and also the price build-up of rent whether empirically or theoretically. Although this sampling technique does not necessarily give rise to a representative sample, it proves to be very useful in situations where there are no pre-existing databases to rely on (Yin, 2003).

The core of the respondents were identified through various social media and emails platforms. These respondents were sent the questionnaire (in electronic format) and they in-turn sent it to others who were within their network and were capable of responding appropriately.

The questionnaire was developed using the online '*Google Forms'* platform. This helped to reduce and eliminate the printing of hardcopy of the questionnaire that was administered. In this case all questions were made available online and the link to access the questionnaire sent to respondents. All that the respondents had to do was to click on the activation link and respond to the questions required. When they are done they submit these responses and automatically it is received by the researcher. Data was then transferred from this medium to excel formats for further analysis.

A draft version of the questionnaire was first piloted for valuable feedback to revise, improve and that it captured relevant information of the research, before actual questionnaire was administered. Based on the pilot survey, refinements and or modifications were effected. Based on the feedback from the pilot survey, a larger survey was then undertaken.

The questionnaire administered to experts and stakeholders was to elucidate their views on what drives residential rental value in the rental housing market to the best of their knowledge. Respondents are asked to rank some explanatory variables that had been identified through literature review and which contributes to rental value. These variables included broad categories of physical, location and neighbourhood characteristics of rental housing. These relevant variables are identified and selected with the aim to confirm, reject or introduce new variables to make this phenomena (key determinants of rental housing value) better understood in a developing country context. Other data elucidated from respondents included years of contact with the rental market; variables that drive the creation of a residential rental housing sub-market; what in their view describes a residential housing market; what describes a residential neighbourhood; whether any variables had been omitted and if any variables had been omitted to provide same. A number of research conducted in this area have been inconclusive as to what are relevant variables to consider, especially in a developing country context (Anim-Odame et al., 2010a; Bourassa, Cantoni, & Hoesli, 2007; Owusu-Ansah, 2012b; Owusu-Ansah & Abdulai, 2014). To proceed on this tangent by relying on only variables identified in the literature could mean that some variables may be omitted. In this research the solution was to find out from the key market stakeholders which variables were critical and could be relied upon as key explanatory variables. The responses from this first step provides illumination on what explanatory variables will be relevant and collected during the empirical fieldwork phase.

The web-link to the questionnaire is provided below;

https://docs.google.com/forms/d/e/1FAIpQLScIJXgdUf9KU0nwSWhbFfFRml2F3NGz6-OVqHgVmgc3YG8v5A/viewform?usp=sf_link

For analysis, the Relative Importance Index (RII) was used to evaluate these variables to determine their relative contribution to rental value and ranking. This was a critical first step to identify which variables will be included in the Hedonic Model construct to explain location and neighbourhood effect. The research utilised the frequently cited RII formula as presented by Holt (2014) :

$$RII = \frac{\Sigma W}{A*N} \qquad (3.2)$$

$$where\ 0 \leq RII \leq 1$$

$W$ is the sum of scores awarded a variable, $V_i$ from $N$ number of respondents. The sum of $N$ respondents selecting a response point multiplied by the point's integer value, for an option on the scale term. $A$ is the largest integer response scale ($A_{max}$ in this case was be 5).

The results were critically analysed to identify trends, and based on this, an objective inclusion or exclusion of variables was identified. The background and experience of the respondents generated the needed confidence to proceed to make generalisations with the results obtained. It must be noted that responses gleaned from this survey served as a guide for further discussions on relevant variables to include in the model. These independent variables needed to be isolated and their impacts assessed to make valid theoretical assumptions. Decisions could easily be arrived at when the outputs and rankings of each variable are displayed graphically. This approach will help to visually analyse and understand trends.

The main reason for using the RII was to determine to what extent respondents agree on ranked variables (inter and intra groups) in terms of importance. Care was taken in the interpretation of such results to ensure robustness.

### 3.7.2. Study area selection and data (fieldwork)

Ghana is located on the west coast of West Africa, surrounded by three francophone countries. Ghana currently has 16 administrative regions (as of 2019). Accra is the capital city of Ghana and also the capital of the Greater Accra region. Accra is the largest city of the country and has the most vibrant real estate market in Ghana (Baffour Awuah et al., 2014; Viruly & Hopkins, 2014). It is dominated by residential properties and an active residential rental market. The Greater Accra region contributes about *14 per cent* to the country's entire housing stock, which further accounts for 19 *per cent* of all households in the country (Ghana Statistical Service, 2013). This is mostly due to the city's status as the capital which attracts large concentrations of the population. Accra's population represents a cosmopolitan mix from all parts of the country thereby making it suitable for such studies. Residential housing markets are spread all over the region, both within the CBD and at the fringes. The region provides a true mix of different socio economic conditions that can effectively mimic a number of African cities in Sub Saharan Africa.

**Sample design**

In terms of local governance structure, the Greater Accra region has 2 Metropolitan, 9 Municipal and 5 District Assemblies (MMDAs).

-***2 Metropolitan*** (Tema and Accra with 10 sub-metropolitan districts);
-***9 Municipal*** (Ga West, Ga East, Ga Central, Ga South, Ledzokuku-Krowor, Adentan, Ashaiman, La-Nkwantanang-Madina, La-Dadekotopon) and
-***5 District*** (Ada West, Ada East, Kpone Katamanso, Ningo Prampram, Shai-Osudoku) Assemblies (MMDAs).

These 16 MMDAs form the administrative districts of the Greater Accra region. The target population was all residential rental housing units in the Greater Accra Region of Ghana. After discussions with real estate experts in the residential rental market in Accra, 4 district assemblies (administrative districts) were selected. The selected administrative districts for this study are (see figures 3.4a and 3.4b):

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

We are generally of the view that such studies should encompass all residential classes to make the study thorough. These districts were chosen to cover a wide geographical area as possible where first, second and third class residential areas seamlessly converge. Each district is then sub-divided into their various neighbourhoods and zones. A number of clusters (neighbourhoods and zones) are selected at random using the proportions of total number of neighbourhoods and zones in each district as weight. We then

selected residential rental units based on the snowball technique. The final selection is based on the number of rental units within these neighbourhoods and geographical representation. Based on the study area selection criteria adopted, only one geographical extent remains as the investigating area (see figure 3.4a).

Housing market data for such studies is rarely available in Ghana unless primary data collection is undertaken. In this instance the stratified sampling technique is adopted in the selection of neighbourhood so that all neighbourhood classes are represented (i.e., low, middle and high income neighbourhoods). The first three district assemblies (LaNMMA, AdMA and LaDNA) contain a mix of all residential classes and the last, Ayawaso West submetro, is a first class residential area (high income neighbourhood).

Selected neighbourhoods can be said to be a reflection of the entire city of Accra and the country at large. Neighbourhoods are selected based on their different characteristics. The study area spans between low, middle and high income areas. This is to ensure that all neighbourhood classes are included and duly analysed. Below are some general characteristics of neighbourhood classes used in this research.

a. **Low income neighbourhood** – congestion, poor sanitation, dilapidated structures, poor infrastructure. Houses are built without planning approval, compound houses dominant (having a common courtyard with shared facilities like kitchen, toilet and bath), normally not walled, many households live in deplorable conditions.
b. **Middle income neighbourhood** – well planned, good access and sanitation, not congested, dominant housing types are separate, semi-detached and detached houses.
c. **High income neighbourhood** – high land and rental values normally quoted in US dollars, well located and planned, good infrastructure and related services.

The last census conducted in Ghana was in 2010. Hence the figures for the 2010 housing stock was used as base figures to project 2016 figures based on an annual rate of housing increase of 5 *per cent* in the Greater Accra region (Ghana Statistical Service, 2013). Total housing stock in the four selected districts is 58,796 in 2010 and the projected figures for 2016 is 78,792. The target sample frame is 47 *per cent* of the total housing stock for 2016 which amounts to 37,032. We sought to cover a representative sample to ensure that residential rental units within these areas are duly represented with statistical precision. Therefore using a residential rental sample frame of 37,000, confidence level of 95 *per cent* and a margin of error of 5 *per cent*, the required sample size to represent the population would be 468 (see table 3.3; https://www.surveysystem.com/sscalc.htm). This figure of 468 was distributed proportionally among the 4 districts using total housing stock as projected as weight.

In this research we adopt the UN recommended definition of a house as a, "*structurally separate and independent place of abode such that a person or group of persons can isolate themselves from the hazards of climate such as storms and the sun*" (Bank of Ghana 2007, pg 10). Houses that were sampled included mainly separate houses, semi-detached houses, flats/apartments and compound houses across the study area. Temporary structures including huts, tents, containers and kiosks were omitted.


Figure 3.4a: Map of study area

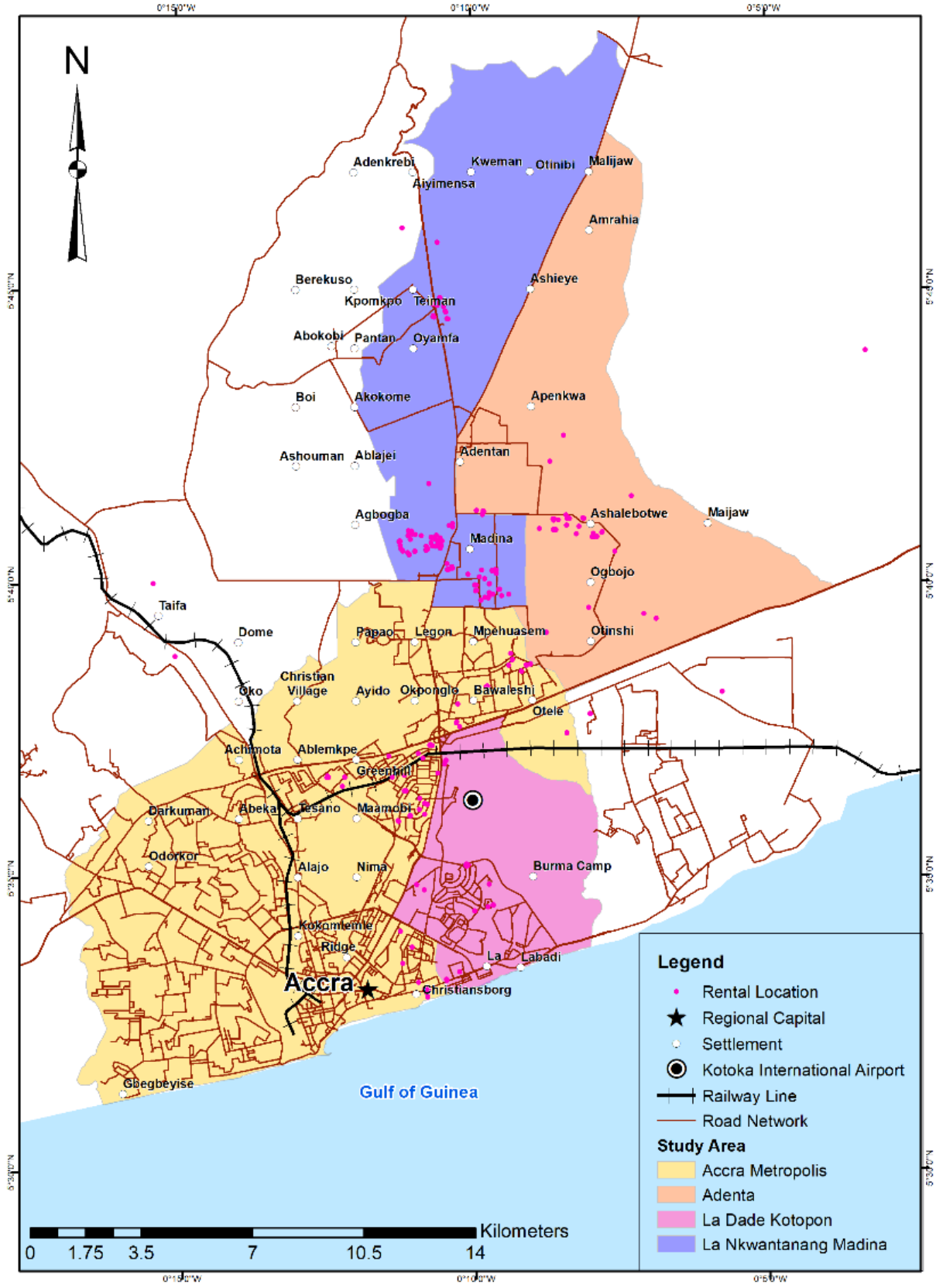



Figure 3.4b: Map of study area

Table 3.3: Sample frame and sample size estimation

| District | 2010 Housing Stock | *2016 Housing Stock | Rental Sample Frame | Required Sample |
|---|---|---|---|---|
| La-Nkwantanang-Madina | 13647 | 18288 | 8595 | 109 |
| Adentan Municipality | 13669 | 18318 | 8609 | 109 |
| La Dadekotopon Municipality | 19174 | 25695 | 12077 | 153 |
| Ayawaso West Submetro | 12306 | 16491 | 7751 | 98 |
| Total | 58796 | 78792 | 37032 | 468 |

Source: (Accra Metropolitan Assembly, 2014; Ghana Statistical Service, 2013)
*Projected figures based on the 2010 population and housing census

**Sample realisation**

The fieldwork comprised cross-sectional data of 536 residential rental transaction data collected during fieldwork in Accra, from March to October 2017. Rental properties were selected based on the purposive and snowball techniques. This sample is representative of rental housing in each of the selected district assemblies.

By using the purposive sampling technique we target only residential rental housing units within neighbourhoods in each administrative district selected (see table 3.4). There is no list of residential rental houses sample frame to draw sub-samples from, as such the snowball technique served as the most practical means to select houses during the field work (with the help of estate agents, landlords and tenants) within several neighbourhoods in a district. Using the '*Mergdata*'[3] mobile platform as the data entry tool, we first identify a rental unit (with the help of estate agents, landlords and tenants); record relevant details such as structural, location and neighbourhood characteristics and move to identify the next rental unit. Each observation is also geo-referenced to add a locational attribute to it.

The object of interest is rental houses and as such were purposively targeted for the field work. Accuracy of the data collected was monitored by researcher to ensure that it is consistent.

Table 3.4: Residential neighbourhoods/ areas in selected districts

| District | Residential neighbourhood/ area |
|---|---|
| La-Nkwantanang-Madina | Madina, Adenta West, Pantang Hospital, Pantang village, Aboman, Teiman, Oyarifa, Kplenko, Oshiyie, Amanfro, Kweiman, Danfa, Adoteiman, Otinibi, Malejor, Amrahia |
| Adentan Municipality | Adenta East, Frafraha, Ashiyie, Amanfro, Amrahia, Ashaley-Botwe, Nmai Dzorn, University Farms, Ogbojo, Dzornaman (Adanaman), Dzen Ayor, Otawor, Adjringanor, Tesa |
| La Dadekotopon Municipality | South La, La, Cantonments, East Cantonments, Burma Camp, Airport |
| Ayawaso West Submetro | Dzorwulu, Agbelenkpe, East Legon, South Legon, Roman Ridge, Airport West, Airport Residential Area |

Source: District population and housing census reports 2010

For the purpose of this study these residential neighbourhoods in table 3.4 are classified into low-class, middle-class and high-class residential areas. These classifications are consistent with how these residential neighbourhoods (areas) are classified by the respective planning and statistical authorities. From these classifications, two neighbourhoods are selected from each of the districts. For an unbiased

[3] See www.mergdata.com

sampling of neighbourhoods the 2010 population and housing census district reports are used to select these neighbourhoods based on population size. The 2 largest populations in each of these neighbourhoods are selected[4]. Table 3.5 provides the final list of selected residential areas based on largest population and geographical areas. Using the above criteria the selected neighbourhoods are Madina, Oyarifa, Ashaley-Botwe, Adenta, La, Airport, Cantonments, Agbelenkpe, Dzorwulu/ East Legon.

Table 3.5: Selected residential neighbourhoods for field survey

| **District** | **Low-class residential area** | **Middle-class residential area** | **High-class residential area** |
|---|---|---|---|
| La-Nkwantanang-Madina | Madina, Oyarifa | | |
| Adentan Municipality | Ashaley-Botwe | Adenta | |
| La Dadekotopon Municipality | *La | | Airport, Cantonments |
| Ayawaso West Submetro | | Agbelenkpe | Dzorwulu/ East Legon |

Source: Field survey 2017

The selected residential neighbourhoods (study area) were selected because of a number of advantages; data consists of many of the determinant factors of rental value; housing stock is heterogeneous (to allow for submarket modelling and analysis); spans across the three neighbourhood classes (low, middle and high income areas); spans across administrative districts that share boundaries; and located in proximity to the central business district (CBD).

### 3.7.3. Field data collection

A case study research is adopted for this study which focused on the residential rental housing market in selected neighbourhoods in Accra. These comprised of low, middle and high income neighbourhoods. The case study approach is preferred when 'how' or 'why' questions need answers (Yin, 2003).

We collected market evidence data based on direct observations of rental transactions. The variables so selected must be consistent with the characteristics of market players, participants and stakeholders. In other words the variables must reflect the perception of the market on the constituents (both implicit and explicit) of rental value. The data was collected between May and October 2017. By the limited time period of the data, it is expected that intertemporal variations in rental values that confound such studies is minimised (Dale-Johnson, 1982). This research makes use of primary data from 536 residential rental transaction data. Attribute data or variables that were collected during data collection included the following;

1. Actual transacted rental value of house (mostly in Ghana Cedis –GHS)
2. Area/size of house (in squared metres)
3. Number of bedrooms
4. Number of bathrooms and toilet
5. Number of public rooms – these include living rooms, dining rooms and kitchen
6. Services available – electricity, water, sanitation, shared utility areas (toilets, washing and cooking areas)
7. Floor material – (e.g. cement sand screed, tiled, terrazzo)
8. Number of floors or storeys
9. Fence wall availability

[4] See http://www.statsghana.gov.gh/DistrictReport.html for district reports for Greater Accra region

10. Garage availability
11. Single family or compound house
12. Neighbourhood characteristics – proximity to schools (nursery and primary, secondary, university), healthcare, police station, transportation, tarred or un-tarred road network, Central Business District (CBD), markets, squatter settlements, places of worship

The hypothesis generally states that each of the variables that will be utilised in the model construct has a statistically significant effect on residential rental value (RRV). To determine whether independent variables have statistically significant effects on the RRV need to be tested with empirical data collected. A confidence level of 95 *per cent* is considered (i.e., a *p*-value $\leq$ significance level $\alpha$ ($\alpha = 0.05$) and necessary to accept or verify the hypothesis so stated. Analysis of Variance (ANOVA) is also used to detect the influence of independent variables on the dependent variable (rental value) and the interrelationships that may exist.

## 3.8. Data cleaning and processing

The data cleaning stage is the process where the original data is scrutinised and inappropriate or incomplete data entries excluded or recoded to make them complete. This ensures suitability and reliability of analysis that are performed on the data. The appropriateness and reliability of housing market analysis is dependent on the quality of data used (Peto 1997; Dunse & Jones 1998; Sheppard 1999 p.1614). As much as practicable we scrutinised the data to ensure that data used in this research is reliable. Data cleaning was undertaken to ensure data integrity. We did ensure that all fields were completely filled and the information provided by interviewers were plausible. Data that could not be relied upon were omitted from the analysis. This included incomplete information and where researcher was of the opinion that, *prima facie*, the data provided by respondents could not be accurate and relied on. For example some respondents start to give information, mid-way they refuse to provide relevant information like rental value or provide a value that seems too low or too high for such similar properties in the market. Since this is one of the key information required, once a respondent is not willing to provide a reliable value of current rent passing, it is omitted from the database, since it would be unethical to assume a value for same. The main purpose of the data cleaning exercise was to ensure that data was reliable and in the right format to be used for relevant analysis.

This data cleaning scrutiny was applied to the perception survey data as well as rental market data. For the perception survey all the responses had to be completely filled before submission could be effected. As all critical information needed for analysis was made compulsory and until such information is given, a respondent could not submit the questionnaire.

For the rental market data collected during the fieldwork, the variables that related to access/ proximity to services, amenities or dis-amenities were recoded to dummy variables (0, 1) since they are all discreet variables, to ensure that further analysis could be performed on them. Further explanations are provided at relevant chapters where analyses are described in much more detail.

## 3.9. Final dataset verification

The data cleaning and preparation stage prepares the (fieldwork) data and makes it ready to be used. This section provides some descriptive statistics on the data set. The dependent variable is the monthly rent of the property, which are converted to United States dollars (USD) and subsequently transformed into their natural logarithms. The independent variables consist of structural, location and neighbourhood variables. The distributions of the data are discussed below. The main objective of this section is to ensure that the dataset as collected during fieldwork is suitable for modelling the rental housing market and to identify submarkets within the aggregate market construct.

### 3.9.1. Data distribution

Table 3.6 provides the number of observations for the aggregate market as well as for submarket groups identified theoretically. The theoretical definitions of submarket classifications are fully explained in chapter 5.1.

Table 3.6: Aggregate market and submarket classifications

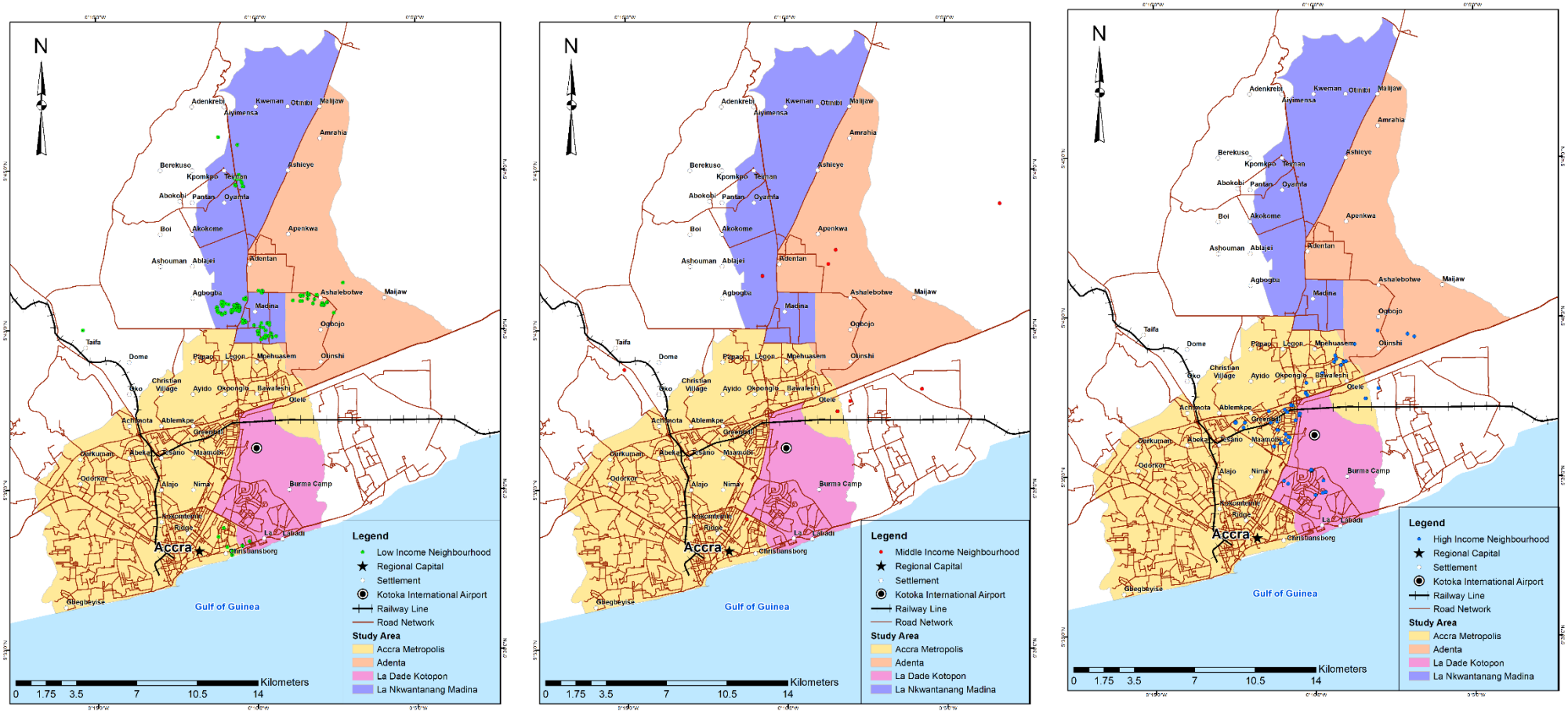
| Market type | Submarket | Definition | N | % |
|---|---|---|---|---|
| Aggregate | | Aggregate market | 536 | 100.0 |
| Spatial | LIN | Low Income neighbourhood | 211 | 39.4 |
| | MIN | Middle Income neighbourhood | 77 | 14.4 |
| | HIN | High Income neighbourhood | 248 | 46.3 |
| Structural | SR |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

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. 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.

Figures 3.5(a-c), 3.6(a-c) and 3.7(a-e) show the specific locations of *a priori* submarkets identified during the fieldwork. This was done by plotting the *XY* locations (geographic coordinates) of various rental units (collected during empirical fieldwork) to *a priori* defined submarkets. An enlarged version of these maps are provided in Appendix Bi-iii, Ci-iii and Di-v.

Figure 3.5 (a – c): Spatial submarkets

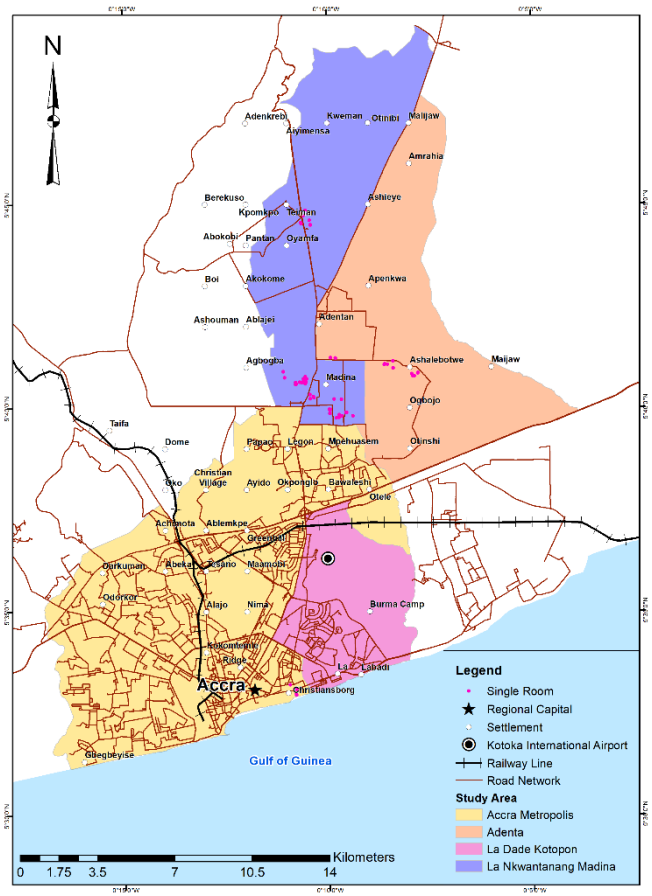



a. Low Income Neighbourhood (LIN)

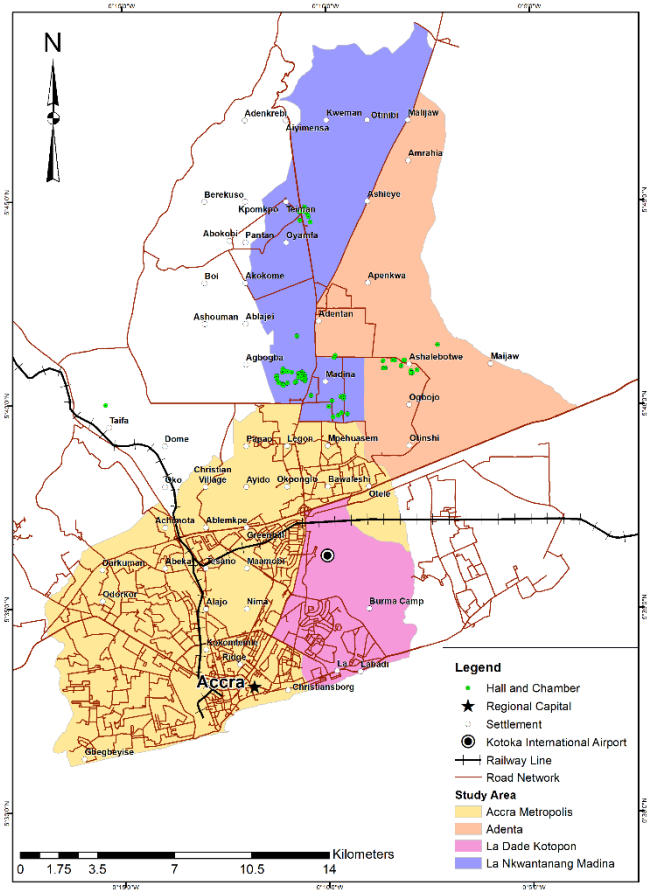
b. Middle Income Neighbourhood (MIN)

c. High Income Neighbourhood (HIN)

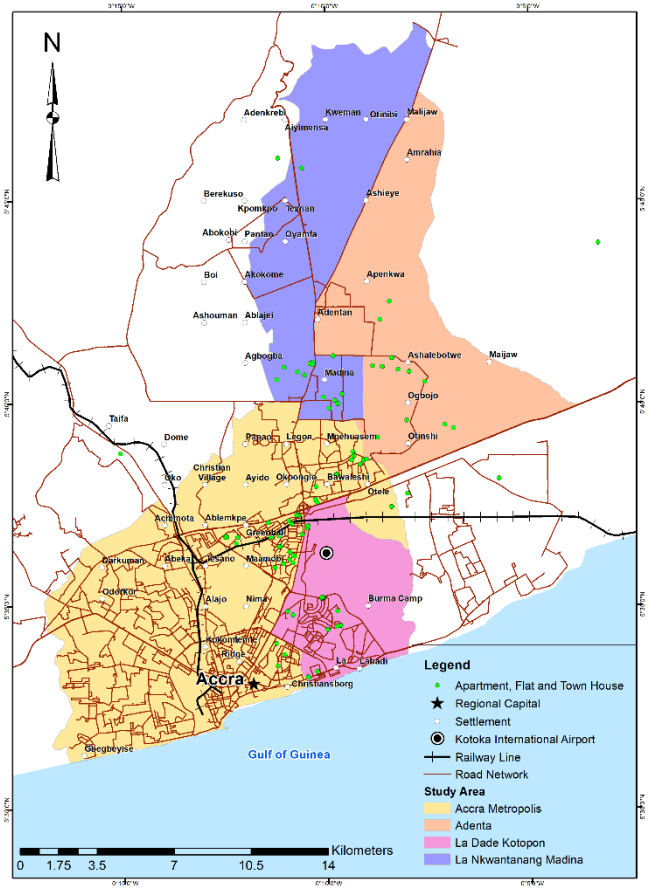
Figure 3.6 (a – c): Structural submarkets




a. Single Room (SR)

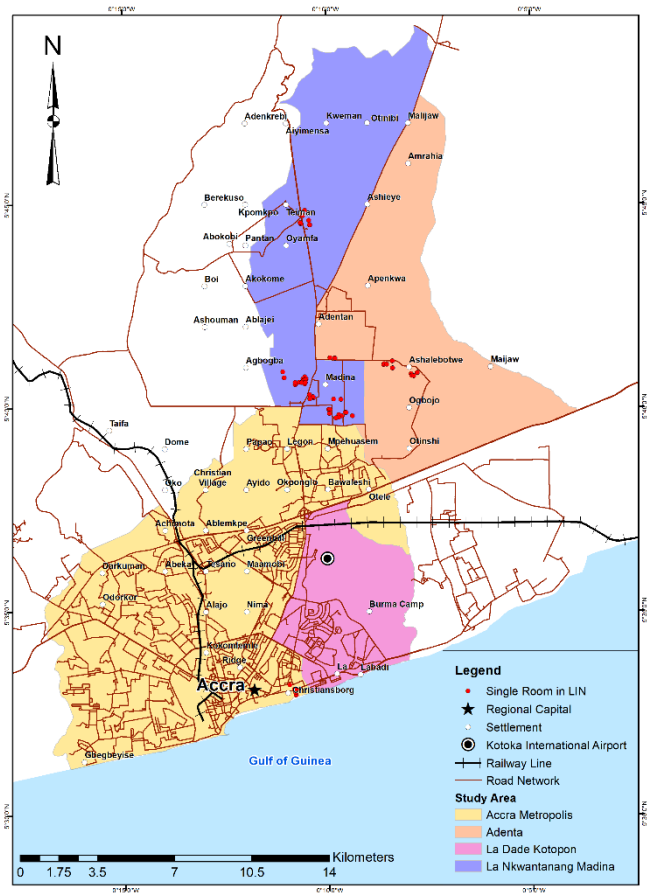



b. Hall and Chamber (HC)

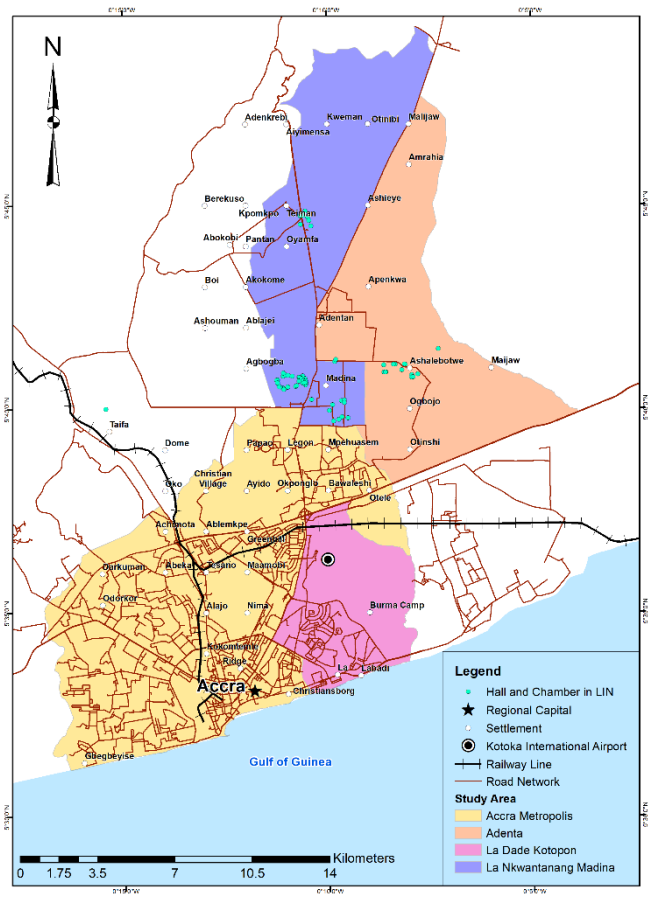



c. Apartments, Flats and Town Houses (AFTH)

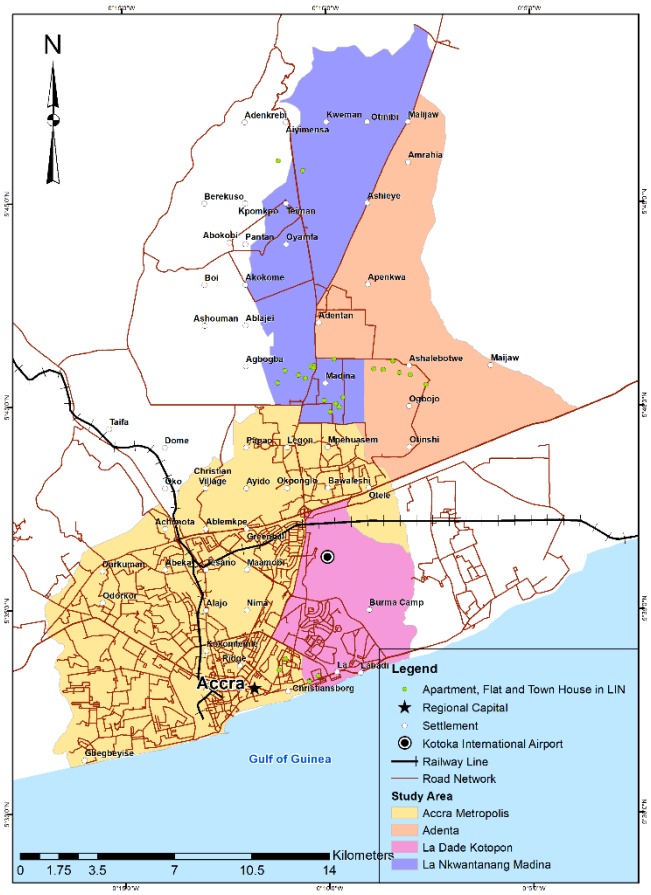
Figure 3.7 (a – e): Nested submarkets



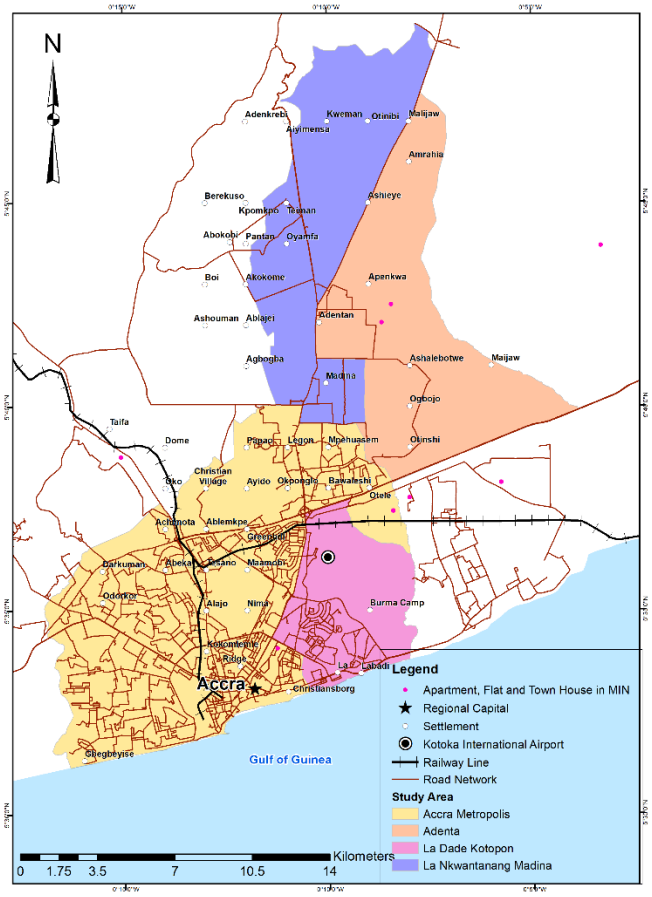

a. LIN.SR



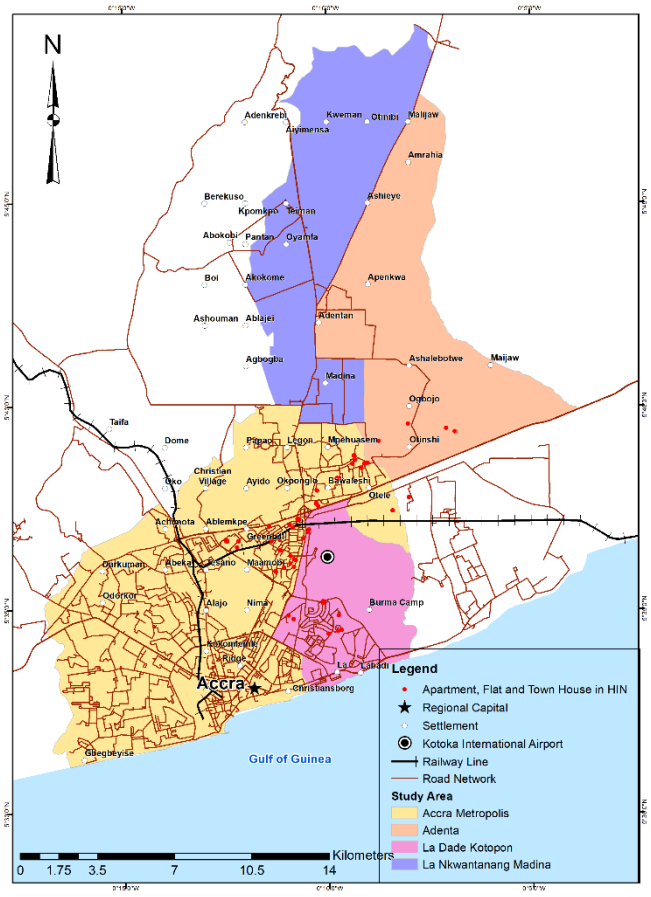

b. LIN.HC




c. LIN.AFTH




d. MIN.SR




e. HIN.AFTH

### 3.9.2. Descriptive statistics

The summaries of descriptive statistics of the dependent variable (rental value) and some key independent (continuous) variables in the dataset are presented in this section. This description is given for the aggregate market as well as for identified submarkets within the dataset. These provide a general overview of the data as utilised for further modelling in chapters 5, 6 and 7. From analysis of the aggregate rental data, rental values (Rent paid per month – USD) are moderately skewed (skewness = 1.039). The reason is to find out whether the mean and median rental values per month are significantly different among the different submarkets identified (see figure 3.8).

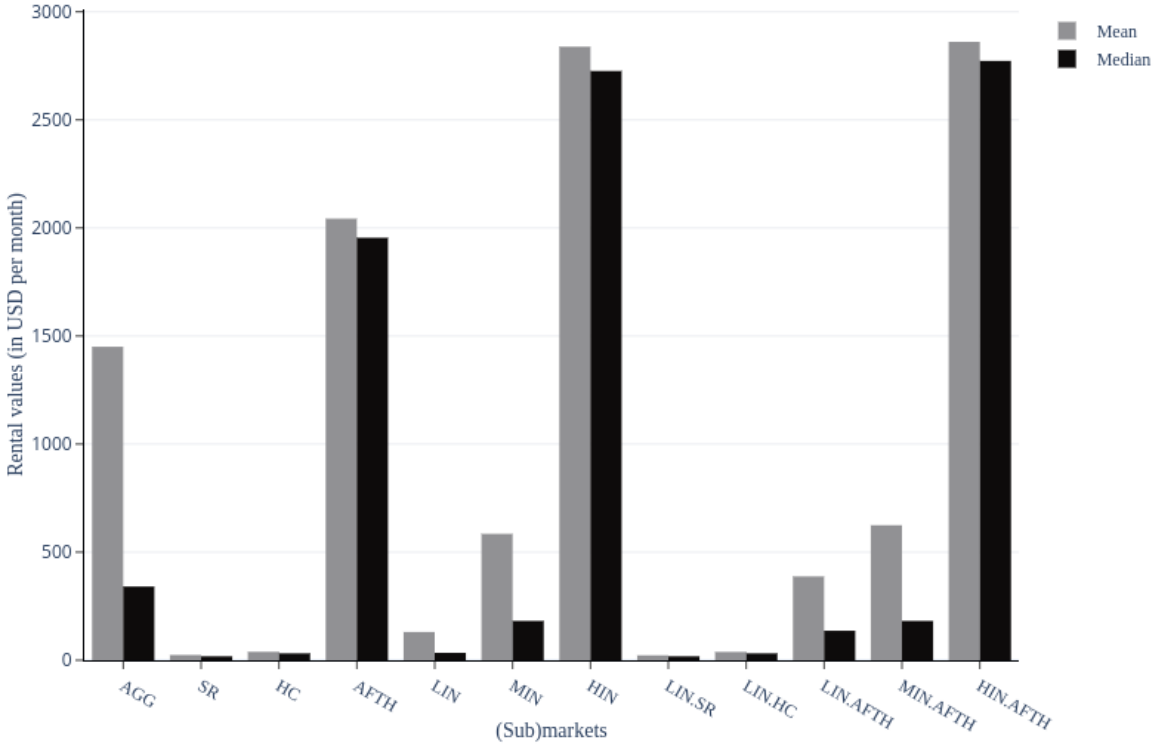



Figure 3.8: Bar graph showing mean and median rental values for (sub)markets in Accra-Ghana

Source: Fieldwork data 2017

The distribution of rental values per month, total floor area, number of bedrooms, number of wc/toilet, number of bathrooms and number of floors/storeys are shown in table 3.7.

