Nordic Journal of Surveying and Real Estate Research 12:1 (2017) 7–37
submitted on 16 March, 2017
revised on 10 June, 2017
accepted on 5 July, 2017

The Impact of Traditional House-type on Rental Values in Kinondoni Municipality Dar es Salaam Tanzania

Samwel Alananga Sanga
Department of Land Management and Valuation (LMV),
School of Earth Sciences, Real Estate, Business and Informatics (SERBI),
Ardhi University (ARU), Dar es Salaam, Tanzania
Email: alananga@aru.ac.tz

Abstract. *Traditional housing type has for a long time been recognised as the most inexpensive way to provide rental housing in cities of the global south. Although the architectural design may be more cost-efficient to construct than modern ones, the ultimate rent paid by a tenant may not necessarily be lower given the multiplicity of factors that affects rent. This study examines the effects of traditional Swahili houses on marginal rental values of occupied rooms, taking into account the neighbourhood and individual characteristics of both tenants and owners in Kinondoni municipality in Dar es Salaam Tanzania. The data were collected using questionnaires which were administered to 2,339 owners and 2,113 tenants between February and June 2014. The survey solicited data on imputed rent from owners and actual rent paid by tenants and included an assessment of households, housing and neighbourhood attributes. The share of Swahili houses in each administrative unit (wards) were first computed to define rental housing submarkets and then marginal rent per bedroom was estimated for each surveyed housing location from a Geographically Weighted Regression (GWR) model. Based on these preliminary results, a Linear Mixed Effect (LME) model was then implemented to identify significant determinants of marginal rent per bedroom across submarkets. The results suggest that, predominantly Swahili-house type rental submarkets are relatively closer to the CBD where rent-per-bedroom tend to be higher in line with both higher income and house size while limitedly Swahili-house type rental submarkets predominates in the periphery where rent-per-bedroom is lower in line with both income and size of the house. Thus, although traditional Swahili houses can easily be supplied by self-builders, room rents in those houses are not necessarily lower unless the houses are located far away from the city centre. These findings provide evidence on a significant departure of rental values from construction cost in self-built housing in developing countries. It is concluded that self-built traditional Swahili houses may not necessarily provide affordable rental housing despite having all the attributes of being low cost housing from the owners' point of view if the rented space is bedroom oriented as it is the case in this study.*

Keywords: *developing countries, housing demand, rental housing, rental values, Swahili houses*

1 Introduction

Across the globe, a significant number of households live in private rental housing. In Kinondoni municipality, one of the municipalities of the Tanzanian major city of Dar es Salaam, private rental housing rights are estimated to be held by around 50 percent of the 446,504 households reported in the 2012 population census (Alananga, 2015) while Anim-Odam et al. (2010) estimate rental housingfor Accra Ghana to be more than 40 percent. Despite the fact that households spend a substantial amount of their income in housing (Sheppard, 1999), governments in developing countries, are reluctant to provide housing through public expenditure (Arnott, 2008; Fekade, 2000). Low income households therefore, have to resort to private rental housing as the only legal means to access housing. Private rental housing can adequately provide housing to the poor majority in cities of the global south provided appropriate policies exist (Parashar, 2014). However, empirical researches into the housing subsector in developing countries are still rare due to data constraints (Anim-Odame, Key, & Stevenson, 2010). The need to carry out such research emanates from the fact that many housing policies are being formulated based on *ad hoc* assumptions about income and price elasticity of demand/supply as well as flexibilities (Jimenez & Keare, 1984). In order to design sustainable land and housing policy, it is important to have a better understanding of land and housing practices in these countries (Durand-Lasserve, Durand-Lasserve, & Selod, 2013).

The housing problem in Tanzania can be looked at from either the stock point of view or the quality point of view. From the housing stock point of view, empirical evidence suggests that Tanzania has been on serious shortages since independence when the housing issue came into policy focus (Mosha, 2012). In the First Five-Year Development Plan (1964–1969) the housing shortage was estimated at 21,000 houses in urban areas. The shortage grew to 25,000 houses at the end of the 2nd Five Year Development Plan (1969–1974) and by 1982 the shortage was estimated at 300,000 houses. Given the complexity of getting genuine data on housing in Tanzania, the annual patterns of housing shortage are not well understood. By the year 2002, the housing shortage was estimated to be 2,000,000 units. Current estimates of formal housing shortage stand at 3,000,000 housing units and is growing at a rate of 300,000 housing units per annum (National Housing Corporation, 2010).

The quality dimension of housing suggests that the Tanzanian urban human settlement comprises both formal and informal housing units. There are no significant housing quality differences in many settlements with a very few exceptions of the high markets ends in some major cities (Limbumba, 2010; Lupala, 2002; Nguluma, 2003). To many urban dwellers housing quality can be described as lacking adequate basic social infrastructure services such as water supply, sewerage, access road, storm water drainage and solid waste management systems. Only 6% of Tanzanians have access to Ventilated Improved Pit (VIP) latrines or flush toilet by the year 2010 (URT, 2012). Using the definitions provided by the Tanzania Demographic and Health Survey (TDHS) (URT, 2010), only 12% of households have access to “improved, latrine facilities”, 74% use non-improved latrine facilities, and 14% do not have access to latrine at all. Similarly, only 12% of urban households are connected to the national electricity grid by the year 2007 (URT, 2009). There are also some indications that about 35% of Tanzanians live in overcrowded housing if overcrowding is defined to mean more than 2 persons per room (URT, 1996). Qualitative indicators suggest that 32% of housing units in Tanzania are in "bad" conditions, 51% in "fair" and 17% are in "good" conditions (URT, 2002). Looking at the two angles of the housing problem, it is clear that both macroeconomic and microeconomic factors are important determinant of the housing problem in Tanzania.

This study focuses in Kinondoni municipality in Dar es Salaam Tanzania where around 40 percent or more of households live in traditional Swahili houses (Hoek-Smit, 1991). Given their importance and dominance, Swahili houses provide a base upon which the private rental housing market can be analysed. This is because, preferences over Swahili house ownership is predominantly shaped by renting motives among low income self-builders (Lupala, 2002; Nguluma, 2003). Based on 2002 population and housing census the municipality has 1,775,049 people in 446,504 households. These statistics makes Kinondoni municipality the most populated municipality of the three municipalities of Dare s Salaam region (others being Temeke and Ilala). The 2012 household budget survey estimated residential owner households to be 37% while other forms of tenure other than private renting was 9.7% for the city of Dar es Salaam as a whole (National Bureau of Statistics -Tanzania, 2014). Assuming a homogenous city population structure, owner and tenant households in private housing could be around 165,206 and 237,987 respectively. The Household size for Kinondoni municipality stands at 4.1 based on the 2012 population and housing census. The Administrative Units (AUs), infrastructure network and the sample location for this study are displayed in Figure 1. It should be noted that the municipality is the most diverse and highly dynamics in terms of population thus the findings of this study may not only reflect rental housing situation in the municipality rather the whole of Dar es Salaam.

The results of this study suggest that renting a room in a Swahili house-type dominated neighbourhood or Administrative Unit (AU) has no significantly different rent compared to modern houses. At the submarket level however, AUs with a larger share of Swahili houses that predominates closer to the CBD have higher rent per bedroom, higher household income and relatively more occupied bedrooms than houses locate in AUs where Swahili houses do not predominate. Neighbourhoods with moderate share of Swahili houses (46–56%) experience higher rent-per-bedroom, potentially in response to higher occupants' income but lower number of occupied bedrooms suggesting that tenants would substitute Swahili houses for modern houses at the cost of lower number of bedrooms. Beyond the moderate share of Swahili houses AUs i.e. as the share of Swahili houses declines towards periphery AUs, rents per bedroom also falls potentially in response to low income of the occupiers and smaller number of occupied bedrooms. This suggests that such submarkets are inhabited by income constrained residents. At fixed effect level, marginal rent-per-bedroom differs in response to education, employment, family size, workplace proximity, ward level population

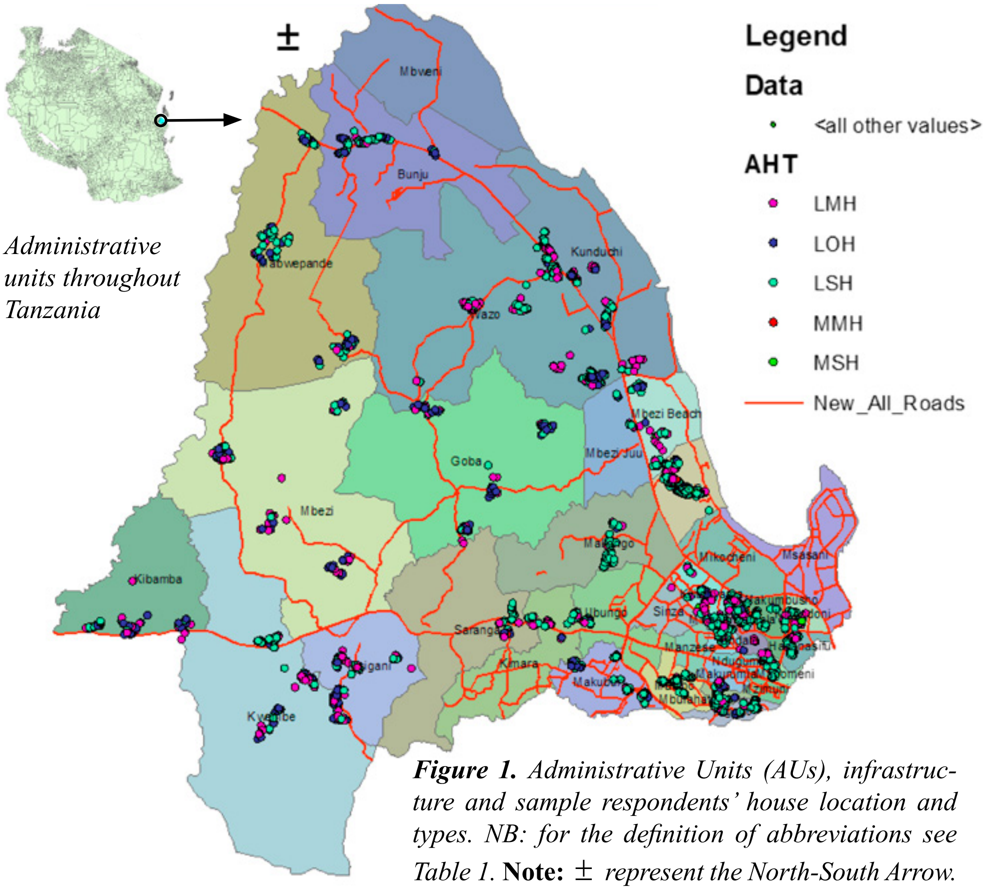


Figure 1. *Administrative Units (AUs), infrastructure and sample respondents' house location and types. NB: for the definition of abbreviations see Table 1.* **Note:** ± *represent the North-South Arrow.*

density, number of bedrooms, house-type, bedroom size, having a living room, store, backyard, garage, floor size, and availability of water and electricity. It was further observed that many neighbourhood attributes for proximity to amenities were not significant rent determinants with the exception of proximity to major roads and the CBD.

2 Literature review

2.1 Determinants of housing rent in developing countries

Theoretically, housing types affect rent by making housing cost higher in certain types of housing and lower in others (García & Hernández, 2008). Takeuchi, et al., (2008) observed that a *chawl*[1] is worth about 400 Rs. ($6.21) per month more than being in a slum, whereas being in a *co-op*[2] is worth about 700 Rs. ($10.9) more than being in a *chawl*. Similarly, being in a high-rise building (flat) was

[1] *Chawl* is a large tenement building divided into separate rental units commonly occupied by relatively poor working-class households.

[2] *Co-op* refers to housing units occupied by people who are members of a housing corporation; a body corporate established for the purpose of providing, managing and maintaining housing units for its members.

worth about 730 Rs. ($11.33) more than being in a *co-op*. Other housing attributes that affect rent include water and electricity (Takeuchi, Cropper, & Bento, 2008; Gulyani & Talukdar, 2008; Choumert, Stage, & Uwera, 2014; Young & Flacke, 2010). Takeuchi, et al. (2006) estimates the value of piped water connection to be about 240 Rs. ($3.73) per month. The effect of water availability however, has been observed to be marginal in certain neighbourhoods where water shortage is a serious problem (Tiwari & Parikh, 1997). Unlike water, availability of electricity is among the major determinant of rent in developing countries (Takeuchi, Cropper, & Bento, 2008; Gulyani & Talukdar, 2008). The estimates by Tiwari and Parikh, (1997) suggest that the availability of electricity increases rent by 10 percent. Both water and electricity have a significant impact on the welfare differentials of household in developing countries (Aliyu, 2012; Babawale, Koleoso, & Otegbulu, 2012).

Furthermore, reasonable access to toilet facilities may increase rent per housing unit (Gulyani & Talukdar, 2008). Takeuchi, et al. (2006) estimated the mean willingness to pay for a private toilet to be 580 Rs. ($9) per month. In both Takeuchi, et.al., (2008) and Tiwari and Parikh, (1997) however, it was observed that the effect of access to toilet on rent was not significant. Related to that is the distance of the toilet to the house where evidence provided by Takeuchi, et al., (2008) suggest a negative relationship between distance to toilets and rent paid. These empirical observations imply that a modern house (a house with a toilet inside the house) is more likely to be associated with higher rent than a traditional house.

Neighbourhood qualities are the external elements that are reflected in the price/rent of a house (Teck-Hong, 2011). Gulyani and Talukdar, (2008) and Aluko, (2011) observed that better neighbourhood qualities in developing countries may not necessarily be associated with higher property values. Possible explanation for the limited effect of neighbourhood qualities on property values or rent can be linked to the smoothing effect of neighbourhood poverty which motivate landlords to spread housing costs to many households leading to crowded neighbourhoods which may further attract crimes (Rose, 2006; Field, 2003); poor sanitation and increased pressure on schools (Tinsley, 1993; Penrose, de Castro, Werema, & Ryan, 2010; Nguluma, 2003; Manaster, 1968), all leading to lower rent. This study incorporates proximity to roads, and service centres such as market and schools, as neighbourhood attributes.

The spatial dimension of rent or housing prices is often captured through distance to the Central Business District (CBD) (Herath & Maier, 2010). Takeuchi, et al. (2008) observed that distance to the CBD reduced the imputed rent of the owner house by 3.5 percent for a distance of 10 km away from the CBD while Tiwari and Parikh (1997) observed that a distance of around 10 km reduced rent by 1.14 percent. Higher rent closer to the CBD in developing countries emanates from the fact that the rich resides closer to the city centre where the best physical infrastructures and social amenities are provided (Vincent, 2009). This suggests that rent tend to be higher in and closer to the CBD than in the periphery. With the co-existence of legal and illegal tenures however, low quality housing may be observed closer to the CBD for low income earners intending to benefit from lower commuting cost (Tinsley, 1993). Given the mono-centric nature of Dar es Salaam city and the fact that some informal settlements are closer to the CBD, the effect of distance to the CBD requires field observations.

Other proximity considerations in rent determination include proximity to public transport, workplaces, peers or social networks, markets, bars, places of worship, public schools and offices (Takeuchi, Cropper, & Bento, 2006). Proximity to infrastructure such as roads or rails improves accessibility on one hand, but increases the risk of forced eviction due to expansion, and death due to accident, on the other (Wu, Gyourko, & Deng, 2012). This study considers proximity to major and minor roads with the hypothesis that proximity to these facilities increases housing demand thus higher rent (Young & Flacke, 2010). Additionally, proximity to workplaces, fellow tribesmen or religiously connected peers increases the willingness to pay for housing (Takeuchi, Cropper, & Bento, 2008). For a worker to be far from his/her workplace or home, compensation in terms of higher wages is theoretically necessary (O'Sullivan, 2012). Households would therefore pay a premium for the increased chances of working closer to their residencies. For the other proximity variables, there are no evidences for their effect on rents in developing countries but expectations can be formulated based on predictions from past literature from developed countries. With the exception of proximity to a bar which may have a negative effect on rent, the remaining amenities are expected to have a positive effect.