Table 3.7: 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** | | 1450.25 | 133.32 | 2.38 | 2.51 | 2.24 | 1.46 |
| **Median** | | 340.91 | 105.00 | 2.00 | 2.00 | 2.00 | 1.00 |
| **Mode** | | 3500 | 100 | 1 | 1 | 1 | 1 |
| **Std. Deviation** | | 1692.621 | 108.170 | 1.442 | 1.599 | 1.281 | 1.205 |
| **Minimum** | | 8 | 9 | 1 | 0 | 0 | 1 |
| **Maximum** | | 7091 | 652 | 10 | 11 | 10 | 19 |

Source: Fieldwork data 2017

Table 3.7 shows that the mean rent paid per month is USD1450 over the period, with the median, minimum and maximum rental values given as USD341, USD8 and USD7091 respectively. The wide range between the minimum and maximum rental values 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.

Tables 3.8 to 3.18 show descriptive statistics per submarket. The tables show that the most expensive rental properties are found within HIN, AFTH and HIN.AFTH submarkets with corresponding median rental values as USD2726, USD1955 and USD2773 respectively.

Table 3.8: Descriptive statistics of rental observations in "Single Room (SR) submarket"

| | | 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 | 73 | 73 | 73 | 73 | 73 | 73 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 24.24 | 22.49 | 1.00 | 1.19 | 1.21 | 1.00 |
| Median | | 18.18 | 20.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Mode | | 16 | 15 | 1 | 1 | 1 | 1 |
| Std. Deviation | | 16.823 | 12.059 | .000 | 1.050 | .576 | .000 |
| Minimum | | 8 | 9 | 1 | 0 | 0 | 1 |
| Maximum | | 102 | 79 | 1 | 6 | 4 | 1 |

Source: Fieldwork data 2017

The mean and median rent in the "SR" submarket are USD24 and USD18 respectively. The standard deviation of this subgroup is about 69% around the mean values. This reflects the large amount of variation in rental values depending on quality of services offered as well as finishes. It must be noted here that there are rental properties that have no wc/toilet and or bathroom facilities; and these command very low rents in the market. More so, majority of properties observed within this market are one storey and have one bedroom. The room sizes are relatively small compared to other submarket constructs, ranging between 9 and 79 sq.m, with the mean floor area as 23 sq.m.

Table 3.9: Descriptive statistics of rental observations in "Hall and Chamber (HC) submarket"

| | | 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 | 85 | 85 | 85 | 85 | 85 | 85 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 39.01 | 36.43 | 1.01 | 1.31 | 1.34 | 1.07 |
| Median | | 31.82 | 34.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| Mode | | 23 | 25 | 1 | 1 | 1 | 1 |
| Std. Deviation | | 31.544 | 12.435 | .108 | .845 | .628 | .338 |
| Minimum | | 11 | 16 | 1 | 0 | 1 | 1 |
| Maximum | | 273 | 80 | 2 | 4 | 3 | 3 |

Source: Fieldwork data 2017

Table 3.9 shows that the "HC submarket" are mostly two room facilities, with one room used as a living area and the other as bedroom. Properties here are mostly within compound houses. The mean and median rental values per month are USD39 and USD32 respectively. The standard deviation of this subgroup is about 81% around the mean values, reflecting also a wide variation in pricing based on

attributes that affect value. Here also there are some properties without wc/toilet facilities. However all properties observed have at least one bathroom for use by tenants. The total floor area for rental units range from 16 to 80 sq.m. This gives an indication that not all units here are large enough even for a single person to dwell. Some smaller units have converted the porch/veranda as a living area. The mean floor area of a unit is about 36sq.m. Rental units range from 1 to 3 storeys.

Table 3.10: Descriptive statistics of rental observations in "Apartments Flats and Town Houses (AFTH) submarket"

| | | 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 | 378 | 378 | 378 | 378 | 378 | 378 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 2042.99 | 176.51 | 2.95 | 3.03 | 2.65 | 1.63 |
| Median | | 1954.55 | 154.00 | 3.00 | 3.00 | 3.00 | 1.00 |
| Mode | | 3500 | 100 | 3 | 3 | 2 | 1 |
| Std. Deviation | | 1694.205 | 100.883 | 1.353 | 1.523 | 1.273 | 1.390 |
| Minimum | | 23 | 27 | 1 | 1 | 1 | 1 |
| Maximum | | 7091 | 652 | 10 | 11 | 10 | 19 |

Source: Fieldwork data 2017

The "AFTH submarket" comprises of apartments, flats, and town houses. Majority of rental observations were in this submarket group. From table 3.10, the mean and median rental values were USD2043 and USD1955 respectively. Properties in this subgroup are relatively more expensive than the others discussed. Room sizes are relatively bigger, with a mean of 177sq.m. All properties here had at least a wc/toilet facility and a bathroom. The median number of bedrooms, wc/toilet and bathrooms are 3, 3 and 3 respectively. Rental units here ranged from 1 to 19 storey units.

Table 3.11: Descriptive statistics of rental observations in "Low Income Neighbourhood (LIN) submarket"

| | | 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 | 211 | 211 | 211 | 211 | 211 | 211 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 130.73 | 57.96 | 1.48 | 1.63 | 1.56 | 1.23 |
| Median | | 34.09 | 34.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| Mode | | 23 | 15[a] | 1 | 1 | 1 | 1 |
| Std. Deviation | | 380.113 | 67.103 | 1.181 | 1.433 | 1.091 | .661 |
| Minimum | | 8 | 9 | 1 | 0 | 0 | 1 |
| Maximum | | 3000 | 550 | 10 | 11 | 10 | 5 |

[a]Multiple modes exist. The smallest value is shown

Source: Fieldwork data 2017

Rental units in this submarket are mostly perceived to be of inferior quality. As is evidenced in table 3.11 there are rental units with no wc/toilet and or bathroom facility. Mean and median rental values observed are USD131 and USD34 respectively. The assumption here is that all rental units irrespective of type may belong to one submarket. As can be observed from table 3.11, rental values range from USD8 to USD3000. The mean floor area is 58sq.m. Properties range from 1 to 5 storey rental units.

Table 3.12: Descriptive statistics of rental observations in "Middle Income Neighbourhood (MIN) submarket"

| | | 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 | 77 | 77 | 77 | 77 | 77 | 77 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 594.77 | 155.31 | 2.70 | 2.40 | 2.16 | 1.14 |
| Median | | 181.82 | 136.11 | 3.00 | 2.00 | 2.00 | 1.00 |
| Mode | | 159 | 150 | 3 | 2 | 2 | 1 |
| Std. Deviation | | 956.291 | 102.655 | 1.319 | 1.369 | 1.089 | .388 |
| Minimum | | 14 | 27 | 1 | 1 | 1 | 1 |
| Maximum | | 5535 | 600 | 8 | 6 | 6 | 3 |

Source: Fieldwork data 2017

Rental units in this submarket are relatively of a better quality than those in low income neighbourhoods. From table 3.12, it can be observed that the mean and median rental values are USD595 and USD182 respectively. The mean total floor area is about 155sq.m. All properties observed here have at least a wc/toilet and bathroom facility.

Table 3.13: Descriptive statistics of rental observations in "High Income Neighbourhood (HIN) submarket"

| | | 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 | 248 | 248 | 248 | 248 | 248 | 248 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 2838.52 | 190.60 | 3.04 | 3.29 | 2.85 | 1.74 |
| Median | | 2726.14 | 180.00 | 3.00 | 3.00 | 3.00 | 1.00 |
| Mode | | 3500 | 100 | 3 | 3 | 3 | 1 |
| Std. Deviation | | 1466.512 | 99.884 | 1.277 | 1.387 | 1.183 | 1.604 |
| Minimum | | 57 | 35 | 1 | 1 | 1 | 1 |
| Maximum | | 7091 | 652 | 10 | 8 | 7 | 19 |

Source: Fieldwork data 2017

From observations from table 3.13, rental units in this submarket are relatively of the best quality and expensive; as can be evidenced in the mean and median rental values of USD2839 and USD2726 respectively. Properties are generally bigger with mean total floor area of 191sq.m. The standard deviation is about 52% around the mean.

The nested submarket subgroup presents similar observations as discussed previously. Tables 3.14 to 3.18 present descriptive statistics for LIN.SR, LIN.HC, LIN.AFTH, MIN.AFTH and HIN.AFTH submarkets. The tables show that HIN.AFTH are more expensive in Accra-Ghana with a mean rental value of USD2861. The next expensive are MIN.AFTH (with mean rent of USD625, followed by LIN.AFTH (with mean rent of USD388) then LIN.HC (with mean rent of USD38) and lastly LIN.SR (with mean rent of USD23). The "LIN.SR submarket" represents all single rooms in low income neighbourhoods. It can be observed that mean and median rental values are USD23 and USD18 respectively, with a mean floor area of 22sq.m.

Table 3.14: Descriptive statistics of rental observations in "Single Rooms in Low Income Neighbourhood (LIN.SR) submarket"

| | | 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 | 71 | 71 | 71 | 71 | 71 | 71 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 22.52 | 22.13 | 1.00 | 1.20 | 1.21 | 1.00 |
| Median | | 18.18 | 20.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Mode | | 16 | 15 | 1 | 1 | 1 | 1 |
| Std. Deviation | | 13.450 | 12.025 | .000 | 1.064 | .583 | .000 |
| Minimum | | 8 | 9 | 1 | 0 | 0 | 1 |
| Maximum | | 102 | 79 | 1 | 6 | 4 | 1 |

Source: Fieldwork data 2017

Table 3.15: Descriptive statistics of rental observations in "Hall and Chamber units in Low Income Neighbourhood (LIN.HC) submarket"

| | | 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 | 81 | 81 | 81 | 81 | 81 | 81 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 38.40 | 35.15 | 1.01 | 1.32 | 1.36 | 1.07 |
| Median | | 31.82 | 34.16 | 1.00 | 1.00 | 1.00 | 1.00 |
| Mode | | 23 | 25 | 1 | 1 | 1 | 1 |
| Std. Deviation | | 31.541 | 10.543 | .111 | .864 | .639 | .346 |
| Minimum | | 11 | 16 | 1 | 0 | 1 | 1 |
| Maximum | | 273 | 80 | 2 | 4 | 3 | 3 |

Source: Fieldwork data 2017

Table 3.16: Descriptive statistics of rental observations in "Apartments Flats and Town houses in Low Income Neighbourhood (LIN.AFTH) submarket"

| | | 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 | 59 | 59 | 59 | 59 | 59 | 59 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 387.71 | 132.40 | 2.71 | 2.56 | 2.25 | 1.73 |
| Median | | 136.36 | 110.00 | 2.00 | 2.00 | 2.00 | 1.00 |
| Mode | | 136 | 100 | 2 | 1 | 1 | 1 |
| Std. Deviation | | 654.315 | 89.662 | 1.702 | 1.950 | 1.625 | 1.031 |
| Minimum | | 23 | 32 | 1 | 1 | 1 | 1 |
| Maximum | | 3000 | 550 | 10 | 11 | 10 | 5 |

Source: Fieldwork data 2017

Table 3.17: Descriptive statistics of rental observations in "Apartments Flats and Town houses in Middle Income Neighbourhood (MIN.AFTH) submarket"

| | | 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 | 73 | 73 | 73 | 73 | 73 | 73 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 624.55 | 160.40 | 2.79 | 2.48 | 2.22 | 1.15 |
| Median | | 181.82 | 140.00 | 3.00 | 2.00 | 2.00 | 1.00 |
| Mode | | 159 | 150 | 3 | 2 | 2 | 1 |
| Std. Deviation | | 973.628 | 102.951 | 1.291 | 1.365 | 1.083 | .397 |
| Minimum | | 50 | 27 | 1 | 1 | 1 | 1 |
| Maximum | | 5535 | 600 | 8 | 6 | 6 | 3 |

Source: Fieldwork data 2017

Table 3.18: Descriptive statistics of rental observations in "Apartments Flats and Town houses in High Income Neighbourhood (HIN.AFTH) submarket"

| | | 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 | 246 | 246 | 246 | 246 | 246 | 246 |
| | Missing | 0 | 0 | 0 | 0 | 0 | 0 |
| Mean | | 2860.91 | 191.86 | 3.05 | 3.31 | 2.87 | 1.75 |
| Median | | 2772.73 | 180.00 | 3.00 | 3.00 | 3.00 | 1.00 |
| Mode | | 3500 | 100 | 3 | 3 | 3 | 1 |
| Std. Deviation | | 1451.147 | 99.299 | 1.269 | 1.378 | 1.176 | 1.609 |
| Minimum | | 57 | 35 | 1 | 1 | 1 | 1 |
| Maximum | | 7091 | 652 | 10 | 8 | 7 | 19 |

Source: Fieldwork data 2017

## 3.10. Data coverage and Variable definitions

Detailed description of cross-sectional data collected and coded are provided in the table 3.19. Those presented are the final set of variables after variables with incomplete data were excluded. The dependent variable is rent and independent variables consists of structural, locational and neighbourhood characteristics.

Dummy variables were created for all location and neighbourhood characteristics. Dummy variables are also created for discrete structural variables and continuous variables were transformed to natural logarithms.

The data variables in the table 3.19 excludes some variables collected, which were incomplete and so excluded. Literature suggests that the age of the property is normally included in hedonic analysis. But that data is absent here because tenants and or landlords interviewed claimed not to know the age of the property. Respondents (comprising tenants and landlords) mostly resorted to estimates or simply did not provide any information, thus making it difficult to include this variable in the table. Also some XY location data was collected for some properties, but not for all. Some tenants and or landlords did not agree that such information should be collected on their properties. As such the reason for most of those fields left blank and not included for further analysis. The alternative was to use the house numbers of these properties, but we also did realise that in an informal and unregulated market such as the one in this case study, most properties had no house number. It should however be noted the government has since 2018 rolled out a directive to have all owners of buildings across the country to obtain a unique

addressing system using the GhanaPost GPS (www.ghanapostgps.com). This is Ghana's official property addressing system which covers every square inch of the country.

Table 3.19: Variable names and definitions

| Category | Variable | Definition |
|---|---|---|
| Dependent | lnRENT | 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 | Natrual 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 |
| | 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 |
| | 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: Author's construct

## 3.11. Conclusion

This chapter on methodology was in two parts. The first part puts the research in its appropriate philosophical context, where the never ending debate on research paradigms were discussed. It is argued that a mixed methods approach is the way to go. Using the research matrix as a diagnostic tool, data that was collected during pre-fieldwork, fieldwork and post-fieldwork stages of the research. How the data was collected and analysed are examined. The specific data are described as well as justification for study area selection are explained. The conceptual framework within which to execute the research were discussed. It follows that theories and models that explain rental value determinants were identified. Based on that, a stakeholder survey to identify variables that are perceived to be critical in determining rental values in Accra was undertaken. The results of this stakeholder survey is the basis of empirical data collected during fieldwork.

The second aspect of this chapter described the study area as well as *a priori* submarkets within the aggregate market. Data collected includes structural, locational and neighbourhood characteristics of rental units as well as rental transaction prices. Data is verified and cleaned for further empirical analysis in subsequent chapters. In this chapter, how various data were collected are also described. Necessary coding and dummy variables are constructed to enable modelling of the rental market. In total 536 rental observations across all neighbourhood and property types are the final dataset used for further analysis. The distribution of data shows that "*Apartments Flats and Town homes*" (*AFTH*) and properties within *High Income Neighbourhoods (HIN*) dominate the data set. Descriptive statistics also show that the most expensive properties are found in the "*Apartment, Flat and Town houses within high income neighbourhoods*" (HIN.AFTH) submarket.

The next chapter analyses the drivers of residential rental values in Ghana by examining explanatory variables suggested by experts and stakeholders within the residential rental housing market space. It provides a step by step procedure on which explanatory variables are perceived to be critical per each stakeholder and expert opinion sort.

# 4. Results: What drives residential rental values in Accra-Ghana? An examination of explanatory variables from experts and stakeholder perspectives[5]

Source: Borteyman Housing Project

*Rent is that portion of the produce of the earth which is paid to the landlord for the use of the original and indestructible powers of the soil.*
(David Ricardo, The Principles of Political Economy and Taxation 1817)

[5] This chapter is based on the article: (Gavu, Gruehn, Schulte, & Asante, 2019)

Gavu, E. K., Gruehn, D., Schulte, K.-W., & Asante, L. A. (2019). Stakeholders' perception of residential rental value determinants in Ghana. *Journal of African Real Estate Research*, 4(1), 45–73. https://doi.org/10.15641/jarer.v4i1.704

## 4.1. Introduction

Little attempt has been made within the Ghanaian literature to determine how housing market stakeholder perception on value actually translates to value. In this chapter, the main drivers of residential rental values (RRV) from stakeholders in the residential rental housing market in a developing country context is analysed. This concept has been encapsulated in the mantra *"location location location"* determines RRV. This phenomenon has not been much understood as various researchers measure the determinants of RRV differently. As Tse (2002 pg.1165) puts it, "*residential property is a multidimensional commodity, characterised by durability and structural inflexibility, as well as spatial fixity*". Not only does location and neighbourhood attributes determine to a large extent RRV, but also the physical characteristics (structural attributes) of the subject property.

We present a first step in recognizing and identifying which explanatory variables are relevant in determining residential rental values from rental market stakeholders' perspectives. This approach sets the discussion to appreciate the peculiarities in a rental market that is highly complex and diverse. The findings from this first step provides an indication as to which explanatory variables may be relevant and collected during fieldwork (empirical data collection) phase. The conclusions to be drawn here will to a large extent reflect the rental market perspectives and used as input for empirical data collection.

## 4.2. Identifying explanatory variables that drive residential rental values/ prices

Each residential unit has a unique set of bundles of attributes that describes its relationship to other units. A variety of theoretical and econometric studies have explored the determinants of house prices (Tse, 2002). One of the theories that help in this regard is the location theory; attributable to Heinrich von Thunen's theory of location of agricultural land uses in his book "*Der Isolierte Staat*" and Alfred Weber's theory of location of manufacturing industries. von Thunen's depiction of concentric circles of agricultural activities or uses around the consuming centre is a useful and a good starting point for research in this field (Predöhl, 1928). In his model those paying higher prices at the consuming centre are compensated by lower costs of commuting to the CBD. The relationship between house prices and location are as a result of unobservable variation in location across properties coupled with a heterogeneous market.

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. Resulting in every property within that neighbourhood having similar qualities; *vice versa* will hold true for a low quality property in a neighbourhood. Figure 4.1 depicts that with the passage of time, a whole neighbourhood can have one common identity in terms of neighbourhood characteristics. On the left hand side of the figure, quality housing is depicted but scattered within a particular neighbourhood, over time other properties mimic the trend and shows a similar identity.

One thing worth noting in this model is 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.

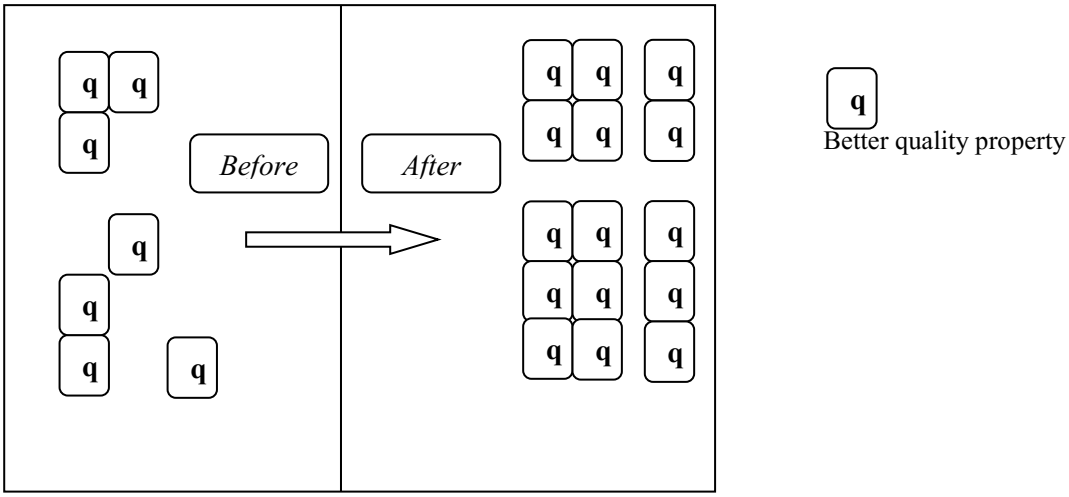



Figure 4.1: Ripple effect to induce more quality housing theory

(adapted from Ozanne & Thibodeau, 1983; Tse, 2002)

The factors that influence house prices are numerous and heterogeneous. Kim and Park (2005) assert that macro variables, spatial differences, characteristics of community structure, environment and neighbourhood amenities affect market price of a house. Using a hedonic equation, house price is regressed on a number of inherent attributes. Some of these attributes could include the size of the house, age, floor area, neighbourhood characteristics and job excess. There are reasons to conclude about disparities between what is reality in the market and the value placed on properties by professional valuers (Baffour Awuah et al., 2016). When these interrelationships are examined it may guide real estate market stakeholders in assigning premium values to housing based on empirical market considerations. However Roulac (2007, 2001) is quick to add that researchers have predominantly used physical metrics of age, size among others as the explanatory variables that determine a residential property's value relative to other property data samples. The emphasis has been on correlation other than the fundamental issue of causation. Roulac's concern has been the need to also focus on what causes these correlations to occur?

It has been established that structural characteristics, location and neighbourhood attributes of the house determines to a large extent the rental value of same. How each individual item affects value and the magnitude are usual disagreements. Factors that determine value can be grouped into four factors (Owusu-Ansah, 2012b);

1. Structural attributes of the house – this comprises size, structural improvements and materials, age and condition.
2. Location and neighbourhood amenities. Fixity in space defines distance of housing from other features such as commercial and other activities or uses (Gelfand, Ghosh, Knight, & Sirmans, 1998). In homogenous neighbourhoods, common amenities are best represented by location.
3. Environmental attributes.
4. Macro attributes such as inflation and interest rates.

This research work focused on the first two factors, whereas the last two factors are already inherent in the transaction prices. So unless a time series analysis is analysed, the effect of environmental and other macro attributes can be said to be negligible.

## 4.3. Explanatory variable of interest: Neighbourhood factors and predictive models in determining rental values

Houses are distinguishable from each other both through intrinsic characteristics (i.e., number of rooms, bathroom) and extrinsic characteristics (i.e., access to amenities – clean water, landscape, and proximity

to nuances – like dump sites and factory). A house is composed of several characteristics which together determine its rental value. The hedonic model is usually the preferred option to regress all housing attributes using the best fitting functional form to reveal implicit marginal prices. Some of these attributes may make significant impact on the rental value or otherwise..

Value could be defined as the importance of something; in this case the value of a residential property or the anticipated benefits from the market perspective. There is no universal single agreement to the definition of value. Some researchers complicate the discussion by asking, is it value in exchange, value in use or cost to a market participant? In this chapter the focus is on perceived value. Zeithaml (1988) describes four (4) categories of this concept, namely; (a) "*value is low price*", (b) "*value is whatever I want in a product*", (c) "*value is the quality I get for the price I pay*" and (d) "*value is what I get for what I give*". Perceived value is basically value as perceived by a particular market participant (or stakeholder).

Explanatory variables explaining the price composition of real estate units show a particular trend in developed countries (Sirmans et al., 2005). Sirmans *et al*. identify a list of 20 housing characteristics appearing most often in hedonic pricing model studies. They assert that bathrooms, bedrooms, public rooms, garages, fireplace, pool, area of the real estate unit are key explanatory variables that consistently show a positive sign across various regions when a hedonic pricing model is adopted. A careful consideration of variables provided by Sirmans *et al*. suggest that structural variables appear to be dominant in the discourse. This is rather interesting and seems to offer a one sided picture as locational and neighbourhood variables are missing in this list; although there is vast empirical research that suggests that locational and neighbourhood variables that affects rental values may vary across social and economic groups (De & Vupru, 2017). In a developing country context like Ghana variables like fireplace, air-conditioning and pool which are absent in many homes may not be relevant factors to determine rental values.

To holistically delve deeper into this theme, there was the need to comprehensively examine variables that had been utilised across the Sub Saharan Africa (SSA) literature. Relevant variables reviewed gave credence to the fact that, there is not as yet a clear direction as to what variables are key determinants of rental value in a developing country context. This provides further illumination on Harrison and Rubinfeld (1978) and Arimah's (1992) view that housing attributes cannot be untied and repackaged at all locations to produce an arbitrary set of attributes.

How are value determinants perceived and ranked by stakeholders in the rental market? Are there any trends that could be realised as a basis for empirical analysis? This research focuses on both formal and informal rental housing markets in Ghana. The available literature shows that there are few recorded research on how these variables have been modelled and variables that are significant in one market may be different in another.

Table 4.1 shows the list of explanatory variables that have been utilised in both developed and developing country context for illustrative purposes. It can be realised that different variables have been utilised by the various researchers. In a developing country context, number of bathrooms, floor area and location of property seem to be the predominant variables (Abidoye & Chan, 2016; Adegoke, 2014; Anim-Odame et al., 2010a, 2010b; Arimah, 1992; Asabere, 2004, 2007; Choumert et al., 2015; Gulyani & Talukdar, 2008; Knight et al., 2004; Owusu-Ansah, 2012b). Location has mostly been treated as one variable, although location has various aspects and normally connotes the proximity/access of housing to services (including health, education central business district among others). Location may not be obvious in a developed country context because every neighbourhood may have the same set of 'basic' amenities present. However, there seem to be some convergence with variables used in the developed country context (Malpezzi, 2002; Sirmans et al., 2005), *i.e*., age of property, floor area, number of storeys, number of bathrooms and bedrooms.

Table 4.1: Key explanatory variables used in extant literature (especially in developing countries in Africa)

| | | | | *Developing country evidence* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Dimension** | **Sirmans et al 2005** | **Malpezzi 2002** | **Arimah 1992** | **Asabere 2004** | **Knight et al. 2004** | **Asabere 2007** | **Gulyani & Talukdar 2008** | **Anim-Odame 2010a** | **Anim-Odame 2010b** | **Owusu-Ansah 2012** | **Adegoke 2014** | **Choumert et al. 2015** | **Abidoye and Chan 2016** | **meqasa.com 2018** | **Total** |
| **Structural** | Real estate type | | | | | | | | X | X | | | | | X | **3** |
| | Age of rental property | X | X | | | | X | | | | X | | | X | | **5** |
| | Lot size | | | | X | | X | | | X | | | | | X | **4** |
| | Total floor area in sqm. | X | X | X | | | | | X | X | | | | X | | **6** |
| | Number of floors/ storeys | X | X | | | | X | | | X | | | | | | **4** |
| | Public room | X | | | | | | | | | X | X | | | | **3** |
| | Number of bedrooms | X | X | X | | X | | X | | X | X | | X | | | **8** |
| | Number of WC/ toilet | | | | | X | | | | | | X | | | | **2** |
| | Type of toilet facility | | | | | | | X | | | | | X | | | **2** |
| | Number of bathrooms | X | X | | | | | | | | X | X | | | | **4** |
| | Floor finish | | | | | | | X | | | | | X | | | **2** |
| | Fence wall availability | | | | | | | | | | X | | | | | **1** |
| | Parking space (Garage or outhouse) available? | X | X | | | | | | | X | X | | | | | **4** |
| | Construction quality | | | | | X | | X | | | | | | | | **2** |
| | Quality of landscaping | | | | | | | | X | X | | | | | | **2** |
| | Property condiction/ Physical deterioration | | | | | | | | | | | | | X | | **1** |
| | Pool area (swimming pool) | X | | | | | | | | | X | | | | | **2** |
| | Fireplace | X | | | | | | | | | | | | | | **1** |
| | Burglar alarm | | | | | | | | | | | X | | | | **1** |
| | Air-conditioning | X | | | | | | | | | | | | | | **1** |
| | Security of Tenure | | | | X | | | | | X | X | | | | | **3** |
| | Tenure type (leasehold or freehold) | | | | | X | X | | | X | | | | | | **3** |
| | Shared facility | | | X | | | | | | | | | | | | **1** |
| **Location** | Location of property | | | | | X | | | X | X | X | | | X | X | **6** |
| | Near to market or shopping centre | | | | | | X | | | | | | | | | **1** |
| | Near to CBD | | | X | X | X | | | | | | | | | | **3** |
| | Near to educational facilties | | | X | | | | X | | | | | | | | **2** |
| | Near to police station (security) | | | | | | | | | | | | | X | | **1** |
| | Access and time variable | | | | X | | | | | | | | | | | **1** |
| **Neighbourhood** | Neighbourhood class | | | | X | | | | | | | | | | X | **2** |
| | Neighbourhood characteristics | | | | | | | | | | | | | X | X | **2** |
| | Electricity connection | | | X | X | X | | X | | | | | | | | **4** |
| | Water availability | | | | | X | | X | | | | | | | | **2** |

Source: Authors' construct

In Kenya, a multivariate analysis of what drives rental values in Nairobi's informal rental housing market suggests that number of rooms, building quality, permanent walls, permanent floor, electricity and water availability, reasonable access to toilet and the presence of public school in the neighbourhood is critical in rent determination (Gulyani & Talukdar, 2008). The authors posit that the informal market mimics the formal market in that rental values are determined by unit's size, location, construction quality and access to infrastructure.

The modelling of Uganda's real estate market shows varied determinants of rental value. Using the Uganda National Housing Survey data, Knight et al. (2004) show from empirical evidence that

electricity and water availability, toilet facility, construction quality, number of rooms, location, distance from the CBD and type of land tenure are significant determinants of rent.

In the Nigerian literature, Arimah (1992) asserts that floor area, number of bedrooms, electricity connection, nearness to educational facilities and CBD, and whether property is a shared facility or otherwise are the significant determinants of rent in Ibadan. Adegoke (2014) posits that different critical factors influence RRVs of buildings in different residential densities. The findings show that number of toilet, number of bathroom, living room and presence of burglar alarm are key determinants of rent in Ibadan in Nigeria. Also Abidoye and Chan's (2016) findings (based on perceptions of professional valuers in Nigeria) reveal that property location, neighbourhood characteristics, state of property repair, size of property, neighbourhood security, age of property are most highly significant influence on residential property value.

In Ghana, Buckley and Mathema (2007) use household income and household size to model housing demand. Asabere (2004) considers lot size, distance to CBD, neighbourhood class, electricity and water availability, type of tenure, access and time variables to price leasehold and freehold interests using hedonic analysis. In another study Asabere (2007) utilises number of storeys, plot size, age and location to model the market in Tema.

Anim-Odame *et al*. (2010a; 2010b) and Owusu-Ansah and Abdulai (2014) used similar datasets from the Land Valuation Division of the Ghana Lands Commission to develop housing price indices for Accra. Explanatory variables used were sale price/ rent, number of bedrooms, number of storeys, plot size, floor area, tenure or tenancy term certain, presence of garage or outhouse, quality of landscaping, real estate type (detached or semi-detached), security of tenure. Anim-Odame *et al*. used a hedonic model to analyse the influence of residential attributes on price and rent and also to test submarket performance. They concluded that the number of bedrooms and unexpired term were not statistically significant, while all other variables showed expected signs for the rental market. Using cross sectional data Owusu-Ansah (2012a) establishes that the number of bedrooms, bathrooms, public (living) rooms, age of property, location of the property, availability of garage, fence wall and swimming pool, and land registration influence real estate values in urban Ghana. The number of floors was found to have the least impact on price.

All the aforementioned country specific examples goes to give credence to the assertion that, due to paucity of data in Africa's rental housing market, most studies draw on the 'few available data' to empirically model RRVs determinants and thus, making it impossible to compare analysis on a standardised basis as earlier discussed.

Researchers who explore the impact of neighbourhoods or the neighbourhood factor (including location) have approached the theme from the perspective of understanding or predicting in particular how neighbourhood factors affects value. Ellen and Turner (1997 p.855) mention that, "*next generation of research on neighbourhood effects needs to do more than simply refine the statistical tools for determining whether neighbourhood environment matters".* It has been well documented in literature that various neighbourhood factors affect the rental value and it is up to a researcher to effectively communicate this phenomenon from empirical data and analysis. For example we may expect that poor neighbourhoods should have low rental values but this trend may not be recognised from empirical research.

In determining neighbourhood variables to include there is the need to review existing empirical literature to establish which factors are best suited for such studies? One important factor to consider according to Ellen and Turner (1997) is the quality of local services. This makes a particular location superior or less superior than another in determining rental values. Local neighbourhood services that can be analysed include availability of educational facilities, medical facilities among others.

Most parents will prefer their children to attend schools in close proximity to their residencies or immediate neighbourhood. Better schools in a particular neighbourhood are known to attract high values in terms of rent passing on residential properties and *vice versa*. Availability of tertiary educational facilities plays a key role in housing markets because of the need for student accommodation. In Ghana, the supply of residential facilities do not meet available demand. Thus nearby residential

accommodation are converted to "*homestels"* (private residential properties turned to hostels because of excess demand over purpose built hostels) for students. As a consequence of this pressure on the supply side prices rises increase.

Less number of medical facilities in a neighbourhood requires that residents have to commute for longer distances to access healthcare and these may have implications on rent. The assumption is that, the relationship between neighbourhood characteristics and individual outcomes should be linear. How then do we explain and measure for non-linear relationships? For example in poor neighbourhoods it would be expected that rental values should be low and or that the neighbourhood should lack certain basic infrastructural facilities.

Actually quantifying the independent variables of neighbourhood factors that have an effect on rental value may be a daunting task. There are some perceived challenges in quantifying neighbourhood effects. Some of these are enumerated below.

1. It may be difficult to identify and measure those neighbourhood factors that actually are important key variables in determining value. The question here is what is important to be measured and how do we identify same?
2. Some of the effects may not be easily noticeable or may be non-linear. The question here would be how do we account for factors that we may not be aware of?
3. It may be difficult to separate or draw a fine line between individual property characteristics (that affect value) and neighbourhood factors, and how these individual factors contribute to price in the real estate market. How do these interrelationships interact to determine rental value in the market?

The failure to successfully address these issues in the methodology may yield to results that perhaps understate or overstate the effect of neighbourhood factors on rental value. The next critical consideration is; how do we measure relevant variables that drive residential rental values?

In determining the effects of neighbourhood characteristics, there is also the need to ascertain the influence of individual houses on the overall neighbourhood. The influence of "outliers" must be critically examined. There is the need to adequately control for unobserved characteristics that may have an effect on value. For example, there may be better quality individual houses that are found in say third ($3^{rd}$) class residential neighbourhoods commanding low rents. There is the need to take these into account in the analysis. The data however should be reliable. These concerns are however cured when data is based on randomly selected houses within a particular neighbourhood so that unobserved characteristics are randomised in the whole neighbourhood and not localised at one particular area. A variety of hedonic techniques are used to model determinants of price variation of properties in the real estate market (Case & Quigley, 1991; Kain & Quigley, 1970). This modelling, results in a kind of regression relationship between rental value of a property, and physical and locational characteristics of same. Proper interpretation requires that a "correct set" of property attributes are included in the analysis.

Most studies that examine neighbourhood effects use a proxy measure for variables that are not continuous in nature (Büchel & Hoesli, 1995). Usually "1" represents availability of a factor while "0" represents non-availability.

The extent of neighbourhood boundaries is critical in this kind of analysis; if a neighbourhood exhibits similar characteristics in terms of infrastructure provision, neighbourhood class, and proximity among others. Where such data is available a census tract can be the boundary of a neighbourhood. But in situations where this data is unavailable it may be appropriate to consider another description of geographical area to guide the research. The Modifiable Area Unit Problem (MAUP) is a key consideration in spatial analysis. Neighbourhood boundaries need to be analysed at the "right" scale to provide meaningful results. A static (point-in-time) analysis or time series can be adopted depending on the objectives of the research to study neighbourhood effects on value. For example Anim-Odame *et al.* (2010b) mention the Town and Country Planning Department (TCPD) classification of neighbourhood as the best system that can be utilised in the absence of other classification types. The TCPD classification is based on neighbourhood characteristics including availability of basic amenities (water,

electricity, and telephone), quality of infrastructure (road, drainage, and utilities), type and quality of building stock.

## 4.4. Methodology

### 4.4.1. Survey design

So now we revert to answer the 3 questions posed earlier in section 4.3. This is to give a direction as to what explanatory variables to consider that drive residential rental values. We set out to develop a questionnaire that was administered to experts, stakeholders and key market players. The main objective of this survey was to elucidate from respondents what drives residential rental value in the rental housing market to the best of their knowledge. A number of explanatory variables were identified through literature review and the role of experts/ stakeholders was to rank these variables based on their perceptions about how the explanatory variables could be incorporated in defining what is relevant from a purely experiential perspective (which may be different from empirical evidence). This was seen as a first step to put the research in its relevant local context and to make analysis of this phenomenon more coherent.

Using the stratified sampling technique, various market stakeholders are identified and divided into 6 homogeneous strata. The snowball sampling technique is then employed to identify specific respondents. The sample frame was drawn from landlords; tenants; real estate agents; real estate developers; academic staff and graduates from Universities (in the real estate and related sectors); and valuation and estate surveyors of the Ghana Institution of Surveyors (GhIS). The data analysed in this chapter is from a total of 114 respondents. The survey was carried out between January and February 2017. A more detailed description of the survey design, how data was collected and which data are collected is provided in Chapter 3 section 3.6.1.

### 4.4.2. Type of data collected during the survey

The following outlines the data collected as part of this first phase of data collection. Most of the questions were compulsory with (pre-coded) multiple choices of answers to choose from.

1. Category of respondent – this section collected data relating to how the respondent identifies him or herself. These are landlord, tenant, real estate developer, real estate agent, academic (real estate and related fields), valuation and estate surveyor (member of the Ghana Institution of Surveyors – GhIS) and others (these are respondents who did not identify with any of the above categories.
2. Residential location – here we sought to find out where respondents were residing. This was to give a fair idea where they lived currently. Respondents had two options to choose from: whether one lives in Accra or outside Accra.
3. Years of contact with the residential real estate rental market – there were basically 5 options to choose from. These were below 5 years, 6 to 10 years, 11 to 15 years, 16 to 20 years and over 21 years.
4. Variables that drive the creation of a residential rental housing submarket – the options considered included location (or spatial segregation), property type, price (rental value of property), location and property type, and all of the above. All options here were deemed to be mutually exclusive and respondents had only one choice.
5. The key variables that drive prices in the rental market are examined using 2 types of scales. The first was assessed using a 5-point likert scale. This considered the effect (whether significant or otherwise) on rental values. The scales were:
   *1 – Highly Insignificant*
   *2 – Insignificant*
   *3 – Neither Insignificant nor Significant*
   *4 – Significant*
   *5 – Highly Significant*

Using an odd numbered scale offers a median choice while an even numbered scale is used to force an opinion. We adopted an odd numbered scale as the objective in this instance was to find out what experts and stakeholders perceived to have an effect on the residential rental values. They were therefore free to say they were not sure the kind of effect to be expected.

The second assessment used the same variables but we wanted to find out whether the choice made earlier (in terms of choosing from the five point likert scale) had a *positive effect, negative effect, no effect* or respondents were *not sure* of the variable's effect on rental value. So in the first assessment we wanted to find out the degree of significance of these variables on rental values. And in the second assessment to estimate whether these variables usually made a positive, negative or no impact on rental values.

6. We also sought to find out whether variables assessed in (*6)* above could be priced and disaggregated from rental values. The options opened to answer this were '*Yes', 'No'* or *'Not Sure'*. Respondents were required to make a choice as to their opinion and give reasons for same. This information was used as a proxy to find out whether respondents are aware of modeling techniques that disaggregate rental values into implicit parts to explain determinants of rental value.
7. Respondents were also asked whether in any variables were omitted. They were first to respond by choosing '*Yes', 'No'* or *'Not Sure'* and give reasons to their choice of answer.
8. We also asked respondents to describe the residential rental market in Accra. This was an open ended question.
9. Lastly respondents were also asked to briefly describe a residential neighbourhood. This was also an open ended question.

## 4.5. Determinants of residential rental values: Evidence from key stakeholder survey

### 4.5.1. Data for stakeholder survey

Data used for analysis consisted of 114 responses from experts and stakeholders collected during pre-fieldwork. We start with a summary of the respondents and the total numbers that responded. Respondents were asked to select one category from the list provided that best describes them (see table 4.2). It can be observed from the table that majority of respondents are tenants, Valuation and Estate Surveyors and Academics (from real estate and related fields) who together make up 35%, 30% and 20% of the sample respectively. The questionnaire made available an option known as 'others' for respondents who did not identify themselves with any of the categorised groupings. This group from the survey was made up of owner occupiers, sharers and rent-free occupiers of rental property (which include children and relatives of both landlords and tenants).

We asked about the residential location of respondents to find out whether they lived in the capital, Accra or outside the capital. It was found out that majority of respondents resided in Accra (this represents 67.5%) while the remaining resided outside the capital. The reasoning behind this question was to ascertain the understanding of respondents to the local residential rental market in Accra. It is however possible for an expert/ stakeholder who does not reside in Accra to have a fairly good perspective and understanding of the rental market there.

There was also the need to ascertain the number of years that the respondents had contact or years of experience with the market. It was found out that majority (about 72%) had below 5 years of experience in terms of market experience. Table 4.3 shows respondents' years of experience with the residential rental market.

From table 4.3 we realised that respondents years of experience with the market is varied and provides a detailed breakdown for each category of respondent. The 'total' represents the statistics for all respondents in each category. We do realise from the table that about 72%, 18%, 4%, 1% and 5% have

5, 6 to 10, 11 to 15, 16 to 20, and above 21 years of experience with the residential real estate market respectively. More than half of the respondents whose experience with the market is below 5 years are considered experts in the field. These are real estate agents, valuation and estate surveyors and academics. Although majority of respondents have experiences below 5 years, they still have valuable information to offer on the topic.

Table 4.2: Summary of respondents

| **Respondent** | **Number** | **Percentage (%)** |
|---|---|---|
| Landlord | 6 | 5.26 |
| Tenant | 40 | 35.08 |
| Real Estate Developer | 1 | 0.88 |
| Real Estate Agent | 5 | 4.39 |
| Academic (real estate and related fields) | 23 | 20.18 |
| Valuation and Estate Surveyor (Ghana Institution of Surveyors – GhIS) | 34 | 29.82 |
| Others | 5 | 4.39 |
| **Total** | **114** | **100.00** |

Source: Expert/ Stakeholder Survey, 2017

Table 4.3: Respondents' years of contact (experience) with the residential real estate market in Accra

| | Experience in number of years | | | | | | |
|---|---|---|---|---|---|---|---|
| **Respondent** | **Below 5** | **6 to 10** | **11 to 15** | **16 to 20** | **Above 21** | ***Total*** | ***Total %*** |
| Landlord | 4 | 1 | 0 | 0 | 1 | ***6*** | ***5,26*** |
| Tenant | 29 | 6 | 1 | 0 | 4 | ***40*** | ***35,08*** |
| Real Estate Developer | 0 | 1 | 0 | 0 | 0 | ***1*** | ***0,88*** |
| Real Estate Agent | 4 | 0 | 1 | 0 | 0 | ***5*** | ***4,39*** |
| Academic | 20 | 2 | 0 | 0 | 1 | ***23*** | ***20,18*** |
| Valuation and Estate Surveyor | 20 | 11 | 2 | 1 | 0 | ***34*** | ***29,82*** |
| Others | 5 | 0 | 0 | 0 | 0 | ***5*** | ***4,39*** |
| ***Total*** | ***82*** | ***21*** | ***4*** | ***1*** | ***6*** | ***114*** | ***--*** |
| ***Total %*** | ***71,93*** | ***18,42*** | ***3,51*** | ***0,88*** | ***5,26*** | ***--*** | ***100,00*** |

Source: Expert/ Stakeholder Survey, 2017

### 4.5.2. Reliability analysis – Cronbach alpha

Cronbach alpha analysis was used to test how reliable the data was. The values range between 0 and 1. Higher values suggest internal consistency and that conclusions can be drawn from the data. Nunnally and Bernstein (1979) are of the opinion that values between 0.50 and 0.60 and above shows a reliable consistency. However, Hair et al. (2010) posits that ≥0.70 is preferred. Overall alpha value of 0.963 was realised which suggests that the data can be relied on to draw conclusions.

The Cronbach alpha for each variable when each variable is deleted is computed. Oyedele (2013) posits this measures significance of each variable compared to the overall Cronbach alpha. The value of a variable equal to or less than the overall alpha value (0.963) suggests a significant contribution of that variable; whereas a value higher than the overall alpha value signifies insignificant contribution. From the data analysed all Cronbach alpha values when each variable is deleted is either below or equal to the overall Cronbach alpha value; hence contributes significantly to internal consistency (see table 4.4).

### 4.5.3. Descriptive statistics – Measures of central tendency

Table 4.5 highlights the measures of central tendency for each of the variables that are perceived to determine rental values. This was measured using a 5-point likert scale and respondents ranked their choices from an ordered scale of 1 – '*highly insignificant*' to 5 – '*highly significant'*. The midpoint 3 represented neither insignificant nor significant (neutral). The researcher measured two different

measures of central tendency; i.e., the median and the mode. We first discuss the median and then the mode and their perceived significance.

***Median***

The median is the middle score in an ordered scale distribution from the smallest to the largest value. The median position is given by the formula;

$$Median\ position = \frac{n+1}{2} \qquad (4.1)$$

Where *n* represents the number of observations. The median is resistant to outliers and in our data set better represents a measure of central tendency. Although the mean is one of the common measures of central tendency, it cannot be used in this case because we are dealing with ordinal data (i.e. rankings from 1 to 5).

As can be generally asserted from table 4.5, majority of respondents (about 58%) are of the opinion that these variables are significant or highly significant in determining residential rental values. Meaning that in terms of significance of these variables being the determinants of residential rental values, there is a general consensus. However about 42% of respondents were not certain about especially locational characteristics.

Almost all locational characteristics had a median score of 3 (10 out of 14 locational variables) with 4 variables having a median score of 4. This result is quite surprising as it was expected that since the mantra that location determines to a large extent rental values, these variables will have significant scores. But that does not seem to be the case. Respondents' by the median score suggest that only 4 specific location variables are significant. These are presence of rental units to suitable surface drainage, near to market or shopping centre, near to educational facility and near to healthcare facilities.

When structural characteristics are considered, it can be concluded from table 4.4 that out of 18 variables measured 11 are perceived to be significant and 1 highly significant. However 6 of these variables are perceived to be a neutral, as there appears to be no consensus as to their significance. These variables are age, plot size, number of bathrooms, number of storeys, storeroom availability and the quality of landscaping. For 'age' the explanation could be that it also depends on its physical condition and how that reflects in terms of deterioration. In Ghana's rental housing market, there appears to be no regard for the plot size. Many tenants are concerned about the physical accommodation space they have at their disposal and not necessarily how large the plot is. That may reflect the reason why that score of 3 was realised. In Ghana unlike in other jurisdictions, no matter the number of storeys high a rental unit is, the rental value of each unit remains the same. This in our opinion may explain why the median reflects such outcomes. More so respondents suggest that the number of baths, availability of a storeroom and the quality of landscaping are neither significant nor significant in determining rental values. In effect respondents suggest that it has no effect in determining rental value.

In terms of neighbourhood characteristics there appears to be a general consensus that they are significant. In fact a rental unit having electricity and piped-water connection are perceived by respondents to be highly significant in determining residential rental values. This perhaps is to be expected in the Ghanaian context where the availability of some of these variables are considered as a 'luxury' and not basic facilities that ought to be present in all accommodation.

***Mode***

The mode refers to the ordinal ranking with the highest frequency. Using the mode presents a slightly different result as regarding which variables are ranked significant or otherwise (see table 4.5). Three variables (age of building, storeroom availability and near place of worship) are perceived and ranked by respondents to be insignificant in determining the value of a rental unit. Respondents also suggest that the quality of landscaping, rental unit near to traffic congestion, rental unit near to recreational facilities and population density have neither a significant nor insignificant effect in determining rental values. This is in agreement with scores obtained when the median was used. All other variables apart from the seven discussed above are perceived to have a significant or highly significant effect in determining rental values according to respondents.

Table 4.4: Cronbach alpha results

| Overall Cronbach alpha reliability 0.963 | | |
|---|---|---|
| **Category of factor** | **Name of Variable** | Cronbach alpha when variable is deleted |
| Structural Characteristics | Type of house (*e.g. apartment, hall & chamber, single room*) | 0.962 |
| | Quality of construction (& materials) | 0.962 |
| | Age of building | 0.962 |
| | Plot size | 0.962 |
| | Size of building (*floor area*) | 0.962 |
| | Number of bedrooms | 0.962 |
| | Number of wc | 0.962 |
| | Number of baths | 0.962 |
| | Floor finish (*screed, concrete, tiled, terrazzo)* | 0.962 |
| | Number of storeys *(floors*) | 0.963 |
| | Kitchen available *(separate or shared)* | 0.962 |
| | Toilet available *(separate or shared)* | 0.961 |
| | Bathroom available *(separate or shared)* | 0.961 |
| | Property condition *(physical deterioration)* | 0.961 |
| | Fence or wall availability | 0.961 |
| | Parking space or garage availability | 0.962 |
| | Storeroom availability | 0.963 |
| | Quality of landscaping | 0.962 |
| Neighbourhood characteristics | Near to suitable vehicular access | 0.961 |
| | Has electricity connection | 0.961 |
| | Has piped-water connection or well | 0.961 |
| | Waste disposal or garbage collection available | 0.961 |
| | Area considered safe *(security)* | 0.962 |
| | Streetlighting present | 0.962 |
| Locational characteristics | Presence of suitable surface drainage | 0.962 |
| | Near to traffic congestion | 0.962 |
| | Near to market or shopping center | 0.961 |
| | Near to CBD | 0.962 |
| | Near to job opportunities | 0.962 |
| | Near to educational facility | 0.961 |
| | Near to healthcare *(medical)* facilities | 0.962 |
| | Near to recreational facilities *(parks & green spaces)* | 0.962 |
| | Near to squatter settlements | 0.963 |
| | Near to Police station *(security post)* | 0.962 |
| | Near to place of worship | 0.962 |
| | Population density | 0.962 |
| | Near to bus stop *(public transport)* | 0.962 |
| | Quality of property view | 0.962 |

Source: Expert/ Stakeholder Survey, 2017

Table 4.5: Measures of central tendency – determinants of rental value (perception)

| Category of factor | Name of Variable | Median | Mode |
|---|---|---|---|
| Structural Characteristics | Type of house (*e.g. apartment, hall & chamber, single room*) | 5 | 5 |
| | Quality of construction (& materials) | 4 | 4 |
| | Age of building | 3 | 2 |
| | Plot size | 3 | 4 |
| | Size of building (*floor area*) | 4 | 4 |
| | Number of bedrooms | 4 | 5 |
| | Number of wc | 4 | 4 |
| | Number of baths | 3 | 4 |
| | Floor finish (*screed, concrete, tiled, terrazzo)* | 4 | 4 |
| | Number of storeys *(floors*) | 3 | 4 |
| | Kitchen available *(separate or shared)* | 4 | 4 |
| | Toilet available *(separate or shared)* | 4 | 5 |
| | Bathroom available *(separate or shared)* | 4 | 4 |
| | Property condition *(physical deterioration)* | 4 | 5 |
| | Fence or wall availability | 4 | 4 |
| | Parking space or garage availability | 4 | 4 |
| | Storeroom availability | 3 | 2 |
| | Quality of landscaping | 3 | 3 |
| Neighbourhood characteristics | Near to suitable vehicular access | 4 | 4 |
| | Has electricity connection | 5 | 5 |
| | Has piped-water connection or well | 5 | 5 |
| | Waste disposal or garbage collection available | 4 | 4 |
| | Area considered safe *(security)* | 4 | 5 |
| | Streetlighting present | 4 | 4 |
| characteristics | Presence of suitable surface drainage | 4 | 4 |
| | Near to traffic congestion | 3 | 3 |
| | Near to market or shopping center | 4 | 4 |
| | Near to CBD | 3 | 4 |
| | Near to job opportunities | 3 | 4 |
| | Near to educational facility | 4 | 4 |
| | Near to healthcare *(medical)* facilities | 4 | 4 |
| | Near to recreational facilities *(parks & green spaces)* | 3 | 3 |
| | Near to squatter settlements | 3 | 5 |
| | Near to Police station *(security post)* | 3 | 4 |
| | Near to place of worship | 3 | 2 |
| | Population density | 3 | 3 |
| | Near to bus stop *(public transport)* | 3 | 4 |
| | Quality of property view | 3 | 4 |

Source: Expert/ Stakeholder Survey, 2017

The second aspect of the ranking required respondents to rank the perceived effect of each of the variables that determines rental value. These nominal rankings allowed respondents to make a choice on four perceived effects of each variable as given in terms of whether they had (i) a '*positive effect'* (+ve), (ii) '*negative effect'* (-ve), (iii) '*no effect'* or (iv) respondents were '*not sure*' of the effect of these variables on residential rental value. So in the first assessment we wanted to find out whether these

variables are significant or otherwise and in the second to find out the extent of significance by measuring the variable's perceived effect on rental value as ranked by respondents (table 4.6).

Table 4.6 shows the percentage of respondents who ranked each variable based on the effects as shown. Each of the variables was ranked by the 114 respondents and as such each percentage adds to 100 *per cent*. From the table it can be seen that majority of the variables are perceived to have a positive effect in determining residential rental value. Also worth noting are variables that are perceived to have a negative effect on determining rental values; these are population density of an area, rental units near to squatter settlements and traffic congestion. This is to be expected as squatter settlements are seen as a blight to any neighbourhood and may account for reduction or lower rental values where these are near to neighbourhoods. Also when a neighbourhood has traffic congestion problems people would prefer to stay in alternative neighbourhoods (if the opportunity exists) where the problem may not be severe.

In general we could observe a convergence with some of the variables presented by Sirmans *et al.* (2005), who are also of the opinion that number of bathrooms, bedrooms, public rooms, garage and size of rental unit predominantly have a positive effect on rental values (see table 4.1). We must mention here that Sirmans *et al.* (2005) assertions are based on empirical evidence. We do realise that although respondents' choice are only perceived to be the effects without any empirical basis, it does present a starting point to examine which variables may be relevant in modelling the rental market in a developing country context. These stakeholder perceptions or results will at a later stage be subject to empirical results to find out whether it effectively mimics the real market situation.

By combining tables 4.5 and 4.6, we generate table 4.7 which provides a summary of the perceived significant effect of each of the variables. Table 4.7 describes for each variable whether it is significant or otherwise and its impact in determining residential rental value. By significance we refer to the 5 point likert scale referred to in table 4.5 and by effect on rental value we refer to the nominal scale as presented in table 4.6. The summary in table 4.7 is an attempt to further summarise and explain (from the 2 tables) what the data suggests in terms of what each variable represents.

From table 4.7 we can clearly observe that variables which are ranked '*significant*' or '*highly significant'* are perceived to also have a positive effect on rental value. This means that when these variables are modelled using a regression equation or hedonic model the signs of the coefficient are expected to be positive and most probably statistically significant.

Another group of variables are perceived as both neutral in terms of significance and effect on rental value. These are '*number of storeys (floors)*', '*storeroom availability*' and rental units '*near to recreational facilities*'. This result also suggest that these variables may not be statistically significant and may not have any effect on rental value when modelled. This suggests that the effect may be 0.

The next group of variables are perceived to have a neutral significance but a positive effect on rental value. These variables include '*age of building'*, '*plot size*', '*number of baths*', '*quality of landscaping*', '*next to CBD*', '*next to job opportunities*', *near to police station*', '*near to bus stop*' and '*quality of property view*'. So it presupposes that when these variables are modelled in a hedonic equation the expected sign of the coefficients may be positive but not have statistical significance. This seems at variance with literature on the effects of some of these variables especially 'plot size' and 'number of baths'. The literature suggests that the coefficients of these variables normally have a positive sign when modelled in a hedonic equation or regression analysis. And that as the number increases, the corresponding rent increases accordingly.

These next set of variables are perceived to also have neutral significance but negative effect on rental value. These variables are '*next to traffic congestion'*, '*near to squatter settlements'.* Since many residents will generally want to avoid these areas, the perception is that it has a negative effect on rental values and as such a negative sign is expected in terms of coefficient sign when modelled. It may also imply that these variables may not be statistically significant.

Table 4.6: Perceived effects of variables in determining residential rental value (in percentages)

| | | % Effects | | | | |
|---|---|---|---|---|---|---|
| **Category of factor** | **Name of Variable** | **+ve** | **-ve** | **no effect** | **not sure** | **Total N=114** |
| Structural Characteristics | Type of house (*e.g. apartment, hall & chamber, single room*) | 92.1 | 0.9 | 4.4 | 2.6 | 100 |
| | Quality of construction (& materials) | 82.5 | 3.5 | 12.3 | 1.8 | 100 |
| | Age of building | 46.5 | 19.3 | 27.2 | 7.0 | 100 |
| | Plot size | 57.0 | 2.6 | 31.6 | 8.8 | 100 |
| | Size of building (*floor area*) | 84.2 | 1.8 | 7.9 | 6.1 | 100 |
| | Number of bedrooms | 93.0 | 2.6 | 2.6 | 1.8 | 100 |
| | Number of wc | 74.6 | 2.6 | 18.4 | 4.4 | 100 |
| | Number of baths | 69.3 | 1.8 | 22.8 | 6.1 | 100 |
| | Floor finish (*screed, concrete, tiled, terrazzo)* | 78.9 | 1.8 | 15.8 | 3.5 | 100 |
| | Number of storeys *(floors*) | 47.4 | 4.4 | 43.9 | 4.4 | 100 |
| | Kitchen available *(separate or shared)* | 82.5 | 3.5 | 11.4 | 2.6 | 100 |
| | Toilet available *(separate or shared)* | 87.7 | 3.5 | 7.0 | 1.8 | 100 |
| | Bathroom available *(separate or shared)* | 86.8 | 5.3 | 5.3 | 2.6 | 100 |
| | Property condition *(physical deterioration)* | 59.6 | 36.0 | 3.5 | 0.9 | 100 |
| | Fence or wall availability | 75.4 | 3.5 | 15.8 | 5.3 | 100 |
| | Parking space or garage availability | 70.2 | 0.9 | 26.3 | 2.6 | 100 |
| | Storeroom availability | 37.7 | 3.5 | 53.5 | 5.3 | 100 |
| | Quality of landscaping | 55.3 | 1.8 | 36.8 | 6.1 | 100 |
| Neighbourhood characteristics | Near to suitable vehicular access | 76.3 | 2.6 | 19.3 | 1.8 | 100 |
| | Has electricity connection | 94.7 | 0.0 | 4.4 | 0.9 | 100 |
| | Has piped-water connection or well | 94.7 | 0.9 | 3.5 | 0.9 | 100 |
| | Waste disposal or garbage collection available | 75.4 | 1.8 | 21.1 | 1.8 | 100 |
| | Area considered safe *(security)* | 89.5 | 1.8 | 7.9 | 0.9 | 100 |
| | Streetlighting present | 66.7 | 5.3 | 25.4 | 2.6 | 100 |
| Locational characteristics | Presence of suitable surface drainage | 72.8 | 5.3 | 18.4 | 3.5 | 100 |
| | Near to traffic congestion | 23.7 | 47.4 | 22.8 | 6.1 | 100 |
| | Near to market or shopping center | 63.2 | 4.4 | 28.1 | 4.4 | 100 |
| | Near to CBD | 53.5 | 12.3 | 26,3 | 7.9 | 100 |
| | Near to job opportunities | 58.8 | 1.8 | 29,8 | 9.6 | 100 |
| | Near to educational facility | 68.4 | 3.5 | 24.6 | 3.5 | 100 |
| | Near to healthcare *(medical)* facilities | 71.9 | 2.6 | 22.8 | 2.6 | 100 |
| | Near to recreational facilities *(parks & green spaces)* | 47.4 | 6.1 | 43.0 | 3.5 | 100 |
| | Near to squatter settlements | 13.2 | 59.6 | 20.2 | 7.0 | 100 |
| | Near to Police station *(security post)* | 65.8 | 2.6 | 25.4 | 6.1 | 100 |
| | Near to place of worship | 39.5 | 9.6 | 38.6 | 12.3 | 100 |
| | Population density | 33.3 | 35.1 | 20.2 | 11.4 | 100 |
| | Near to bus stop *(public transport)* | 63.2 | 8.8 | 23.7 | 4.4 | 100 |
| | Quality of property view | 68.4 | 2.6 | 25.4 | 3.5 | 100 |

Source: Expert/ Stakeholder Survey, 2017

Table 4.7: Perceived significant effect of each variable as extracted from tables 4.5 and 4.6 (Summary)

| Category of factor | Name of Variable | Significance | Effect on rental value (expected sign) | Comment |
|---|---|---|---|---|
| Structural Characteristics | Type of house (*e.g. apartment, hall & chamber, single room*) | Highly Significant | Positive | |
| | Quality of construction (& materials) | Significant | Positive | |
| | Age of building | Neutral | Positive | Inconclusive |
| | Plot size | Neutral | Positive | |
| | Size of building (*floor area*) | Significant | Positive | |
| | Number of bedrooms | Significant | Positive | |
| | Number of wc | Significant | Positive | |
| | Number of baths | Neutral | Positive | |
| | Floor finish (*screed, concrete, tiled, terrazzo)* | Significant | Positive | |
| | Number of storeys *(floors*) | Neutral | Neutral | Inconclusive |
| | Kitchen available *(separate or shared)* | Significant | Positive | |
| | Toilet available *(separate or shared)* | Significant | Positive | |
| | Bathroom available *(separate or shared)* | Significant | Positive | |
| | Property condition *(physical deterioration)* | Significant | Positive | Effect could be negative |
| | Fence or wall availability | Significant | Positive | |
| | Parking space or garage availability | Significant | Positive | |
| | Storeroom availability | Neutral | Neutral | Neutral |
| | Quality of landscaping | Neutral | Positive | Effect could be neutral |
| Neighbourhood characteristics | Near to suitable vehicular access | Significant | Positive | |
| | Has electricity connection | Highly Significant | Positive | |
| | Has piped-water connection or well | Highly Significant | Positive | |
| | Waste disposal or garbage collection available | Significant | Positive | |
| | Area considered safe *(security)* | Significant | Positive | |
| | Streetlighting present | Significant | Positive | |
| Locational characteristics | Presence of suitable surface drainage | Significant | Positive | |
| | Near to traffic congestion | Neutral | Negative | Inconclusive |
| | Near to market or shopping center | Significant | Positive | |
| | Near to CBD | Neutral | Positive | Effect could be neutral |
| | Near to job opportunities | Neutral | Positive | Effect could be neutral |
| | Near to educational facility | Significant | Positive | |
| | Near to healthcare *(medical)* facilities | Significant | Positive | |
| | Near to recreational facilities *(parks & green spaces)* | Neutral | Neutral | Effect could be positive |
| | Near to squatter settlements | Neutral | Negative | |
| | Near to Police station *(security post)* | Neutral | Positive | |
| | Near to place of worship | Neutral | Positive/Negative | Inconclusive |
| | Population density | Neutral | Positive/Negative | Inconclusive |
| | Near to bus stop *(public transport)* | Neutral | Positive | |
| | Quality of property view | Neutral | Positive | |

Source: Expert/ Stakeholder Survey, 2017

The final set of variables in terms of significance are neutral but could have both positive and negative impacts on rental value. These variables are '*near to place of worship*' and '*population density'*. The perceived effect here is inconclusive and suggests that when modelled in a hedonic equation the variable coefficient could be positive or negative depending on the empirical data analysed and probably

statistically insignificant. This may be attributable to the fact that it depends on the view of residents and how they perceive these variables. For example in a "very religious" neighbourhood, being near to a church building or mosque may be seen as a good neighbourhood amenity. However *vice versa* may perceive the presence of a religious building as inappropriate.

To conclude, we do realise that most of the variables identified throughout the literature and presented here are perceived to be statistically significant and may have a positive coefficient sign when modelled in a hedonic equation. It should however be noted that these are effects perceived by various respondents and empirical evidence may suggest otherwise. We only present here what the data from respondents suggest. We will later in a subsequent chapter present empirical results and compare whether any trends, similarities or divergence could be identified. As was highlighted earlier in this chapter these analyses are only a first step in trying to identify variables that may be selected and utilised in empirical data collection. The empirical data will give a strong direction as to the conclusions that may be drawn from these variables especially in a developing country context.

The next section discusses another important aspect of the analysis. The objective is to rank all variable scores from lowest to highest based on results of the perception survey. Section 4.6 explains the Relative Importance Index (RII) and how it is utilised to rank determinants of rental value.

## 4.6. Relative Importance Index (RII)

The Relative Importance Index (RII) is used to evaluate each variable in order to determine their relative contribution to rental value and ranking same. This index is computed by utilising all individual variable scores and ranking variables against each other. So that in the end we can determine the rank of one variable based on all other variables computed. We utilise the frequently cited RII formula as presented by Holt (2014):

$$RII = \frac{\Sigma W}{A*N} \qquad (4.2)$$

Where $0 \leq \text{RII} \leq 1$

$W$ is the sum of scores awarded a variable, $V_i$ from $N$ number of respondents. The sum of $N$ respondents selecting a response point multiplied by the point's integer value, for an option on the scale term. $A$ is the largest integer response scale ($A_{max}$ in this case will be 5). The index has a value between 0 and 1. When the value of the index is close to 1, it suggests that respondents rank that particular variable high and vice versa suggests that the variable has a low ranking.

The relative importance index computes the 'relative importance' of (independent) variables by comparing the rank attributed to the variable by respondents and also by comparing with other variables that are computed. The main reason for using the RII is to rank variables in terms of importance as perceived and ranked by respondents. These rankings are computed from the raw data used in table 4.5. Respondents were asked to rank each variable based on a 5-point likert scale from 1 (*highly insignificant*) to 5 (*highly significant*). Table 4.8 provides the computed RII for each variable and category of respondent using the RII formula. The RII scores range from 0.48 to 0.97.

It would be realised from tables 4.8 and 4.9 that no computations were made in respect of the respondent category Real Estate Developer. The reason is that only one response was received and as such it would not be possible for the index to be computed. Hence the total sample used in these analyses are 113 instead of 114.
Based on the results from table 4.8, table 4.9 is computed which ranks each variable from the highest to the lowest. There are 38 individual variables and the RII is computed for each category of respondents. The RII for each category is ranked from the highest value (1) to the lowest (38).

Table 4.8: Relative Importance Index of variables by category

| Category of factor | Name of Variable | Academics N = 23 | VES N = 34 | REA N = 5 | Tenant N = 40 | Landlord N = 6 | Others N = 5 | Total N = 113 |
|---|---|---|---|---|---|---|---|---|
| Structural Characteristics | Type of house (*e.g. apartment, hall & chamber, single room*) | 0.92 | 0.89 | 0.96 | 0.85 | 0.90 | 0.80 | 0.88 |
| | Quality of construction (& materials) | 0.80 | 0.79 | 0.84 | 0.72 | 0.63 | 0.64 | 0.76 |
| | Age of building | 0.67 | 0.61 | 0.60 | 0.67 | 0.77 | 0.56 | 0.65 |
| | Plot size | 0.70 | 0.66 | 0.72 | 0.58 | 0.67 | 0.52 | 0.64 |
| | Size of building (*floor area*) | 0.82 | 0.76 | 0.84 | 0.69 | 0.83 | 0.68 | 0.75 |
| | Number of bedrooms | 0.89 | 0.83 | 0.88 | 0.81 | 0.97 | 0.76 | 0.84 |
| | Number of wc | 0.70 | 0.62 | 0.76 | 0.66 | 0.83 | 0.68 | 0.67 |
| | Number of baths | 0.67 | 0.60 | 0.72 | 0.66 | 0.83 | 0.64 | 0.66 |
| | Floor finish (*screed, concrete, tiled, terrazzo)* | 0.79 | 0.74 | 0.80 | 0.74 | 0.77 | 0.52 | 0.75 |
| | Number of storeys *(floors*) | 0.73 | 0.61 | 0.64 | 0.62 | 0.67 | 0.44 | 0.63 |
| | Kitchen available *(separate or shared)* | 0.79 | 0.76 | 0.80 | 0.77 | 0.87 | 0.72 | 0.78 |
| | Toilet available *(separate or shared)* | 0.82 | 0.84 | 0.84 | 0.81 | 0.90 | 0.76 | 0.82 |
| | Bathroom available *(separate or shared)* | 0.82 | 0.84 | 0.80 | 0.81 | 0.90 | 0.76 | 0.82 |
| | Property condition *(physical deterioration)* | 0.90 | 0.85 | 0.96 | 0.83 | 0.83 | 0.68 | 0.85 |
| | Fence or wall availability | 0.73 | 0.67 | 0.68 | 0.73 | 0.83 | 0.72 | 0.71 |
| | Parking space or garage availability | 0.71 | 0.62 | 0.72 | 0.67 | 0.73 | 0.68 | 0.67 |
| | Storeroom availability | 0.59 | 0.49 | 0.48 | 0.59 | 0.57 | 0.56 | 0.55 |
| | Quality of landscaping | 0.64 | 0.61 | 0.48 | 0.60 | 0.63 | 0.44 | 0.60 |
| Neighbourhood characteristics | Near to suitable vehicular access | 0.83 | 0.71 | 0.88 | 0.74 | 0.80 | 0.68 | 0.75 |
| | Has electricity connection | 0.92 | 0.92 | 0.92 | 0.87 | 0.97 | 0.84 | 0.90 |
| | Has piped-water connection or well | 0.91 | 0.88 | 0.92 | 0.83 | 0.97 | 0.80 | 0.87 |
| | Waste disposal or garbage collection available | 0.78 | 0.72 | 0.84 | 0.70 | 0.93 | 0.64 | 0.74 |
| | Area considered safe *(security)* | 0.86 | 0.85 | 0.92 | 0.79 | 0.93 | 0.76 | 0.83 |
| | Streetlighting present | 0.75 | 0.64 | 0.56 | 0.66 | 0.80 | 0.56 | 0.67 |
| Locational characteristics | Presence of suitable surface drainage | 0.77 | 0.69 | 0.64 | 0.65 | 0.83 | 0.72 | 0.69 |
| | Near to traffic congestion | 0.73 | 0.65 | 0.68 | 0.65 | 0.80 | 0.44 | 0.66 |
| | Near to market or shopping center | 0.74 | 0.64 | 0.56 | 0.66 | 0.77 | 0.56 | 0.66 |
| | Near to CBD | 0.75 | 0.62 | 0.80 | 0.65 | 0.60 | 0.60 | 0.66 |
| | Near to job opportunities | 0.69 | 0.62 | 0.68 | 0.62 | 0.77 | 0.56 | 0.64 |
| | Near to educational facility | 0.70 | 0.65 | 0.80 | 0.63 | 0.83 | 0.60 | 0.66 |
| | Near to healthcare *(medical)* facilities | 0.70 | 0.68 | 0.84 | 0.66 | 0.83 | 0.56 | 0.69 |
| | Near to recreational facilities *(parks & green spaces)* | 0.60 | 0.55 | 0.64 | 0.53 | 0.70 | 0.52 | 0.56 |
| | Near to squatter settlements | 0.70 | 0.65 | 0.72 | 0.68 | 0.77 | 0.44 | 0.67 |
| | Near to Police station *(security post)* | 0.59 | 0.68 | 0.52 | 0.64 | 0.83 | 0.52 | 0.64 |
| | Near to place of worship | 0.58 | 0.54 | 0.56 | 0.57 | 0.83 | 0.52 | 0.57 |
| | Population density | 0.64 | 0.59 | 0.72 | 0.65 | 0.77 | 048 | 0.63 |
| | Near to bus stop *(public transport)* | 0.70 | 0.55 | 0.72 | 0.66 | 0.73 | 0.64 | 0.64 |
| | Quality of property view | 0.66 | 0.65 | 0.68 | 0.68 | 0.83 | 0.44 | 0.66 |

Source: Expert/ Stakeholder Survey, 2017

N.B. – For tables 4.8 and 4.9;

*Academics represents – academic (real estate and related fields); VES represents – Valuation and Estate Surveyor (GhIS); REA represents – Real Estate Agent*

Table 4.9: Ranking of the variables based on the Relative Importance Index (RII) by category

| Name of Variable | Academics N = 23 | VES N = 34 | REA N = 5 | Tenant N = 40 | Landlord N = 6 | Others N = 5 | Total N = 113 |
|---|---|---|---|---|---|---|---|
| Has electricity connection | 1 | 1 | 3 | 1 | 1 | 1 | 1 |
| Type of house (*e.g. apartment, hall & chamber, single room*) | 1 | 2 | 1 | 2 | 6 | 2 | 2 |
| Has piped-water connection or well | 3 | 3 | 3 | 3 | 1 | 2 | 3 |
| Property condition *(physical deterioration)* | 4 | 4 | 1 | 3 | 10 | 11 | 4 |
| Number of bedrooms | 5 | 8 | 6 | 5 | 1 | 4 | 5 |
| Area considered safe *(security)* | 6 | 4 | 3 | 8 | 4 | 4 | 6 |
| Toilet available *(separate or shared)* | 8 | 6 | 8 | 5 | 6 | 4 | 7 |
| Bathroom available *(separate or shared)* | 8 | 6 | 13 | 5 | 6 | 4 | 7 |
| Kitchen available *(separate or shared)* | 12 | 10 | 13 | 9 | 9 | 8 | 9 |
| Quality of construction (& materials) | 11 | 9 | 8 | 13 | 35 | 16 | 10 |
| Size of building (*floor area*) | 8 | 10 | 8 | 15 | 10 | 11 | 11 |
| Near to suitable vehicular access | 7 | 14 | 6 | 10 | 21 | 11 | 11 |
| Floor finish (*screed, concrete, tiled, terrazzo*) | 12 | 12 | 13 | 10 | 24 | 28 | 11 |
| Waste disposal or garbage collection available | 14 | 13 | 8 | 14 | 4 | 16 | 14 |
| Fence or wall availability | 19 | 18 | 25 | 12 | 10 | 8 | 15 |
| Presence of suitable surface drainage | 15 | 15 | 29 | 26 | 10 | 8 | 16 |
| Near to healthcare *(medical)* facilities | 23 | 16 | 8 | 20 | 10 | 22 | 16 |
| Number of wc | 23 | 26 | 18 | 20 | 10 | 11 | 18 |
| Parking space or garage availability | 22 | 26 | 19 | 18 | 30 | 11 | 18 |
| Streetlighting present | 16 | 24 | 33 | 20 | 21 | 22 | 18 |
| Near to squatter settlements | 23 | 20 | 19 | 16 | 24 | 34 | 18 |
| Number of baths | 30 | 33 | 19 | 20 | 10 | 16 | 22 |
| Near to educational facility | 23 | 20 | 13 | 31 | 10 | 20 | 22 |
| Near to CBD | 16 | 26 | 13 | 26 | 37 | 20 | 22 |
| Near to market or shopping center | 18 | 24 | 33 | 20 | 24 | 22 | 22 |
| Quality of property view | 32 | 20 | 25 | 16 | 10 | 34 | 22 |
| Near to traffic congestion | 19 | 20 | 25 | 26 | 21 | 34 | 22 |
| Age of building | 30 | 30 | 32 | 18 | 24 | 22 | 28 |
| Near to bus stop *(public transport)* | 23 | 35 | 19 | 20 | 30 | 16 | 29 |
| Near to job opportunities | 29 | 26 | 25 | 32 | 24 | 22 | 29 |
| Near to Police station *(security post)* | 36 | 16 | 36 | 30 | 10 | 28 | 29 |
| Plot size | 23 | 19 | 19 | 36 | 33 | 28 | 29 |
| Population density | 33 | 34 | 19 | 26 | 24 | 33 | 33 |
| Number of storeys *(floors)* | 19 | 30 | 29 | 32 | 33 | 34 | 33 |
| Quality of landscaping | 33 | 30 | 37 | 34 | 35 | 34 | 35 |
| Near to place of worship | 38 | 37 | 33 | 37 | 10 | 28 | 36 |
| Near to recreational facilities *(parks & green spaces)* | 35 | 35 | 29 | 38 | 32 | 28 | 37 |
| Storeroom availability | 36 | 38 | 37 | 35 | 38 | 22 | 38 |

Source: Expert/ Stakeholder Survey, 2017

Structural characteristics
Neighbourhood characteristics
Locational characteristics

It can be observed from table 4.9 that the following variables are generally ranked high (among the top 5). These are '*electricity connection', 'piped-water connection', 'type of house', 'property condition'* and *'number of bedrooms'*. Colour coding is used to differentiate the categories of variables measured. For example it is striking to notice that among the category landlords, a variable like '*property condition'*, which we expect to be ranked probably among the top 5 rather has a rank of 10. The same can be realised from the '*quality of construction material*' which has a score of 35. Could it probably mean that landlords generally do not really consider the '*quality of construction material'* and '*property condition'* when they decide on rental value? From table 4.9 it is observed that neighbourhood and structural characteristics generally rank higher than locational characteristics.

## 4.7. Can these variables be individually priced and disaggregated from rental value?

We asked the above question as a proxy in our quest to find out whether respondents are aware of modelling techniques that allow individual variables to be priced in a regression equation. The results are presented in table 4.10.

Table 4.10: Can these variables be disaggregated from rental value?

| | Frequency (N = 114) | Percentage (%) |
|---|---|---|
| **Yes** | 51 | 44.7 |
| **No** | 30 | 26.3 |
| **Not Sure** | 33 | 28.9 |

Source: Expert/ Stakeholder Survey, 2017

It can be observed from the table that although majority of respondents (45%) are in agreement that these individual variables can be priced and disaggregated from rental value the result is not conclusive. More than half of the respondents (55%) are either not sure or do not agree that these variables can be priced individually. Generally the reason for this assertion could be that housing is a composite good and it is let or sold wholly as one unit although individual characteristic variables as discussed above play a role in determining how high the rental value should be.

Respondents gave reasons why they perceive that variables could be disaggregated from rental value. We present some of these reasons below;

> *"These variables inherently add value to the property once they are provided in the neighbourhood within which the subject property is situate";*
>
> *"Can be broken down into components because, each variable has its unique way of influencing rent";*
>
> *"These variables have considerable effect of determining the rental value of a property. They can be priced to determine their degree of influencing the rental value";*
>
> *"Hedonic pricing models in mainstream economics are capable of allowing a disaggregation of the variables making up rental values and even assigning their respective values. These techniques however require extensive and relatively detailed property sales or rental data to accomplish";*
>
> *"Through some hedonic valuation techniques, various elements can be priced differently to ascertain their contribution to rental value";*
>
> *"Theoretically through regression analysis".*

As can be observed from the above responses the agreement to the assertion that these variables can be priced stem from hedonic or regression analysis that can be performed on these variables to examine the level of contribution to rental values. However, it can be realised that there are a few respondents who

although agree that the variables can be disaggregated, perceive that these can be done by subjective analysis by an appraiser/ valuer. For example a respondent opines that these analysis could be done;

> *"Mainly by subjectivity of appraiser on the current market conditions on such property directly compared to comparables and/or cost rates".*

For respondents who disagreed that variables as provided in the survey could not be disaggregated offered the following reasons including;

> *"Rental values seem to be pegged at certain value ranges based on aggregated locational and neighbourhood characteristics which may be difficult to segregate accurately";*
>
> *"It is practically difficult to estimate these variables on their own since [they] are intrinsic";*

## 4.8. Omitted variables

In order to ensure that no variables would be possibly omitted during data collection, respondents were asked to indicate whether any variables may have been omitted. The results to the question, '*Are there other variables that may have been omitted*?' are presented in table 4.11.

Table 4.11: Are there other variables that may have been omitted?

| | Frequency (N = 114) | Percentage (%) |
|---|---|---|
| **Yes** | 26 | 22.8 |
| **No** | 35 | 30.7 |
| **Not Sure** | 53 | 46.5 |

Source: Expert/ Stakeholder Survey, 2017

It was realised that majority of the respondents (47%) were not sure whether some variables were omitted or otherwise. This may be due to an allusion mentioned early on that housing is a composite good. It may be difficult to identify all individual variables that together make up the rental value. Although this may be the case we are of the view that most of the relevant variables have been identified in this chapter. For respondents who responded in the affirmative (23%) a number of variables to be included were suggested. These included, availability of telecommunication infrastructure, whether location or neighbourhood is flood prone, presence of landlord in the same facility, environmental pollution levels in neighbourhood, type of tenant (e.g. government, private company or individual), type of land tenure arrangement and quality of property management.

## 4.9. Submarket formation

The determinants of residential rental value cannot possibly be discussed, while failing to also discuss the rental housing submarket. In the quest to find out from respondents what their opinion were in terms of how submarkets are formed. Respondents were asked to select from a list of options, *what drives the creation of residential rental submarkets*? In an attempt to answer this question *a priori* submarket categories were provided and respondents asked to select a choice (table 4.12)

Table 4.12: What drives residential rental submarket creation?

| Category | Number of respondents | Percentage (%) |
|---|---|---|
| Location (spatial segmentation) | 6 | 5.3 |
| Property type | 2 | 1.8 |
| Price (rental value of property) | 8 | 7.0 |
| Both location and property type | 36 | 31.6 |
| All of the above | 62 | 54.4 |
| **Total** | **114** | **100** |

Source: Expert/ Stakeholder Survey, 2017

From the table 4.12 majority of respondents are of the opinion that more than one category of factors drives the creation of a submarket. It can be observed that about 32% of respondents suggest that both location and property type (nested approach) drives submarket creation. While 54% of respondents suggest that location, property type and price all contribute to create submarkets. The literature suggests and supports the assertion that there are a combination of ways that submarkets are created and formed (see Hwang, 2015).

## 4.10. Which variables drive residential rental values?

In this chapter an attempt has been made to discuss determinants of residential rental values from experts and stakeholders' perspective. A summary of the relevance of structural, neighbourhood and locational characteristics is provided in giving guidance as to which of these drives residential rental values. Figure 4.2 provides the median values of Relative Importance Index (RII) based on experts and stakeholders' perceptions (computed from table 4.8). The median is preferred since it is less affected by outliers and skewed data. The median values for neighbourhood, structural and locational characteristics range from 0.72 to 0.93; 0.68 to 0.83; and 0.54 to 0.79 respectively. Respondents are in general agreement and suggest that in terms of ranking from the highest to the lowest, neighbourhood characteristics are ranked highest, then followed closely with structural characteristics and then locational characteristics rank third.

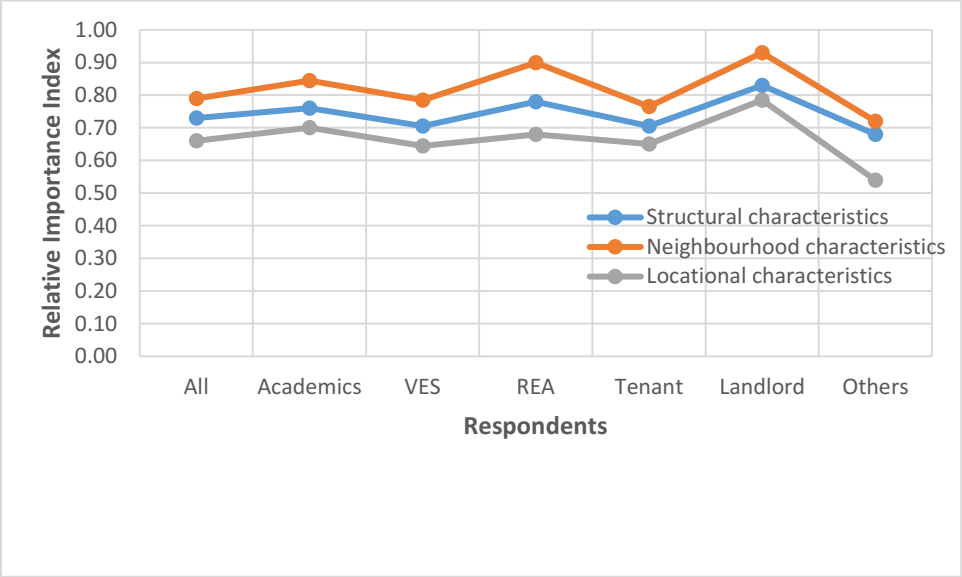



Figure 4.2: Relative Importance Index of structural, neighbourhood and locational characteristics

Source: Expert/ Stakeholder Survey, 2017

## 4.11. Conclusion

There have been attempts to analyse and explain determinants of residential rental value, however previous research did not (to the best of our knowledge) provide comprehensive overview based on the methodology utilised in this research. In this chapter we have established explanatory variables that drive the determination of residential rental values (RRVs) from an expert and stakeholder perspective. We began by identifying variables that are generally used in modelling residential rental values from extant literature. It is agreed that structural, neighbourhood and locational characteristics are the main factors that determine RRVs in the residential rental housing market. But how each of these characteristics affect rental values is where the usual disagreements are. The hedonic pricing model and the theory underlying its use are also examined. Residential value or rent that is observed in the market has individual utility bearing attributes that could be modelled to ascertain the significance or contribution of same on overall rental value.

114 respondents (who comprise experts and stakeholders in the rental market) were asked about their views on what they perceive, based on their individual experiences on what variables drive the fixing of RRVs in the housing market. This was done to situate the research in a local context and tap from the experience of these market players on their perception about how the rental market functions and how rental values are determined. We summarise briefly some of the major findings.

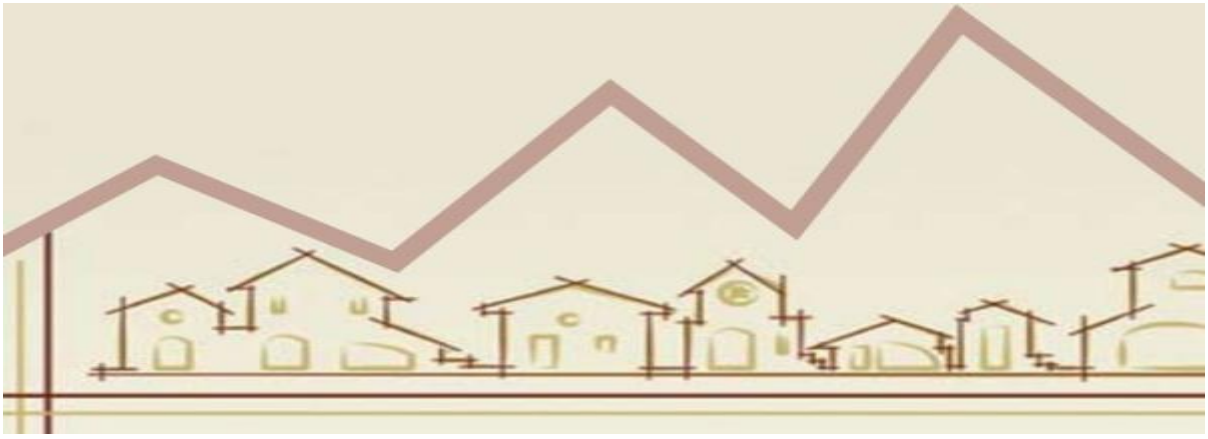
1. Respondents generally agree that out of the 38 variables identified, most are statistically significant and may have a positive effect on rental value when modelled.
2. Respondents agree that the variables *electricity connection, piped water connection, type of house, property condition* and *number of bedrooms* ranked among the top 5 variables per the relative importance index as provided in tables 4.7 and 4.8.
3. Respondents are also of the opinion that the variables *storeroom availability, rental units near to recreational facilities* and a *place of worship, quality of landscaping* and *number of storeys* ranked among the bottom 5 variables based on the relative importance index.
4. Respondents suggest that in terms of ranking from the highest to the lowest (based on median values), neighbourhood characteristics are ranked highest, then followed closely with structural characteristics and then locational characteristics rank third.