Physical attributes of a house are generally associated with higher rent. The effect of house size is often reported in terms of price elasticity of housing demand. For example the price elasticity of demand estimated by Tiwari and Parikh (1997) was -0.75 and García and Hernández (2008) estimated it to be roughly between −0.6 and −1. These studies concluded that since tenants consume housing services today, it is likely that their housing consumption would decline in nearly the same proportion as the increase in its price. It should be noted, however, that the amount consumed on housing related services is often difficult to measure and the use of hedonic models suggest that the different housing attributes can be priced differently to arrive at the overall price of the housing unit. Since this paper does not address housing expenditure as a whole, the demand for bedrooms in response to changes in its price is preferred.

Along the bedroom dimension, Anim-Odame et al. (2010b) observed that an additional bedroom increases rent by 2 percent which was however, not significant;Takeuchi et al. (2008) observed that imputed rent for owner houses increases by 13 percent with an increase of one room. Similar results were observed by Gulyani and Talukdar (2008) and Babawale et al. (2012). Tiwari and Parikh,(1997) observed that one additional room has 38 percent more rent. In terms of gross internal area, Follain-Jr, et. al. (1982) observes that an increase in floor space of one *pyong* (around 3.31m^2) increased monthly rental expenditures by 1.9 percent. Similar observations are found in Anim-Odame etal. (2010b), Buchel and Hoesli (1995), and Bajari and Kahn (2008). Other attributes of a house that may lead to higher rent include presence of a garage and bathrooms.

Anim-Odame etal. (2010b) observes that having a garage increases rent by 17.7 percent. Similarly, the higher the number of bathrooms the higher the rent (Buchel & Hoesli, 1995; Goodman, 1988). In addition to the above attributes, this study explicitly incorporates living rooms, dining, kitchen, backyard, store and garden as rent determinants, all of which have a positive effect on rent.

Housing demand is also sensitive to changes in demographic and households' characteristics such as income, age and marital status (Day, 2001; Lim & Lee, 2013; Selod & Tobin, 2013).Jimenez and Keare (1984) found out that an increase in the household size by one member increases rent by 6.2 percent when evaluated at the mean. Mayo (1981) noted that household housing expenditures first increase with household size and then decrease. Age of the household head has been observed to be weakly related to rent in early ages and tend to pick-up at between 35 and 55 years of age, but decline later-on (Takeuchi, Cropper, & Bento, 2008; Lim & Lee, 2013). Possible reasons for this observation include the fact that expenditure on housing depends on accessibility to finances, which may be available after several years of saving or after obtaining collateral. Thus, as the household head ages beyond the threshold age of 55 years, holding family size constant, he/she will spend less on housing (Jimenez & Keare, 1984). In some other studies age has, however, been observed to be not a significant determinant of rents/prices (Goodman, 1988). Generally, cross-country cultural differences could explain the variability in rent across different studies.

Other household characteristics that are related to rent include gender, education, skills, employment status, stay-duration and marital status. Empirical observations suggest that female-headed households spend more on housing than male-headed households (Mayo, 1981). In terms of marital status, Jimenez and Keare (1984) observed that married couples pay 15 percent higher monthly rent compared to singles. Similarly, the higher the education of the household head, the higher the rent paid, and the larger the proportion of educated people in a neighbourhood, the greater the demand for housing will be (García & Hernández, 2008; Goodman, 1988; Bajari & Kahn, 2008). Skills and employment status of the household head affects tenant mobility resulting into positive effects on rent (Jimenez & Keare, 1984). Tiwari and Parikh (1997) found that duration of stay is associated with a decrease in rent of 3.5 percent per year of residence while Friedman, et al. (1988) observes a 17 percent decline in rent for each additional year of stay. Although there is no direct mechanism facilitating this rental decline as a result of longer stays, it can be urged that the social relationship developing over time between the landlord and the tenant may sway bargaining power in favour of staying rather than new tenants.

The relationship between income and housing demand is often reported through income elasticity. Jimenez and Keare (1984) observed that the permanent income elasticity of housing demand for owners in developing countries ranges between 0.5 and 0.7 and are slightly higher than estimates for renters which range mostly from 0.3 to 0.5. Similar estimates are found in Follain & Jimenez (1985) Mayo (1981) and Tiwari and Parikh (1997). Despite the general hypothesis that income elasticity of housing demand is positive, that hypothesis may not always be true, especially when higher income household live in rented houses as a luxury, rather than a necessity (Tiwari & Parikh, 1997; Jimenez & Keare, 1984). The observed differences in the estimates of income elasticity are a result of characteristics inherent in each country's housing markets (García & Hernández, 2008) and data problems (Jimenez & Keare, 1984). This justifies further works along similar lines in as many countries as possible in order to expound such cross-country differences.

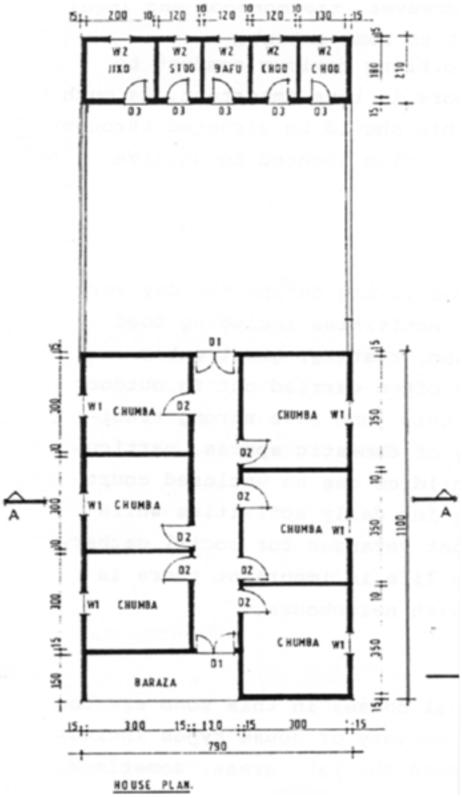
2.2 Housing in Kinondoni municipality

2.2.1 Housing typologies

For the purpose of this study, the Kinondoni housing submarkets were presumed to comprise the following house types: traditional Swahili houses (coded as type S), Modern European style houses (coded as type M) and Other (coded as type O) house types. Type S houses are low-rise buildings with toilets, store and kitchen separated from the main building. Despite their different typologies, the most common nowadays is the NHC model depicted in Figure 1. The characteristics of a Swahili house include (Swahili names in brackets); shared space for cooking (*jiko*), backyard, bathing (*bafu*) and toilet (*choo*). Nguruma (2003) characterises a Swahili house with a central corridor from which all rooms (singular: *Chumba*) are accessed; a front veranda (*baraza*) and a courtyard as shown in Figure 2 (a). The external appearance of most Swahili houses is homogenous as shown in Figure 2 (b) but where housing transformation has taken place the appearance may be different. Type "O" houses do not have the basic characteristics of a Swahili house especially a central corridor and an enclosed backyard. This includes many of the houses that are found in the outskirts of the city, which can be identified through their simple linear, "L" or "U" shapes (Nguluma, 2003; Lupala, 2002). Type "M" houses comprise all houses that do not have the characteristics of the preceding two types. This include multi-storey single-family houses, apartments and other low-rise buildings with toilets and bathrooms facilities inside the main building.

Within Kinondoni municipality Swahili houses are common in almost everywhere. For example, Lupala (2002) observes that traditional Swahili houses are common in Magomeni, Kinondoni, Mabibo, Mwananyamala, and a small segment of Oysterbay area. Those in Oyster Bay were planned for African workers ('houseboys') to the former European areas of Oyster Bay. The other subtypes of traditional Swahili houses are common in areas such as Manzese, Hananassif, Msasani, Kigogo, Mabibo and Kinondoni. Detailed field observations and measurement work carried out by Lupala (2002) in Msasani revealed that density in Swahili dominated settlements was 43 houses per hectare. The remaining housing types within the municipality can be grouped under the category "Other" because of the diversity they exhibit in terms of both physical and morphological structure. Grouped under this category are low-rise buildings with simple shape such as L or U or linear (Nguluma, 2003).

The different types of houses observable in Dar es Salaam city, may contribute to rental price differentials as imputed by owners or as directly paid by tenants.