Although these findings represent expert and stakeholder perception about the residential rental market and the implicit composition of rental values, we are quick to add that these results in themselves are not conclusive unless empirical studies to ascertain the veracity of findings are undertaken. We do acknowledge this limitation, but provide evidence in subsequent chapters to discuss results of empirical evidence and how these results (perception survey) perform against empirical results.

Knowledge that is already available is critical in the understanding of a housing market that lacks the required data for empirical analysis. This chapter provided a basis as to which variables to collect and measure during the empirical study. The philosophy is to start from the known to the unknown; from experts and stakeholder knowledge about the market to empirical leanings.

The subsequent chapters will analyse empirical evidence based on fieldwork data. This allows reasonable conclusions to be arrived at and relied upon.

# 5. Empirical analysis of submarket existence in Ghana – a nonparametric test approach[6]



*"In reality different [renters] have different housing preferences and have a variety of spatial as well as sectorally distributed dwelling alternatives which may not comprise a single market*"
(Maclennan & Tu, 1996)

[6] This chapter is partly based on the article: (Gavu & Owusu-Ansah, 2019)

Gavu, E. K., & Owusu-Ansah, A. (2019). Empirical analysis of residential submarket conceptualisation in Ghana. *International Journal of Housing Markets and Analysis*. Retrieved from https://doi.org/10.1108/IJHMA-10-2018-0080

## 5.1. Introduction

In chapter 4, we discussed the drivers of residential rental values in Ghana based on the perceptions of stakeholders and key market players. The results suggested that *electricity availability, water availability, type of house, property condition (state of deterioration) and the number of bedrooms*, ranked among the top five factors that determine rental values in Ghana's rental market. Other variables like *storeroom availability, near to recreational facilities, quality of landscaping*, in the Ghanaian context could be viewed as luxuries (not available within many residential rental properties) and as such were ranked among the bottom five. More so, the thesis is guided by the research of Sirmans *et al.* (2005) who posit that *bathrooms, bedrooms, public rooms, garages, fireplace, pool, area of real estate unit,* are key explanatory variables that consistently show a positive coefficient when modelled in hedonic regression. Sirmans *et al.* suggest that structural variables to a large extent determine rental values. However the extant literature also mentions the inclusion of location and neighbourhood variables that determine rental values. Since available literature is not conclusive on the exact variables to utilise for such empirical analysis, we explore the data collected during the field work and present results.

In this chapter, an important aspect in this discourse is to use empirical evidence to analyse submarkets existence in Accra's rental market; whether the residential rental market is segmented. And if these segmentations exists whether they are statistically significant. This chapter first proceeds by examining literature on theoretical and empirical underpinnings to submarket formation. Towards the end we examine how submarkets can be identified using the Kruskal-Wallis One-Way Analysis-of-Variance-by-Ranks test (or H test) and the Jonckheere-Terpstra test; by testing the null hypothesis that mean ranks of rental values are equal across *a priori* delineated submarkets identified.

## 5.2. Housing submarkets

### 5.2.1. Definition and identification

Submarkets are created through the interactions of heterogeneous consumer preferences and highly varied housing stock (Keskin & Watkins, 2017). So basically, there is segmented demand; coupled with a differentiated housing stock; that results in the creation of submarkets in the long run; and these submarkets exhibit price variations. The taste and preference of consumers to various housing types are varied, so are corresponding rental values. This gives rise to a housing market that is diversified and can be further segmented into smaller components for further analysis. This segmentation is what is referred to as a housing submarket or localised segment within the market. There is the general agreement that housing sub-markets do exists (Anim-Odame et al. 2010a; Anim-Odame et al. 2010b; Jones & Watkins 2009:78) and there are standard acceptable statistical tests for the existence of such (Schnare & Struyk, 1976). Submarket definition is an important aspect in hedonic price analysis and this is very useful in making market predictions (Wheeler et al., 2014). A housing submarket can be defined as an area where there are statistically significant and enduring price differences for some commodity or housing characteristic in relation to the overall market or other similarly defined areas within it (Maclennan & Tu, 1996). Wheeler *et al.* (2014, p.664) further assert that, "*the practice of defining submarkets for price assessment is based on the principles of landscape compartmentalization and substitutability that combine to produce relatively homogeneous assessment units*". This principle ensures that analysis of housing market produces results that actually throw more light on how the market really functions. Mutually exclusive areas are selected and analysed based on research objectives and the particular market specifications.

Just as there are many and varied definitions of housing submarket, there are likewise many ways to identify same (Hwang, 2015). The principle of substitution plays a role defining submarket boundaries. The question most probably asked is, can the property be substituted by another and perform same or similar functions? If the answer is yes then these substitutable properties could be within a similar submarket. Carruthers (1989) opines that if there is a high degree of substitutability between two or more market subgroups, say $S_i$ and $S_n$, then these subgroups effectively belong to the same submarket and should not be segmented. Models are then estimated for each homogeneous area and the hypothesis tested is whether these homogeneous areas (submarket) are indeed heterogeneous. The focus of several

research have based submarket definitions on spatial; structural; or nested spatial/ structural segmentation of the market (Watkins, 2001).

Housing submarket research and analysis are beneficial in a number of ways: models exhibit a greater prediction accuracy; provide useful framework for policy makers and planners to explore the complex and dynamic housing market; and improve decision making by specifically helping housing market actors to understand and minimise the search cost of a new house among others (Keskin & Watkins, 2017). Although theoretically many submarkets may exist based on several combinations, they should also be revealed by empirical evidence.

The next sections discusses what constitutes spatial, structural and nested submarket groupings as informed by theory.

### 5.2.2. Spatial segmentation

Spatial segmentation uses *a priori* methods to delineate so called submarket boundaries. The approach has been to use income groups and neighbourhoods that exhibit similar characteristics to segment the market. The housing submarket is typically defined as geographic areas where the price per unit cost [rent] of housing quality (identified by using some index of housing characteristics) is constant (Goodman & Thibodeau, 1998; Jones, Leishman, & Watkins, 2009). Housing market areas are composed of spatially defined housing sub-markets (Goodman, 1978; Jones et al., 2009). Few studies examine the spatial contiguity on housing sub-market classification (Wu & Sharma, 2012). It is the aggregation of sub-market features that constitutes the housing market. To avoid biases in these classifications, some researchers resort to empirical analysis to define submarkets. Hedonic regressions may be used (Ugarte, Goicoa, & Militino, 2004); use of a finite mixture model using demographic information (Belasco, Farmer, & Lipscomb, 2012) and the use of hierarchical models (Goodman & Thibodeau, 1998) are examples of methods adopted to spatially delineate the housing market. A geographically weighted regression model can also be used to detect housing sub-markets (Borst, Mccluskey, & William, 2007; McCluskey & Borst, 2011). The assumption here is that if submarkets exists then the hedonic coefficients or price functions are distinguishably different from each other and also different from a single market in equilibrium.

Bourassa et al. (1999) use survey data from Australia to determine the composition of sub-markets. They made use of principal components and cluster analysis in combination with individual dwelling data. The results show that three factors derived from twelve proximity and neighbourhood attributes explain over 82 *per cent* of the variance in house prices. This gives credence to the assumption that location matters in fixing housing prices. Goodman (1978) provides empirical basis to support a geographical segmented housing market. Goodman and Thibodeau (2007) model sub-markets using a semi-log function with two alternative procedures; one that determines census block groups into areas with enough transactions to estimate a hedonic house price equation and another method that permit spatial characteristics in the classification.

### 5.2.3. Structural segmentation

Structural segmentation focuses on the housing structure and its inherent characteristics. So for example apartments may be segmented from single family homes. Allen *et al*. (1995) use the Tiao-Goldberger test and the Swamy Random Coefficient Model techniques to examine the existence of submarkets based on property type. Using this approach submarkets exists when coefficients from hedonic modelling are statistically tested and results suggests that these coefficients are not the same or equal.

### 5.2.4. Nested spatial/ structural segmentation

The nested spatial/ structural segmentation approach focuses on the joint importance of both the spatial and structural attributes in defining submarkets. Housing sub-markets are generally determined by both spatial and structural factors (Adair et al., 1996; Watkins, 2001).

Whereas Watkins (2001) mentions that submarkets have broadly been categorised based on three groupings, McClusky and Borst (2011) posit that in modelling location and submarket delineation, the existing literature can rather be organised into six broad categories. They further argue that models utilise one or a combination of these categories: (i) Market segmentation – *a priori* segmentation by structure or spatially; (ii) Neighbourhood delineation variable – normally make use of predefined administrative boundaries; (iii) Neighbourhood influence variables – amenity variables that affect value either positively or negatively; (iv) Accessibility measures – distance to economic centres or transport opportunity; (v) Explicit and implicit use of location – techniques that utilise *x,y* locations; (vi) Advanced model specification methods – *i.e.*, using geographically weighted regression techniques.

Wheeler *et al*. (2014) also categorise methods of delineating housing submarkets as *a priori* methods, statistical approaches and subjective/ perceptual analysis as perceived by experts in the field. In subjective/ perceptual analysis the argument in support of utilising this approach is that submarket identification and description needs to be defined empirically based on how various experts and stakeholder groups define it.

Fletcher *et al.* (2000) opines that the implicit pricing of housing attributes is not stable between locations. In housing sub-market modelling and construction, one question that rings in the minds of many researchers is that, should geographic areas be spatially adjacent in order to be seen as a sub-market? Goodman and Thibodeau (2007) suggest that prediction accuracy of sub-market models increase if sub-markets are delineated by dwelling size and median census block group per square foot transaction price. An understanding of sub-market structure may help homeowners and renters make informed decisions about their location choice.

### 5.2.5. Spatial disaggregation of housing sub-markets in hedonic predictions

In the land economics literature the mantra has been that location is a key determinant of price. There are several empirical studies that suggests that location is more important than structural characteristics (Watkins, 2001). However how the spatial and structural context translates to an implicit price is treated differently by researchers. Figure 5.1 explains some characterizations that surrounds sub-market classification by considering spatial dimensions.

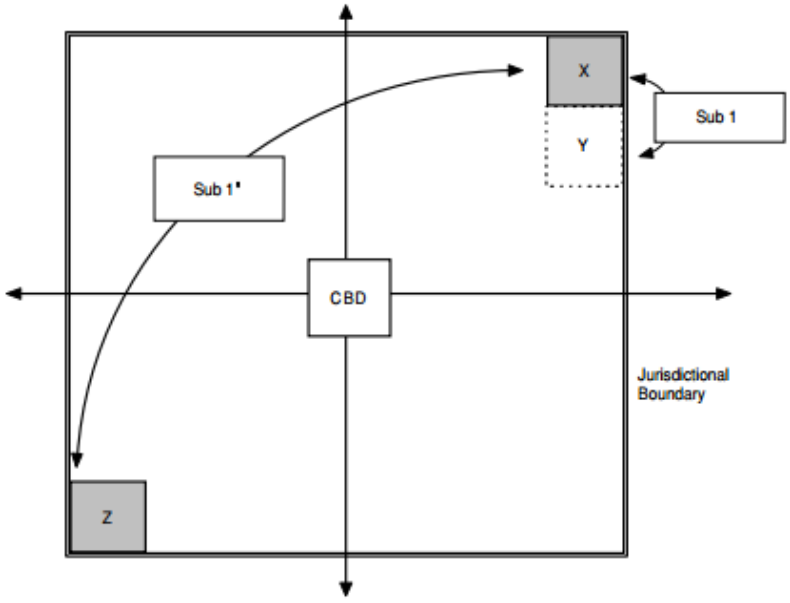



Figure 5.1: Sub-market characterisations

Source: (Adapted from Goodman & Thibodeau 2007)

*X, Y* and *Z* are dwelling units (housing) at arbitrary distances from the CBD. The assumption is that occupiers of these units prefer to be close to the CBD because it offers greatest access. Now in the assignment of a property *X* to a sub-market, should it be assigned to submarket *Y* because they are close? What should determine whether *X* should be in the same sub-market with *Y* or *Z*?

If the definition of sub-market is an area where per unit price of housing is constant, then the price should determine how sub-market groupings are done. If the price per unit is the same then housing *X* should belong to the same sub-market as housing *Z*, although the two are not in close proximity. Using the model in figure 5.1, sub-markets are classified using the following steps;

*Step 1 – Per unit area rental prices are ranked in percentiles*
*Step 2 – Properties within each per unit rental price percentile are assigned to sub-markets according to dwelling size (as measured by square unit of living area)*
*Step 3 – Smaller properties are separated from larger ones holding median per square unit rental transaction price roughly constant*

As has been shown, there is not a clear direction of how submarket classification should proceed. The term submarket connotes several meanings (Watkins, 2001). There is little guidance on economic theory to appropriate definition and extent of submarket classification. Jones and Watkins (2009) ask the question; *how can (sub) markets be modelled*? Theoretically submarkets exists because of multiple equilibria or disequilibrium. Jones and Watkins (2009, p.80)further posit that ' … f*ollowing micro-economic theory, a submarket is deemed to exist if the "law of one price" exists within the submarket; and if a hypothetical, standard housing unit trades at different prices in different submarkets*'. These price differentials are as a result of segmented demand, characterised by consumer groups, and a segmented supply characterised by product group (Watkins, 2001). Two assumptions stems from this particular definition. The first is that housing units within a submarket are relatively close substitutes within the same market. The second is that if there exists price differentials then it presupposes that units are operating in different markets.

In guiding the way forward in submarket identification and classification, a standard three stage test procedure as introduced by Schnare and Struyk (1976) to identify submarket boundary extent is proposed (Jones & Watkins, 2009; Watkins, 2001). The first stage involves house prices decomposed into component parts largely by relying on hedonic modelling techniques for each potential submarket. The assumption here is that renters know the rent of the property; can list the various attributes that have an effect on rent; and implicit prices from the hedonic model can be compared. The second stage requires a Chow test computed to compare regression equations for each (potential) submarket and analyse whether there is equality based on statistical significance. In the third stage when there appears to be statistically significant price differences, perform a Weighted Standard Error test to compare effect on the accuracy of house price models. It is generally accepted that when the error associated with the submarket level equations is more than 10 *per cent* less than the error generated by a single market-wide equation then submarkets exists (Dale-Johnson, 1982).

The approaches to define submarkets have become very complex due to the complexity of the housing market phenomenon being analysed. Some researchers have also resorted to consulting independent market experts such as valuers to help define these submarkets. Bourassa *et al*. (2003) conclude that established neighbourhoods or other neighbourhood boundaries could define submarkets with no need of using elaborate statistical methods. Two of the approaches adopted in this research is the Kruskal-Wallis *H* test and the Jonckheere-Terpstra test to satisfy Bourassa *et al*'s (2003) concern.

Hwang (2015, p.95) generalises the forgone analysis and argues that all these methods can be generalised into three steps namely; *"(i) a hedonic regression analysis to identify factors that explain variation in housing prices, (ii) a cluster analysis to delineate homogeneous clusters, and (iii) a statistical test to identify functional clusters*".

To sum up the discussions so far, submarkets could be viewed within the context of an analytical framework for applied housing studies (Watkins, 2001). We do agree with Watkins when he further observes that the failure to develop a coherent approach to submarket identification and develop submarket models could stem from the following reasons.

1. No coherent single definition of housing submarket. Both spatial and structural characteristics, separately or interactively (nested approaches) may generate submarkets. Submarkets have been defined to comprise all dwellings with similar physical characteristics (that represents close substitutes) irrespective of location; and also dwellings within a particular geographical space.
2. No consensus as to how submarkets should be identified.

3. Urban areas for housing markets research differ from location to location.
4. Time period for market data varies across studies; same with market conditions prevalent during those research outputs.
5. How submarkets are tested also differs across studies.

In this research however, we consider a number of practical approaches discussed to test submarket existence based on empirical data available.

As discussed earlier, housing sub-markets are generally determined by both spatial and structural factors (Adair et al., 1996; Watkins, 2001). In the next sections rental housing submarket existence are analysed using the Kruskal-Wallis *H* test based on spatial, structural and nested segmentation 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 as a submarket segment (i.e., single room; chamber and hall; and apartment, flat, house and town house). And lastly, by a nested segmentation of the rental market, we test whether submarket exists based on a combined definition of submarket based on spatial and structural characteristics (i.e. Low income neighbourhood single rooms, Middle income neighbourhood apartments, High income neighbourhood apartments among others).

In identifying submarket classifications, *a priori* delineations based on real estate experts are explored in this research. This research agrees with the notion that information flow, especially within an opaque market like Ghana's, requires the help of experts in identifying or delineating submarket boundaries. According to Keskin and Watkins (2017) expert defined submarket boundaries tend to perform well similar (or at times better than) to other range of statistical procedures for delineating same and may be used with some degree of confidence.

The purpose of the next section is to determine whether there is a statistically significant difference at an alpha level of 0.05 in rental values based on spatial, structural and nested segmentations of the market. The critical question to ask are: Are these submarket segmentations really different? Or are the differences found merely a reflection of variations expected from random sampling from the same population? Are the differences genuine or do they only occur by chance. We operationalize this objective by using the Kruskal-Wallis One-Way Analysis-of-Variance-by-Ranks Test (or the H test). The test is further explained below.

## 5.3. The Kruskal-Wallis One-Way Analysis-of-Variance-by-Ranks Test (or H test)

This test sometimes called the "*one-way ANOVA on ranks*" is a nonparametric test which is used to determine whether there is a statistically significant difference between two or more groups of an independent variable on a continuous or ordinal dependent variable. Chan and Walmsley (1997) explain that the *H* test is used to determine whether independent groups are the same or different on some variable of interest when an ordinal level data or an interval or ratio level of data is available. This technique basically tests the null hypothesis that the *k* samples are from the same population or different. In the computation process, all scores from the *k* samples combined are ranked in a single series. The smallest score gets a rank of 1, the next smallest 2, and in this order until the largest gets a rank score of *N*. The sum of ranks in each sample or group is computed. The Kruskal-Wallis test then determines whether the sum of ranks in each group are disparate and are not likely to come from samples drawn from the same population (Siegel & Castellan, 1988 p.185).

To ensure that the data can be analysed using the Kruskal-Wallis *H* test, the data has to satisfy the assumptions inherent in using the test. These assumptions are stated below (see Siegel & Castellan, 1988);

1. The dependent variable should be measured at the ordinal or continuous level.
2. The independent variable should consist of two or more categorical independent groups.
3. Independence of observations.

Determine whether data distribution for each of the groups are similar (i.e., have the same shape) or not. This is done by computing the homogeneity of variance test for nonparametric data. The results we hope

to get is a significant value that is greater than 0.05 which indicates that the distribution for each of the groups is similar. If the distributions have the same shape then we use the Kruskal-Wallis *H* Test to compare the medians of the dependent variable (in this case rent) for the different groups within the independent variable of interest. Further, if the distributions have different shapes, then the Kruskal-Wallis *H* Test is rather used to compare the mean ranks.

Chan and Walmsley (1997) further explain that when given multiple samples (*C*), with $n_i$ observations in the $i^{th}$ sample, the *H* statistic tests the null hypothesis that the samples come from identical population distributions. (For further reading see Breslow, 1970; Chan & Walmsley, 1997; Kruskal, 1952; Kruskal & Wallis, 1952; MacDonald, 2009).

The *H* test statistic is given as;

$$H = \left[ \frac{12}{n(n+1)} \sum_{j=1}^{c} \frac{T_j^2}{n_j} \right] - 3(n+1) \qquad (5.1)$$

Where:
$n$ = sum of sample sizes for all samples,
$c$ = number of samples,
$T_j$ = sum of ranks in the $j^{th}$ sample,
$n_j$ = size of the $j^{th}$ sample.

Where;
$H_0$: population medians/ mean ranks are equal
$H_1$: at least one of the population medians/ mean ranks are not equal

The computed value of the *H* statistic is used to determine whether to accept or reject the null hypothesis. If there are more than five samples in each group, the *H* statistic has been shown to be distributed approximately as a chi-square($X^2$) distribution (with $df = C - 1$) at a previously set level of significance. The decision is made by comparing the *H* statistic value to the $X^2$ value. The decision criteria are as follows;
-If critical chi-square value is less than the *H* statistic, reject the null hypothesis that medians/ mean ranks are equal.

-If the chi-square value is greater than the *H* statistic, then there is not enough evidence to suggest that the medians/ mean ranks are equal.

When the *H* statistic is statistically significant, it shows that at least one of the groups is different from the rest. The omnibus test does not indicate which groups are different? How many groups are different? Or whether the differences are also statistically significant? To determine this another procedure called "*multiple comparisons between groups*" is used. Pair-wise multiple comparisons are constructed to identify the source of these significant differences (Hettmansperger, 1984). This procedure analyses the various subgroups within the population and tests the null hypothesis that some groups *a* and *b* are the same, as against the alternate hypothesis that some groups *a* and *b* are different. The hypothesis is tested at an alpha level of significance of 0.05. The null hypothesis is rejected if the *H* statistic is greater than the $X^2$.

The next section tests submarket existence based on spatial segmentation. In other words do low, middle and high income neighbourhoods constitute separate residential housing submarkets based on empirical evidence? If they do, then we examine whether these submarkets are also statistically significant.

## 5.4. Determining submarket existence based on spatial segmentation of the rental housing market

### 5.4.1. Evidence from empirical study

Based on the assumptions that characterize this technique, we conclude that the data can be tested using the Kruskal-Wallis *H* Test. The dependent variable is a continuous level (i.e., Rent per month in US Dollars); the independent variable consists of three distinct categories (i.e., low, middle and high income neighbourhoods – LIN, MIN and HIN). Lastly the distribution in each of the neighbourhood categories have different shapes and data does not assume a normal distribution as can be seen in the box plots (see figure 5.2).

Spatial segmentation uses *a priori* methods to delineate so called submarket boundaries. The approach has been to use income groups and neighbourhoods that exhibits similar characteristics in the segmentation. In this analysis we aggregate neighbourhoods based on *a priori* definition based on neighbourhood income class and test submarket existence at a single point in time. This assumption is premised on the idea that each neighbourhood class is independent and distinct. The composition of all *a priori* identified housing submarkets (sample frame) are presented in table 5.1.

Table 5.1: Composition of a priori identified spatial housing submarkets

| Submarket name | Constituent neighbourhoods |
|---|---|
| Low income neighbourhoods | Amrahia, Ashaiman, Ashaley Botwe, Ashiyie, Ashongman, Dome, Haatso, Lartebiokorshie, Madina, New Bortianor, Osu, Oyarifa, Taifa, Teiman |
| Middle income neighbourhoods | Adenta, Frafraha, Adenta Powerland, East Legon Hills (Santor), Agbelenkpe, Batsonaa, Spintex, Community 18 Lashibi, Community 20 & 25 Tema, Dansoman, Labone, Sakumono, Tantra Hill, Teshie Nungua Estates |
| High income neighbourhoods | Airport Residential Area, Airport Hills, Airport West, American House, Cantonments, Dzorwulu, East Legon, East Airport, Nmai Djorn, North Ridge, Roman Ridge |

Source: Fieldwork data 2017

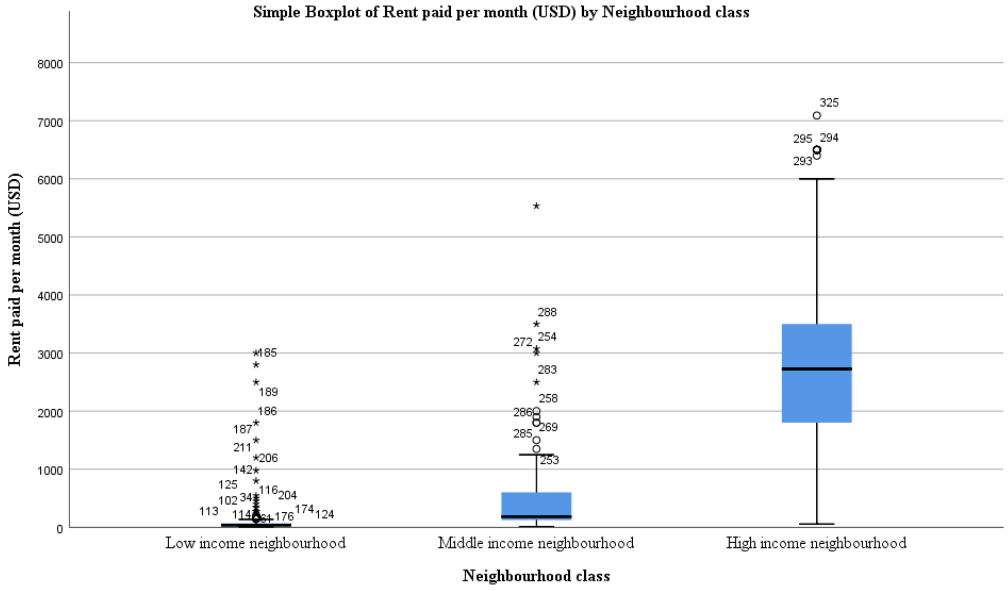



Figure 5.2: Box plots of rent differentiated by spatial segmentation of the market

Source: Fieldwork data 2017

### 5.4.2. Omnibus test (spatial submarkets)

The omnibus test is first computed and then a *post hoc* analysis to determine where specifically the differences occur.

*Null hypothesis* – $H_o$: there is no difference in median residential rental values from the three neighbourhood classes. $H_1$: median residential rental values from the three neighbourhood classes differ and are not all equal based on spatial segmentation of the market.

*Statistical test* – since all three neighbourhood classes are independent, using the statistical test for *k* independent samples is appropriate. Rental values used for this computation are measured in US Dollars per month.

*Significance level* – let $\alpha = 0.05$ and N = 536 = total number of rental units under study.
*Sampling distribution* – from formula (5.1) as computed, *H* is distributed approximately as a chi-square with $df = k - 1$. As such the probability associated with the occurrence under the $H_o$ of values as large as an observed value of H will be determined by comparison with the $X^2$.

*Rejection region* – The region of rejection consists of all values of H which are so large that the probability associated with their occurrence under $H_o$ for $[df = 2] \leq \alpha = 0.05$.

The data used for the analysis has 536 rental values obtained from three neighbourhood classes as discussed extensively in chapter 3. Specifically low income neighbourhoods had a sample size of 211; middle income neighbourhoods with a sample size of 77 and high income neighbourhoods with a sample of 248.

A Kruskal-Wallis H Test was conducted to determine if Rental Values were significantly different for the three neighbourhood groups (i.e., LIN, MIN and HIN). The results show that there was a statistically significant difference in Rental value depending on neighbourhood group; with $X^2 = 367.99$ and a $p = 0.000$.

The results of the Kruskal-Wallis H Test shows that the mean ranks for LIN, MIN and HIN are 121, 246 and 401 respectively (see table 5.2). These results suggests that the rental values in MIN are generally higher than rental values in LIN; and rental values in HIN are also generally higher than rental values in MIN.

Table 5.2: Results of omnibus test – spatial segmentation

| | | **Low income neighbourhood** | **Middle income neighbourhood** | **High income neigbourhood** |
|---|---|---|---|---|
| Rent paid per month (USD) | > Median | 12 | 22 | 232 |
| | ≤ Median | 199 | 55 | 16 |
| | | | | |
| | N | 211 | 77 | 248 |
| | Mean Rank | 120.57 | 245.95 | 401.36 |
| *Test statistics* | | | | |
| N | 536 | | | |
| Mean | 1450.25 | | | |
| Median | 340.91 | | | |
| Std. Deviation | 1692.62 | | | |
| Minimum rent | 8 | | | |
| Maximum rent | 7091 | | | |
| Chi-Square | 367.99 | | | |
| Kruskal Wallis H | 376.82 | | | |
| df | 2 | | | |
| Asymp. Sig. | .000 | | | |

Source: Fieldwork 2017

Decision – The chi-square of 367.99 is less than the H-statistic of 376.82 and the *p*-value (α) is less than the significance level of 0.05. The probability associated with the occurrence under the $H_o$ of a value as large as H = 376.82, df = 2 is $p < 0.05$. This means that we reject the null hypothesis and conclude that

not all mean ranks are equal. It can therefore be concluded that there are differences in rental values based on the three neighbourhood groups (spatial segmentation exists).

In order to further understand the results we compute the effects size estimate. The formula is given as;

$$\textit{Effects size estimate} = \frac{\text{Chi-square}}{N - 1} \quad (5.2)$$

$$= \frac{367.92}{536 - 1} = 0.6878$$

The results of the effects size estimate suggests a high effects size, and that about 68% of the variability in rental value was accounted for by the neighbourhood class or by a spatial segmentation of the residential rental market. This further suggests that depending on the location of the house (i.e., in either of the neighbourhood classes), one is likely to pay more rent or otherwise.

The above results indicate that the H statistic is statistically significant, which further suggests that at least one of the neighbourhood groups is different from the others. The omnibus test does not indicate where these differences occur, whether these differences are statistically significant, or how many of these groups differ actually. The next procedure, "multiple comparisons between groups" (also known as *post hoc* analysis or the specific comparison testing), uses pair-wise multiple comparisons to identify the source of the differences. This procedure tests the null hypothesis that some groups *a* and *b* are the same and the alternate hypothesis that some groups are different (i.e. $H_o$: $\theta_a = \theta_b$; and $H_1$: $\theta_a \neq \theta_b$). This is tested at $\alpha = 0.05$. The null hypothesis is rejected when above conditions for rejection are observed.

### 5.4.3. Post hoc analysis (specific comparison testing)

To further determine where the differences occur among the neighbourhoods, the multiple pair-wise comparisons to test the null hypothesis are computed. Rental values among (a) *LIN and MIN;* (b) *LIN and HIN;* and (c) *MIN and HIN* are compared.

**(a) Low income and middle income neighbourhoods**

Table 5.3: Results of post hoc analysis – LIN and MIN

| | | **Low income neighbourhood** | **Middle income neighbourhood** |
|---|---|---|---|
| Rent paid per month (USD) | > Median | 62 | 74 |
| | ≤ Median | 149 | 3 |
| | | | |
| | N | 211 | 77 |
| | Mean Rank | 116.00 | 222.60 |
| *Test statistics* | | | |
| N | 288 | | |
| Mean | 254.80 | | |
| Median | 56.82 | | |
| Std. Deviation | 624.67 | | |
| Minimum rent | 8 | | |
| Maximum rent | 5535 | | |
| Chi-Square | 100.76/ 98.10* | **Yates' Continuity correction Chi-square* | |
| Kruskal Wallis H | 92.59 | | |
| df | 1 | | |
| Asymp. Sig. | .000 | | |

Source: Fieldwork data 2017

The sample used for the analysis has 288 rental values obtained from two neighbourhood classes (i.e. LIN and MIN). Specifically LIN had a sample size of 211 and MIN with a sample size of 77 (table 5.3).

A *post hoc* Kruskal-Wallis H Test was conducted to determine if rental values were significantly different between these two neighbourhood groups. The results show that there was a statistically significant difference in rental value depending on neighbourhood group based on $p = 0.000$ and $X^2 = 100.76$. The results of the Kruskal-Wallis *H* Test shows that the mean ranks for LIN and MIN are 116.00 and 222.60 respectively. This means that the rents in MIN are higher than rents in LIN.

The chi-square of 100.76 is more than the H-statistic of 92.59 and the *p*-value (α) is less than the significance level of 0.05. Based on the decision rule, we accept the null hypothesis and conclude that there are no real differences between LIN and MIN rental values. And that the significant differences between rental values among neighbourhoods is not within this group.

In order to further analyse the results we compute the effects size estimate as provided in formula (5.2). This is computed as; 100.76 / (288 – 1) = 0.3511. The results of the effects size estimate suggests a low effects size, and that about 35% of the variability in Rental value was accounted for by the neighbourhood class or location.

**(b) Low income and high income neighbourhoods**

The sample used for the analysis has 459 rental values; specifically LIN had a sample size of 211 and HIN with a sample size of 248 (table 5.4).

The results of a *post hoc* Kruskal-Wallis H Test conducted show that there was a statistically significant difference in rental value depending on neighbourhood group based on $p = 0.000$ and $X^2 = 346.36$. The results of the Kruskal-Wallis H Test shows that the mean ranks for low income and high income neighbourhoods are 110.58 and 331.61 respectively. This means that the rents in HIN are higher than rents in LIN.

The chi-square of 346.36 is more than the H-statistic of 316.77 and the *p*-value (α) is less than the significance level of 0.05. Based on the decision rule, we accept the null hypothesis and conclude that there is not enough evidence to suggest that all mean ranks are unequal. And that the significant differences in rental values we aim to identify is not within this group.

Table 5.4: Results of post hoc analysis – LIN and HIN

| | | **Low income neighbourhood** | **High income neighbourhood** |
|---|---|---|---|
| Rent paid per month (USD) | > Median | 5 | 222 |
| | ≤ Median | 206 | 26 |
| | | | |
| | N | 211 | 248 |
| | Mean Rank | 110.58 | 331.61 |
| *Test statistics* | | | |
| N | 459 | | |
| Mean | 159.73 | | |
| Median | 1200.00 | | |
| Std. Deviation | 1746.77 | | |
| Minimum rent | 8 | | |
| Maximum rent | 7091 | | |
| Chi-Square | 346.36 | | |
| Kruskal Wallis H | 316.77 | | |
| df | 1 | | |
| Asymp. Sig. | .000 | | |

Source: Fieldwork data 2017

The effects size estimate, given as; 346.36 / (459 – 1) = 0.7562. The results of the effects size estimate suggests a high effects size, and that about 76% of the variability in Rental value was accounted for by the neighbourhood class or location. This further suggests that depending on the location of the house within those two neighbourhoods, rental values will differ.

**(c) Middle income and high income neighbourhoods**

The sample used for the analysis has 325 rental values obtained from two neighbourhood classes. MIN had a sample size of 77 and HIN with a sample size of 248 (table 5.5).
A post hoc Kruskal-Wallis H Test conducted show that there was a statistically significant difference in Rental value depending on neighbourhood group based on $p = 0.000$ and $X^2(2) = 75.86$. The results show that the mean ranks for MIN and HIN are 62.35 and 194.25 respectively. This means that the rents in HIN are higher than rents in MIN.

Table 5.5: Results of post hoc analysis – MIN and HIN

| | | **Middle income neighbourhood** | **High income neighbourhood** |
|---|---|---|---|
| Rent paid per month (USD) | > Median | 5 | 157 |
| | ≤ Median | 72 | 91 |
| | | | |
| | N | 77 | 248 |
| | Mean Rank | 62.35 | 194.25 |
| *Test statistics* | | | |
| N | 325 | | |
| Mean | 2306.93 | | |
| Median | 2393.18 | | |
| Std. Deviation | 1663.44 | | |
| Minimum rent | 14 | | |
| Maximum rent | 7091 | | |
| Chi-Square | 75.86/ 73.61* | **Yates' Continuity correction Chi-square* | |
| Kruskal Wallis H | 115.91 | | |
| df | 1 | | |
| Asymp. Sig. | .000 | | |

Source: Fieldwork data 2017

The chi-square of 75.86 is less than the H-statistic of 115.91 and the p-value (α) is less than the significance level of 0.05. Based on the decision rule, we reject the null hypothesis that the mean ranks are equal. It is concluded that there exists statistically significant differences between rental values in middle and high income areas. In other words the submarkets that show marked differences in rental values exists only between these two neighbourhood classes.

The effects size estimate was computed as follows; 75.86 / (325 – 1) = 0.2341. The results of the effects size estimate suggests a low effects size, and that about 23% of the variability in Rental value was accounted for by the neighbourhood class or location.

## 5.5. Determining submarket existence based on structural segmentation of the rental housing market

### 5.5.1. Evidence from empirical study

Based on the analysis of the data available and assumptions underlying the use of the H test, it was concluded that the data can be analysed using the Kruskal-Wallis H Test. The dependent variable used is a continuous level; Rent per month in US Dollars. The independent variable (i.e., submarket) to be analysed is the variable "*Real Estate Type*". This is categorized into (i) "Single Room - SR"; (ii) "Chamber and Hall" - HC and (iii) "Apartment, Flat, House and Town House" - AFTH. Based on assumption 4 as explained earlier, the data does not assume a normal distribution as can be seen in the box plots (figure 5.3).

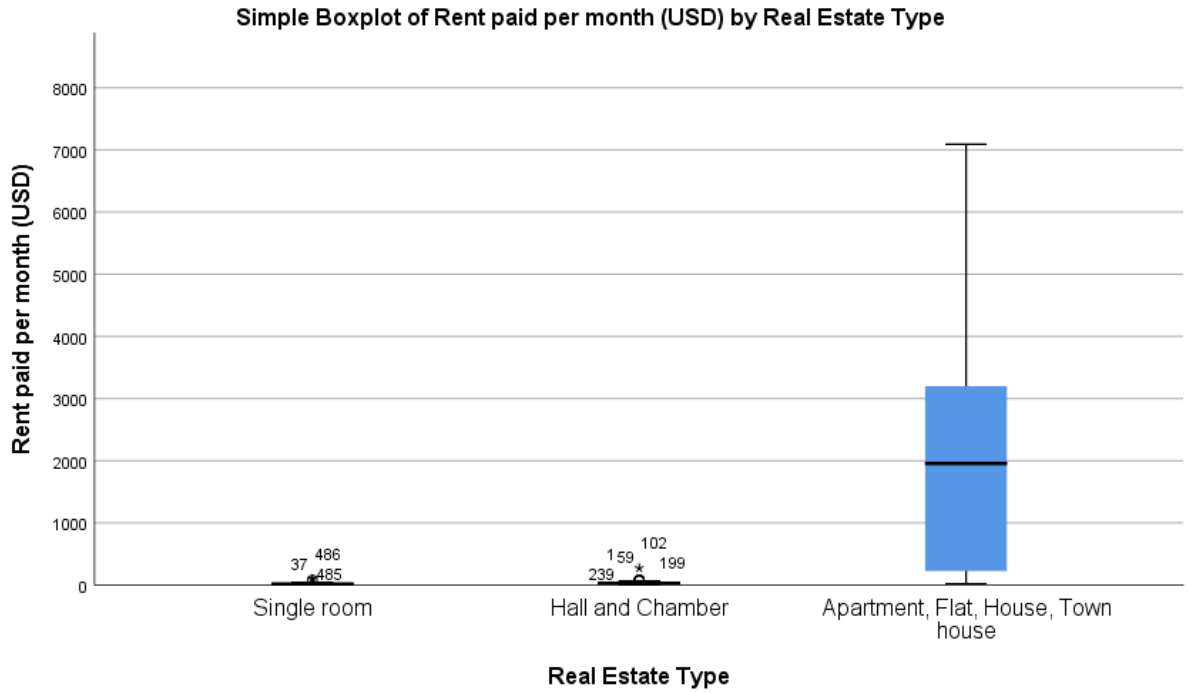



Figure 5.3: Box plots of rent differentiated by structural segmentation of the market

Source: Fieldwork data 2017

By structural segmentation of the market, submarkets are identified based on type of real estate. The underlying reason for this segmentation is that, separate submarkets may exist for residential rental housing based on the type of real estate. In this research three broad groupings are identified based on information from major stakeholders in the market and also through market observation. It is assumed that the market for residential rental housing is segmented *a priori.*

An omnibus test to determine whether there are significant differences in rental values based on real estate type is first analysed. When results suggest that there are indeed significant differences, then a *post hoc* analysis to determine where specifically the difference(s) occur are also identified through pairwise comparisons.

### 5.5.2. Omnibus test (structural submarkets)

*Null hypothesis* – $H_o$: there is no difference in median residential rental values based on a structural segmentation of the market. $H_1$: median residential rental values differ and are not equal based on structural segmentation of the market.

*Statistical test* – since all three structural segments are independent, using the statistical test for *k* independent samples is appropriate. Rental values used for this computation are measured in US Dollars per month.

*Significance level* – let $\alpha = 0.05$ and N = 536 = total number of rental units under study.
*Sampling distribution* – from formula (5.1) as computed, *H* is distributed approximately as a chi-square with $df = k - 1$. As such the probability associated with the occurrence under the $H_o$ of values as large as an observed value of *H* will be determined by comparison with the $X^2$.

*Rejection region* – The region of rejection consists of all values of *H* which are so large that the probability associated with their occurrence under $H_o$ for $[df = 2] \leq \alpha = 0.05$.

The results of the Kruskal-Wallis *H* omnibus test based on a structural segmentation of the rental market are presented in table 5.6.

Table 5.6: Results of omnibus test – structural segmentation

| | | Single room | Hall and chamber | Apartment, Flat, House and Town House |
|---|---|---|---|---|
| Rent paid per month (USD) | > Median | 0 | 0 | 266 |
| | ≤ Median | 73 | 85 | 112 |
| | | | | |
| | N | 73 | 85 | 378 |
| | Mean Rank | 61.47 | 102.05 | 345.91 |

| *Test statistics* | |
|---|---|
| N | 536 |
| Mean | 1450.25 |
| Median | 340.91 |
| Std. Deviation | 1692.62 |
| Minimum rent | 8 |
| Maximum rent | 7091 |
| Chi-Square | 220.72 |
| Kruskal Wallis H | 323.24 |
| df | 2 |
| Asymp. Sig. | .000 |

Source: Fieldwork data 2017

The data used for this confirmation analysis consists of 536 rental values. SR had a sample size of 73 with a mean rank of 61.47; HC units with a sample size of 85 and a mean rank of 102.05 and AFTH also have a sample size of 378 with a mean rank of 345.91. These mean ranks suggests that the rents in each group are distinct from each other. Rents are generally lowest for the SR grouping, then highest for real estate type AFTH.

A Kruskal-Wallis *H* Test was conducted to determine if Rental Value was significantly different for three real estate types (i.e., SR, HC and AFTH). The results show that there is a statistically significant difference in Rental value depending on the type of real estate; with $X^2 = 220.72$ and a $p = 0.000$.
The effects size estimate of 0.4126 suggests that about 41% of the variability in rental value was accounted for by real estate type. Although this is a low effects size, it suggests that depending on the specific real estate type rental values are likely to be different.

The chi-square of 220.72 is less than the H-statistic of 323.24, and the *p*-value (α) is also less than the significance level of 0.05. By the rule of thumb, the null hypothesis is rejected and that not all mean ranks are equal. It can therefore be concluded that there are significant differences in rental values based on a structural segmentation of the market among the three groups. As discussed earlier, the omnibus test does not show specifically where the differences occur, a post hoc analysis can determine that.

### 5.5.3. Post hoc analysis (specific comparison testing)

The results from the omnibus test showed that there exists a statistically significant difference in rental value depending on real estate type. Multiple pair-wise comparisons are analysed and compared to rental values among the sub-groupings to determine where these differences occur. The specific pairwise comparisons analysed are; (a) SR and HC; (b) SR and AFTH; and (c) HC and AFTH.

**(a) Comparison between "Single Room" and "Chamber and Hall" submarkets**

Table 5.7: Results of post hoc analysis – SR and HC

| | | Single room | Hall and chamber |
|---|---|---|---|
| Rent paid per month (USD) | > Median | 19 | 48 |
| | ≤ Median | 54 | 37 |
| | | | |
| | N | 73 | 85 |
| | Mean Rank | 59.58 | 96.61 |
| *Test statistics* | | | |
| N | 158 | | |
| Mean | 32.18 | | |
| Median | 27.27 | | |
| Std. Deviation | 26.77 | | |
| Minimum rent | 8 | | |
| Maximum rent | 273 | | |
| Chi-Square | 14.90/ 13.68* | **Yates' Continuity correction Chi-Square* | |
| Kruskal Wallis H | 25.91 | | |
| df | 1 | | |
| Asymp. Sig. | .000 | | |

Source: Fieldwork data 2017

The sample size for this analysis consists of 158 rental values. The sample size for SR is 73 and that of HC units is 85. A *post hoc* Kruskal-Wallis H Test analysis was conducted to determine if rental value was significantly different between these two submarket constructs (table 5.7). The results suggests that there is a statistically significant difference in rental value depending on submarkets analysed based on a $p = 0.000$ and $X^2 = 14.90$. The results show that the mean ranks for SR and HC are 59.58 and 96.61 respectively. This suggests that the rental values are higher for HC market than for the SR market.

The chi-square of 14.90 is less than the H-statistic of 25.91 with the significance level of $p$ below 0.05. By this result the null hypothesis is rejected and that not all mean ranks are equal. It can therefore be concluded that there is a statistically significant difference between the submarkets SR and HC; thus rental values differ by these market segmentations. Further, the effects size estimate of 0.0949 suggests that about 9% of the variability in rental value was accounted for by real estate type among these two groups. Although this is a low effects size, it suggests that depending on the specific grouping of real estate type one is likely to pay a different rent.

**(b) Comparison between "Single Room" and "Apartment, Flat, House and Town House" submarkets**

The sample size for this analysis is 451 rental values. The sample size for SR submarket is 73 and that of the AFTH submarket is 378. A *post hoc* Kruskal-Wallis H Test analysis was conducted to determine if rental value was significantly different between these two submarket constructs (table 5.8). The results suggests that there is a statistically significant difference in rental value depending on submarkets analysed based on a $p = 0.000$ and $X^2 = 86.71$. The results show that the mean ranks for SR and AFTH markets are 38.90 and 262.13 respectively. This suggests that the rental values are distinctly higher for AFTH than for the SR market.

The chi-square of 86.71 is less than the H-statistic of 179.59 with the significance level of *p* below 0.05. By this result we reject the null hypothesis and conclude that not all mean ranks are equal. This means that there exists significant differences in rental values based on these submarket constructs. It is therefore concluded that separate submarkets exists for them. Further, the effects size estimate of 0.1927 suggests that about 19% of the variability in rental value was accounted for by real estate type among these two groups. Although this is a low effects size, it suggests that depending on the real estate type rental values are likely to be different.

Table 5.8: Results of post hoc analysis – SR and AFTH

| | | **Single room** | **Apartment, Flat, House and Town House** |
|---|---|---|---|
| Rent paid per month (USD) | > Median | 0 | 225 |
| | ≤ Median | 73 | 153 |
| | | | |
| | N | 73 | 378 |
| | Mean Rank | 38.90 | 262.13 |
| *Test statistics* | | | |
| N | 451 | | |
| Mean | 1716.23 | | |
| Median | 1400 | | |
| Std. Deviation | 1720.13 | | |
| Minimum rent | 8 | | |
| Maximum rent | 7091 | | |
| Chi-Square | 86.71 | | |
| Kruskal Wallis H | 179.59 | | |
| df | 1 | | |
| Asymp. Sig. | .000 | | |

Source: Fieldwork data 2017

**(c) Comparison between "Chamber and Hall" and "Apartment, Flat, House and Town House" markets**

The sample size for this analysis is 463 rental values. The sample size for HC submarket is 85 and that of the AFTH submarket is 378. A *post hoc* Kruskal-Wallis H Test analysis conducted to determine if rental value was significantly different between these two submarket constructs suggest that there is a statistically significant difference in rental value depending on submarkets analysed (table 5.9); based on a $p = 0.000$ and $X^2 = 103.67$. The results show that the mean ranks for HC and AFTH are 48.44 and 273.28 respectively. This suggests that the rental values are distinctly higher for AFTH than for the HC submarket.

The chi-square of 103.67 is less than the H-statistic of 196.07 with the significance level of *p* below 0.05. By this result the null hypothesis is rejected and it can be concluded that not all mean ranks are equal. The results indicate that there exists a statistically significant difference in rental values between these two submarket constructs. Further, the effects size estimate of 0.2244 suggests that about 22% of the variability in rental value was accounted for by real estate type among these two groups. Although this is a low effects size, it suggests that rental values differ among the submarkets analysed.

Table 5.9: Results of post hoc analysis – HC and AFTH

| | | Chamber and Hall | Apartment, Flat, House and Town House |
|---|---|---|---|
| Rent paid per month (USD) | > Median | 0 | 231 |
| | ≤ Median | 85 | 147 |
| | | | |
| | N | 85 | 378 |
| | Mean Rank | 48.44 | 273.28 |

| *Test statistics* | | |
|---|---|---|
| N | 463 | |
| Mean | 1675.09 | |
| Median | 1300 | |
| Std. Deviation | 1716.29 | |
| Minimum rent | 11 | |
| Maximum rent | 7091 | |
| Chi-Square | 103.67/ 101.24* | **Yates' Continuity correction Chi-Square* |
| Kruskal Wallis H | 196.07 | |
| df | 1 | |
| Asymp. Sig. | .000 | |

Source: Fieldwork data 2017

## 5.6. Determining submarket existence based on nested spatial/structural segmentation of the rental housing market – evidence from empirical study

Based on the explanation of submarket formation, we recognise the combined importance of both spatial and structural characteristics when defining submarket constructs. Submarkets are identified by subdividing the study area into low, middle and high income neighbourhoods (LIN, MIN and HIN respectively) and then differentiating between "*single room*" (SR), "*Hall and Chamber*" (HC) and "*Apartment, Flat and Town House*" (AFTH) within each area. By this criteria nine submarkets are identified in Accra's residential rental market (see table 5.10). However based on empirical data available only five of these nested submarkets can be examined. Note however that MIN**.**SR, MIN**.**HC, HIN**.**SR and HIN**.**HC are not part of the analysis because sample data were either below five or data was not available.

Table 5.10: Nested submarkets and definitions

| Submarket | Definition | N |
|---|---|---|
| LIN**.**SR | Single rooms within low income neighbourhoods | 71 |
| LIN**.**HC | Hall and chamber units within low income neighbourhoods | 81 |
| LIN**.**AFTH | Apartment, Flat and Town houses within low income neighbourhoods | 59 |
| MIN**.**SR | Single rooms within middle income neighbourhoods | 0 |
| MIN**.**HC | Hall and chamber units within middle income neighbourhoods | 4 |
| MIN**.**AFTH | Apartment, Flat and Town houses within middle income neighbourhoods | 73 |
| HIN**.**SR | Single rooms within high income neighbourhoods | 2 |
| HIN**.**HC | Hall and chamber units within high income neighbourhoods | 0 |
| HIN**.**AFTH | Apartment, Flat and Town houses within high income neighbourhoods | 246 |

Source: Fieldwork data 2017

Based on assumption 4 as explained earlier, the data does not assume a normal distribution, for all nested submarket groups, as can be seen in the box plot (figure 5.4).

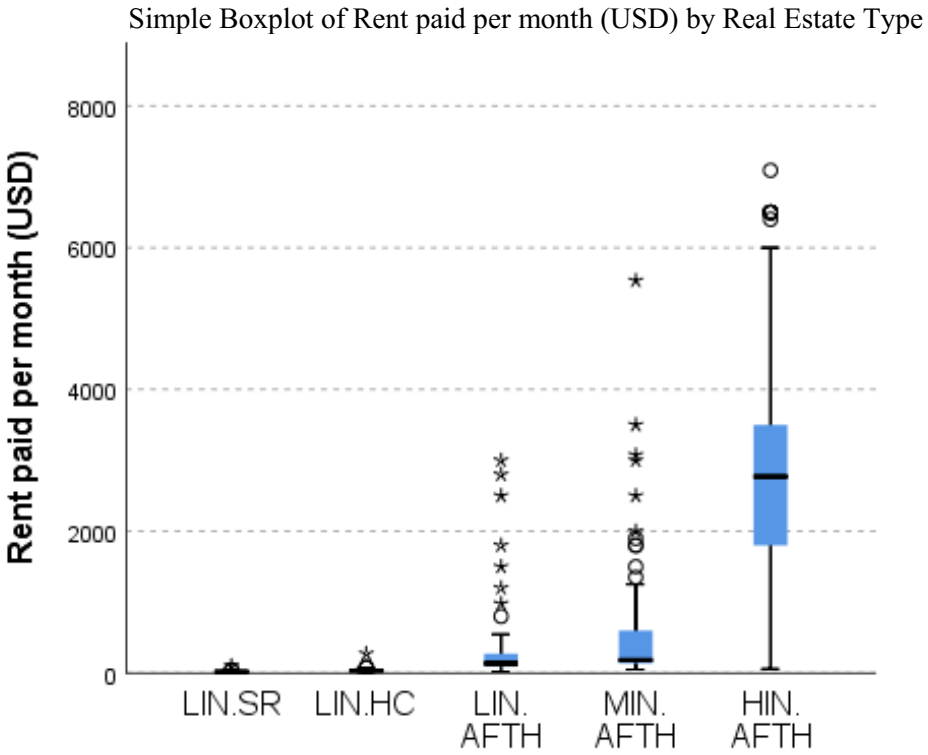



Figure 5.4: Box plots of rent differentiated by nested segmentation of the market

Source: Fieldwork data 2017

The Kruskal-Wallis *H* test is used to empirically analyse whether submarkets do really exist by pairwise comparisons. This combined definition is plausible on the basis that spatial and structural dimensions may combine to determine submarket formation in some cities. Within a particular geographic (spatial) segmentation of the market, there could be a further structural differentiation and vice versa. An attempt is made to replicate the approach by Adair *et al*. (1996) on the nested definition of submarkets.

*Null hypothesis* – $H_o$: there is no difference in median residential rental values based on a nested segmentation of the market. $H_1$: median residential rental values differ and are not all equal based on nested segmentation of the market.

*Statistical test* – the assumption here is that there exists a separate submarket construct for spatial segmentation of the market (i.e. low, middle and high income neighbourhoods) submarket differentiated by real estate type. Just like for the previous analysis, both the omnibus and *post hoc* analysis are computed. The reverse is also implicit, where we assume that there exists separate submarket of each real estate type submarket differentiated by space (i.e., low, middle and high income neighbourhoods). The results of the H test are presented in table 5.11.

*Significance level* – let $\alpha = 0.05$ and $N$ total number of rental units under study.
*Sampling distribution* – from formula (5.1) as computed, $H$ is distributed approximately as a chi-square with $df = k - 1$. As such the probability associated with the occurrence under the $H_o$ of values as large as an observed value of $H$ will be determined by comparison with the $X^2$.

*Rejection region* – The region of rejection consists of all values of $H$ which are so large that the probability associated with their occurrence under $H_o$ for $[df = 2] \leq \alpha = 0.05$.

Table 5.11: Kruskal H test results for nested submarkets

| Nested submarket | N | H test | *Chi square* ($X^2$) | Submarket existence | Comment |
|---|---|---|---|---|---|
| Omnibus test – all 5 nested submarkets | 530 | 415.44* | 379.11 | Yes | $H_0$ rejected |
| LIN.SR with LIN.HC | 152 | 29.48* | 15.66 | Yes | $H_0$ rejected |
| LIN.SR with LIN.AFTH | 130 | 88.84* | 96.57 | No | Not enough evidence |
| LIN.SR with MIN.AFTH | 144 | 106.66* | 128.54 | No | Not enough evidence |
| LIN.SR with HIN.AFTH | 317 | 164.82* | 90.92 | Yes | $H_0$ rejected |
| LIN.HC with LIN.AFTH | 140 | 77.96* | 64.71 | Yes | $H_0$ rejected |
| LIN.HC with MIN.AFTH | 154 | 108.22* | 127.24 | No | Not enough evidence |
| LIN.HC with HIN.AFTH | 327 | 181.16* | 107.01 | Yes | $H_0$ rejected |
| LIN.AFTH with MIN.AFTH | 132 | 6.12* | 1.60 | Yes | $H_0$ rejected |
| LIN.AFTH with HIN.AFTH | 305 | 111.76* | 54.78 | Yes | $H_0$ rejected |
| MIN.AFTH with HIN.AFTH | 319 | 112.07* | 69.99 | Yes | $H_0$ rejected |

Note: * indicates significance level at 5%
Source: Fieldwork data 2017

Since p-value = 0.000 ≤ 0.05 = α, the $H_0$ for the omnibus test is rejected. At α = 0.05 level of significance, there exists enough evidence to conclude that there is a difference in the median rental values (and mean rental values) among the five nested submarkets analysed. The omnibus test suggests that there is the existence of submarkets at least for one of the submarket segments based on the decision rule.

Based on the results of the omnibus test, we proceed to construct multiple pairwise comparisons to test the null hypothesis (table 5.11). For example comparing LIN.SR with LIN.HC show that there is a statistically significant difference between these two submarket constructs. The $X^2$ value of 15.66 is less than the *H* value of 29.48 at a significance p-value less than 5%. Based on the decision rule, the null hypothesis that the median rental values are equal is rejected. In other words there are statistically significant differences between LIN.SR and LIN.HC.

Based on the results from table 5.11 on ten pairwise comparisons, in seven cases the $H_0$ is rejected. However in three cases there is not enough evidence to reject the $H_0$.

In the next section 5.7, we test submarket existence using another nonparametric, the Jonckheere Terpstra test. This is another confirmatory test for submarket existence based on empirical evidence from fieldwork.

## 5.7. The Jonckheere-Terpstra test

The Jonckheere-Terpstra (J-T) test compares and provides significant difference between more than two population medians when they arranged in order. It tests the null hypothesis that the distribution of the response variable does not differ among classes. It is designed to detect alternatives of ordered class differences, which can be expressed as $\tau_1 \leq \tau_2 \leq \cdots \leq \tau_R$ (or $\tau_1 \geq \tau_2 \geq \cdots \geq \tau_R$), with at least one of the inequalities being strict, where $\tau_i$ denotes the effect of class $i$. For such ordered alternatives, the J-T test can be preferable to tests of more general class difference alternatives, such as the Kruskal–Wallis test.

The J-T test statistic is computed as:

$$J = \sum_{1 \leq i < i' \leq R} \sum M_{i,i'} \tag{5.2}$$

This test rejects the null hypothesis of no difference among classes for large values of *J*. Asymptotic p-values for the J-T test are obtained by using the normal approximation for the distribution of the standardized test statistic. The standardized test statistic is computed as:

$$J^* = (J - \mathrm{E}_0(J)) \;/\; \sqrt{\mathrm{var}_0(J)} \tag{5.3}$$

where $\mathrm{E}_0(J)$ and $\mathrm{var}_0(J)$ are the expected value and variance of the test statistic under the null hypothesis,

$$\mathrm{E}_0(J) = \left(n^2 - \sum_i n_{i.}^2\right)/4 \tag{5.4}$$

$$\mathrm{var}_0(J) = A/72 + B/\left(36n(n-1)(n-2)\right) + C/\left(8n(n-1)\right) \tag{5.5}$$

where

$$A = n(n-1)(2n+5) - \sum_i n_{i.}(n_{i.}-1)(2n_{i.}+5) - \sum_j n_{.j}(n_{.j}-1)(2n_{.j}+5) \tag{5.6}$$

$$B = \left(\sum_i n_{i.}(n_{i.}-1)(n_{i.}-2)\right)\left(\sum_j n_{.j}(n_{.j}-1)(n_{.j}-2)\right) \tag{5.7}$$

$$C = \left(\sum_i n_{i.}(n_{i.}-1)\right)\left(\sum_j n_{.j}(n_{.j}-1)\right) \tag{5.8}$$

The data consists of observed rental values across several neighbourhood classes within Accra grouped according to theoretical definitions of submarket classifications (i.e. spatial, structural and nested submarket groups). The spatial and structural submarkets have three subgroups, whereas the nested submarket has five subgroups to be tested. We hope to refute the null hypothesis that within each submarket group, the data is randomly drawn and from the same population.

### 5.7.1. Computation

Let $(X_{s1}, X_{s2}, \ldots, X_{sm}), \ldots, (X_{t1}, X_{t2}, \ldots, X_{tm}), \ldots, (X_{n1}, X_{n2}, \ldots, X_{nm})$ of $k$ samples of rental values $m_1, m_2, \ldots, m_i, \ldots, m_k$, randomly drawn from study area, with continuous cumulative distributions $F_1(X), F_2(X), \ldots, F_i(X), \ldots, F_k(X)$ respectively ordered in such a way that, $F_1(X) < F_2(X) < \ldots, F_i(X) < \ldots, F_k(X)$ for all $X$. We test the hypothesis that $F_i(X) < F_j(X)$ $(i < j)$ for all $X$. We specifically test whether for example

within the spatial submarket, all three subsamples come from the same population, as against the alternative hypothesis that the rental values from subsamples are in an expected order of increasing value. Where *LIN* < *MIN* < *HIN*.

### 5.7.2. Spatial submarket results

Figure 5.4 shows the average rank within the spatial submarket. The results suggests that the average rank of *LIN* is less than *MIN* less than *HIN*. This already shows a difference within the submarkets. The value of standardised test statistics was 82798 with p-value = 0.00. The J-T test findings statistically confirmed that the median count for submarket *LIN* is lesser than *MIN*, which is lesser than *HIN* (table 5.12). The results rejects the null hypothesis that, the distribution of monthly rent is the same across *a priori* spatial submarkets. The results confirm that spatial submarkets exists based on empirical data.

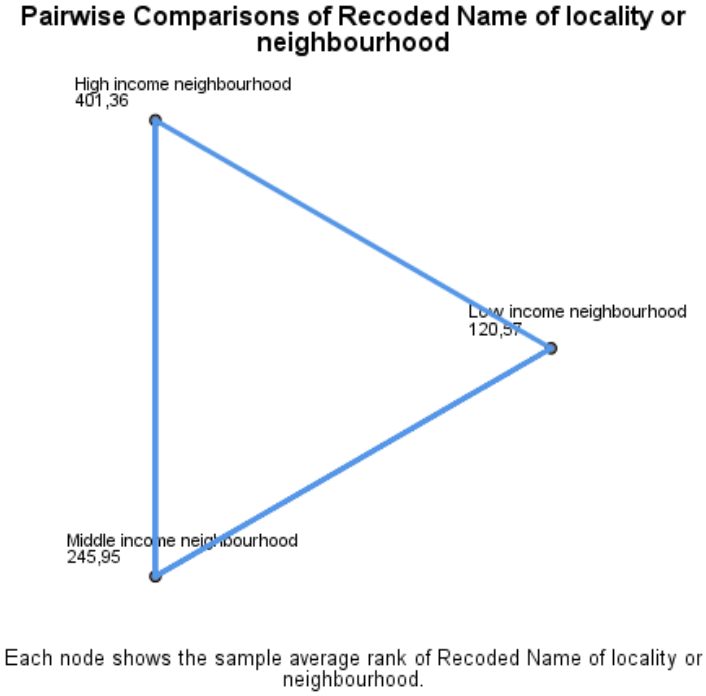



Figure 5.4: Average rank of spatial submarkets

Source: Fieldwork data 2017

Table 5.12: Jonckheere Terpstra test results for spatial submarkets

| Submarket | N | $T_{JT}$ | $z$ | p-value | Submarket existence | Comment |
|---|---|---|---|---|---|---|
| Omnibus test – all 3 spatial submarkets | 536 | 82,798.00 | 20.58 | 0.00 | Yes | $H_0$ rejected |
| LIN with MIN | 288 | 14,137.50 | 9.62 | 0.00 | Yes | $H_0$ rejected |
| LIN with HIN | 459 | 51,362.50 | 17.80 | 0.00 | Yes | $H_0$ rejected |
| MIN with HIN | 325 | 17,298.00 | 10.77 | 0.00 | Yes | $H_0$ rejected |

Source: Fieldwork data 2017

### 5.7.3. Structural submarket results

Figure 5.5 shows the average rank within the structural submarket. The results suggests that the average rank of *SR* is less than *HC* less than *AFTH*. The value of standardised test statistics was 63680 with p-value = 0.00. The J-T test findings statistically confirmed that the median count for submarket *SR* is lesser than *HC*, which is lesser than *AFTH* (table 5.13). Pairwise comparison results rejects the null hypothesis that, the distribution of monthly rent is the same across *a priori* structural submarkets. It can thus be concluded that submarkets exists within the structural submarket based on empirical evidence available.

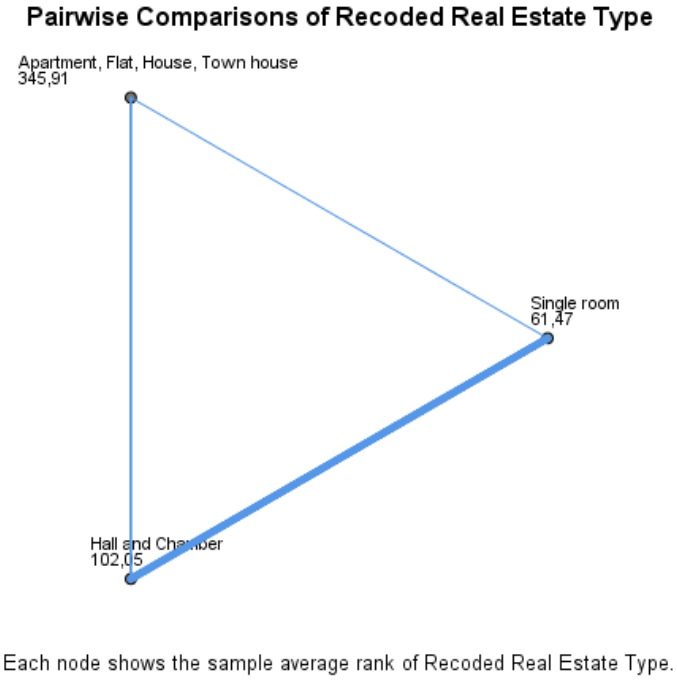



Figure 5.5: Average rank of structural submarkets

Source: Fieldwork data 2017

Table 5.13: Jonckheere Terpstra test results for structural submarkets

| Submarket | N | $T_{JT}$ | $z$ | p-value | Submarket existence | Comment |
|---|---|---|---|---|---|---|
| Omnibus test – all 3 structural submarkets | 536 | 63,680.50 | 18.51 | 0.00 | Yes | $H_0$ rejected |
| SR with HC | 158 | 4,557.00 | 5.09 | 0.00 | Yes | $H_0$ rejected |
| SR with AFTH | 451 | 27,455.50 | 13.40 | 0.00 | Yes | $H_0$ rejected |
| HC with AFTH | 463 | 31,668.00 | 14.00 | 0.00 | Yes | $H_0$ rejected |

Source: Fieldwork data 2017

### 5.7.4. Nested submarket results

Figure 5.6 shows the average rank within the nested submarket. The results suggests that the average rank of *LIN.SR* is less than *LIN.HC*, less than *LIN.AFTH*, less than *MIN.AFTH* and less than *HIN.AFTH*. The value of standardised test statistics was 93960 with p-value = 0.00. The J-T test findings statistically confirmed that the median count for submarket *LIN.SR* is less than *LIN.HC*, less than

*LIN.AFTH*, less than *MIN.AFTH* and less than *HIN.AFTH* (table 5.14). Pairwise comparison results rejects the null hypothesis that, the distribution of monthly rent is the same across *a priori* nested submarkets, apart from between LIN.AFTH and MIN.AFTH (where the $H_1$ is accepted). This rejection of the $H_0$ could be as a result of shared characteristics between AFTHs in LIN and MIN. As has been earlier discussed, properties within the MIN have both formal and informal market characteristics. The data here suggests that these two submarkets may be within the same submarket and should not be separated. It can thus be concluded that submarkets exists within most of the nested submarkets based on empirical evidence available.

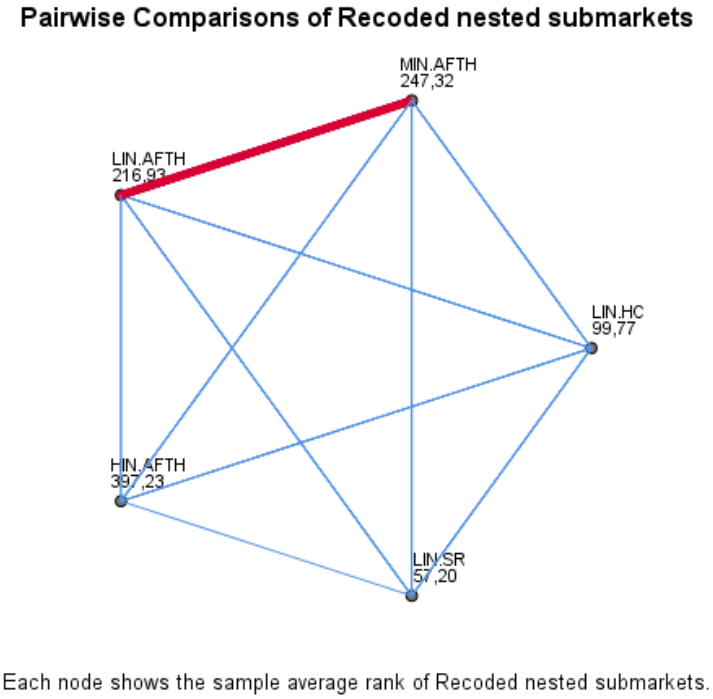



Figure 5.6: Average rank of nested submarkets

Source: Fieldwork data 2017

Table 5.14: Jonckheere Terpstra test results for nested submarkets

| Submarket | N | $T_{JT}$ | $z$ | p-value | Submarket existence | Comment |
|---|---|---|---|---|---|---|
| Omnibus test – all 5 nested submarkets | 530 | 93,960.00 | 22.90 | 0.00 | Yes | $H_0$ rejected |
| LIN.SR with LIN.HC | 152 | 4,340.00 | 5.43 | 0.00 | Yes | $H_0$ rejected |
| LIN.SR with LIN.AFTH | 130 | 4,107.50 | 9.43 | 0.00 | Yes | $H_0$ rejected |
| LIN.SR with MIN.AFTH | 144 | 5,173.50 | 10.33 | 0.00 | Yes | $H_0$ rejected |
| LIN.SR with HIN.AFTH | 317 | 17,462.50 | 12.84 | 0.00 | Yes | $H_0$ rejected |
| LIN.HC with LIN.AFTH | 140 | 4,478.50 | 8.83 | 0.00 | Yes | $H_0$ rejected |
| LIN.HC with MIN.AFTH | 154 | 5,828.50 | 10.40 | 0.00 | Yes | $H_0$ rejected |
| LIN.HC with HIN.AFTH | 327 | 19,891.00 | 13.46 | 0.00 | Yes | $H_0$ rejected |
| LIN.AFTH with MIN.AFTH | 132 | 2,693.50 | 2.47 | 0.07 | No | Not enough evidence |
| LIN.AFTH with HIN.AFTH | 305 | 13,684.50 | 10.57 | 0.00 | Yes | $H_0$ rejected |
| MIN.AFTH with HIN.AFTH | 319 | 16,300.50 | 10.59 | 0.00 | Yes | $H_0$ rejected |

Source: Fieldwork data 2017

## 5.8. Conclusion

Three submarket categorisations were used to analyse the existence of submarkets in the residential rental market using the Kruskal-Wallis One-Way Analysis-of-Variance-by-Ranks Test (or *H* test) and the Jonckheere Terpstra test. The data comprised cross-sectional data of 536 residential rental values from Accra, Ghana's capital.

Based on the results of the Kruskal-Wallis *H* test, it was observed from the analyses that based on spatial segmentation of the rental market there exists statistically significant submarkets based on rental value for only MIN and HIN. The other pairwise comparisons of submarket existence between LIN and MIN, and between LIN and HIN proved not to be statistically significant. This results suggests that when the rental market is segmented based on spatial segmentation, the marked differences in rental value is found mostly among MIN and HIN based on empirical evidence.

Further based on a structural segmentation of the rental market, there exists statistically significant differences between rental values based on all three submarket constructs as analysed (i.e., for *SR, HC* and *AFTH* submarkets). The null hypotheses were rejected for all multiple pair-wise comparisons examined. This further suggests that submarkets exists based on a structural segmentation of the residential rental market. Based on a nested segmentation of the market, seven out of ten pairwise comparisons, tested positive for submarket existence. For the other three, it can be concluded that there is not enough evidence to suggest that submarket exists for those submarket segments.

However, based on the Jonckheere-Terpstra test, it can be concluded that submarkets exists for all submarkets, except between LIN.AFTH and MIN.AFTH. The J-T test is preferred to the Kruskal-Wallis h test as it compares and provides significant difference between more than two population medians when they arranged in order.

Previous studies suggested submarket existence based on several market segmentations (Allen et al., 1995; Anim-Odame et al., 2010a, 2010b; Fletcher et al., 2000; Goodman, 1978; Goodman & Thibodeau, 2007; Schnare & Struyk, 1976; Wheeler et al., 2014; Wu & Sharma, 2012). The empirical results based on the Kruskal-Wallis h test suggest that submarkets exists for a structural segmentation of the market than for a full span of spatial segmentation. More so, the results from the Jonckheere-Terpstra test confirms submarket existence for almost all submarket groupings. These results are further examined using a parametric test (hedonic modelling) to confirm submarket existence. Further research is needed with probably an expanded data set covering the whole region to further examine this phenomenon to make far reaching recommendations.

Knowing whether differential rental values exists for different submarket constructs is important for a number reasons; (i) policy decisions to target differently as factors that determine rental values in the market may vary, (ii) stakeholder investors in the rental space would understand the market dynamics better for profit maximisation, (iii) end users would also be able to maximise utility in deciding where to live – and as such households could benefit from making informed investment decisions on housing, and (iv) the research community would be able to provide timely information on (sub)market dynamics for various stakeholders in the market.

In the next chapter, the phenomenon of incorporating hedonic modelling techniques for the aggregate residential rental market and also at submarket level to determine submarket existence are further tested. This analysis is necessary (i) to further examine the existence of submarkets based on Schnare and Struykt's (1976) recommendation on submarket construction (where coefficients of hedonic models based on submarket constructs are analysed); and (ii) examine the determinants of rental value and the contribution of various factors both at the aggregate market level and also at submarket level. In testing for submarket existence, hedonic price functions are estimated for each potential submarket construct; then a chow test computed to examine whether significant differences exists between submarkets; and lastly a weighted standard error is computed.

# 6. Empirical analysis of submarket existence in Ghana – a Hedonic Pricing Model approach[7]

*"Property markets and business today are dominated by concerns of getting people into boxes; then, once you get people in the box, you want them to think outside the box"*
(The Property Knowledge System, Dr. Stephen Roulac)

[7] This chapter is partly based on the article: (Gavu & Owusu-Ansah, 2019)

Gavu, E. K., & Owusu-Ansah, A. (2019). Empirical analysis of residential submarket conceptualisation in Ghana. *International Journal of Housing Markets and Analysis*. Retrieved from https://doi.org/10.1108/IJHMA-10-2018-0080

## 6.1. Introduction

In this chapter we test for submarket existence based on the hedonic modelling technique, a parametric approach. In chapter 5, we examined the phenomenon using the non-parametric approach (the Kruskal-Wallis H test and the Jonckheere-Terpstra test) with the aim of comparing the methods to understand how submarkets are conceptualised within the Ghanaian housing market. The hypothesis that differential rents exists within submarket constructs has implications on the housing market and provides an understanding of the dynamics of price movements within the market.

An attempt is made to answer the question: *Do submarkets really exist in Ghana's residential rental market?* If they do, how are they conceptualised within the housing market based on empirical evidence?

## 6.2. Modelling approach – the hedonic pricing model (HPM)

Hedonic models will primarily depend on data availability. Data sources to construct and measure this phenomenon is virtually non-existent, especially for the Ghanaian market. In Ghana, residential rental information are larger in terms of transaction volumes, however these are not organised in any repository for researchers to utilise. The appropriate modelling technique to adopt will depend on the nature of the research activity and the volume of data to do same (Owusu-Ansah, 2012b; Sirmans et al., 2005).
Anim-Odame (2010) asserts that real estate values (prices and rent) are important for (1) economic and financial developments, (2) financial analysis and (3) public policy. He further explains that these are major store of wealth and account for household expenditure, contract mortgages and estimate lending risks, as well as determine housing affordability and access among different social groups.

In disaggregating residential rental values, empirical evidence is provided through survey of rental accommodation by comparing spatial, structural and nested submarket constructs. In hedonic modelling, it should also be noted that if data is carefully segmented, the resulting implicit prices will represent prices which theoretically arises from each submarket construct or multiple equilibria (Dale-Johnson, 1982).

Hedonic, etymologically in Greek is "*hedonikos*" which means pleasurable. This method has a greater appeal when heterogenous goods are the subject matter. It must be noted that housing attributes are enjoyed or consumed jointly with location and neighbourhood characteristics that surround them; and this is the conceptual basis upon which the hedonic model is built (thus to identify the economic significance of distinct housing attributes) (Maclennan, 2012). The use of the hedonic method has roots in multiple regression analysis; where independent variables are regressed over a dependent variable. In terms of real estate, rental value may be regressed over structural, location and neighbourhood characteristics to explain implicit contribution of each characteristic on value. The hedonic pricing model (HPM) tends to utilise all available evidence of transactions in order to model the market. The choice of a modelling approach may be described as not a purely technical problem, but rather one of finding the "*best statisctical solution*" that explains the particular market understudy. The selection of the appropriate method is dependent on the market structure, the volume of quality data available, objectives of the study. Based on the foregone arguments, the HPM is appropriate to model this phenomenon better.

The data used for this analysis includes mainly private sector residential rental housing values across three neighbourhood classes. Although such studies are important in order to anlyse and explain rental housing dynamics in a developing economy like Ghana, research has rather been given little attention (Anim-Odame et al., 2010a, 2010b) as earlier discussed.

## 6.3. The model

The hedonic equation in simple terms regresses rent (or price) on housing characteristics. The assumption here is that the determinants of these rents are known;

$$R = f(S, N, L, C, T) \qquad (6.1)$$

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:

$$R = e^{x\beta\varepsilon} \tag{6.2}$$

Equation (2) interprets as:

$$lnR = \mathrm{X}\beta + \varepsilon \tag{6.3}$$

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

$$lnR = \mathrm{X}b + \mathrm{e} \tag{6.4}$$

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:

$$R = e^{xb} \tag{6.5}$$

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:

$$lnR(x_j) = \beta_0 + \sum_{i=1}^{n} \beta_i \ln(x_{ij}) + \sum_{k=1}^{n} \beta_k D_{kj} + \varepsilon \tag{6.6}$$

Where $lnR\ (x_j)$ is the natural logarithm of rent, $\beta_i$ and $\beta_k$ are coefficients, $lnX_{ij}$ are the natural logarithms of continuous independent variables, $D_{kj}$ are dummy variables and $\varepsilon_j$ 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:

$$R = \alpha_1 S^{\beta 1} L^{\beta 2} N^{\beta 3} \tag{6.7}$$

Where R is a vector of rental values; S is a vector of structural characteristics, L is a vector of locational characterisitcs and N is a vector of neighbourhood characteristics. Some variables are dummy which do not transform because the natural logarithm of 0 is not defined. Therefore the model to be estimated is:

$$lnR = \beta_0 + \beta_1 lnS_1 + \beta_2 lnS_2 + \beta_3 lnL_2 + \beta_4 lnN_2 + \varepsilon \tag{6.8}$$

Where $S_1$ is a vector of structural continuous variables; $S_2$ is a vector of structural dummy variables; $L_2$ is a vector of locational dummy variables and; and $N_2$ is a vector of neighbourhood dummy variables and $\varepsilon$ is an error term.

Estimated vectors of coefficients of transformed continuous variables (i.e., $\beta_1$) represent the relative variation of rent after a 1 per cent change in the quality of the characteristic, which represents elasticities. $\beta_2$, $\beta_3$ and $\beta_4$ are semi-elasiticities where $e^{coefficient}$ represents the percentage change in rent after the dummy changes its state (i.e., from 0 to 1 or vice versa). The intercept in this case could be defined as the mean effect of all excluded explanatory variables.

## 6.4. Empirical evidence from the residential rental market of Accra

In this analysis the objective is to examine and identify which variables as per empirical data explains the variations in residential rental value. And then, based on these results, submarket existence or otherwise are explored. The hedonic equation is modelled for the (i) aggregate rental market (city-wide rental housing market); (ii) spatial submarket construct comprising of the three neighbourhood classes, (iii) structural submarket construct comprising three distinct real estate types and (iv) nested approach in which both spatial and structural submarkets coexist.

The data comprises 536 rental values collected during fieldwork in Accra between May and October 2017. This comprises the total number of complete records after records with missing values were removed. The rental value as well as structural, location and neighbourhood characteristics were collected. Variable names and definitions are presented in table 3.19.

### 6.4.1. The aggregate rental market model

For variable inclusion into the aggregate rental market model, we first run a stepwise regression to determine which of the variables are statistically significant at a predetermined α level of 0.05. Stepwise hedonic regression method prevents redundant and insignificant variables from inclusion in the model, and also eliminates the problem of multicollinearity (Eckert, Gloudemans, & Almy, 1990). The aggregate (final) model is accepted based on the highest $R^2$ value and the lowest standard error of estimate (SEE). The adjusted $R^2$ represents the model's goodness of fit to the data based on different data sets from the same population. Out of a total 49 different independent (predictor) variables, 16 of them better explains the data with an ajdusted $R^2$ of 0.919 (see table 6.1). The strongest effect is when rental property is located in a high income area (LOC_3). This is followed by the total floor area of the property (lnAREA). Table 6.2 provides descriptive statistics of the significant variables as used for the aggregate model. Variables maintained and utilised for analysis are those where coefficient estimates are significant at the 1%, 5% and 10% levels of significance.

Table 6.1: Summary results of stepwise regression – aggregate model

| Model | R | $R^2$ | Adjusted $R^2$ | Std. Error of the Estimate |
|---|---|---|---|---|
| a. (Constant), LOC_3 | 0.821 | 0.674 | 0.673 | 1.17159 |
| b. (Constant), LOC_3, LnAREA | 0.924 | 0.854 | 0.854 | 0.78434 |
| c. (Constant), LOC_3, LnAREA, LQual | 0.940 | 0.883 | 0.882 | 0.70277 |
| d. (Constant), LOC_3, LnAREA, LQual, MKT | 0.945 | 0.893 | 0.892 | 0.67455 |
| e. (Constant), LOC_3, LnAREA, LQual, MKT, FEN | 0.948 | 0.899 | 0.897 | 0.65634 |
| f. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO | 0.950 | 0.902 | 0.901 | 0.64430 |
| g. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4 | 0.952 | 0.906 | 0.905 | 0.63310 |
| h. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl | 0.954 | 0.909 | 0.908 | 0.62260 |
| i. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC | 0.954 | 0.911 | 0.909 | 0.61706 |
| j. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC, LOC_2 | 0.955 | 0.913 | 0.911 | 0.61144 |
| k. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC, LOC_2, CBD | 0.956 | 0.914 | 0.912 | 0.60683 |
| l. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC, LOC_2, CBD, BUS | 0.957 | 0.916 | 0.914 | 0.60178 |
| m. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC, LOC_2, CBD, BUS, LnBATH | 0.958 | 0.918 | 0.915 | 0.59641 |
| n. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC, LOC_2, CBD, BUS, LnBATH, RET_1 | 0.959 | 0.919 | 0.917 | 0.59163 |
| o. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC, LOC_2, CBD, BUS, LnBATH, RET_1, TBATH_2 | 0.959 | 0.921 | 0.918 | 0.58642 |
| p. (Constant), LOC_3, LnAREA, LQual, MKT, FEN, STO, FLO_4, LnNoFl, REC, LOC_2, CBD, BUS, LnBATH, RET_1, TBATH_2 , CQual | 0.960 | 0.922 | 0.919 | 0.58174 |

Source: Fieldwork data 2017

Table 6.2: Descriptive statistics for residential rental data for Accra (aggregate rental market)

| Variables | Minimum | Maximum | Mean | Std. deviation |
|---|---|---|---|---|
| RENT (usd) | 8 | 7091 | 1450.25 | 1692.6210 |
| lnRENT | 2.07 | 8.87 | 5.8724 | 2.0975 |
| LOC_3 | 0 | 1 | 0.46 | 0.4990 |
| AREA (sqm) | 9 | 652 | 13.32 | 108.1700 |
| lnAREA | 2.25 | 6.84 | 4.5108 | 0.9525 |
| LQual | 0 | 1 | 0.57 | 0.4950 |
| MKT | 0 | 1 | 0.83 | 0.3790 |
| FEN | 0 | 1 | 0.75 | 0.4360 |
| STO | 0 | 1 | 0.48 | 0.5000 |
| FLO_4 | 0 | 1 | 0.69 | 0.4610 |
| NoFl | 1 | 19 | 1.46 | 1,2050 |
| lnNoFl | 0 | 2.94 | 0.239 | 0.4464 |
| REC | 0 | 1 | 0.41 | 0.4920 |
| LOC_2 | 0 | 1 | 0.14 | 0.3510 |
| CBD | 0 | 1 | 0.12 | 0.3200 |
| BUS | 0 | 1 | 0.96 | 0.1850 |
| BATH | 0 | 10 | 2.24 | 1.2810 |
| lnBATH | 0 | 2.3 | 0.6562 | 0.5568 |
| RET_1 | 0 | 1 | 0.14 | 0.3430 |
| TBATH_2 | 0 | 1 | 0.81 | 0.3930 |
| CQual | 0 | 1 | 0.98 | 0.1420 |
| | | | N = 536 | |

Source: Fieldwork data 2017

We estimate a market-wide residential rental market model based on equation 6.8 above. To capture non-linearity, continuous variables are expressed as natural logarithms (Colwell, 1990). The aggregate model is presented in table 6.3 and this is fairly consistent with similar results presented in the literature (see Anim-Odame et al., 2010a, 2010b). The explanatory power of the model also compares well with other models of the Ghanaian market (*ibid*).

Continuous variables are transformed and enter the model equation as natural logarithms and the other variables are entered as dichotomous dummies that indicate whether a particular variable is present or not. For instance, *FEN* takes a value of 1 if fence wall is available and 0 if otherwise. The variable, *lnAREA*, represents the natural logarithm of the total floor area of the rental accommodation.

From table 6.3, estimated vectors of coefficients of transformed continuous variables represent the relative variation of rent after a 1 *per cent* change in the quality of the characteristic. Dichotomous variables represent the percentage change in rent after the dummy changes its state (i.e. from 0 to 1 or *vice versa*). The intercept in this case could be defined as the mean effect of all excluded explanatory variables.

Table 6.3: Hedonic price estimate for Accra (aggregate rental market)

| Variables | Coefficients | t-values |
|---|---|---|
| Constant | 0.272 | 0.786 |
| LOC_3 | 1.530 | 15.428* |
| lnAREA | 0.401 | 6.002* |
| LQual | 0.677 | 7.410* |
| 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 | 0.340 | 3.349* |
| CBD | 0.332 | 3.723* |
| BUS | 0.530 | 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 3.19 (includes all variables collected during fieldwork).