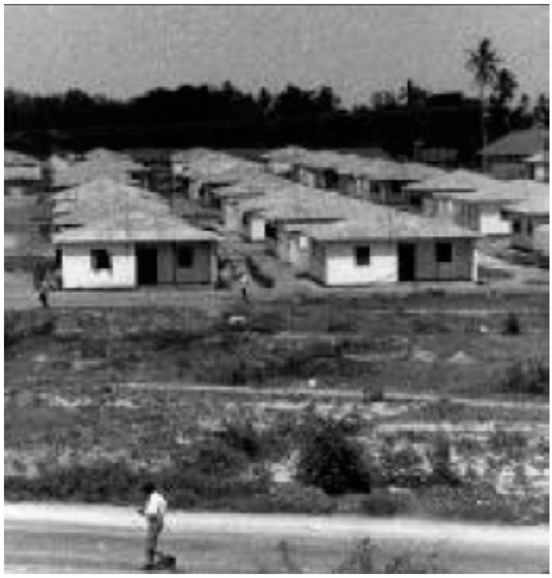


Figure 2 (a). *A sketch plan of a Swahili house based on NHC model.*

Figure 2 (b). *A planned Swahili neighbourhood.*

Until 2016 however, there has been no study from Kinondoni municipality that has attempted to examine this effect. Mosha (2012) noted that informal walk-up rental apartments are developed closer to the CBD and tend to attract more low-income tenants suggesting for lower rent in informal apartments. Despite the limited evidence from Tanzania on the link between housing types and housing market outcome, the effect may be manifest through related variables. The fact that certain types of housing predominates in certain neighbourhoods calls for a scrutiny on neighbourhoods' characteristics. Modern houses for example are rarely found in informal settlements thus are less likely to face problems associated with informality such as lack of adequate water and sanitation facilities, effective police and fire services, good roads, and educational and health services (Penrose, de Castro, Werema, & Ryan, 2010; Nguluma, 2003). Based on experience from other countries, these indicators are directly linked to rental prices thus may induce lower rent in predominantly informal Swahili submarkets.

2.2.2 Other factors affecting rental values

Residential location choices of many people in Dar es Salaam city are also shaped by pursuit for livelihoods and living closer to relatives who have already settled in the area (Eliwaha, 2011; Limbumba, 2010). People tend to choose locations where they can easily find work and where some of their peers had moved earlier (Eliwaha, 2011; Young & Flacke, 2010; Limbumba, 2010; Alananga 2015). Similarly, plot size, location and road accessibility to the respective plot have an impact on residential choice (Mosha, 2012). Apartments located closer to the CBD are likely to rent at a higher price than similar apartments in the outskirt. Other consideration in housing demand include proximity to water points, roads, footpaths, local market, and bus stop, with priorities for water points, roads, and footpaths and avoidance of flood prone areas, steep slopes, and swamps (Young & Flacke, 2010). These observations suggest that both neighbourhood and housing quality attributes are important determinant of residential property prices.

Anecdotal evidence suggests that life cycle attributes and socio-demographic characteristics of residents determine residential decision of households in Dar es Salaam city. In terms of household characteristics, Young & Flacke, (2010) found that there is a clear difference in behavioural patterns between households headed by an individual with formal employment and one headed by an individual with self (or informal) employment. Differences pertain to location preferences and constraints, and other characteristics such as household threshold size, price ranges, and house size (number of habitable rooms). Movement to outer wards is also preferred by those with larger families suggesting space demand could easily be met outside the city at somehow lower price (Eliwaha, 2011; Alananga, 2015). Other socio-economic variables such as income and age could also be very important determinant of residential choices. The above noted demographic and household characteristics can also be important determinants of residential property price in as much as they shape residential choices.

3 Research methodology

3.1 The model of rental housing demand

The demand for rental housing is motivated by the "utility maximization" objective where a purchaser wishes to maximize utility subject to a budget constraint. Suppose that the purchaser's utility is maximized from the enjoyment of housing (H) of type $\text{h;h} \in \{\text{Swahili,Modern,Others}\}$ and a composite good g, as $U_{ih} = u(H_{ih}, g_i)$ subject to a budget constraint given as $Y = H_{ih}P_h + g_iP_c$. Where Y is household wealth, P_h is the price for housing type h and "g_i" is a composite good considered as a numeraire with its price (P_c) set to unity. The maximization problem can be written as:

$$\max_{H,C} \; u(H_{ih}, g_i) \quad \text{s.t.} \quad Y = H_{ih}P_h + g_i . \qquad [1]$$

To obtain first order condition we define and differentiate a Lagrangian (L) in the Cobb-Douglas utility function of the form $U_{ih} = H_{ih}^{\alpha} g_i^{1-\alpha}$. This can be written as:

$$L = \alpha \ln H_{ih} + (1-\alpha)\ln g_i + \lambda(Y - H_{ih}P_h - g_i) \qquad [2]$$

Solving for first order condition, the equilibrium values of the housing can be written as:

$$H_{ih}^{*} = \alpha \frac{Y}{P}, \quad [3]$$

Y and P reflect household income (Y_i) and housing prices (P_h) relative to prices of other goods (P_g) since housing consumption is assumed homogenous of degree zero in income and prices. In Cobb-Douglas formulation, the demand for a composite good is simply the proportion of income not spent on housing good. Housing demand is downward sloping as a function of its own price. This is called the Marshallian demand function and can be regarded as a function of prices: $P \in \left(P_g, P_h\right)$ and income as:

$$H_{ih}^{*} = h^{*}(P, Y) \quad [4]$$

To obtain an inverse housing demand function, equation 4 can therefore be written as:

$$P = p(H_{ih}, Y) \quad [5]$$

But H_{ih} is a heterogeneous good which can best be described by its consumable attributes (X_{ih}) such as number of rooms (NBR_{ih}), available facilities (F_{ih}) such as kitchen, toilets, dining and store), services (S_{ih}) such as water, electricity, parking and garden and neighbourhood (N_{ih}) such as i.e. nearby open space, schools, hospitals as well as shopping and recreation centres. This study therefore assumes that rent depends on housing and neighbourhood attributes since preference for housing is a reflection of preferences on the collection of housing attributes (Lancaster, 1966; Day, 2001; Rosen, 1974; Teixeira, Caridad, & Ceular, 2010). Thus equation 5 can be estimated as a hedonic function in a simple linear regression model:

$$\begin{aligned} \ln P_{ih} &= \beta_0 + \beta_1 NBR_{ih} + \beta_2 F_{ih} + \beta_3 S_{ih} + \beta_4 N_{ih} + \beta_5 Y_{ih} + \varepsilon_{ih} \\ &= \sum_{k=1}^{K} \beta_k X_{ih} + \varepsilon_{ih} \end{aligned} \quad [6]$$

Where $\ln P_{ih}$ the natural log of rental is price; β_k are the k coefficients to be estimated and ε_{ih} is the random component of the model assumed to normal i.e. $E\left[\varepsilon_{ih}\right] = 0$. In well classified submarkets, equation 6 is re-applied in each submarket separately to ensure compliance with the assumption of normality in the random error term. When such submarket classification is arbitrary or cannot fully differentiate one submarket from another, then estimation of separate hedonic function in each submarket may yield misleading results because of cross-correlation between markets. A mechanism to establish whether the submarkets are significantly different and whether such difference matters in rental price determination is therefore a pre-requisite.