Source: Fieldwork data 2017

### 6.4.2. Number of bedrooms not included in model

It will be realised from coefficient estimates that the number bedrooms is not significant even at the 10% level of significance. Although this appears to be a deviation from modelling results from other researchers on the Ghanaian housing market (Anim-Odame et al., 2010a, 2010b; Owusu-Ansah, 2012a, 2018; Owusu-Ansah et al., 2017, 2018), we provide empirical evidence to support this trend realised.

In the Ghanaian literature, the number of bedrooms is perceived to be an important factor to consider when analyzing the determinants of rental value. In this research, we did not find that based on the empirical evidence. Further analyses were conducted to confirm that such a critical variable (such as number of bedrooms) to the model was not omitted. Dummy variables were created for properties with one bedroom (BRM 1), two bedrooms (BRM 2), three bedrooms (BRM 3) and four and above (BRM 4 – 10). In all "BRM 1", "BRM 2", "BRM 3" and "BRM 4 – 10" had 201, 100, 133 and 99 rental data samples respectively.

First, the natural logarithms of the "number of bedrooms" were utilised in the aggregate model as dummy variables; the result of the stepwise regression showed no statistical significance even at a 10 *per cent* level of significance (using all variables as shown in table 3.19), as shown in table 6.4. The table shows the coefficients, the *t* values, significance level among others. It could be observed the level of significance ranged from 0.12 to 0.96, which are above the acceptable treshold.

Table 6.4: Results of stepwise regression (with number of bedrooms as dummy)

| | ß ln | t | Sig. | Partial correlation | Tolerance | VIF | Min. Tolerance |
|---|---|---|---|---|---|---|---|
| BRM 1 | -0.039 | -1.548 | 0.122 | -0.070 | 0.243 | 4.108 | 0.153 |
| BRM 2 | 0.011 | 0.805 | 0.421 | 0.036 | 0.836 | 1.197 | 0.171 |
| BRM 3 | 0.002 | 0.144 | 0.885 | 0.006 | 0.802 | 1.246 | 0.171 |
| BRM 4 – 10 | 0.001 | 0.053 | 0.958 | 0.002 | 0.507 | 1.973 | 0.161 |

Source: Fieldwork data 2017

Next was to omit some variables deemed insignificant in the previous analysis, to test how robust the coefficients perform. We omit "*type of WC*", "*type of bath*", "*type of kitchen*", and "*electricity available*". All other variables are included in the model. Table 6.5 shows the results of BRMs (in the stepwise regression). All other results are still the same as reported in the aggregate model (see table 6.3).

Table 6.5: Results of stepwise regression (with number of bedrooms as dummy, and 4 omitted variables)

| | ß ln | t | Sig. | Partial correlation | Tolerance | VIF | Min. Tolerance |
|---|---|---|---|---|---|---|---|
| BRM 1 | -0.031 | -1.130 | 0.259 | -0.051 | 0.208 | 4.806 | 0.161 |
| BRM 2 | 0.03 | 0.179 | 0.858 | 0.008 | 0.751 | 1.331 | 0.165 |
| BRM 3 | 0.002 | 0.148 | 0.883 | 0.007 | 0.803 | 1.246 | 0.170 |
| BRM 4 – 10 | 0.008 | 0.447 | 0.655 | 0.020 | 0.499 | 2.006 | 0.155 |
| CQual | 0.018 | 0.951 | 0.342 | 0.043 | 0.468 | 2.135 | 0.171 |

Source: Fieldwork data 2017

When natural logarithm of the "AREA" (lnAREA) and the squared natural logarithm of "AREA" (lnAREAsq) are together utilised as independent variables in the aggregate model, only (lnAREAsq) was statistically significant (see table 6.6). All other results remain unchanged as reported earlier in table 6.3.

Table 6.6: Results of stepwise regression (using lnAREA and lnAREAsq)

| | Unstandardised ß | Coefficients standard error | Standardised coefficients Beta | t | Sig. | Tolerance | VIF |
|---|---|---|---|---|---|---|---|
| lnAREAsq | 0.200 | 0.033 | 0.182 | 6.002 | 0.000 | 0.172 | 5.817 |
| | | | | | | | |

Source: Fieldwork data 2017

The reason why the number of bedrooms was not statistically significant in these analyses as compared to similar local context Ghanaian models could be that, the "size of the rental unit" might be a better indicator of size than "number of bedrooms".

We adopt the most common procedure for testing submarket existence at a single point in time (Dale-Johnson, 1982; Schnare & Struyk, 1976; Watkins, 2001). To determine the existence of submarkets involves these processes. Firstly, the hedonic price function for each of the potential submarket constructs are estimated, so that standardised comparison can be undertaken. Next, a chow test is computed to determine whether by pairwise comparisons, significant differences exist between hedonic estimates of potential submarkets. Then lastly, a weighted standard error is computed to test the significance of price differentials for standardised rental housing in these potential submarkets. This procedure has the potential to test the accuracy of computed models when different submarket

definitions are utilised. These steps are repeated for identified submarkets within the spatial, structural and nested submarkets. The basis for this procedure is grounded in the assumptions that (1) *" ... all dwellings within a submarket are relatively close substitutes and are within the same market*, and (2) *"... if differential prices exists then there is good reason to believe that ... these operate in different submarkets"* (Watkins 2001 p.2241). The hedonic modelling results show that the explanatory and predictive power of the models have improved when separate models are estimated for some submarkets, but have not improved for some others.

### 6.4.3. The Spatial submarket models

In this section we discuss and examine spatial submarket constructs based on *a priori* classification of the rental market. We differentiate between "*low income neighbourhoods*" (LIN); "*middle income neighbourhoods*" (MIN) and "*high income neighbourhoods*" (HIN). Spatial markets are defined by grouping contiguous residential neighbourhood income classes together, i.e. low, middle and high income areas. For example, all low income areas within the study area are presumed to be in the same submarket, although these areas may not fall within one spatial location. Real estate agents in Ghana, are predominantly of the opinion that depending on which neighbourhood class a property is located, it commands a particular rental value within the market. This definition is also consistent with similar studies that segmented the market based on income groupings.

A summary of regression results for *a priori* spatial submarkets is presented in table 6.7. Coefficients are relatively not important when explaining and testing for submarket existence (Dale-Johnson, 1982; Watkins, 2001). We therefore highlight significant variables variables for each of the submarkets. Explanatory power of variables for the three models have adjusted $R^2$ values ranging from 0.50 to 0.82. With the exception of *MIN*, *LIN* and *HIN* produce high explanatory power of the model. This could reflect the high number of transactions for this market in dataset used. The results of the chow test in table 6.8 suggests that submarkets exists and are statistically different from each other at a 1% level of significance.

Table 6.7: Regression results for *a priori* spatial submarkets

| A priori submarkets | N | Adjusted $R^2$ | F-statistic | Significant variables | Number of variables |
|---|---|---|---|---|---|
| LIN | 211 | 0.823 | 70.013 | lnAREA*, MKT*, STO*, FLO_4* lnNoFl*, REC*, CBD*, lnBATH*, RET_1*, TBATH_2*, CQual* | 11 |
| MIN | 77 | 0.496 | 7.072 | LQual**, lnNoFl**, REC**, lnBATH***, BUS* | 5 |
| HIN | 248 | 0.781 | 74.378 | CONSTANT*, lnAREA***, LQual*, MKT*, FEN*, STO*, lnNoFl***, REC*, CBD**, lnBATH*, RET_1* | 11 |

Note: variables included where coefficient estimates are significant at 1% (*), 5% (**) and 10% (***) levels of significance.

Source: Fieldwork data 2017

Table 6.8: *F*-test results for *a priori* spatial submarkets

| Pooled segments | Chow |
|---|---|
| LIN with MIN | 3.93* |
| LIN with HIN | 35.17* |
| MIN with HIN | 17.38* |

Note: * indicates significance level at 1%

Source: Fieldwork data 2017

The chow test results show that price differs among the housing submarkets analysed. This suggests and gives empirical credence to the theoretical assumptions of the existence of spatial submarkets, and that implicit rental prices are not constant across the rental market in Accra. Based on these conclusions we state that the appropriate number of spatial submarkets may be three.

### 6.4.4. The Structural submarket models

In this section submarkets are defined based on the structural characteristics of the rental accommodation based on type. In the analysis that follow we differentiate between "*Single Room*" (SR); "*Chamber and Hall*" (HC) and "*Apartment, Flat, House and Town House*" (AFTH). The significant variables in each of the market segments are summarised in table 6.9.

The explanatory power of structural equations is high for the AFTH submarket with an adjusted $R^2$ of 0.84; where as the SR and HC submarkets have adjusted $R^2$ of 0.47 and 0.39 respectively. The results suggests that there could be no distinct differences between SR and HC segments but only a unique segment for AFTH. The results of the chow test (table 6.10) confirms this assertion by showing that there is no statistically significant difference between SR and HC submarkets (at an α of 10% level). The chow test further shows that differences only exist when 'SR with AFTH' and 'HC with AFTH' are compared.

Table 6.9: Regression results for dwelling-type (structural) submarket models

| A priori submarkets | N | Adjusted $R^2$ | F-statistic | Significant variables | Number of variables |
|---|---|---|---|---|---|
| SR | 73 | 0.474 | 6.810 | CONSTANT*, lnAREA*, FEN**, TBATH_2*, CQual***, LOC_3*** | 6 |
| HC | 85 | 0.393 | 5.936 | lnAREA*, MKT**, FLO_4***, lnNoFl**, lnBATH***, TBATH_2***, CQual*, LOC_2*** | 8 |
| AFTH | 378 | 0.836 | 127.967 | lnAREA*, LQual*, MKT*, FEN*, STO**, FLO_4***, lnNoFL*, REC*, CBD*, BUS*, lnBATH*, CQual***, LOC_2*, LOC_3* | 14 |

Note: variables included where coefficient estimates are significant at 1% (*), 5% (**) and 10% (***) levels of significance.

Source: Fieldwork data 2017

Table 6.10: *F*-test results for dwelling-type (structural) submarkets

| Pooled segments | Chow |
|---|---|
| SR with HC | 1.64 |
| SR with AFTH | 4.31* |
| HC with AFTH | 3.12* |

Note: * indicates significance level at 1%
Source: Fieldwork data 2017

### 6.4.5. The Nested submarket models

In this section, the possibility that submarket constructs may have both spatial and structural dimensions are tested (see chapter 5 for detailed discussion and definitions). Here we test whether within each spatial dimension of submarket construct, a differentiation based on structural dimension was plausible. A distinction is made between "*Single Room*" (SR); "*Chamber and Hall*" (HC) and "*Apartment, Flat, House and Town House*" (AFTH) for "*low income neighbourhoods*" (LIN); "*middle income neighbourhoods*" (MIN) and "*high income neighbourhoods*" (HIN). It should be noted that due to data availability MIN and HIN are only differentiated by AFTH because the data for MIN**.**SR, HIN**.**SR, MIN**.**HC and HIN**.**HC are either too small or not available. Based on the rental market outlook of Accra, the sample is consistent with actual happenings in the market. This is because MIN and HIN are mostly dominated by AFTH, while there is a good mix of structural differentiation of properties within LIN.

Based on this nested definition of submarket classification, SR, HC and AFTH within each neighbourhood income class are treated as separate submarkets. This produces a total of five submarkets. For example LIN**.**SR represents all single room accommodation in low income areas. The results for the regressions are presented in table 6.11. In terms of the explanatory power, the nested submarket equations range from 0.35 for LIN**.**SR to 0.81, for LIN**.**AFTH equations.

The chow test results in table 6.12 suggests that submarket do exist for nested submarkets at various significant levels. In other words the null hypothesis of similarity between coefficients of the regressions at the α of 1% and 5% levels (for most of the submarket constructs) are rejected, and that meaningful market segments or multiple equillibria exists. The results also suggest there is evidence of non-substitutability between dwelling types nested definitions of submarket constructs.

Table 6.11: Regression results for nested submarket models

| A priori submarkets | N | Adjusted $R^2$ | F-statistic | Significant variables | Number of variables |
|---|---|---|---|---|---|
| LIN**.**SR | 71 | 0.349 | 4.695 | CONSTANT*, lnAREA*, TBATH_2*, CQual*** | 4 |
| LIN**.**HC | 81 | 0.507 | 9.235 | lnAREA*, MKT**, FLO_4**, lnNoFl**, lnBATH**, TBATH_2***, CQual* | 7 |
| LIN**.**AFTH | 59 | 0.809 | 19.592 | FLO_4***, lnNoFl*, REC**, CBD*, lnBATH*, TBATH_2* | 6 |
| MIN**.**AFTH | 73 | 0.520 | 7.316 | CONSTANT***, LQual**, FEN**, lnNoFl**, REC**, CBD***, BUS*** | 7 |
| HIN**.**AFTH | 246 | 0.753 | 68.760 | CONSTANT*, lnAREA***, LQual*, MKT*, FEN*, STO*, lnNoFl***, REC*, CBD**, lnBATH* | 10 |

Note: variables included where coefficient estimates are significant at 1% (*), 5% (**) and 10% (***) levels of significance.
Source: Fieldwork data 2017

Table 6.12: *F*-test results for nested submarkets

| Pooled segments | Chow |
|---|---|
| LIN.SR with LIN.HC | 2.14** |
| LIN.SR with LIN.AFTH | 7.12* |
| LIN.SR with MIN.AFTH | 2.46** |
| LIN.SR with HIN.AFTH | 24.60* |
| LIN.HC with LIN.AFTH | 1.77*** |
| LIN.HC with MIN.AFTH | 2.25** |
| LIN.HC with HIN.AFTH | 11.37* |
| LIN.AFTH with MIN.AFTH | 3.56* |
| LIN.AFTH with HIN.AFTH | 32.44* |
| MIN.AFTH with HIN.AFTH | 18.29* |

Note: *, ** and ** indicates significance at 1%, 5% and 10% respectively
Source: Fieldwork data 2017

## 6.5. Standard Error of Estimate (SEE) analysis

As mentioned earlier the last step in order to make a determination whether submarkets do exist, is to examine the standard error estimate (SEE) of all the model estimates. This requires that where there are statistically significant differences between submarket constructs, a weighted standard error test is performed to compare the accuracy of the submarket models. It is generally accepted that sumarkets exist when the error associated with submarket level equations is 10 *per cent* more than the error generated by the market wide equation (aggregate model) (Dale-Johnson, 1982; Schnare & Struyk, 1976). Based on this understanding, the percentage in SEE for all submarkets are computed (see table 6.13).

Table 6.13: SEE and percentage change in SEE for submarkets

| Submarkets | SEE | % Δ in SEE |
|---|---|---|
| Aggregate model | 0.5817 | - |
| LIN | 0.4875 | 16.1997 |
| MIN | 0.8666 | **-48.9703** |
| HIN | 0.4040 | 30.5515 |
| SR | 0.3870 | 33.4737 |
| HC | 0.4230 | 27.2837 |
| AFTH | 0.5890 | **-1.2635** |
| LIN.SR | 0.3901 | 32.9408 |
| LIN.HC | 0.3715 | 36.1416 |
| LIN.AFTH | 0.4995 | 14.1421 |
| MIN.AFTH | 0.8037 | **-38.1579** |
| HIN.AFTH | 0.4048 | 30.4122 |

Source: Fieldwork data 2017

As can be observed from table 6.13, eight submarkets (LIN, HIN, SR, HC, LIN.SR, LIN.HC, LIN.AFTH and HIN.AFTH) showed large positive differences between submarket and the market wide model, which suggests significant effects on rental prices. The empirical results generally suggest that the residential rental market is segmented based on spatial, structural and nested categorisations. However, one submarket each from the three submarket groupings had percentage changes below 0, suggesting that submarkets may not exists for those market segments.

Comparing the market wide model to submarket modelling results, it was observed that submarket results yielded substantial reduction in standard error estimates and thus suggests that submarkets do exist in the rental market in Ghana.

## 6.6. Conclusion

This chapter examined Accra's residential rental market (RRM) by testing the empirical existence of submarkets using the Hedonic modelling technique. Due to data paucity and asymmetries, research of this nature are given less attention by researchers. Anecdotal and theoretical evidence suggests that submarkets may exist within Accra's RRM. This chapter fills the literature gap by providing empirical evidence to test submarket existence or otherwise at different scales of market disaggregation using a parametric approach.

Potential residential rental submarkets are selected based on conclusions from literature, discussions with rental market stakeholders and market observations. To test for submarket existence, separate models are computed for each submarket construct, which sample are drawn from the aggregate rental market. The total number of observations for each potential submarket are provided in each analysis.
Based on the hedonic models analysed, the aggregate market model fits very well with the data, with an adjusted $R^2$ of 0.92. Independent variables utilised for regression analysis suggested that multicollinearity was not present. The aggregate model had sixteen independent variables which were highly significant, whereas submarket constructs had fewer significant independent variables. Potential submarkets tested, did show statistically significant attributes (based on the $F$-statistic and $p$-values). All $F$-estimates for the hedonic models are significant at a 1% level. This suggests that the joint effort of the variables are significant. The $F$ test results suggests that the $H_0$ that rental values are equal, is rejected between the submarkets analysed.

Comparison of the standard error of the estimate (SEE) provides the effects on the model improvement. Difference in SEE is more than 10% for eight out of eleven submarkets examined. It can therefore be concluded that these differences have a significant effect on rental prices. It should be noted that MIN, AFTH and MIN.AFTH submarkets have percentage change in SEE below 0, which also suggest that these differences are negligible in terms of overall variation in rental prices. It could thus be concluded that submarkets may not exist for those three submarkets constructs.

The findings generally suggest that, residential rental submarkets do exists and can be defined by spatial, structural and nested segmentation of the market. Based on empirical evidence of submarket existence, structural and nested submarket constructs tend to better explain submarket existence better than spatial constructs. This test provides useful insights to price and value dynamics within Ghana's rental housing market.

Further research could consider stratifying submarkets based on other theoretical definitions (i.e. number of bedrooms, type of floor finish, walled or otherwise) and test the existence of submarkets. This will determine whether the segmentations defined and analysed in this research is robust to be used for generalisations in the rental market in Ghana. The results discussed here however have important implications to support the understanding of the rental housing market dynamics in a developing country context.
It can be concluded that based on empirical results analysed and discussed, submarkets do exist in Accra's Residential Rental Market.

The next chapter builds on the results from chapters 5 and 6 to quantify the effects of location and neighbourhood variables at the aggregate market and submarket levels.

# 7. Detecting and quantifying location and neighbourhood effects from residential rental values at aggregate market and submarket levels

*"All things by a mortal power near or far,*
*hiddenly to each other linked are,*
*that thou canst not stir a flower without the troubling of a star"*
(Francis Thompson, "The Mistress of Version")

## 7.1. Introduction

This chapter focuses on quantifying location and neighbourhood effects on rental values. Various techniques were examined to assess the interrelationships between neighbourhood and location characteristics on one side and residential rental values on the other.

Traditional location theory examines effects of access to central locations. It is thus understood that those paying higher rents are compensated by lower costs of commuting to the Central Business District (CBD). Now as these rents continue to increase (for households who live close to the CBD), households that cannot afford increased rental payments may be 'forced' to move towards locations with inferior access, where rents may be relatively lower. High income areas are expected to have better quality housing, larger room sizes and higher median rental values as compared to other areas (i.e., low income areas).

As the housing market cannot be characterized by a single hedonic function (Goodman & Thibodeau, 1998), there is the need to carefully examine separate influences of various attributes on rental values. Tse (2002 p.1168) posits that, "*effects of different attributes tends to vary across geographical locations"* and thus could vary across submarkets. This research has established and examined the empirical conceptualisation of submarket existence; and can therefore conclude that residential rental submarkets do exist in the rental housing market in Ghana. Tse (*ibid*) further argue that, "*if each neighbourhood [and location] has its own effect, the hedonic model would ideally need a separate indicator for each neighbourhood [and location]*" (p.1168). It is thus assumed that households make rental decisions based on multiple factors within each submarket construct. Based on this underlining assumption, we can then proceed by examining and quantifying location and neighbourhood effects from rental values.

Information on location and neighbourhood characteristics were collected through site observations and field survey. For example quality of property view, nearness to bus stop, construction quality among others. Sample data collected for modelling purposes represents rental market data within three neighbourhood classes as discussed earlier. With most of these characteristics measured, the dummy variable method is used. The condition is classified as good or bad; present or absent; available or not available.

For example in terms of access to transportation (road network), Accra is quite dense at the core and sparse at the fringes. At the core there is always the problem of slow vehicular traffic with no alternative routes. Hence if access to transport is measured by distance or travel time, it may not reflect actual traffic conditions, only a reflection of designed speeds on those roads. Hence a walking distance of 10 minutes to the nearest road is adopted as good access. We safely assume that access is good when a house is less than 10 minutes walking distance to the nearest transportation option.

As has been discussed earlier, it has been demonstrated that instead of considering the residential rental housing market as a unitary model, submarkets have been empirically identified to serve as the analytical framework within which to proceed with the analysis of location and neighbourhood effects. In table 7.1, the results from the two nonparametric and one parametric test are summarised based on chapters 5 and 6. The results suggested that when pairwise comparison of submarkets are analysed, distinct submarkets exist especially based on the J-T test and the hedonic approach.

From the results obtained, it can be concluded that using the Kruskal-Wallis *H* test approach, distinct submarkets exists for pairwise comparisons of submarkets can be identified, save between; LIN and MIN; LIN and HIN; LIN**.**SR and LIN**.**AFTH; LIN.SR and AFTH**.**MIN; and between LIN**.**HC and MIN**.**AFTH. However, based on the J-T test and the hedonic modelling approaches, submarkets exists for almost all theoretical submarket constructs.

Where the methods suggest divergent findings in terms of submarket existence, the results of the J-T test and hedonic approaches are used. The reason being that the hedonic approach utilises all statistically significant variables in computing results (parametric approach), as compared to the Kruskal-Wallis *H* test which analyses rental values to make that determination. And also the J-T test can be used to determine trend data compared to the Kruskal-Wallis H test. The use of the hedonic model implicitly assumes that the relative prices among different housing attributes remain unchanged, provided that attributes used in the modelling remain also unchanged. In this case each submarket construct is

exclusively modelled, and effects and changes in implicit attributes (or variables) are examined based on model coefficients. In the aggregate rental market model, it was realised that rental values were more sensitive to total floor area than the number of bedrooms. It was thus concluded that total floor area may be a better indicator of size in the data sample than number of bedrooms.

Table 7.1: Submarket existence using K-W test, J-T test and Hedonic method

| Submarket | N | H test | $T_{JT}$ | Hedonic |
|---|---|---|---|---|
| Omnibus test – all 3 spatial submarkets | 536 | Yes | Yes | - |
| LIN with MIN | 288 | No | Yes | Yes |
| LIN with HIN | 459 | No | Yes | Yes |
| MIN with HIN | 325 | Yes | Yes | Yes |
| | | | | |
| Omnibus test – all 3 structural submarkets | 536 | Yes | Yes | - |
| SR with HC | 158 | Yes | Yes | No |
| SR with AFTH | 451 | Yes | Yes | Yes |
| HC with AFTH | 463 | Yes | Yes | Yes |
| | | | | |
| Omnibus test – all 5 nested submarkets | 530 | Yes | Yes | - |
| LIN.SR with LIN.HC | 152 | Yes | Yes | Yes |
| LIN.SR with LIN.AFTH | 130 | No | Yes | Yes |
| LIN.SR with MIN.AFTH | 144 | No | Yes | Yes |
| LIN.SR with HIN.AFTH | 317 | Yes | Yes | Yes |
| LIN.HC with LIN.AFTH | 140 | Yes | Yes | Yes |
| LIN.HC with MIN.AFTH | 154 | No | Yes | Yes |
| LIN.HC with HIN.AFTH | 327 | Yes | Yes | Yes |
| LIN.AFTH with MIN.AFTH | 132 | No | No | No |
| LIN.AFTH with HIN.AFTH | 305 | Yes | Yes | Yes |
| MIN.AFTH with HIN.AFTH | 319 | Yes | Yes | Yes |

Source: Fieldwork data 2017

The next section provides a brief overview of the conceptualisation of rental values in the housing market. Conclusions are established based on stakeholder perceptions of value determinants as well as empirical findings based on actual rental market data.

## 7.2. Rental value conceptualisation: stakeholder perception versus empirical evidence

A summary of how rental values are conceptualised in Ghana's residential housing market by comparing stakeholder perceptions of value to empirical findings are provided here (see figure 7.1). Figure 7.1 shows on one side stakeholders' perception of rental value determinants as against empirical evidence and grouped by utility-bearing attributes of structural, neighbourhood and location characteristics. Stakeholders' perceptions are ranked from 1 to 38.

The perceived aggregate significance of variables by the various stakeholders from highest ranked (with value of 1) to least ranked (with a value of 38). On the right side of the figure shows the results of the aggregate hedonic model and their corresponding percentage contribution to model (and by extension rental value in the aggregate rental market).

"ELEC", "RET", "WAT", "DET", and "BRM" are among the perceived highest determinants of rental value; while on the other side "LOC_3", "LQual", "CQual", "BUS" and "lnAREA" are the highest percentage contributors (and together contribute 51.85%) to model fit per empirical results. There seems to be a disconnect between these two groups of variables. It can be concluded that the five highly ranked

variables as perceived by the stakeholders was not confirmed by empirical results. As can be further observed, variables such as "AREA", "FLO" and "FEN" are generally ranked high by stakeholders and also empirical evidence gives credence to same. These three variables empirically contribute about 12% to the model fit.

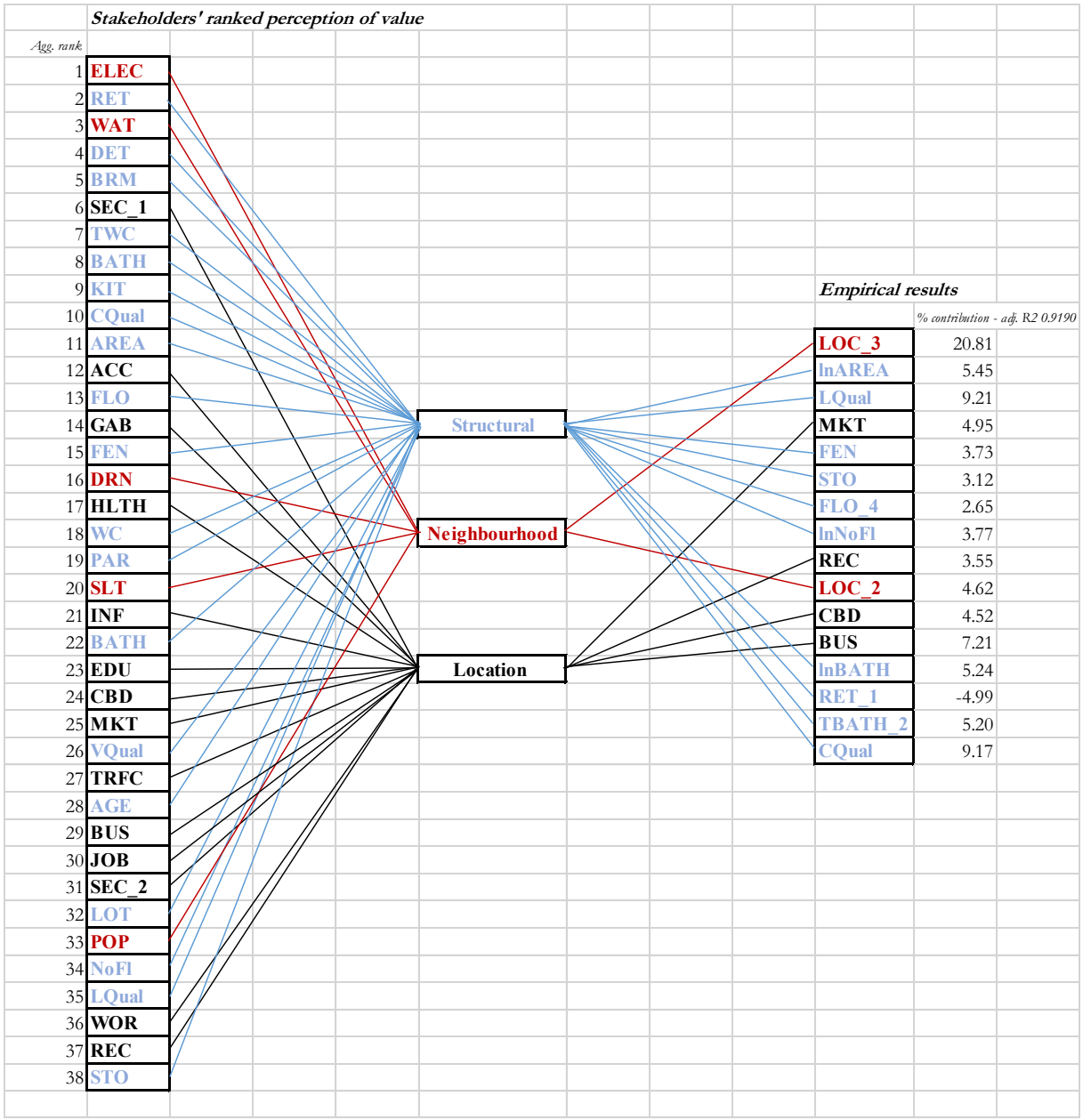



Figure 7.1: Residential rental value conceptualisation: stakeholder perception versus empirical evidence

Source: Author's construct, 2019

More so variables such as "RET", "BATH" and "CQual" which are perceived to be significant determinants of rental value by stakeholders (and therefore ranked high) also contribute about 15% to model fit per empirical results.

What is striking in the results are variables such as "LQual", "MKT" and "STO" which contribute about 17% to model fit are the least ranked by market stakeholders (ranked 25, 33 and 36 respectively out of a total of 38 different variables).

When a particular property is located in a high income neighbourhood (LOC_3), the assumption is that the landscape quality (LQual) and construction quality are good, the area is well served with amenities

and a premium is paid based on the size of the property. This may be the reason why LOC_3 and middle income neighbourhoods (LOC_2) are statistically significant variables in the aggregate model.

## 7.3. Quantifying effects of location and neighbourhood variables on rental values

Figure 7.2 shows the analytical framework for quantifying location and neighbourhood effects. In this research, *a priori* knowledge of the rental housing market was used to delineate the extent of submarkets. Submarkets are empirically tested to confirm their existence or otherwise based on fieldwork data. Model coefficients are examined and the percentage contribution of variables within the aggregate market and submarket constructs are computed.

Once the foundation has been laid, we proceed to detect and quantify the effects of these variables on residential rental values. The relationship between rental values, location and neighbourhood characteristics are explored. Although all variable effects on rental values across all submarket constructs will be analysed, the main focus will be on location and neighbourhood variables.

From chapters 5 and 6, this research has empirically identified submarkets within the residential rental housing market of Accra, Ghana. Using the hedonic equation in chapter 6 (equation 6.8), the aggregate market and *a priori* delineated submarkets are computed. 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. The hedonic equation 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.

These modelling results are the focus for the next set of analysis. In the section that follows, the percentage contribution of individual variables as well as aggregated variables are computed for identified submarket constructs.

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

$$\%\ contribution\ X_i = \frac{coefficient\ X_i}{\sum_{k=1}^{n} coefficient\ X_{i\text{-}n}} * \text{adj. } R^2 * 100\% \qquad (7.1)$$

Where;
*Coefficient* $X_i$ represents variable coefficient;
*% contribution* $X_i$ represents the percentage contribution of variable $X_i$ to rental value;
$\sum_{k=1}^{n} coefficient\ X_{i\text{-}n}$ , 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 submarket (including the constant), then multiply by the adjusted $R^2$ value and then multiply by 100 *per cent*.

Apart from computing the percentage contribution of each individual variable within each submarket to rental values, the variables are also grouped by structural, neighbourhood and location variables and the contribution analysed at the aggregate level. Although the effects of location and neighbourhood attributes (at an aggregate level) on rental value are interesting to analyse, such analysis must be carefully preceded by examining the effects of individual attributes.

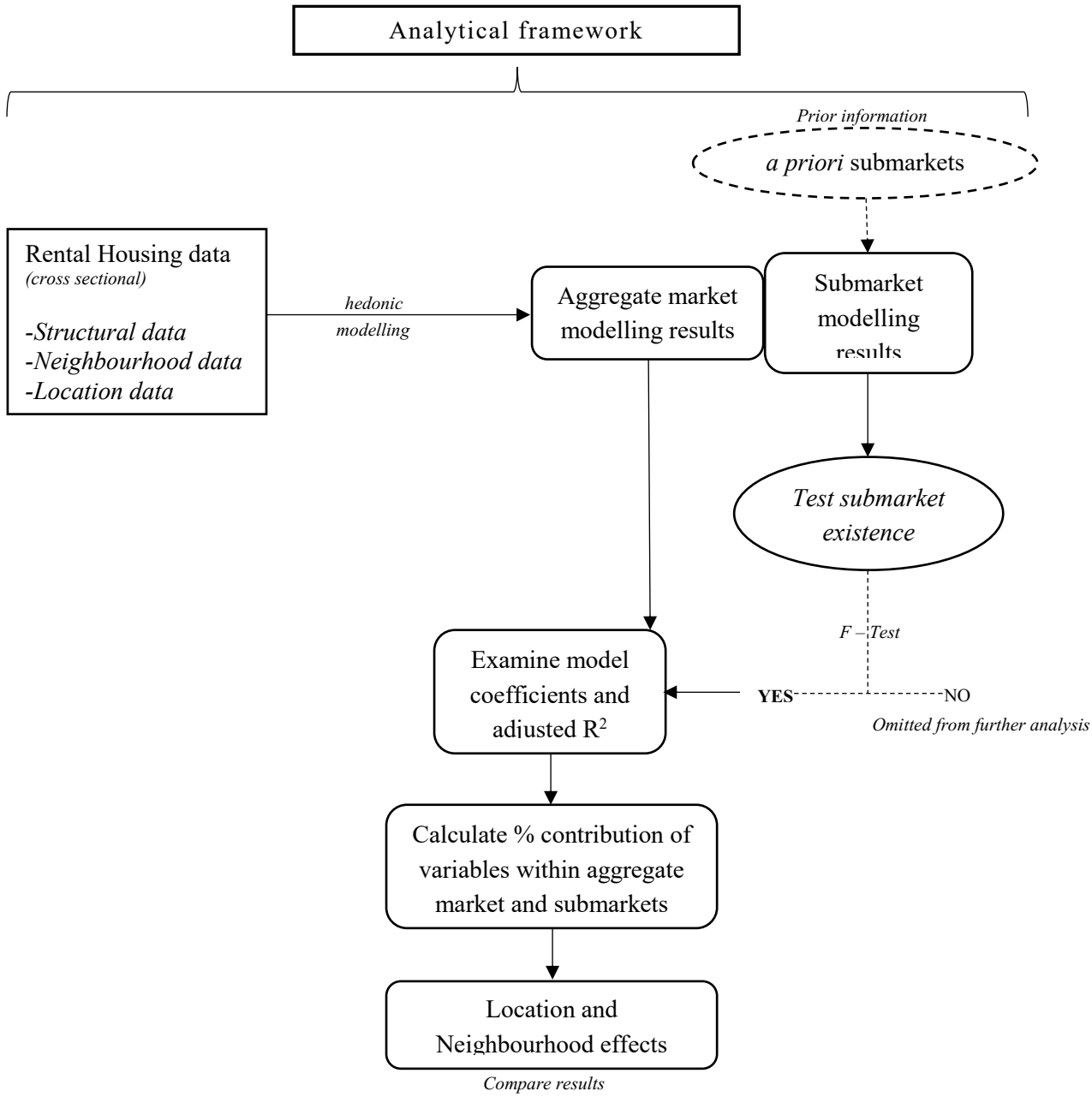



Figure 7.2: Simplified analytical framework for location and neighbourhood effects

Source: Author's construct, 2019

To interpret results of the percentage contribution of variables, three factors are important to enable proper interpretation. The first is the statistical significance of the variable. The second is to consider the sign of the variable (i.e., 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.

Table 7.2 shows statistically significant variables (at an $\alpha$ of $\leq 10\%$) within the aggregate market and submarkets. This provides an overview of variables utilised in quantifying location and neighbourhood effects on rental values. All variable effects are reported, but only statistically significant variables are discussed in much detail.

Table 7.2: 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 | | | * | | * | | | * | * | | * | * | | | | |
| | 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 for the aggregate and submarket constructs

Source: Author's construct, 2019

## 7.4. Results and Discussion

### 7.4.1. Spatial submarkets and percentage contribution of variables to rental value

*LIN*

As has been already discussed, the assumption with the Low Income Neighbourhood (LIN) submarket is that all properties irrespective of the property type found in low income areas belong to this submarket group. From table 7.3 it can be seen 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 that 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 attracted lower rental values. 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.

*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 predominantly dominated by the middle income working class. The modelling results only explains 50% of the data. The results present a different picture as only four 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 High Income Neighbourhood (HIN) submarket comprises all properties within these neighbourhoods. The justification for this submarket classification as previously stated is that all properties irrespective of type belongs to one submarket. It should be noted that properties available here are predominantly apartments, flats and town houses. 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 connotes the status of the inhabitant. Hence the presence of these, invariably, should contribute 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 HIN. 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 two 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.

Table 7.3: 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* | | |
| | | | | | | | | | | | | |
| 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 7.4: Structural submarket coefficients and percentage contribution of hedonic model regressors (variables)

| Variables | Aggr. | % Contr. | SR | % Contribution | HC | % Contribution | AFTH | % Contribution | SR + HC | % Contribution | HC + AFTH | % Contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constant | 0.27 | 3.70 | 1.28* | 17.79* | -0.35 | -6.26 | 0.19 | 2.13 | 0.32 | 5.93 | 0.20 | 2.56 |
| LOC_3 | 1.53* | 20.81* | 0.61*** | 8.41*** | | | 1.51* | 16.65* | 0.45 | 8.24 | 1.49* | 18.77* |
| lnAREA | 0.40* | 5.45* | 0.35* | 4.82* | 0.74* | 13.26* | 0.33* | 3.59* | 0.62* | 11.48* | 0.40* | 5.07* |
| LQual | 0.68* | 9.21* | 0.26 | 3.53 | | | 0.56* | 6.15* | 0.05 | 0.88 | 0.69* | 8.69* |
| MKT | 0.36* | 4.95* | -0.04 | -0.50 | 0.22** | 3.86** | 0.51* | 5.65* | 0.11 | 1.99 | 0.40* | 5.02* |
| FEN | 0.27* | 3.73* | 0.28** | 3.81** | 0.08 | 1.39 | 0.69* | 7.60* | 0.20* | 3.68* | 0.31* | 3.92* |
| STO | 0.23* | 3.12* | | | | | 0.16** | 1.78** | | | 0.21* | 2.67* |
| FLO_4 | 0.20*** | 2.65*** | 0.18 | 2.42 | 0.31*** | 5.55*** | 0.25*** | 2.71*** | 0.27** | 4.96** | 0.28** | 3.55** |
| lnNoFl | 0.28* | 3.77* | | | 0.53** | 9.51** | 0.26* | 2.89* | 0.51** | 9.45** | 0.27* | 3.35* |
| REC | 0.26* | 3.55* | -0.36 | -4.93 | -0.06 | -0.98 | 0.26* | 2.88* | -0.15 | -2.67 | 0.27* | 3.35* |
| LOC_2 | 0.34* | 4.62* | | | -0.68** | -12.15** | 0.39* | 4.36* | -0.60** | -11.00** | 0.31* | 3.93* |
| CBD | 0.33* | 4.52* | -0.02 | -0.28 | | | 0.41* | 4.57* | -0.16 | -2.93 | 0.42* | 5.36* |
| BUS | 0.53* | 7.21* | | | 0.30 | 5.39 | 0.56* | 6.14* | 0.17 | 3.04 | 0.54* | 6.85* |
| lnBATH | 0.39* | 5.24* | -0.01 | -0.08 | 0.30*** | 5.26*** | 0.41* | 4.50* | 0.19*** | 3.48*** | 0.37* | 4.71* |
| RET_1 | -0.37* | -4.99* | | | | | | | | | | |
| TBATH_2 | 0.38* | 5.20* | 0.41* | 5.64* | 0.25*** | 4.41*** | 0.42 | 4.69 | 0.28* | 5.07* | 0.33* | 4.18* |
| CQual | 0.67* | 9.17* | 0.49*** | 6.77*** | 0.56** | 10.07** | 0.66*** | 7.32*** | 0.43* | 8.00* | 0.68* | 8.64* |
| | | | | | | | | | | | | |
| Standard error | 0.5817 | | 0.39 | | 0.42 | | 0.59 | | 0.41 | | 0.58 | |
| $R^2$ | 0.922 | | 0.56 | | 0.47 | | 0.84 | | 0.54 | | 0.91 | |
| Adjusted $R^2$ | 0.919 | | 0.47 | | 0.39 | | 0.84 | | 0.50 | | 0.91 | |
| N | 532 | | 72 | | 85 | | 375 | | 157 | | 460 | |
| | | | | | | | | | | | | |
| Structural | | (42.54) | | 26.91 (21.04) | | 49.46 (48.07) | | 41.22 (36.53) | | 47.00 (46.12) | | 44.77 (44.77) |
| Neighbourhood | | (25.44) | | 8.41 (8.41) | | -12.15 (-12.15) | | 21.01 (21.01) | | -2.76 (-11.00) | | 22.70 (22.70) |
| Location | | (20.23) | | -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 7.5: Nested submarket coefficients and percentage contribution of hedonic model regressors (variables)

| Variables | Aggr. | % Contr. | LIN.SR | % Contribution | LIN.HC | % Contribution | LIN.AFTH | % Contribution | MIN.AFTH | % Contribution | HIN.AFTH | % Contribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constant | 0.27 | 3.70 | 1.29* | 15.93* | -1.01 | -21.20 | 1.34 | 14.96 | 2.01*** | 12.30*** | 3.31* | 32.93* |
| LOC_3 | 1.53* | 20.81* | | | | | | | | | | |
| lnAREA | 0.40* | 5.45* | 0.35* | 4.31* | 0.92* | 19.34* | 0.17 | 1.94 | -0.01 | -0.07 | 0.17*** | 1.66*** |
| LQual | 0.68* | 9.21* | 0.26 | 3.16 | | | -0.29 | -3.21 | 0.56** | 3.40** | 0.77* | 7.67* |
| MKT | 0.36* | 4.95* | -0.04 | -0.45 | 0.22** | 4.53** | 0.24 | 2.70 | 0.38 | 2.32 | 0.44* | 4.39* |
| FEN | 0.27* | 3.73* | 0.28** | 3.41** | 0.09 | 1.87 | 0.03 | 0.35 | 0.67** | 4.12** | 1.38* | 13.76* |
| STO | 0.23* | 3.12* | | | | | 0.26 | 2.91 | 0.30 | 1.86 | 0.19* | 1.93* |
| FLO_4 | 0.20*** | 2.65*** | 0.18 | 2.17 | 0.30** | 6.36** | 0.33*** | 3.65*** | 0.19 | 1.15 | 0.07 | 0.72 |
| lnNoFl | 0.28* | 3.77* | | | 0.53** | 11.21** | 0.52* | 5.74* | 0.86** | 5.24** | 0.10*** | 1.02*** |
| REC | 0.26* | 3.55* | -0.36 | -4.41 | -0.04 | -0.92 | 0.53*** | 5.93*** | -0.65** | -4.00** | 0.39* | 3.89* |
| LOC_2 | 0.34* | 4.62* | | | | | | | | | | |
| CBD | 0.33* | 4.52* | -0.02 | -0.25 | | | 1.63* | 18.20* | 1.54*** | 9.41*** | 0.15** | 1.53** |
| BUS | 0.53* | 7.21* | | | 0.33 | 7.01 | 0.19 | 2.09 | 0.88*** | 5.38*** | 0.07 | 0.66 |
| lnBATH | 0.39* | 5.24* | -0.01 | -0.07 | 0.29** | 5.98** | 0.73* | 8.09* | 0.59 | 3.63 | 0.52* | 5.15* |
| RET_1 | -0.37* | -4.99* | | | | | | | | | | |
| TBATH_2 | 0.38* | 5.20* | 0.41* | 5.04* | 0.21*** | 4.39*** | 1.10* | 12.24* | 1.19 | 7.28 | | |
| CQual | 0.67* | 9.17* | 0.49*** | 6.06*** | 0.58* | 12.13* | 0.48 | 5.32 | | | | |
| | | | | | | | | | | | | |
| Standard error | 0.5817 | | 0.39 | | 0.37 | | 0.50 | | 0.80 | | 0.40 | |
| $R^2$ | 0.922 | | 0.44 | | 0.57 | | 0.85 | | 0.60 | | 0.76 | |
| Adjusted $R^2$ | 0.919 | | 0.35 | | 0.51 | | 0.81 | | 0.52 | | 0.75 | |
| N | 532 | | 70.00 | | 81.00 | | 58.00 | | 71.00 | | 246.00 | |
| | | | | | | | | | | | | |
| Structural | | (42.54) | | 24.08 (18.82) | | 61.28 (59.41) | | 37.02 (29.72) | | 26.60 (12.76) | | 31.91 (31.19) |
| Neighbourhood | | (25.44) | | | | | | | | | | |
| Location | | (20.23) | | -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 7.5 (cont'd): Nested submarket coefficients and percentage contribution of hedonic model regressors (variables) – continuation

| Variables | LIN.SR + LIN.HC | % Contribution | LIN.HC + LIN.AFTH | % Contribution | LIN.AFTH + MIN.AFTH | % Contribution | LIN.AFTH + HIN.AFTH | % Contribution | MIN.AFTH + HIN.AFTH | % Contribution |
|---|---|---|---|---|---|---|---|---|---|---|
| Constant | 0.20 | 3.63 | 0.49 | 7.30 | 0.91 | 7.88 | -2.17* | -26.90* | 0.60 | 5.42 |
| LOC_3 | | | | | | | | | | |
| lnAREA | 0.66* | 12.23* | 0.50* | 7.34* | 0.34*** | 2.97*** | 0.50* | 6.19* | 0.12 | 1.10 |
| LQual | 0.05 | 0.84 | -0.01 | -0.13 | 0.37** | 3.18** | 0.95* | 11.70* | 1.15* | 10.37* |
| **MKT** | **0.11** | **2.07** | **0.22**** | **3.24**** | **0.51**** | **4.41**** | **0.64*** | **7.89*** | **0.29**** | **2.60**** |
| FEN | 0.20* | 3.71* | 0.02 | 0.31 | 0.42** | 3.61** | 0.33*** | 4.06*** | 1.05* | 9.54* |
| STO | | | 0.23*** | 3.46*** | 0.22 | 1.86 | 0.16*** | 1.97*** | 0.10 | 0.92 |
| FLO_4 | 0.27** | 4.97** | 0.28** | 4.09** | 0.43** | 3.69** | 1.15* | 14.20* | 0.37 | 3.35 |
| lnNoFl | 0.51** | 9.40** | 0.45* | 6.65* | 0.27 | 2.33 | 0.07 | 0.87 | 0.34* | 3.09* |
| **REC** | **-0.15** | **-2.72** | **0.29*** | **4.21*** | **-0.21** | **-1.82** | **0.68*** | **8.41*** | **0.34*** | **3.10*** |
| LOC_2 | | | | | | | | | | |
| **CBD** | **-0.15** | **-2.83** | **1.70*** | **25.12*** | **1.50*** | **12.92*** | **0.30*** | **3.69*** | **0.48*** | **4.30*** |
| **BUS** | **0.18***** | **3.37***** | **0.22** | **3.31** | **0.58**** | **5.02**** | **0.93*** | **11.53*** | **1.06*** | **9.62*** |
| lnBATH | 0.19 | 3.48 | 0.46* | 6.83* | 0.45** | 3.92** | 0.41* | 5.11* | 0.62* | 5.58* |
| RET_1 | | | | | | | | | | |
| TBATH_2 | 0.27* | 4.99* | 0.45* | 6.59* | 0.27 | 2.31 | 0.77*** | 9.53*** | 1.50* | 13.61* |
| CQual | 0.43* | 8.06* | 0.55* | 8.08* | 0.35 | 3.02 | 1.55* | 19.16* | | |
| | | | | | | | | | | |
| Standard error | 0.39 | | 0.44 | | 0.78 | | 0.64 | | 0.66 | |
| $R^2$ | 0.55 | | 0.88 | | 0.60 | | 0.78 | | 0.74 | |
| Adjusted $R^2$ | 0.51 | | 0.86 | | 0.55 | | 0.77 | | 0.73 | |
| N | 151.00 | | 139.00 | | 129.00 | | 304.00 | | 317.00 | |
| | | | | | | | | | | |
| Structural | | 47.68 (43.36) | | 43.22 (43.04) | | 26.88 (17.37) | | 72.79 (71.92) | | 47.56 (42.19) |
| Neighbourhood | | | | | | | | | | |
| **Location** | | **-0.11 (3.37)** | | **35.88 (32.57)** | | **20.54 (22.35)** | | **31.51 (31.51)** | | **19.62 (19.62)** |

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

*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 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 we realise 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. The results suggests confirm what is already known in practice. Other variables like lnBATH, CBD, REC, lnNoFl and MKT all have positive 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.

The next section analyses the percentage contribution of individual variables of the structural submarkets on rental value (see table 7.4).

### 7.4.2. Structural submarkets and percentage contribution of variables to rental values

*SR*

This submarket is based on the assumption that all single rooms (SR) irrespective of location or neighbourhood belong to one submarket. The greatest contributor to rent is the neighbourhood class where the property is located (LOC_3, 8%). The results confirm that once the single room is found within a HIN it contributes about 8% to rental value. The result confirms the perception of differentiated rental values across various neighbourhood classes; HIN areas attracting highest rental values due to 'good' amenities found here. The quality of construction (CQual) and separate bathroom availability (TBATH_2) both contribute 7% and 6% respectively. Intuitively the CQual should attract a slightly higher rent than a property of inferior quality *ceteris paribus*. The size of the rental unit is also statistically significant and contributes 5% to rental value. The results confirm that the larger the size of the room, the higher the rental value and vice versa. The availability of a fence wall (FEN) also contributes 4% to rental value. This is to be expected as it ensures extra level of security for the property. Landscape quality (LQual) is not statistically significant probably because such properties are hardly landscaped and built mostly to suit low income tenants. As such the result is not surprising. It is also interesting to note that the variable tiled floor (FLO_4) is also not statistically significant. The data used for this research shows that about 85% of single rooms do not have a tiled floor (which is a common floor finish for most homes in Ghana currently); only 15% of SR are tiled. Property owners rather prefer cement-sand-screed as a cheaper finish because of the target market of the finished product.

*HC*

As with other submarkets the assumption here is that all hall and chamber units (HC) belong to one submarket irrespective of location. In the Ghanaian rental market, the ladder system works as well. Poor households may rent SR initially, then as income improves move to a HC, then as income continues to improve they move to AFTH. Both SR and HC are mostly found within LIN as the data used also supports this assertion. The results show that the size of the HC unit is a significant contributor to rental value; contributing about 13% to rent. We must state here that the housing market is predominantly informal and as such although the size of the room is statistically significant, not many tenants are aware or able to tell you the size of the rooms. The descriptives that go with size in the market are usually, '*small*' or '*big*'. So although the actual size may not be known by tenants or landlords, the data suggests that this is statistically significant in determining rental values. CQual contributes 10% to the rental value. Other positive contributors to rental value include MKT, FLO_4, lnNoFl, lnBath and TBATH_2. However when the HC is within a MIN, it contributes negatively to rental value (-12%). The data shows that only 0.7% of HC are within MIN areas. The majority of HC units are within LIN. This could explain why this variable contributes negatively to rental value as there are not enough data points within the MIN subgroup.

*AFTH*

The data used shows that as much as 46% of apartments flats and town houses (AFTH) are located within HIN, and the rest are spread within LIN and MIN areas. The modelling results of this submarket performs well with an adjusted $R^2$ of 0.84. All but one variable are statistically significant. The greatest contributor to rental value is when this property type is found within a HIN; this contributes 17% to rental value. In Ghana the AFTH

rental submarket is perceived as a market for predominantly the middle and high income earners. However when the property is located within MIN areas it contributes 4% to rental value. This confirms that differential rents exists for different neighbourhood classes. All other variables show the expected signs. lnAREA contributes 4%, LQual 6%, MKT 6%, FEN 8%, STO 2%, FLO_4 3%, lnNoFl 3%, REC 3%, CBD 5%, BUS 6%, lnBATH 5% and CQual 7% to rental value. Properties within this submarket will generally be of a higher quality (in terms of materials of construction) compared to the other two discussed above; the landscape quality will be good; if property is fenced will attract a higher rental value; will have recreational facilities nearby or in close proximity to the neighbourhood; most of the floors are finished in tiles; and good access to a local market and the CBD. It is quite interesting to note that the number of floors or on which floor a property is (lnNoFl) is statistically significant. The empirical data suggests that there exists no differential rents with respect to which floor a rental unit is. Which means that irrespective of the floor/ storey a rental unit is located in a multi-tenanted property within the same compound, the rent remains the same for all units. The data shows that about 99% of properties within the AFTH submarket (373) are located between 1 to 4 storeys. The tallest building in Ghana currently is 19 storeys high.

As was done for the spatial submarket, we also explore the possibility pairwise comparisons among these submarkets. To be more specific between SR and HC (SR+HC), and between HC and AFTH (HC+AFTH). These are discussed below.

*SR+HC*

This submarket combines the SR and HC and we assume here that it is one submarket and not different from each other. The modelling result with an adjusted $R^2$ of 0.50 is a slight improvement of the individual $R^2$s. The greatest significant positive contributors are lnAREA, lnNoFl and CQual, contributing 12% 10% and 8% respectively to rental value. This suggests that the size of the rental unit and the quality of construction affects rental values positively. Other positive contributors include FEN (4%), FLO_4 (5%), lnBATH (4%) and TBATH_2 (5%). The results also suggests that when the rental unit within this submarket construct is located within a LOC_2 (MIN), then it contributes -11% to overall rental value. This observation is a bit surprising, as it was expected to contribute positively to rental value. The reason could be that most of the SR+HC submarket properties are located within LIN areas. It is also interesting to note that although when the property is located within LOC_3 (HIN) it contributes 8% to rental value, it is not statistically significant. Other variables not statistically significant are LQual, MKT, REC, CBD, and BUS. This is to be expected as a good number of these properties hardly have any landscaping done and will not be in close proximity to recreational/ green areas as has been discussed under SR submarket. It must be noted that majority of properties found here are within a close proximity to satellite markets including the Madina, Adenta, Oyarifa, Ogbojo and La satellite markets.

*HC+AFTH*

This submarket construct combines what is perceived to be properties within predominantly MIN and HIN areas. The results of the regression analysis shows an adjusted $R^2$ of 0.91. All 15 variables modelled are statistically significant at the 1% level of significance. The results confirm the existence of differential rental values based on neighbourhood; that when the rental unit is located in LOC_3 (HIN) it contributes 19%

to rental value, whereas if located in LOC_" (MIN) contributes 4%. Also the LQual and CQual contributes 9% and 9% respectively to rental value. This is significant as poor construction quality and poor landscaping will be a negative contributing factor to rental value. Structural variables of lnAREA, (5%), FEN (4%), STO (3%), FLO_4 (4%), lnBATH (5%) and TBATH_2 (4%) all contribute positively to rental value as expected. This suggests that with the continuous variables the larger the value the greater the rent; and for the discrete variables the availability of same contributes positively to rental value. More so being in close proximity to a market (5%), recreational facility (3%), CBD (5%) and a bus stop (7%) all contribute positively to rental value as expected.

### 7.4.3. Nested submarkets and percentage contribution of variables to rental values

Among all the submarket groupings, the nested submarkets seem to be the most probable and realistic characterisation in the Ghanaian rental market. This is because in this submarket both neighbourhood class and for real estate type are controlled for (see table 7.5). The contribution of nested submarket categorisations are examined below.

*LIN.SR*

The assumption for this submarket categorisation is that all single rooms (SR) in low income neighbourhoods (LIN) form one submarket. The logic is that low income tenants who seek SR accommodation will only consider similar neighbourhoods that can fit their budget (i.e. single rooms within low income neighbourhoods only). The data shows that 13% of properties within the nested submarket are LIN.SR. The hedonic modelling process records an adjusted $R^2$ of 0.35. The greatest contributor to rental value are CQual and TBATH_2 with 6% and 5% respectively. This shows that when the quality of construction is good and the type of bath is not shared, they have a positive effect on rental value. More so, the size of the rental unit (lnAREA) and availability of a fence wall (FEN) contributes 4% and 3% respectively to rental value. It is interesting to note that the significant variables are all structural attributes which together contribute about 19% to rental value. This trend is to be expected in the LIN.SR submarket where the market puts a premium on size of the unit, quality of the construction, type of bath and fence wall availability (which is a form of security against using the property as a thorough-fare). It must be observed that the constant, which represents all omitted variables is also statistically significant and contributes 16% to rental value. This figure could also represent the minimum amount of rent to be paid irrespective of the specific attributes of the rental unit.

*LIN.HC*

This submarket categorisation makes the assumption that all hall and chamber units (HC) within low income neighbourhoods (LIN) constitute one submarket and should be analysed as such. The hedonic modelling results show the adjusted $R^2$ of 0.51 which is quite a good fit of the data. The LIN.HC submarket make up 15% of all properties within the nested submarkets. The greatest contributor to rental value is the size of the unit (lnAREA), which contributes 19% to rental value. The quality of construction (CQual) and the number of floors (lnNoFl) contribute 12% and 11% to rental value respectively. Unlike in the LIN.SR submarket, the size of the unit contributes more to how much rent a tenant pays. Units in this submarket are relatively larger and thus should command higher prices as has been confirmed. More so a tiled floor (FLO_4), number of

bathrooms (ln BATH) and a separate bathroom (TBATH_2) contributes 6%, 6% and 4% respectively to rental value. When the unit is near to a market or shopping area (MKT) it adds additional 5% to rental value. All significant variables examined show expected signs and contribute positively to value. It is important to note that once the floor is finished in tiles, the price dynamics change and tenants are expected to pay more than other lower floor finishes (like ordinary cement sand screed finishes). Although lnNoFl is statistically significant, empirical evidence does not confirm that those units located on higher floors pay higher rents than those below (within the same compound) because of quality of the view. The empirical data suggests that irrespective of which floor/ storey a unit is located in a multi-tenanted rental property, the rent remains the same for all units. To summarise, structural variables that are statistically significant together contribute 59% to rental value, whereas location variables contribute only 5%. Which suggests that in this submarket structural attributes determine rental values to a very large extent.

*LIN.AFTH*

The assumption with this submarket categorisation is that all apartments flats and town houses (AFTH) within low income areas (LIN) constitutes one submarket and should be analysed as such. The LIN.AFTH submarket make up 11% of properties within the nested submarkets. The modelling results show that the adjusted $R^2$ is 0.81, which is a very good fit for the data. All significant variables show the expected signs. The greatest contributor is proximity to the CBD, which accounts for 18% of value. The reason could be that tenants in these rental units prefer to be in areas which gives them easy access to the CBD for work purposes. This is to be expected to ensure economic livelihoods are not unnecessarily hampered. A separate bath facility (TBATH_2) contributes 12% to rental value. The main reason why tenants prefer AFTH is that, they do not get to share facilities such as toilet, bath and kitchen spaces with others outside their household. And this has been confirmed with a 12% premium on value. The number of bathrooms (lnBATH), number of floors (lnNoFl) and a tiled floor finish (FLO_4) contribute 8%, 6% and 4% respectively to rental value. The results suggests that the higher the number of bathroom spaces available within the unit the higher the rent a tenant pays and vice versa. The explanation for the number of floors is same as discussed within other submarkets. A tiled floor finish seems to be the preferred floor finish and as such in this submarket contributes 4% to value. It must also be noted that although LIN are generally noted to have low quality housing (with no open green spaces) as compared to similar properties within the MIN and HIN, when a unit is located near a recreational facility it contributes 6% to value. Structural and location variables that are statistically significant together contribute 30% and 24% to value respectively.

*MIN.AFTH*

This submarket is categorised based on the assumption that all apartments flats and town houses (AFTH) within middle income neighbourhoods (MIN) constitutes one submarket. This submarket constitutes 14% of properties within the nested submarkets. The modelling results shows the adjusted $R^2$ is 0.52 with 71 observations. The greatest contributor to value in this submarket is when the unit is near the CBD. This contributes 9% to rental value. This MIN.AFTH submarket is more like a transition zone between the rich and the poor in the society. In other words an area which is predominantly occupied by the growing middle class. It can be understood that easy access to the CBD is critical to ensure they reach economic activities within the shortest possible time. More

so being close to a bus stop or public transport route (BUS) also contributes 5% to rental value. However the results show that being close to a recreational facility (REC) contributes -4% to rental value. The probable explanation is that majority of properties within this submarket sampled are not near recreational facilities (or green areas). The LQual, FEN and lnNoFl contribute 3%, 4% and 5% respectively to value. The quality of landscape and availability of a fence wall of the subject property is important for value determination. These are seen as value addition that should be compensated for in terms of additional rent to tenants. The data suggests that structural and location characteristics that are statistically significant together contribute 13% and 11% to value respectively.

*HIN.AFTH*

This submarket categorisation is based on the assumption that all apartments flats and town houses (AFTH) within high income neighbourhoods (HIN) constitutes one submarket. The evidence from fieldwork suggests that this submarket class has the largest number of properties (46%) within the nested submarket category. The hedonic results show that with 246 observations modelled, the adjusted $R^2$ is 0.75. This is a good fit for the model and hence valid conclusions can be made. The constant which represents the base value irrespective of the individual characteristics of the subject property is statistically significant and contributes 33% to value. This is the largest percentage contribution within all submarket groups modelled. All other variables show the usual signs. The size of the unit (lnAREA) contributes 2% to value. This was to be expected as the size of the unit relative to rental value is positively correlated, but the magnitude (or contribution to value) was lower than expected. However the confirmation needed was that size of a unit was statistically significant. The landscape quality (LQual) also contributes 8% to value. Signifying that when the landscape is of a very good quality it contributes significantly to rental value. The availability of a fence wall (FEN) contributes 14% to rent. For most of these properties in HIN, the availability of a FEN connotes privacy and security. This added protection to the property as observed in these results are statistically significant and thus must be paid for. Also the availability of a store room (STO) contributes 2% to value. For majority of AFTH this added feature is an added 'luxury'. Many AFTH do not have STO and as such this goes to confirm that the size of a unit has an impact on value. The number of bathrooms (lnBATH) in an AFTH is positively significant and contributes 5% to value. Also when the residential unit in this submarket is near a MKT, REC or CBD contributes 4%, 4% and 2% respectively. Normally properties within HIN have a neighbourhood MKT and near to REC. This adds to the neighbourhood features and makes the location attractive to tenants who can afford such locations.

The data suggests that all excluded variables, structural and location characteristics contribute 33%, 31% and 11% respectively to rental value.

As was done previously for other submarket categorisations, pairwise comparisons among nested submarkets are explored. The idea is to pair observed submarkets and to observe how they perform if they were categorised as one submarket instead of as individual submarkets. The specific submarkets are LIN.SR + LIN.HC; LIN.HC + LIN.AFTH; LIN.AFTH + MIN.AFTH and MIN.AFTH + HIN.AFTH which are discussed below.

*LIN.SR + LIN.HC*

This submarket construct assumes that all SR and HC within LIN are indeed one submarket and should be examined as such and not split as two different (2) submarkets. Using 151 observations, the results of the hedonic modelling show that the adjusted $R^2$ is 0.51. The results confirm that in this submarket structural variables are the main determinants of rental value. In that depending on the structural attributes of the subject property, significant differences in rental values are to be expected. lnAREA, FEN, FLO_4, LnNoFl, TBATH_2 and CQual contribute 12%, 4%, 5%, 9%, 5%, 8% and 3% to rental value respectively. It must be observed that nearness to a bus stop (BUS), contributes 3% to rental value. This observation is typically observed in LIN as have been discussed previously. Structural and location variables that are statistically significant contribute 43% and 3% to value respectively. This is a marked improvement considering the results from only the LIN.SR submarket.

*LIN.HC + LIN.AFTH*

Here the assumption is that within the LIN submarket, HC and AFTH form one submarket, whiles LIN.SR forms the other. In other words there exist only two submarkets within the LIN when the nested categorisation is used. With 139 observations used for the modelling, the results show that the adjusted $R^2$ is 0.86. This is a good fit for the data and thus valid conclusions can be drawn from observations. The largest contribution to value is when rental units are near the CBD; this contributes 25% to value. Also rental units near a recreational facility (REC) and a market (MKT) contribute 4% and 3% respectively. Altogether, statistically significant location variables contribute 33% to value. Also CQual contributes 8% to value. Whereas lnAREA, lnBATH, lnNoFl and TBATH contribute 7% each to value. Further, FLO_4 and STO contribute 4% and 3% to value respectively. Structural variables together contribute 43% to value.

*LIN.AFTH + MIN.AFTH*

This submarket construct makes the assumption that all AFTH within LIN and MIN are one submarket and should be considered as such. As has been discussed earlier, MIN areas are seen as a transition zone between LIN and HIN. And as such it is possible for MIN to have characteristics of both LIN and HIN. Based on 129 observations the adjusted $R^2$ is 0.55. The greatest contributor to rental value is CBD (13%). The assumption here is that being close to the CBD offers the opportunity to engage in economic activities without having to travel longer distance to reach same. This is important for occupants of the LIN.AFTH+MIN.AFTH submarket, as they are seen as economically better off than others occupying lesser quality accommodation (i.e. LIN.SR and LIN.HC). Likewise the variables BUS and MKT contributes 5% and 4% respectively. Nearness to a market is seen as an added advantage to a location. This is because occupants may have access to cheaper goods and services than locations without same. Access to a bus stop is critical for moving around easily as a large number of the population do not have access to their own personal vehicles. As such the use of public transportation is and may be the only means of moving from one location to another.

More so, the variables lnBATH, lnNoFl and FEN contribute 4% each to value; while LQual and lnAREA also contribute 3% each to value. It is worth noting that structural variables within this submarket construct together contribute 17% to rental value.

It is interesting to note that in all submarkets modelled, it is only within this submarket construct that location variables outperforms structural and neighbourhood variables in terms of statistically significant contribution to rental value. Location variables together contribute 22% to value.

*MIN.AFTH + HIN.AFTH*

This submarket is modelled based on the assumption that all AFTH within MIN and HIN are one submarket and should not be split. Based on 317 observations (about 60% of data) the adjusted $R^2$ is 0.73. This is a good fit which suggests that conclusions can be relied upon. Statistically significant structural variable contribution to value are as follows; TBATH_2 14%, LQual 10%, FEN 10%, lnBATH 6% and lnNoFl 3%. It is interesting to note that the size of the unit was not statistically significant as was the case in many other submarket constructs. The type of bath (i.e. separate bath within unit) and number of bathrooms contribute significantly to value. Structural variables together contribute 42% to rental value.

More so, the variables BUS and CBD contribute 10% and 4% respectively to value. While REC and MKT also contribute 3% each to value. It is interesting to note that all these four location variables are statistically significant, as they are the respective features that attract occupants to the AFTH submarket. Altogether location variables contribute 20% to value.

### 7.4.4. Aggregate Market

Results from table 7.3 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 has been clearly illustrated by the percentage contribution of variables within each submarket construct.

## 7.5. Conclusion

To conclude, it can be observed that identifying significant variables and quantifying the effects of same can be a daunting task. The research analysed the effects of location and neighbourhood characteristics on rental values in Ghana's residential rental housing market. The main aim was to test the hypothesis that differential rental values observed within submarket constructs are mainly due to the greater contributions of location and neighbourhood variables. Due to the lack of a consistent dataset, this research seldom receives the attention of researchers. This research fills the literature gap by providing empirical evidence to test this hypothesis and make far reaching conclusions.

Separate hedonic models were computed for both the aggregate market and submarket constructs. Using statistically significant model coefficients and the adjusted $R^2$, the effects of location and neighbourhood are specifically analysed.

The empirical results suggest that statistically significant structural variables contribute 43% to rental values, whereas location and neighbourhood variables contribute 20% and 25% respectively within the aggregate market. In terms of percentage contribution of variables within the markets analysed, there seem to be a consistent trend. The only exception was within the LIN**.**AFTH+MIN**.**AFTH submarket where statistically significant location variables contributed about 4% more than structural variables. In this research it is confirmed that although location and neighbourhood variables are important in determining rental values, structural variables contribute the most. Table 7.6 summarises the percentage contributions (aggregate effects) of structural, neighbourhood and location effects within submarket categories. The research 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 7.6: 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 |
| | 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: Fieldwork data 2017

These findings in this chapter are relevant to various stakeholders in a number of ways. It provides investors within the rental housing space empirical evidence to support the

determinants 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 rental value determination. This research is however an important step in this direction and makes significant contribution to the housing market literature in Ghana.

# 8. Synthesis

*"It always seems impossible until it's done"*
(Nelson Mandela)

## 8.1. Conclusions

The main goal of this thesis was to develop a model that can be used to disaggregate residential rental housing values and use it to explain location and neighbourhood effects of housing sub-markets in Accra. This was operationalised in four (4) sub-objectives. The first part of this chapter draws the key conclusions from each of these sub-objectives. The second section reflects on the main contributions of this thesis and makes recommendations for future work.

The main conclusions drawn from each of the sub-objectives are presented.

### 8.1.1. Research Objective 1

*To evaluate the relative appeal of location and neighbourhood attributes to rental value and identify theories that explain effects of same on property value.*

A number of theoretical and econometric studies have examined the determinants of property value (Tse, 2002). Heinrich von Thünen's theory of location of agricultural lands (in the book "Der Isolierte Staat") and Alfred Weber's theory of location of manufacturing industries provide useful insights to glean from. The relevance of the theories of land rent in current urban contexts has been examined by a number of scholars (Ball, 1977, 1985b, 1985a; Haila, 2016; Harvey, 1973; Lipietz, 1985). We conclude that no one single theory is able to explain in entirety the current urban contexts; different theories complement each other. An assumption of urban economic models is that rental value decreases with distance from the city centre. Haila (2016, p.59) posits that, "*empirical research has neither verified nor disproved this*".

Housing market research has long established that structural, location and neighbourhood characteristics of a house do matter and play a role in determining housing values. We show from Sub-Saharan Africa (SSA) literature that there is not a consensus as to the unique set of housing attributes that could be used to model residential rental value (RRV) determinants. Different explanatory variables have been utilised mainly as a result of data asymmetry. It is critical to note that housing attributes cannot be untied and repackaged at all locations to produce an arbitrary set of attributes (Arimah, 1992; Harrison & Rubinfeld, 1978). This we conclude makes it impossible to compare SSA housing market research on a standardised basis.
In chapter 2, we review relevant literature on location, neighbourhood, housing market concepts and how rental housing markets work. The chapter explores the ontology of key concepts in rental housing modelling by defining concepts such as markets, housing markets, neighbourhood and submarket definition. The structure of the rental market in Ghana is discussed to situate the research in its local context. The research also examines how the rental market works and which explanatory variables are used to model same. The research emphasises that location and neighbourhood factors contribute to rental value determination and thus the need to assess how to quantify and measure their effects on value.

In this research we departed from the usual trend of adopting models (and input variables) mostly utilised in a developed country context and then "forcing" same to fit a developing country context. In order to situate the research contextually, we examined the main drivers of RRVs from the perspectives of a broad spectrum of experts and stakeholders. Previous research only used one or two of these experts and stakeholder views for analysis. In this research however, a comprehensive list is developed to incorporate as many experts and stakeholders as possible in the analysis.

The hedonic model is the most preferred model in housing market analysis as a result of its sound logic to researchers (Owusu-Ansah, 2013). The price function of a hedonic model describes the functional relationship that exists between real estate prices as well as between different housing characteristics. A typical hedonic equation regresses observed rent (or price) on a number of identified attributes. There is the difficulty in being able to identify all relevant variables/ attributes that determine rental value. And more importantly, which functional form to model such data. To avoid biases in choosing relevant variables for housing market analysis, this research first examined the results from a survey of experts and stakeholders who are conversant with the Ghanaian rental market to rank value determinants. These pre-selected variables were identified through an extensive literature review (Abidoye & Chan, 2016; Adegoke, 2014; Anim-Odame et al., 2010b, 2010a; Arimah, 1992; Asabere, 2004, 2007; Choumert et al., 2015; Gulyani &

Talukdar, 2008; Knight et al., 2004; Malpezzi, 2002; Owusu-Ansah, 2012a; Sirmans et al., 2005). The relative importance index (RII) was used to rank all variables within stakeholder groups and also as an aggregate measure.

The conclusions from the perception survey suggests that, *storeroom availability, rental units near to recreational facilities, near the place of worship, quality of landscaping* and *number of storeys* are the least ranked variables per experts and stakeholder views. This suggests that the presence or absence of these intrinsic and extrinsic characteristics in a property may not have any significant effect on rental values. The highly ranked and most significant variables are *electricity connection, piped water connection, type of house, property condition* and *number of bedrooms*. When all variables are grouped and ranked, it was realised that neighbourhood characteristics rank highest, followed by structural and then locational characteristics. It should be noted that the perception survey presents results which can be a good starting point for empirical verification.

### 8.1.2. Research Objective 2

*To apply an effective technique (as per objective 1) to estimate location and neighbourhood values, and use same in measuring and valuation of these effects.*

Real estate as a heterogeneous good, has different means of setting prices within the market. In basic economic literature, demand and supply forces are deemed to interact to fix prices of goods and services in a free market model.

The results from the perception survey provided the basis for the specific data collected during fieldwork. Submarket existence is tested and this provides critical understanding into how the rental housing market operates (Wheeler et al., 2014). Submarket analysis is an important aspect in housing market studies which has received little attention from developing country researchers. Owusu-Ansah (2012) posits that data asymmetries and the lack of a consistent dataset are hindering comprehensive housing market analysis in developing countries. Ghana's housing market has no established databank where required data could even be obtained at a fee (Baffour Awuah et al., 2016). Since no such comprehensive dataset existed for this research, fieldwork was required to collect relevant data.

A total of 536 rental transaction data is collected for all neighbourhood classes in Accra between March and October 2017. Each row of data consists of structural, neighbourhood and location characteristics of rental data.

In chapter 2 we discuss that there exists several statistical approaches in modelling the rental market in a developed country context. Submarkets are theoretically defined in three main groupings; spatial, structural and nested segmentations. There appears not to be a clear direction as to how to empirically test for submarket existence. However, we adopt Jones and Watkins' (2009) procedure that allows different hedonic models to be constructed for each submarket. It is further argued that in a theoretical model that may be utilised in a developing country context, there was the need to optimise explanatory power of variables used. Studies conducted in the Ghanaian context suggested that consistent explanatory variables used in to model rental value determinants included number of bedrooms, age, plot size, presence of a garage and location attributes.

The hedonic pricing model (HPM) is widely used to analyse the implicit contribution of housing characteristics on value. The model tends to use all available evidence of transactions in order to model the market; which is based on the availability of quality data and the objectives of the study. The HPM modelling technique is used to model the rent function of the aggregate market as well as various *a priori* delineated submarket constructs. Based on theoretical definitions of submarkets, they are empirically tested to find out whether they truly exist in Ghana's rental market.

The most common procedure for testing submarket existence using cross sectional data is adopted (Dale-Johnson, 1982; Schnare & Struyk, 1976; Watkins, 2001). Three methods are adopted to empirically test for

submarket existence; the Kruskal-Wallis H test (non-parametric in chapter 4), the Jonckheere-Terpstra test (non-parametric in chapter 4) and the Hedonic modelling technique (parametric in chapter 5). The results from each of the submarkets modelled suggested that when pairwise comparisons are analysed, distinct submarkets existed within the aggregate market. Empirical evidence suggested that submarkets exists in Ghana's rental housing market. However, anecdotal evidence in the Ghanaian market suggests that structural and nested submarket definitions tend to better explain the existence of submarkets than spatial definition.

In chapter 3, the research presented a general overview of how the data was collected and how they were prepared for further analysis. Dummy variables were created for all location and neighbourhood data that were collected during the fieldwork, and after data cleaning was done. Dummy variables are also created for discrete structural variables and continuous variables were transformed to natural logarithms Based on the aggregate market modelling results, it is realised that the following location and neighbourhood variables are the key determinants of value; *close to market or shopping centre, near recreational facilities, near to the CBD, near bus stop, property is in middle income neighbourhood* and *property is in high income neighbourhood*. These were variables which were statistically significant at an $\alpha$ of 1%.

### 8.1.3. Research Objective 3

*To analyse estimated location and neighbourhood values and their impact on residential rental housing submarkets.*

In the housing markets literature, it has long been established that structural, location and neighbourhood characteristics do determine rental values. There is however disagreement as to how much structural, location and neighbourhood characteristics influence rental values (Arimah, 1992; De & Vupru, 2017; Harrison & Rubinfeld, 1978; Roubi & Ghazaly, 2007; Sirmans et al., 2005). Real estate goods and services place a premium on location and neighbourhood attributes although their contribution to value are not traded explicitly (Owusu-Ansah, 2012a). A number of studies in the Ghanaian literature have analysed various aspects of the housing market (Anim-Odame et al., 2010b, 2010a; Obeng-Odoom, 2011a, 2011b; Owusu-Ansah, 2012a, 2014, 2018; Owusu-Ansah et al., 2017), but none of these studies have empirically tested the impacts of location and neighbourhood attributes on rental value. There is little documented research on this subject area in the Ghanaian literature.

In chapter 7, the research empirically tested the hypothesis ($H_o$) that location and neighbourhood attributes determine to a large extent rental values in Ghana than do structural attributes. As has been discussed severally in this thesis, the mantra has been that location and neighbourhood attributes determine to a large extent price in the rental market. The hedonic modelling technique is used to model both the aggregate and submarket constructs to examine the effects of statistically significant attributes on rental values. The percentage contribution of all variables within the aggregate market as well as within submarkets are examined.

Based on the data, the results suggests that structural attributes contribute 43%, whereas location and neighbourhood attributes contributes 20% and 25% respectively. The results also shows a similar trend for all submarket constructs, where structural attributes were the key determinants of value. The explanation could be mainly because of the informal nature of the market. The data gives credence to the fact that within Ghana's residential rental housing market, structural attributes of properties have the greatest price premium on rental values than anecdotal evidence which suggests that location and neighbourhood variables do. The research finds that the explanatory power of location and neighbourhood attributes are improved when separate hedonic equations are estimated for each submarket construct.

### 8.1.4. Research Objective 4

*To empirically examine how location and neighbourhood characteristics contribute to residential rental housing value and the interrelationships that exist.*

Model interpretations are very crucial in exploring meaningful contributions of input-output data. To examine the price premium of location and neighbourhood attributes on rental values, it is important to ensure proper interpretation of results. The percentage contribution of a variable, $X_i$ is computed by dividing the sum of all coefficients in a particular (sub)market including the constant term ($\sum_{k=1}^{n} coefficient$ $\mathrm{X_{i\text{-}n}}$ ), then multiplying this by the adjusted $R^2$ value, and multiplying the results by 100 *per cent*. Three factors are important for proper interpretation – (a) statistical significance of the variable, (b) the sign of the variable, whether positive or negative, and (c) the magnitude of the variable.

In chapter seven, the research explores the interrelationships between the perceptions of stakeholders and empirical results on determinants of rental values. Reflecting on the results, it was realized that availability of electricity, real estate type (i.e. single room, hall and chamber, apartments flats and town houses), availability of water (stand pipe or well), condition of the property and the number of bedrooms are among the perceived highest determinants of rental value according to market stakeholders; while on the other hand, a property within a high income neighbourhood, landscape quality, construction quality, if property is near a bus stop and the total floor area of a property are among the highest percentage contributors (52%) to rental value as per empirical results. There seem to be a disconnect between the perception of value and what empirical evidence suggests. More so variables such as landscape quality, nearness to a market (or shopping centre) and storeroom availability, which contribute about 17% to model fit (per empirical analysis) are the least ranked by market stakeholders (ranked 25, 33 and 36 respectively out of a total of 38 different variables). In other words, the perception of value deviates from what the empirical data supports. It can be concluded that although the perception of value from market stakeholders is critical in understanding the dynamics of price movements in the residential rental housing market (especially in developing countries where access to good quality housing data is difficult), it is important to analyse empirical data to make far reaching conclusions. The distinction between relevant determinants of rental value are clearly identifiable when researchers have access to good quality rental housing data.

## 8.2. Reflections

This section reflects on the entire findings of the research work. It summarises the main contributions and makes recommendations for further research.

### 8.2.1. Main contributions

The main contributions of this research is three fold – conceptual, methodological and empirical findings.

Within the context of conceptual contribution, one of the main contributions of this thesis is the conceptual framework developed to analyse rental value determinants in Ghana. Different explanatory variables have been utilised in the Sub Saharan African literature, making it difficult to assess value determinants on a standardised basis. Based on the ontological approach, the research conceptualises different variables that could be utilised to determine rental values. These variables are scrutinised and adapted to fit the Ghanaian housing context. Thus, the research examines the perception of stakeholders in Accra's housing market, in order to identify and conceptualise commonalities and differences in variables that determine residential rental values (RRVs). It adopts the relative importance index (RII) to rank different variables that determine RRVs. It further bridges the gap in previous studies by incorporating a broader spectrum of stakeholders in the quest to identify rental value determinants based on expert and stakeholder perceptions. Moreover, the research contextualises RRVs by identifying variables that reflect characteristics of the rental housing market in Accra and serve as a guide in understanding rental market dynamics in African cities where access to data remains a challenge. This research contributes to the discussion on rental value determinants by extending the spatial scope in a developing country context by examining how submarkets are

conceptualised. This was operationalised using the perceptions of market stakeholders to feed into what data were relevant for empirical analysis. Then linking stakeholder perceptions to empirical results to draw meaningful conclusions on the operations of the residential rental housing market.

In terms of methodological contribution, this research empirically tested for submarket existence within Ghana's residential rental housing market and use the results in understanding how the rental market operates. Submarket definition is a critical aspect in housing market analysis, and this is very useful in understanding market dynamics and making market predictions (Wheeler et al., 2014) at a lower level of disaggregation. Anecdotal evidence suggests that submarkets do exist but researchers have ignored the empirical testing of same due to data asymmetries in African cities. The research presented an innovative method that utilised real estate and stakeholder consultations to delineate *a priori* submarkets based on spatial, structural and nested approaches. Submarket existence was tested using the Kruskal-Wallis H test and the Jonckheere-Terpstra test (non-parametric), and the hedonic pricing model (parametric). The advantage of using both parametric and non-parametric methods to test for submarket existence were to provide reliable results based on different data types (skewed data, non-normal, small or large data size, ranked data and outliers). The research provides stakeholder investors in the rental space an understanding of market dynamics for profit maximisation, and end-users to maximise utility in deciding where to live – and as such households could benefit from making informed investment decisions on housing. This research is one of the first attempts to empirically identify and test for submarkets existence in Ghana's residential rental housing market.

Within the context of empirical findings, the research tested the hypothesis that, location and neighbourhood attributes determine to a larger extent residential rental values in Ghana than structural attributes does. In housing market research it has been long established that structural, location and neighbourhood characteristics do interact to determine housing values; however the extent of contribution is the source of usual disagreements. The research provides an overview of the main determinants of rental value based on empirical data. Based on the aggregate rental market, the data suggests that structural attributes contribute about 43% to rental value, whereas location and neighbourhood attributes contribute 20% and 25% respectively. There exists several potential applications of quantifying the specific contributions of variables within the aggregate market as well as submarket models as presented in chapter seven. Quantifying value determinants is influenced by the quality of data. These findings offers property investors a better understanding of price movements within the rental housing market to maximise returns on their investment. This contribution is one of the first attempts to quantify the price premiums of structural, location and neighbourhood attributes in Ghana's residential rental housing market.

It is further recommended that a national housing data bank is established by real estate teaching universities in Ghana to facilitate the acquisition of housing related data for research purposes.

### 8.2.2. Limitations of research

The limitations in the research methodology are discussed below.

The first part of the thesis discusses the perception of key stakeholders regarding determinants of rental value in the rental market. It would have been appropriate to receive responses from a larger pool of landlords from the questionnaire administered. It would have been insightful for this specific group of stakeholders to add invaluable insights to understand the pricing regime from the lenses of landlords. It was difficult to access these landlords for several reasons; some did not complete all required questions, hence making responses not suitable for final analysis; others could also be as a result of questionnaire fatigue; others also thought the information required of them were confidential and thus the reason for their null responses. However other respondents fill the gap to capture some of these inaccessible information. For example the group who identified themselves as "*others*" are either relatives or friends of these landlords and as such provided same information that could have been provided by these landlords.

The second part of the thesis was to collect empirical data to analyse the effects of location and neighbourhood explanatory variables on rental value determination. Time series data that could have been used to analyse rental value trends over the years was not available. Some secondary data examined had incomplete fields that did not include some basic explanatory variables that could be utilised in the modelling process. Missing variables included size of rental unit (floor area), number of bedrooms, proximity to amenities, basic structural details of rental unit. The solution then was to use cross-sectional data collected during fieldwork in Accra. A time series data would have been appropriate to test hypothesis (or examine) whether rental value determinants do indeed change over time. To understand rental housing market dynamics in more specific and appropriate developing country context, the case study approach is utilised. In this thesis rental data (from different rental housing types) are collected from four district assemblies.

### 8.2.3. Recommendations for further research

Having investigated how location and neighbourhood characteristics affect residential rental values in housing submarkets, the following topics could be considered for future direction of research in housing markets in a developing country context:

- The methodology should be explored in other developing countries. A worldwide applicability would offer the opportunity to test the robustness of findings within different urban settings.
- Further research can consider stratifying submarkets based on other submarket definitions (i.e. number of bedrooms) and test the existence of submarkets. This will determine whether the segmentations defined and analysed in this research is robust to be used for generalisations in the rental market in Ghana.
- The inclusion of GIS layers would improve spatial analysis. Spatial trends of housing markets could be studied over time to analyse the dynamics of rental value in a time series.
- Regional data could also be explored to analyse inter-regional trends in housing markets within country and among countries.