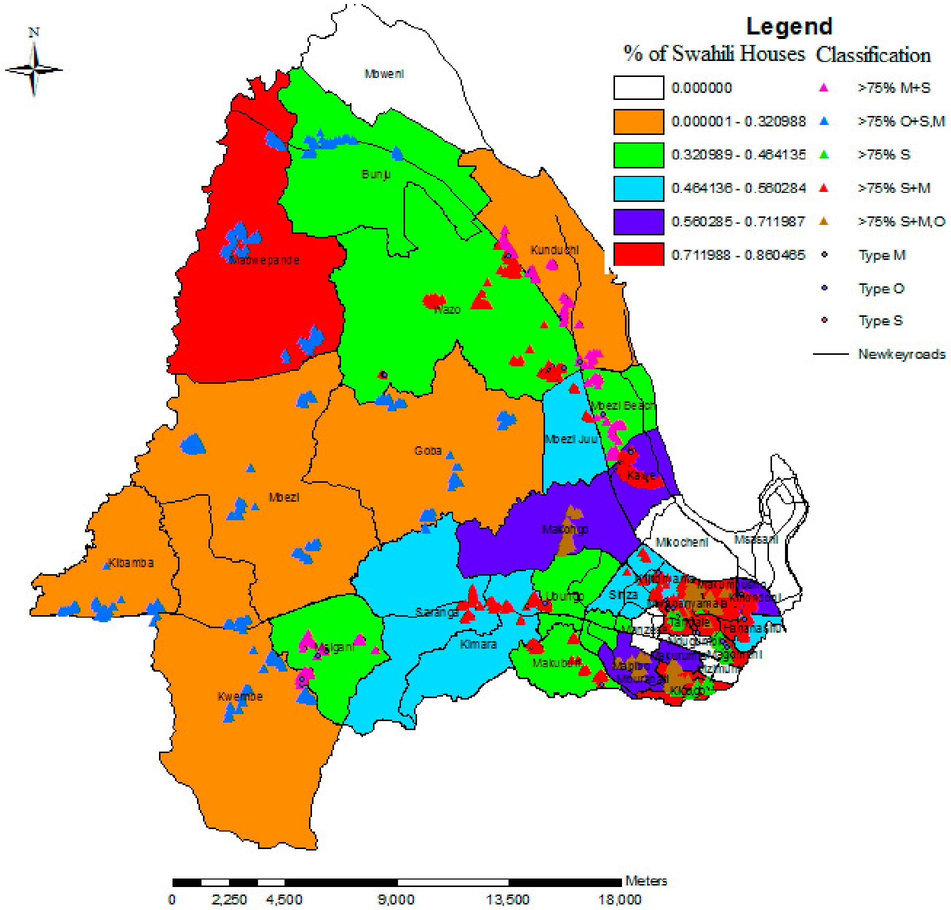


Figure 3.*Tenant and owners sample locations by housing-types (HTF). AUs have been combined into rental housing submarkets based on the percentage of Swahili houses (PERS). NB: 0 represents no data.*

3.2 Data analysis

To obtain the data for this study, a household survey was administered between February and June 2014 in 27 out of 34 Administrative Units (wards) of Kinondoni municipality. The data collected includes imputed rent from owners and actual rent from tenants, estimates of income per month from permanent employment (for those without permanent employment daily expenditure was used to estimate income). Data on floor area, size and number of bedrooms and other housing and neighbourhood attributes were observed at the site. The approach adopted in this study is a 3-step process. The first step is submarket identification where the share of Swahili houses in each AU based on sample data were computed. Then the resulting shares were grouped into 5 natural breaks (Jenks) categories with slight adjustment at 71% instead of 72% natural break in Arc Map 10. The results were mapped to identify spatial patterns as shown in Figure 3. The use of submarkets in housing research assumes an appropriate prior delineation of neighbourhoods based on value affecting amenities (Sobrino, 2014; Chen, Cho, Poudyal, & Roberts, 2007; McCluskey & Borst, 2011). This study uses administrative delineation (wards) to identify submarkets in the study area. The major drawback of this approach is that it does not start at the lowest areal unit of interest i.e. the house (Kryvobokov, 2013). The approach may also fail to capture some of the value affecting factors due to lack of internal homogeneity. Despite the general rule that submarkets should not be based on administrative boundaries, such administrative boundaries often provide a base upon which data are collected and therefore preferred in this context.

The second step was to define the dependent variable given the multiple dimensions through which the rental data were quoted. Given the common practice in Dar es Salaam city of quoting residential rent as "rent per room" rather than per house, a room was considered an appropriate measure of housing consumption at the lowest level. The "rent per room" is however not observable in the imputed rental values among owners and in some cases in single-tenant rented housing units. It was therefore, necessary to find a mechanism through which such differences could be harmonized into a single measurement unit. Since any rental housing unit has a bedroom, a measure of "willingness to pay for a bedroom" was considered an appropriate "SI" unit for housing consumption. In the first place, rent for an additional bedroom based on a Geographically Weighted Regression (GWR) model was therefore determined. Thus, the classical regression model in equation 6 is re-written in terms of GWR as:

$$\ln P_{ih}(u_j, v_j) = B_0(u_j, v_j) + \sum_{K=1}^{K} \beta_k(u_j, v_j) \bullet X_{ih} + \varepsilon_{ih}(u_j, v_j) \ldots\ldots j = 1, 2, \ldots, n \quad [7]$$

Where (u_j, v_j) are the coordinates determining the location of the sample point and the other variables remain as defined in 6. The parameters for each independent variable β_k are estimated in a similar way as in OLS, but the weights of observations determined by location are taken into account (Cellmer 2012). In GWR it is possible to extract marginal rent for an additional bedroom at each location because of the unique location (u_j, v_j) attributes attached to each β_k. The rental prices predicted by GWR are "implicit" because they cannot be directly observed in the market, rather through the total rent paid (Osland, 2013; Sheppard, 1999; Rosen, 1974; Gundimeda, 2005). That is the natural log of Rent per Month for each household *i*, i.e. $\ln RPM_i$ was regressed onto Number of Bedrooms (*NBR*), Number of Bathrooms (*NBO*) and dummies for Living room (*SLR*), Dining (*SDR*), Kitchen (*SKR*), Store (*SSR*), Backyard (*SBR*) and Others (*SOR*) (garage/parking). The estimated implicit prices for each household ($\partial \ln RPM_i / \partial NBR_i$) were then used as price-per-bedroom in submarket *s*, i.e. P_{ihs}.

The last step involved the use of LME model to predict the marginal rental values of bedrooms in response to a number of housing and neighbourhood characteristics. The LME models both the fixed-effects and random-effects to account for the interdependence of observations and omitted variable bias (Osland, 2013; Arash, Mohsen, & Abbasian, 2011). Bedroom values P_{ihs} were regressed onto both fixed-effect variables, and random-effect dummies which are assumed to affect marginal rent only through mean income (Y_{is}^{1}), and mean number of bedrooms (R_{ihs}^{2}) in each submarket (*s*), and in each house-type (*h*) in submarket (*s*). This assumption is partly based on observations made by Goodman (1988) that the number of rooms is among the attributes that significantly vary across submarkets. This is because, the mean NBR reflect the size of rental space that is available to everyone. Furthermore, the variability of marginal bedroom rent may be moderated by the overall income in a particular submarket. In submarkets where the majority is rich for example, rental value variance is likely to be lower than in areas where the majority is poor. The inclusion of average income as a submarket level effect may also be supported by the fact that many occupiers are self-employed in activities closer to their home thus higher income for one may mean lower for another. Thus, the marginal rent per-bedrooms is given by:

$$P_{ihs} = \beta_{hs}^{0} + \sum^{K} \beta_{hs}^{k} X_{ihs}^{k} + \beta_{s}^{1} Y_{is}^{1} + \beta_{hs}^{2} R_{ihs}^{2} + \varepsilon_{ihs} \quad [8]$$

Where P_{ihs} is the natural log of price-per-bedroom for household *i* who lives in house-type *h* which is located in submarket *s*; $\beta_{hs}^{k}, k = 3,4 \ldots K$ are the *K* fixed-effect coefficients associated with the observed fixed-effect variables X_{ihs}^{k} (including interaction variables $X_{hs}^{k} X_{hs}^{j},\ k \neq j$); β_{0i} is the overall intercept and ε_{ihs} is the population level random error term. Since Y_{is}^{1} and R_{ihs}^{2} are assumed to be random across submarkets, their associated effects can be written as a function of submarkets mean income and mean number of bedrooms as:

$$\begin{aligned} \beta_{hs}^{0} &= \beta_{0s}^{0} + \beta_{1s}^{0} \overline{Y_{s}}^{1} + \beta_{2s}^{0} \overline{R_{hs}}^{2} + \mu_{hs}^{0} \\ \beta_{s}^{1} &= \gamma_{0s}^{1} + \gamma_{1s}^{1} \overline{Y_{s}}^{1} + \mu_{s}^{1} \\ \beta_{hs}^{2} &= \beta_{0s}^{2} + \beta_{2s}^{2} \overline{R_{hs}}^{2} + \mu_{hs}^{2} \end{aligned} \quad [9]$$

Where $\overline{Y_{s}}^{1s}$ is the mean neighbourhood income and $\overline{R_{hs}}^{2s}$ is the mean number of bedroom per house-type in each submarket; β_{1s}^{1} and β_{1s}^{2} captures the effects Y_{is} and R_{ihs} respectively on price variations across submarkets; μ_{hs}^{0}, μ_{s}^{1}, and μ_{hs}^{2} are the within submarket error terms associated with Y_{is}^{1} and R_{ihs}^{2}. Since the number of bedrooms depends on house-type in each submarket, the coefficients of equation 9 will vary by house-types as:

$$\begin{aligned} \beta_{0s}^{0} &= \gamma_{00}^{0} + \gamma_{01}^{0} \overline{R_{1s}}^{h} + e_{0s}^{0} \\ \beta_{1s}^{0} &= \gamma_{10}^{0} + \gamma_{11}^{0} \overline{R_{1s}}^{h} + e_{1s}^{0} \\ \beta_{2s}^{0} &= \gamma_{20}^{0} + \gamma_{21}^{0} \overline{R_{1s}}^{h} + e_{2s}^{0} \\ \beta_{0s}^{2} &= \gamma_{00}^{2} + \gamma_{01}^{2} \overline{R_{1s}}^{h} + e_{0s}^{2} \\ \beta_{1s}^{2} &= \gamma_{10}^{2} + \gamma_{11}^{2} \overline{R_{1s}}^{h} + e_{1s}^{2} \end{aligned} \quad [10]$$

Where γ_{00}^{0}, $\gamma_{10}^{0}, \gamma_{20}^{0}, \gamma_{00}^{2}$ and γ_{10}^{2} are house-type intercepts in each submarket; γ_{00}^{0}, $\gamma_{10}^{0}, \gamma_{20}^{0}, \gamma_{00}^{2}$ and γ_{10}^{2} are the associated slope and e_{0s}^{0}, e_{1s}^{0}, e_{2s}^{0}, e_{0s}^{2} and e_{1s}^{2} are the house-type specific random error terms associated with R_{ihs}^{2}. Substituting 10 into 9 gives:

$$\beta_{hs}^{0} = \gamma_{00}^{0} + \gamma_{01}^{0}\overline{R_{1s}}^{h} + e_{0s}^{0} + \left(\gamma_{10}^{0} + \gamma_{11}^{0}\overline{R_{1s}}^{h} + e_{1s}^{0}\right)\overline{Y_{s}}^{1} + \left(\gamma_{20}^{0} + \gamma_{21}^{0}\overline{R_{1s}}^{h} + e_{2s}^{0}\right)\overline{R_{hs}}^{2} + \mu_{hs}^{0} \quad [11]$$

$$\beta_{hs}^{2} = \gamma_{00}^{2} + \gamma_{01}^{2}\overline{R_{1s}}^{h} + e_{0s}^{2} + \left(\gamma_{10}^{2} + \gamma_{11}^{2}\overline{R_{1s}}^{h} + e_{1s}^{2}\right)\overline{R_{hs}}^{2} + \mu_{hs}^{2} \quad . \quad [12]$$

Substituting 11 and 12 into 8 leads to the final model:

$$P_{ihs} = \gamma_{00}^{0} + \gamma_{01}^{0}\overline{R_{1s}}^{h} + \gamma_{10}^{0}\overline{Y_{s}}^{1} + \gamma_{11}^{0}\overline{R_{1s}}^{h}\overline{Y_{s}}^{1} + \gamma_{20}^{0}\overline{R_{hs}}^{2} + \gamma_{21}^{0}\overline{R_{1s}}^{h}\overline{R_{hs}}^{2} + \sum_{k=3}^{K}\beta_{hs}^{k}X_{ihs}^{k} +$$

$$\gamma_{01}^{1}Y_{is}^{1} + \gamma_{11}^{1}\overline{Y_{s}}^{1}Y_{is}^{1} + \gamma_{00}^{2}R_{ihs}^{2} + \gamma_{01}^{2}\overline{R_{1s}}^{h}R_{ihs}^{2} + \gamma_{10}^{2}\overline{R_{hs}}^{2}R_{ihs}^{2} + \gamma_{11}^{2}\overline{R_{1s}}^{h}\overline{R_{hs}}^{2}R_{ihs}^{2} +$$

$$\mu_{hs}^{2}R_{ihs}^{2} + e_{0s}^{2}R_{ihs}^{2} + e_{1s}^{0}\overline{Y_{s}}^{1} + e_{2s}^{0}\overline{R_{hs}}^{2} + e_{1s}^{2}\overline{R_{hs}}^{2}R_{ihs}^{2} + \mu_{s}^{1}Y_{is}^{1} + \mu_{s}^{1} + \mu_{hs}^{0} + e_{0s}^{0} + \varepsilon_{ihs} \quad [13]$$

Where, $\beta_{hs}^{k}, \gamma_{01}^{1}, \gamma_{01}^{0}$ as the unknown vector of simple fixed-effect for each household; γ_{01}^{0}, γ_{10}^{0} and γ_{20}^{0} are the house-types and submarket level effects; γ_{11}^{0}, γ_{21}^{0} γ_{11}^{1}, γ_{01}^{2} and γ_{10}^{2}, are the two way interaction effect between income and number of bedrooms and γ_{11}^{2} is the three way interaction effect for number of bedrooms for household *i*, living in house-type *h* located in submarket *s*. The *μ*'s and *e*'s are the level 2 and 3 random errors terms respectively. Equation 13 is an LME model with fixed-effect terms, the population intercept and random error terms. The model assumes the household level errors are normally distributed with a constant variance. Similarly, the covariance matrix that characterise variation due to among-submarkets and house-type sources is assumed to be constant. Estimation of equation 13 is based on Restricted Maximum Likelihood (REML) which was implemented in R using the *nlme* function (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2014). The results of *modLmer* test for three models each for tenants and owners and the combined model are presented in order to aid interpretation. The interpretation of fixed-effect coefficients and dummies is based on Dougherty, (2007). The test of whether the inclusion of Swahili submarkets into the model significantly improved model fit was evaluated based on ANOVA.

4 Results of analysis

4.1 Descriptive statistics

Table 1 summarises the descriptive statistics for the collected data. It can be observed that the total number of tenants and owners was 4,452 with 2,339 owners, and 2,113tenants. The samples are substantially larger when compared to the minimum sample size requirement which were estimated based on Oktay, et al. (2014), to be 384 and 383 for the population of owners and tenants respectively estimated to be 403,193 households. A summary of the characteristics of each submarket based on the proportion of traditional Swahili house type per Ward is provided in Table 2. It can be observed in part A of Table 2 that the mean bedroom-price move with income in both upside and downside direction but marginally reflect the mean number of bedroom suggesting that income could be an important determinant of rental submarkets in the municipality. Further it can be noted in part B that many households live in Swahili houses but have on average lower number of bedrooms than those living in modern houses. This is typical since modern houses are in most cases family houses while Swahili houses are bedroom oriented where many household pay rent per room rather than per house and could be a prime target of singles or low-income households. Part C of Table 2 show that, households living in modern houses pay higher rent per-bedroom in multiples of 2 or 3 compared to all other types of houses.