[i] *Note: The exchange rate used is USD1.0000 = GHS4.4009 as at August 27, 2017.*

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## Appendix A

**Residential Rental Housing in Accra – Questionnaire for Expert Survey**

***Instruction***

*The purpose of this research is to assess key explanatory variables that contribute to residential rental value and use these to explain neighbourhood effects of housing (sub) markets in Accra, Ghana. This is part of a PhD research conducted through the Faulty of Spatial Planning, Technishe Universität Dortmund, Germany.*

*Please complete the following questions to reflect your opinions as accurately as possible and answer questions to the best of your knowledge. Your responses will be anonymous and kept strictly confidential. Thank you for your cooperation.*

***Personal Information***

**1.** Please tick appropriate: ☐ Landlord ☐ Tenant ☐ Estate Agent ☐ Academic
☐ Valuation and Estate Surveyor (GhIS Member)
☐ Other _____

**2.** Do you have an understanding of the residential rental market in Accra? ☐ Yes ☐ No

**3.** Residential location (*Please tick*) ☐ Accra ☐ Outside Accra

**4.** Years of contact with the residential real estate rental market in Accra

☐ 0 to 5 years ☐ 6 to 10 years ☐ 11 to 15 years ☐ 16 to 20 years ☐ Over 21 years

***Key variables that determine Rental Value***

**5.** Which variables drive the creation of a residential rental housing sub-market?

☐ Location (spatial segmentation) ☐ Property type ☐ Price (rental value of property)
☐ Both location and property type ☐ All of the above ☐ Other: _____

**6.** The table below provides some **explanatory variables** that may contribute to residential rental value. Please indicate by placing an **X** in the appropriate box corresponding with what you think has an **effect on rental value** based on a 5-Point Likert scale as explained below;

*1 - Highly Insignificant Effect*
*2 – Insignificant Effect*
*3 - Not sure*
*4 – Significant Effect*
*5 - Highly Significant Effect*

| **FACTOR** | **RANKING** | | | | |
|---|---|---|---|---|---|
| **Structural Characteristics** | **1** | **2** | **3** | **4** | **5** |
| Type of house (*eg. apartment, hall & chamber, single room*) | | | | | |
| Quality of construction (& materials) | | | | | |
| Age of building | | | | | |
| Plot size | | | | | |
| Size of building (*floor area*) | | | | | |
| Number of bedrooms | | | | | |
| Number of wc | | | | | |

| Number of baths | | | | | |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** |
| Floor finish (*screed, concrete, tiled, terrazzo)* | | | | | |
| Number of storeys *(floors*) | | | | | |
| Kitchen available *(separate or shared)* | | | | | |
| Toilet available *(separate or shared)* | | | | | |
| Bathroom available *(separate or shared)* | | | | | |
| Property condition *(physical deterioration)* | | | | | |
| Fence or wall availability | | | | | |
| Parking space or garage availability | | | | | |
| Storeroom availability | | | | | |
| Quality of landscaping | | | | | |
| ***Neighbourhood characteristics*** | | | | | |
| Near to suitable vehicular access | | | | | |
| Has electricity connection | | | | | |
| Has piped-water connection or well | | | | | |
| Waste disposal or garbage collection available | | | | | |
| Area considered safe *(security)* | | | | | |
| Streetlighting present | | | | | |
| Presence of suitable surface drainage | | | | | |
| ***Locational characteristics*** | | | | | |
| Near to traffic congestion | | | | | |
| Near to market or shopping center | | | | | |
| Near to CBD | | | | | |
| Near to job opportunities | | | | | |
| Near to educational facility | | | | | |
| Near to healthcare *(medical)* facilities | | | | | |
| Near to recreational facilities *(parks & green spaces)* | | | | | |
| Near to squatter settlements | | | | | |
| Near to Police station *(security post)* | | | | | |
| Near to place of worship | | | | | |
| Population density | | | | | |
| Near to bus stop *(public transport)* | | | | | |
| Quality of property view | | | | | |

**7.** Please indicate your choice by placing an **X** in the appropriate box corresponding with your level of agreement based on the **perceived effect** of each variable on overall **Residential Rental Value**.

| **FACTOR** | **EFFECTS** | | | |
|---|---|---|---|---|
| ***Structural characteristics*** | **Positive effect** | **No effect** | **Negative effect** | **Not sure** |

| | | | | |
|---|---|---|---|---|
| Type of house (*eg. apartment, hall & chamber, single room*) | | | | |
| Quality of construction (& materials) | | | | |
| Age of building | | | | |
| Plot size | | | | |
| Size of building (*floor area*) | | | | |
| Number of bedrooms | | | | |
| Number of wc | | | | |
| Number of baths | | | | |
| Floor finish (*screed, concrete, tiled, terrazzo*) | | | | |
| Number of storeys *(floors*) | | | | |
| Kitchen available *(separate or shared)* | | | | |
| Toilet available *(separate or shared)* | | | | |
| | **Positive effect** | **No effect** | **Negative effect** | **Not sure** |
| Bathroom available *(separate or shared)* | | | | |
| Property condition *(physical deterioration)* | | | | |
| Fence or wall availability | | | | |
| Parking space or garage availability | | | | |
| Storeroom availability | | | | |
| Quality of landscaping | | | | |
| ***Neighbourhood characteristics*** | | | | |
| Near to suitable vehicular access | | | | |
| Has electricity connection | | | | |
| Has piped-water connection or well | | | | |
| Waste disposal or garbage collection available | | | | |
| Area considered safe *(security)* | | | | |
| Streetlighting present | | | | |
| Presence of suitable surface drainage | | | | |
| ***Locational characteristics*** | | | | |
| Near to traffic congestion | | | | |
| Near to market or shopping center | | | | |
| Near to CBD | | | | |
| Near to job opportunities | | | | |
| Near to educational facility | | | | |
| Near to healthcare *(medical)* facilities | | | | |
| Near to recreational facilities *(parks & green spaces)* | | | | |
| Near to squatter settlements | | | | |
| Near to Police station *(security post)* | | | | |
| Near to place of worship | | | | |

| | | | | |
|---|---|---|---|---|
| Population density | | | | |
| Near to bus stop *(public transport)* | | | | |
| Quality of property view | | | | |

**8.** Can these variables be priced and disaggregated from rental value? ☐ Yes ☐ No ☐ Not sure

**9.** Please explain further:

**10.** Are there other variables that may have been omitted? ☐ Yes ☐ No ☐ Not sure

**11.** Please explain further:

**12.** In your own words describe the residential rental housing market in Accra?

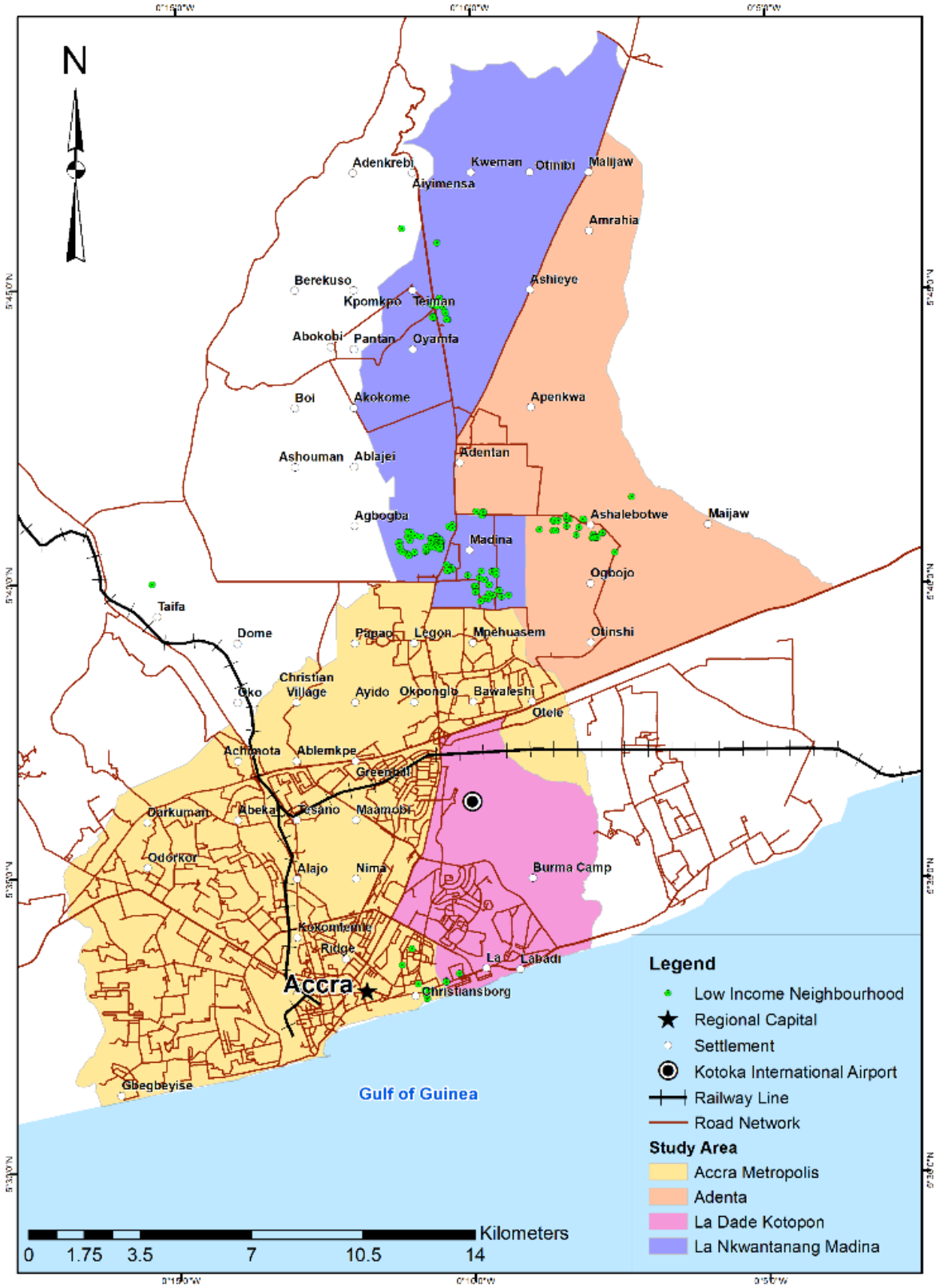
**13.** In your own understanding give a brief description of a residential neighbourhood?

***End … Thank you***

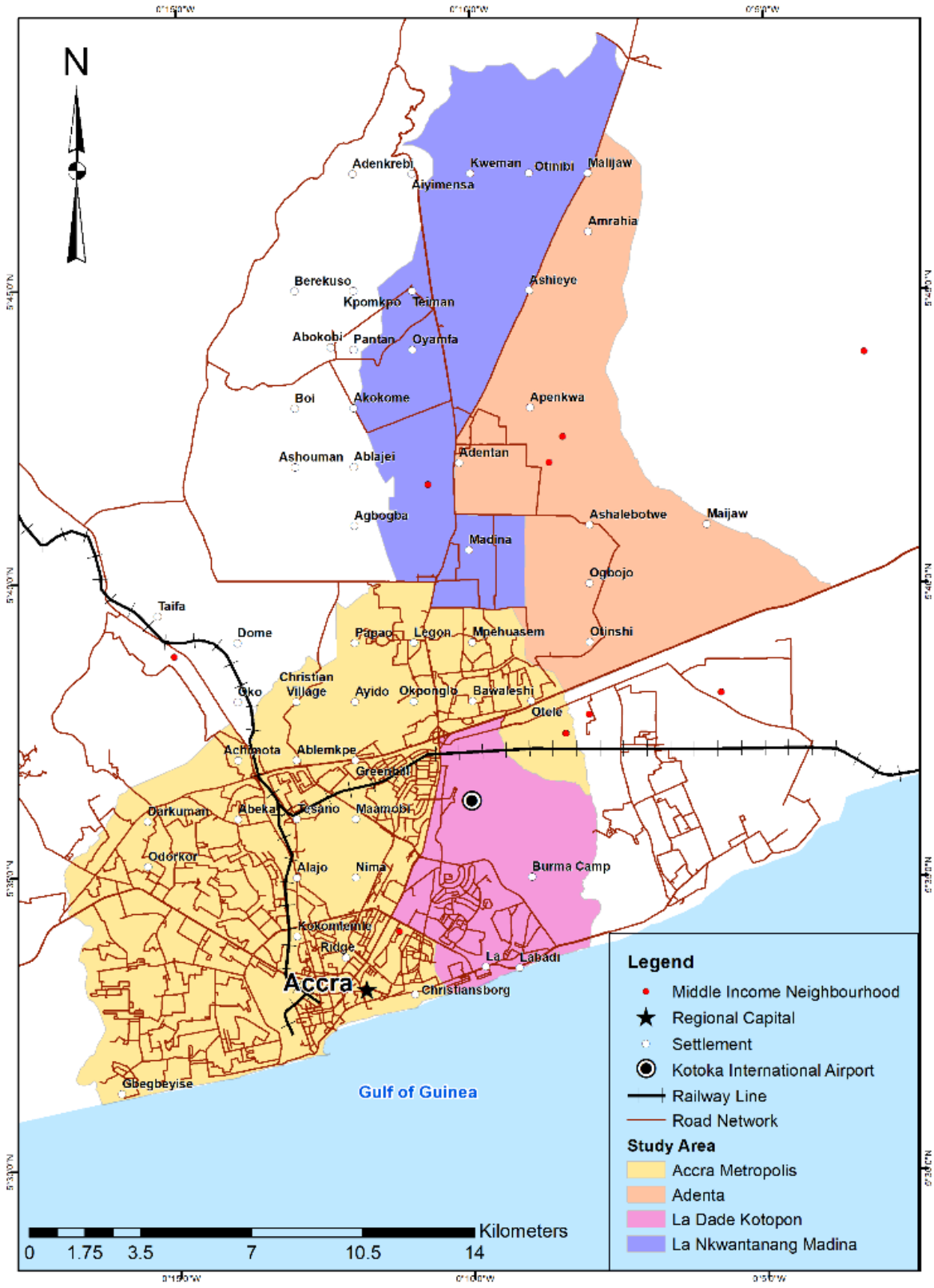
***Contact – ekgavu@gmail.com***

## Appendix B

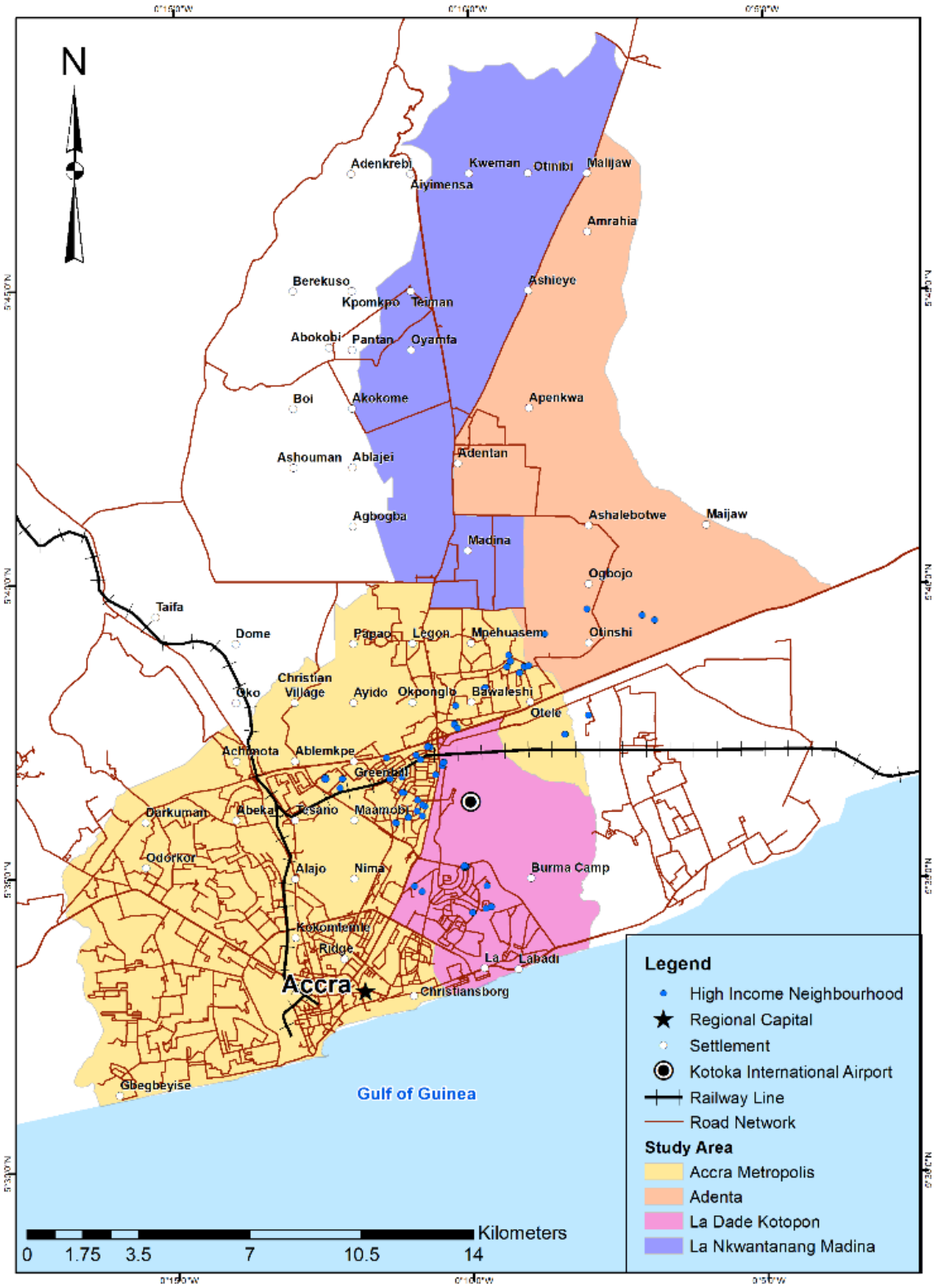
Appendix Bi: Spatial submarket – Low Income Neighbourhood (LIN)



Appendix Bii: Spatial submarket – Middle Income Neighbourhood (MIN)

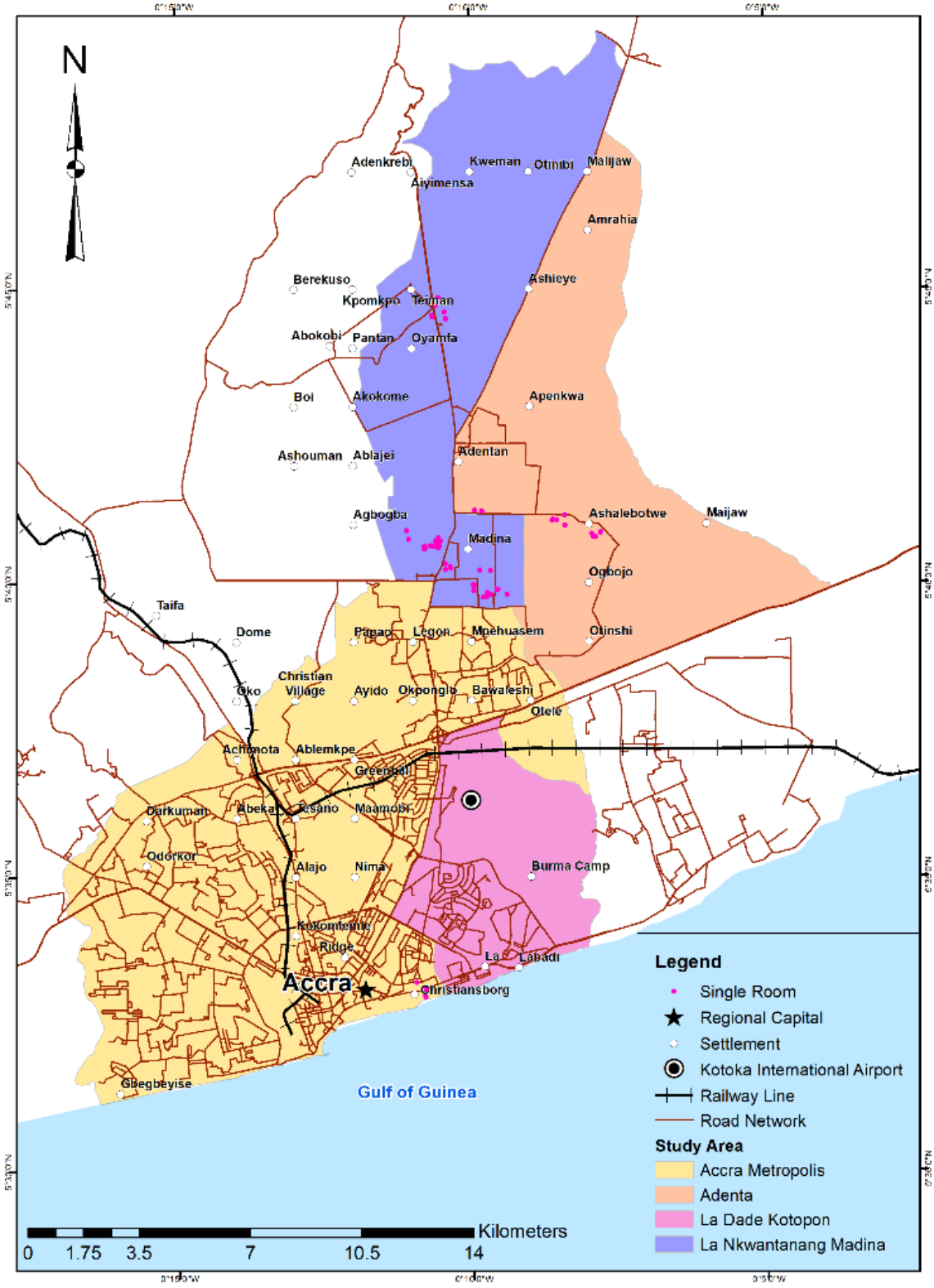


Appendix Biii: Spatial submarket – High Income Neighbourhood (HIN)

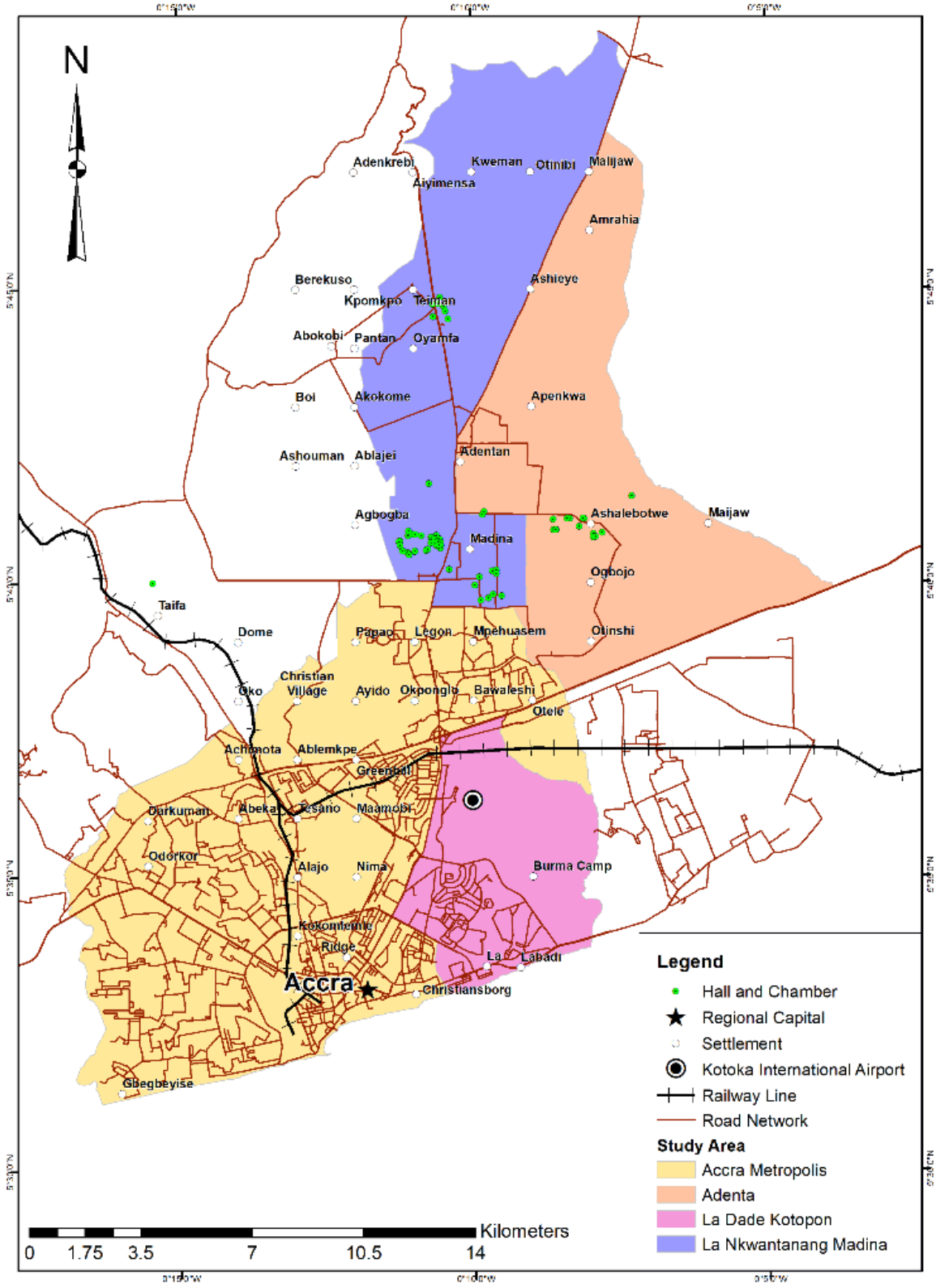


## Appendix C

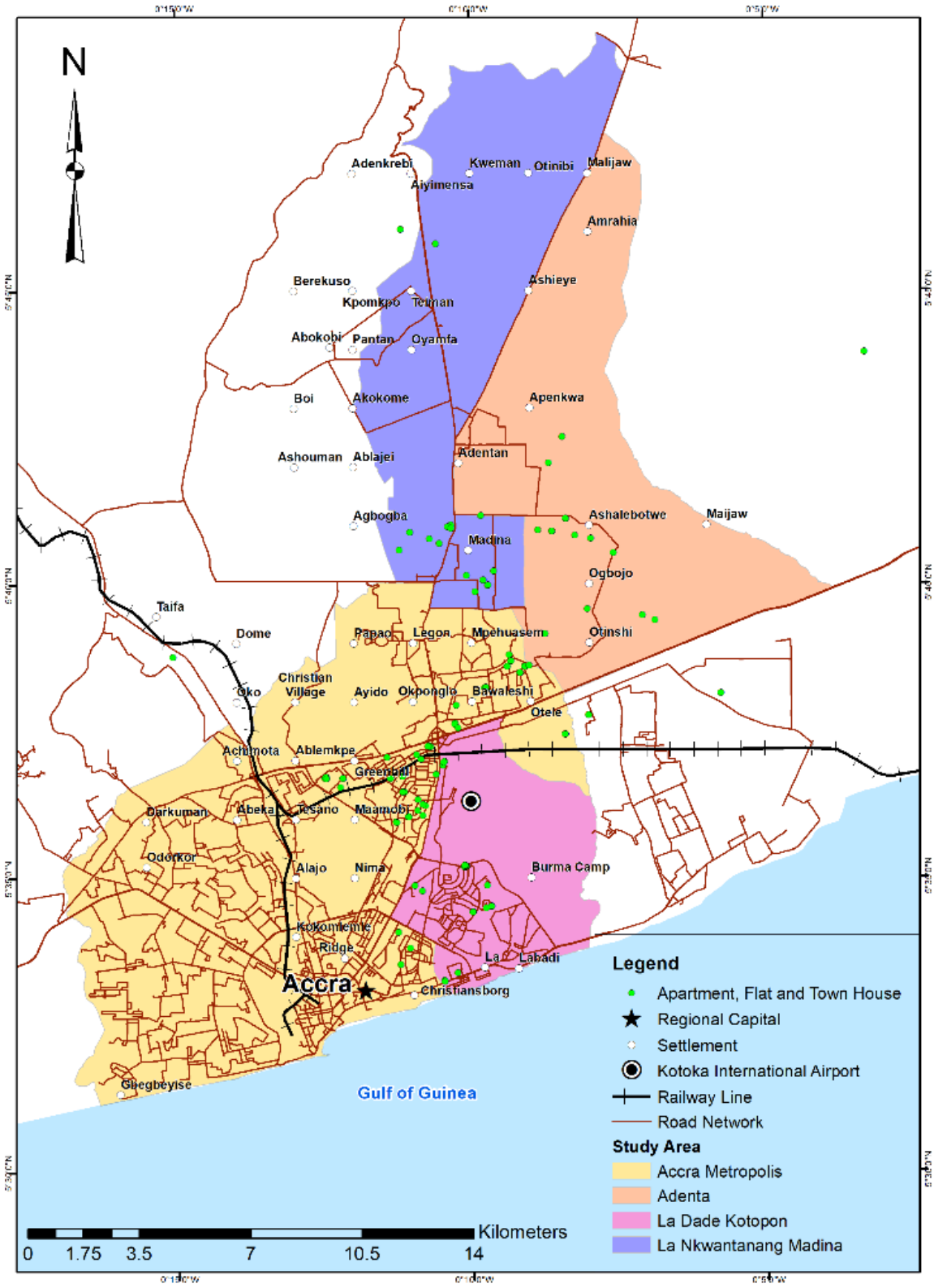
Appendix Ci: Structural submarket – Single Room (SR)



Appendix Cii: Structural submarket – Hall and Chamber (HC)

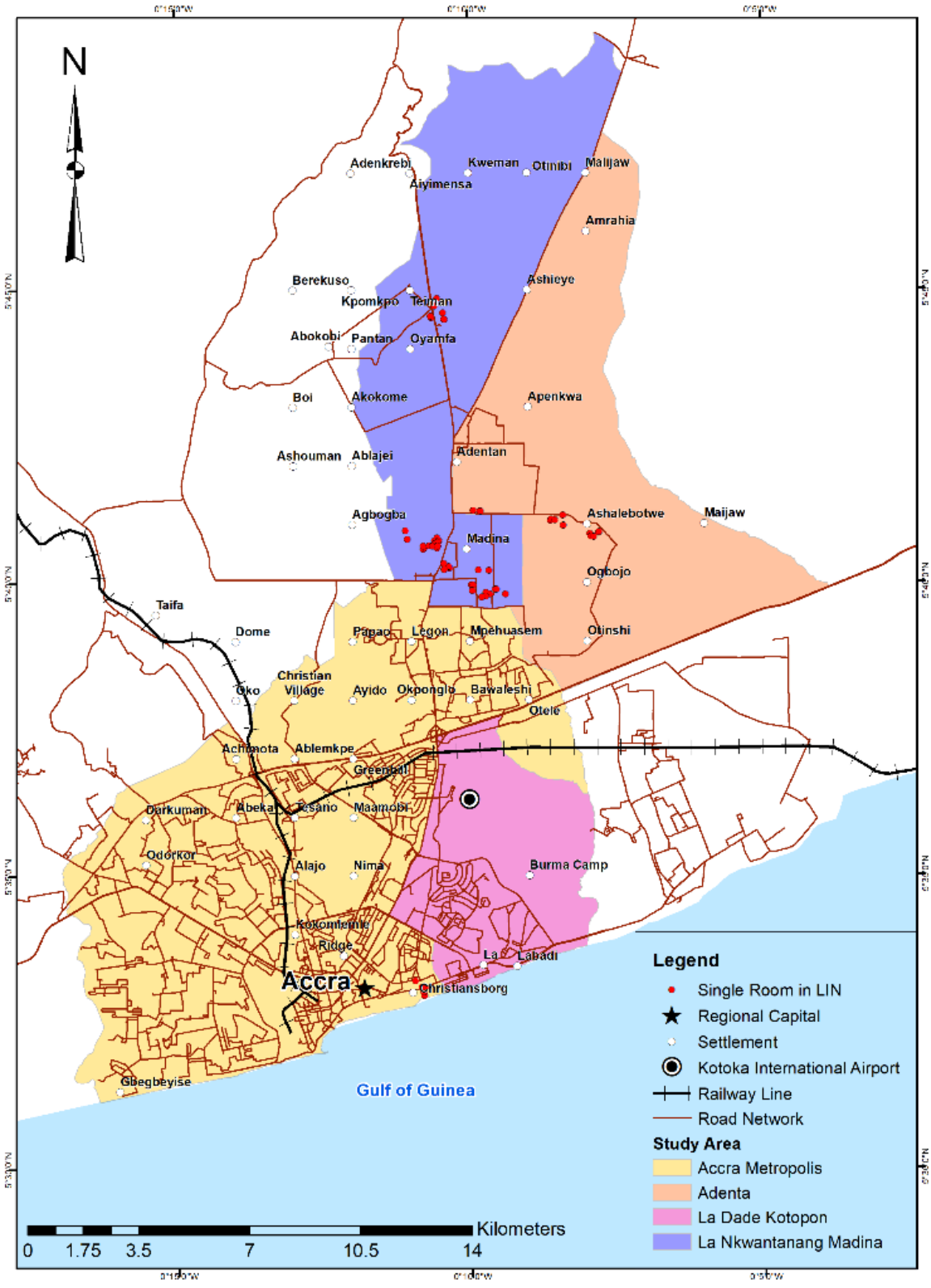


Appendix Ciii: Structural submarket – Apartments Flats and Town Houses (AFTH)

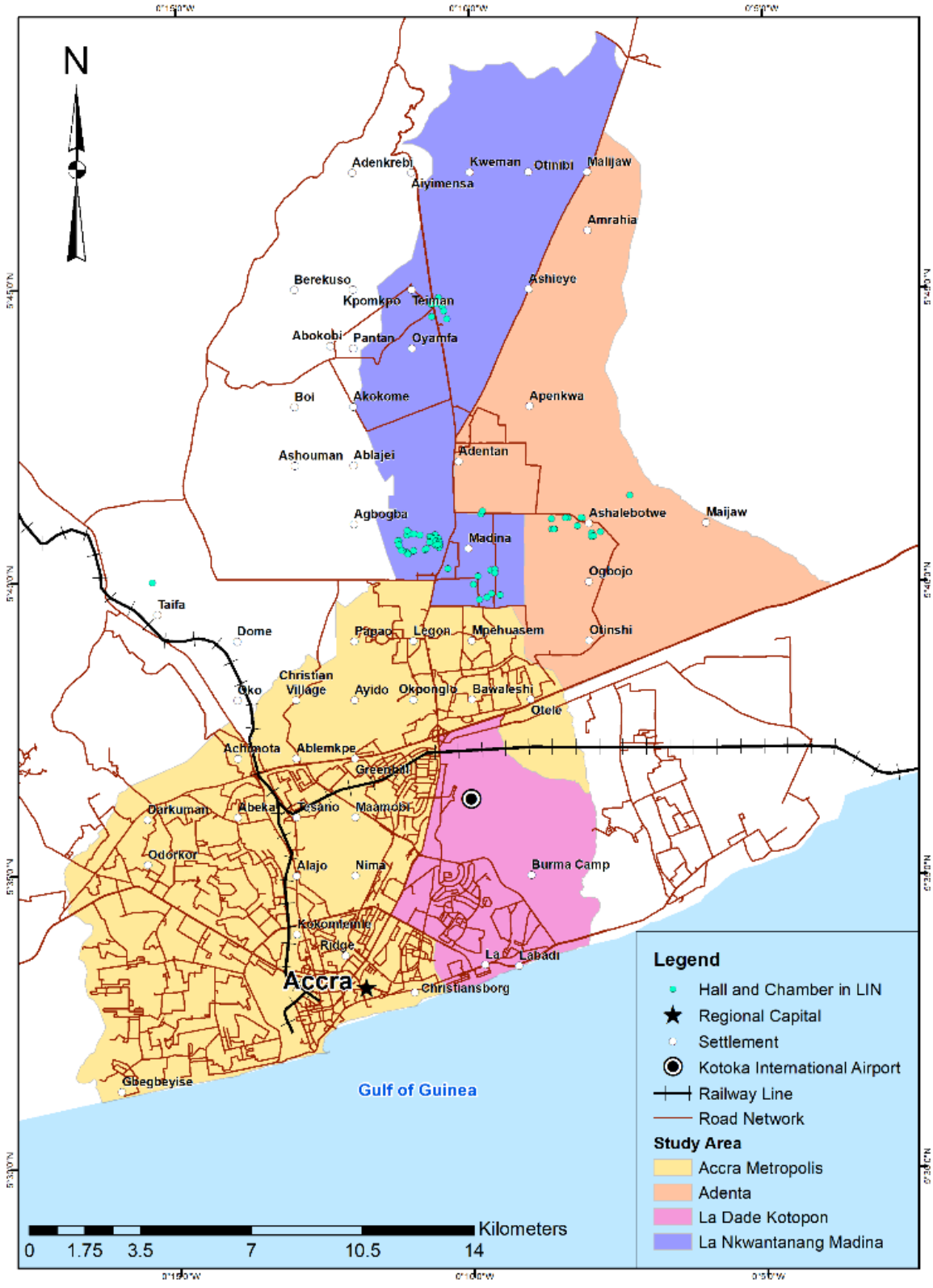


## Appendix D

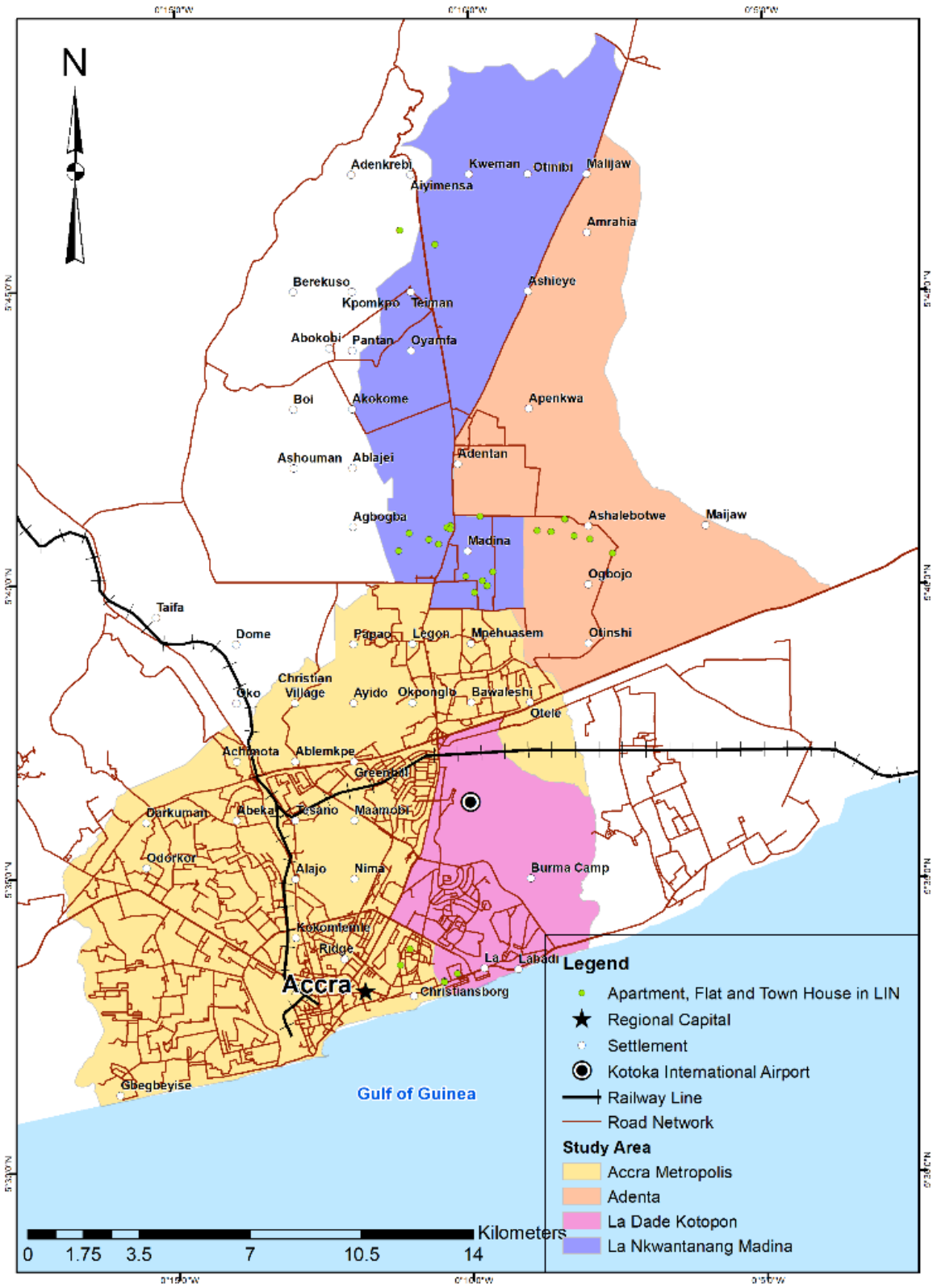
Appendix Di: Nested submarket – LIN.SR



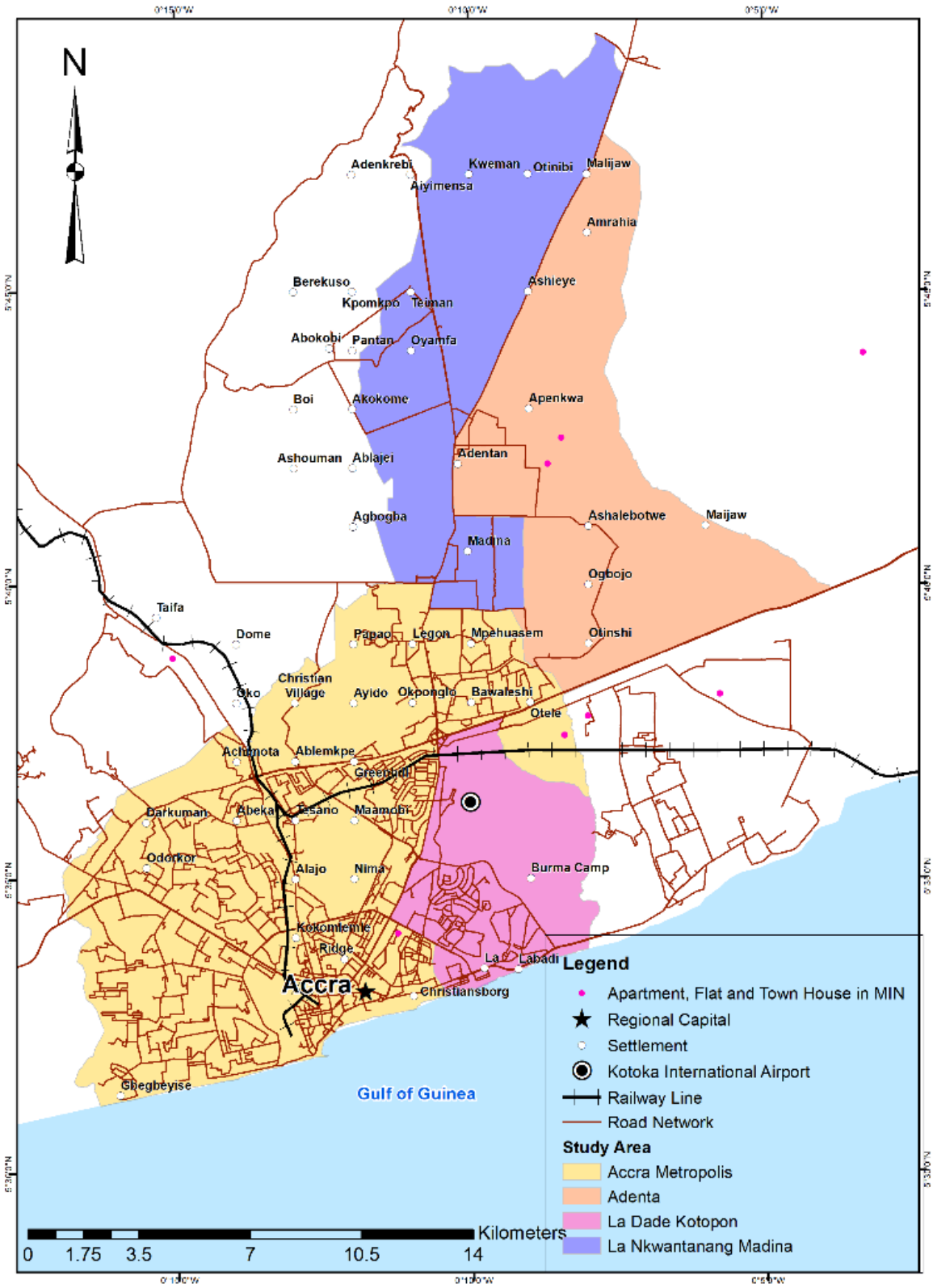
Appendix Dii: Nested submarket – LIN.HC



Appendix Diii: Nested submarket – LIN.AFTH



Appendix Div: Nested submarket – MIN.AFTH



Appendix Dv: Nested submarket – HIN.AFTH