Table 1. *Summary statistics for the combined dataset.*

	ABBR	Description	N	Min	Max	Mean	Std. Dev
		Dependent variables					
	LnPBR	Natural Log of Price–per–bedroom(Tshs)	4454	7.21	14.17	10.25	1.09
		Independent Variables					
House Specific Attributes	**NBR**	Number of Bedrooms	4423	1.00	19.00	3.00	2.35
	HTM	Housing Type Modern (0 = No, 1 =Yes)	4452	0	1	0.29	0.46
	SLR	Has a Living Room (0 = No, 1 =Yes)	4452	0	1	0.56	0.50
	SDR	Has a Dining Room (0 = No, 1 =Yes)	4452	0	1	0.22	0.41
	SKR	Has a Kitchen(0 = No, 1 =Yes)	4452	0	1	0.32	0.46
	SSR	Has a Store (0 = No, 1 =Yes)	4452	0	1	0.20	0.40
	SBR	House has Backyard (0 = No, 1 =Yes)	4452	0	1	0.47	0.50
	SOR	House has Other Facilities (0 = No, 1 =Yes)	4452	0	1	0.04	0.20
	LNTSR	Natural Log of Total Space Rented (sqm)	4034	1.79	5.86	3.57	0.89
	ABS	Average Bedroom Size (sqm)	3994	6.25	36.00	12.44	4.25
	NOB	Number of Bathrooms	4451	1.00	11.00	1.25	0.56
	AWS	House has Water (0 = No, 1 = Yes)	4452	0	1	0.38	0.49
	AES	House Has Electricity (0 = No, 1 =Yes)	4452	0	1	0.66	0.47
	AGS	House has a Garden (0 = No, 1 =Yes)	4452	0	1	0.11	0.31
Household Specific Attributes	**LMI**	Natural Log of Average Monthly Income	3838	10.71	16.52	12.68	0.79
	AGE	Age of Household Head (Years)	4400	17.00	103.00	41.55	14.59
	HWC	Household Work–Within Chances	4356	0.01	24.00	2.80	3.59
	AHS	Average Household Size in a ward	4452	3.64	4.29	3.96	0.17
	PDK	Population Density in a ward (per square km)	4452	0.49	47.29	13.18	12.01
	CFS	Current Family Size	4396	1.00	17.00	4.43	2.29
	DSH	Duration of Stay in a House (Years)	4165	1.50	85.50	24.79	152.08
	GHH	Gender (0 = Female, 1 = Male)	4452	0	1	0.81	0.39
	CMS	Married (0 = No, 1 =Yes)	4452	0	1	0.70	0.46
	HHS	Household Head Skilled (0 = No, 1 = Yes)	4452	0	1	0.48	0.50
	HSE	Self–employed (0 = No, 1 = Yes)	4452	0	1	0.57	0.50
	ECB	Education Category Basic (0 = No, 1 = Yes)	4452	0	1	0.59	0.49
	ECS	Education Secondary (0 = No, 1 = Yes)	4452	0	1	0.25	0.43
	ECV	Education Skill–Specific (0 = No, 1 = Yes)	4452	0	1	0.06	0.23
	ECT	Education Tertiary (0 = No, 1 = Yes)	4452	0	1	0.08	0.26

	ABBR	Description	N	Min	Max	Mean	Std. Dev
Distance and Neighbourhood Attributes	**LnD-CBD**	Natural Log of Distance to the CBD (Km)	4452	1.15	3.43	2.27	0.63
	LnDNR	Natural log of Distance to Nearby Road (Km)	4452	(9.21)	1.24	(1.66)	1.27
	LnDMR	Natural log of Distance to Major Road (Km)	4452	(7.79)	2.13	(1.06)	1.38
	NSM	Closer to Supermarket (0 = No, 1 = Yes)	4452	0	1	0.04	0.19
	NMK	Closer to Market (0 = No, 1 = Yes)	4452	0	1	0.15	0.36
	NBA	Closer to a Bar (0 = No, 1 = Yes)	4452	0	1	0.20	0.40
	NWP	Closer to Worship Building (0 = No, 1 = Yes)	4452	0	1	0.04	0.19
	NSL	Closer to School (0 = No, 1 = Yes)	4452	0	1	0.38	0.49
	NGT	Closer to Government Building (0=No,1= Yes)	4452	0	1	0.29	0.45
	32% or Less	Not Swahili (0 = No, 1 = Yes)	4452	0	1	0.20	0.40
	32%–46%	Marginal Swahili (0 = No, 1 = Yes)	4452	0	1	0.13	0.34
	46% – 56%	Moderate Swahili (0 = No, 1 = Yes)	4452	0	1	0.20	0.40
	56% – 64%	Swahili (0 = No, 1 = Yes)	4452	0	1	0.17	0.38
	64% and above	Typical Swahili (0 = No, 1 = Yes)	4452	0	1	0.26	0.44

Table 2. *Characteristics of different neighbourhoods based on the percentage of Swahili Houses per ward.*

Percentage of Swahili Houses	Occupation Status		Mean-Number of Bedroom	Mean Price (Tshs)	Mean Income (Tshs)	Respondents
	Tenant	**Owner**	**NMP**	**NMP**	**NMI**	**N**
A: Mean bedroom-price, mean Income and mean number of bedrooms across submarkets						
32% or less	191	399	2.7	44,583.88	442,676.52	590
32%-46%	390	495	2.6	59,237.59	508,735.43	885
46%-56%	405	356	3.3	61,186.06	556,261.94	761
56%-64%	625	544	2.9	43,088.06	376,709.84	1169
64% or above	502	545	3.4	47,202.95	403,938.23	1047
Total	**2113**	**2339**				**4452**
B: Mean number of bedroom per tenant/owner per house-type and across submarkets						
House-Types	**N**	**Percentage of Swahili Houses**				
		32% or less	**32–46%**	**46–56%**	**56–64%**	**64% or above**
Modern	1313	3	3	4	4	3
Swahili	2460	3	2	3	3	3
Others	680	2	2	3	3	3
C: Mean bedroom rent per house-type (Tshs) and across submarkets						
Modern	1313	67,834.36	97,711.26	106,405.48	75,190.72	87,716.25
Swahili	2460	31,449.45	37,905.37	36,865.79	32,528.42	39,388.09
Others	680	22,896.32	31,502.69	38,558.05	34,358.11	37,375.92

NB: At the time of survey in 2014, Tshs 1,600 was equivalent to 1USD but currently Tshs 2,200 is equivalent to 1USD

Table 2 also provides a model fit summary and the variance components of the three models which were implemented. It can be observed in Table 2 that the combined model fits best to the data but subsequent interpretations and discussions are based on the overall results. By examining the occupation status column, one observes some evidence that the proportion of tenants increases as the share of Swahili houses increases thus providing some evidence that Swahili houses are predominantly rental housing units. In terms of size as proxied by number of bedroom, there is no clear indication on whether predominantly Swahili submarkets have larger houses than other settlements. In terms of price and income, it is evident that they both peek at around average Swahili house wards. That is the rental price and income tends to be higher in balanced house type AUs.

4.2 The effect of Swahili house type

The results of the GWR for owners and tenants are presented in Table 3. The overall model fits well in the tenant's model based on the adjusted R^2 statistic. Many of the housing attributes have a positive effect as expected, except for 'shadow trees' which has a lower rent per month. Of interest in this study, is the effect of Swahili house types. The results of the GWR model suggest that rent per month is higher in modern houses than in traditional houses. These results reflect a potential bias in the monthly rental values since modern houses are predominantly rented by the most affluent while the general tenants tent to rent rooms. Thus, modern house-type effect on monthly rent could be capturing some of the income effect which was not included in this second step analysis. To evaluate the validity of the observation across submarkets simultaneously, an LME model was implemented the results of which are presented in Table 4.

The variance component section of Table 4 shows that only about 0–3% of the variation in price-per-bedroom are associated with changes in average submarket NBR. However, when the neighbourhoods are identified based on mean submarket income (LMI), the intercepts of neighbourhoods, KRN.1 captures 90 percent of the overall variance in the tenant and owner models while in the combined model it captures 46 percent. The above observations suggest that neighbourhoods classified based on the share of Swahili houses are highly dependent on neighbourhood mean LMI differences rather than mean NBR. Contrariwise, the effect of mean LMI on price-per-bedroom goes up to five (5) percent. In the linear model results presented in the Appendix it is evident that AUs with higher proportion of Swahili houses have significantly higher rent than those with smaller share of Swahili houses. When this is combined with the results in Table 4, it can be suggested that AUs with a smaller share of Swahili houses have both lower LMI and NBR marginal effects on price-per-bedroom while in AUs with a larger share of Swahili houses both LMI and NBR have a higher positive marginal rental price-per-bedroom effect.

4.3 The effect of households and neighbourhood qualities

The population level effects for household and neighbourhood qualities are presented in Table 5. It shows that owners' marginal price-per-bedroom significantly

Table 3. *Regression Results for a Geographically Weighted Regression.*

Name			GWR Results for Owners			GWR Results for Tenants		
Neighbors			522.000			1,000.000		
Residual Squares			531.722			258.536		
Effective Number			195.618			99.831		
Sigma			0.498			0.358		
AIC			3,508.021			1,722.495		
R2			0.586			0.770		
R2Adjusted			0.548			0.759		
Standardised Residuals			(0.025)			(0.017)		
	Independent Variables		**Estimates**			**Estimates**		
	Abbr	**Definition**	**Coefficient**	**Change**	**Standard Error**	**Coefficient**	**Change**	**Standard Error**
		Intercept	11.317	82175.6	0.110	9.499	13343.5	0.074
1	NBR	Number of Bedrooms	0.097	0.101	0.015	0.453	0.573	0.026
2	ABS	Average Bedroom Size	0.001	0.001	0.005	0.003	0.003	0.004
3	NOB	Number of Bathrooms	0.042	0.043	0.050	0.036	0.037	0.036
4	AWS	Availability of Water	0.142	0.152	0.083	0.114	0.121	0.033
5	AES	Availability of Electricity	0.118	0.125	0.076	0.327	0.386	0.041
6	AGS	Availability of a garden	0.079	0.082	0.105	–0.016	(0.016)	0.061
7	ASS	Availability of Shadow Trees	–0.043	(0.042)	0.081	–0.032	(0.031)	0.043
8	AOS	Availability of Other Services	0.088	0.092	0.350	–0.141	(0.131)	0.162
9	HHM	Household House is Modern	0.233	0.262	0.082	0.137	0.147	0.045
10	SLR	Space Living room	0.202	0.223	0.078	0.556	0.743	0.037
11	SDR	Space Dining	0.249	0.283	0.083	0.173	0.188	0.083
12	SKR	Space Kitchen	0.120	0.127	0.082	0.138	0.148	0.056
13	SSR	Space Store	0.128	0.136	0.082	–0.033	(0.033)	0.071
14	SBR	Space Backyard	0.075	0.078	0.067	0.056	0.057	0.033
15	SOR	Space Others	0.100	0.106	0.166	0.136	0.146	0.099

NB: Dependent variable: LnRPM – Natural log of Rent per Month

increases with income and age, and declines with ward level household size (AHS), population density (PDK) Family size (CFS) and being unskilled (HHS). Tenants pay for similar attributes but in additional they pay higher because of higher education levels compared to basic education while lower rent is likely in high population density AUs. The combined models however, include self-

Table 4. *LME model result for the group level effects and overall fit.*

Variance Components							
		(Owners)		**(Tenants)**		**(Combined)**	
Groups	**Name**	**Variance**	**Std dev.**	**Variance**	**Std dev.**	**Variance**	**Std dev.**
HTF.KRN2	(Intercept)	0.006	0.078	0.026	0.160	0.004	0.063
	NBR	0.000	0.016	0.011	0.105	0.000	–0.980
KRN2	(Intercept)	0.055	0.234	0.024	0.153	0.004	0.012
	NBR	0.001	0.024	0.003	0.050	0.000	0.008
KRN2.1	(Intercept)	0.083	0.288	0.000	0.000	0.255	0.505
	LMI	0.000	0.014	0.000	0.000	0.001	0.031
	Residuals	0.186	0.431	0.128	0.357	0.191	0.436
Number of obs:		**1562.000**		**1849.000**		**3411.000**	
groups:	KRN2:HTF	15					
	KRN2	5					
Random–effect coefficients (intercept only)							
% Swahili		**Owners**		**Tenants**		**Combined**	
		NBR	LMI	NBR	LMI	NBR	LMI
.1%–32%		0.027	0.015	0.075	0.000	0.003	0.050
32%–46%		0.017	–0.008	0.000	0.000	0.006	–0.008
46%–56%		0.013	–0.002	0.002	0.000	0.000	–0.010
56%–64%		–0.024	0.008	–0.049	0.000	–0.007	–0.007
64%–86%		–0.008	–0.012	–0.028	0.000	–0.002	–0.026
Model fit parameters							
		Null Model	**Full Model**	**Null Model**	**Full Model**	**Null Model**	**Full Model**
AIC		3321.100	1903.300	4068.100	1546.600	10253.800	4125.100
BIC		3342.500	2213.900	4084.700	1866.900	10272.200	4480.900
logLik		–1656.560	–893.670	–2031.050	–715.320	–5123.900	–2004.500
deviance		3313.100	1787.300	4062.100	1430.600	10247.800	4009.100
Chisq/Df		1525.800		2631.500		6238.700	
Pr(>Chisq)		< 2.2e–16	***	< 2.2e–16	***	< 2.2e–16	***
Pseudo R^2			0.848		0.763		0.718
NB: Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘’ 0.1 ‘ ’ 1							
Linear mixed model fit by REML [‘merModLmerTest’]							
*Formula:lnPPB~LMI+NBR+HTM1+SLR1+SDR1+SKR1+SSR1+SBR1+SOR1+TAS+LnTSR+ABS+AGE+LnDCBD+LnDNR+LnDMR+HWC+AHS+PDK+NOB+AWS1+AES1+AGS1+CFS+DSH1+GHH1+CMS1+HHS1+HSE1+HEC1+NSM1+NMK1+NBA1+NWP1+NGT1+NSL1+AGE*NBR+CMS1*CFS+CFS*NBR+LMI*AGS1+NBR*HTM1+CFS*LMI+LMI*HTM1+HHS1*LMI+(NBR|KRN2/HTF)+(LMI|KRN2)*							

employment as having a positive effect on rental values while workplaces being within AUs and gender being male as having a significant negative effect on price-per-bedroom. In terms of neighbourhood characteristics, owners’ price-per-bedroom increases with distance to the CBD (lnDCBD) nearby road (LnDNR) and duration of stay (DSH) and declines with distance to the main road (lnDMR) and proximity to a bar (NBA) and a school. Tenants behave in like manners with the exception that they would also pay less for being far from the CBD and longer stays in the house. Proximity to bar or school are not statistically significant in the tenants’ model. The combined model suggests that proximity to schools and bars

Table 5. *LME Model Results for Households Attributes.*

Type	Variable	Owners	Tenants	Combined
Household Specific Attributes	(Intercept)	3.0530	6.0170	4.7680
		0.0018 **	< 2e–16 ***	0.0000 ***
	LMI	0.5740	0.1706	0.2312
		< 2e–16 ***	0.0003 ***	0.0000 ***
	AGE	0.0061	0.0042	0.0082
		0.0013 **	0.0898 .	0.0000 ***
	HWC	–0.0057	–0.0048	–0.0148
		0.2443	0.2015	0.0000 ***
	AHS	–0.3225	0.0445	–0.0834
		0.0042 **	0.5907	0.2633
	PDK	–0.0131	–0.0138	–0.0140
		0.0000 ***	< 2e–16 ***	< 2e–16 ***
	CFS	–0.2518	–0.0474	–0.6463
		0.0114 *	0.5874	< 2e–16 ***
	CMS1Not married	–0.0491	0.0124	–0.0028
		0.5065	0.7667	0.9395
	HSE1Selfemployed	–0.0112	0.0066	0.0665
		0.7036	0.7489	0.0003 ***
	HEC1Basic education	–0.0515	0.1025	0.0223
		0.4968	0.1705	0.7019
	HEC1Secondary education	0.0132	0.1882	0.1113
		0.8662	0.0134 *	0.0614 .
	HEC1Tertiary education	–0.0552	0.3420	0.1632
		0.5273	0.0000 ***	0.0128 *
	HEC1Vocation education	–0.0408	0.1712	0.0538
		0.6464	0.0406 *	0.4182
	GHH1Male	–0.0915	–0.0407	–0.0593
		0.1132	0.1672	0.0493 *
	HHS1Unskilled	–1.1510	–0.3313	–0.1700
		0.0116 *	0.2998	0.5124
Distance and Neighbourhood Attributes	LnDCBD	0.1132	–0.0742	0.0661
		0.0047 **	0.0055 **	0.0074 **
	LnDNR	0.0570	0.0416	0.0511
		0.0000 ***	0.0000 ***	0.0000 ***
	LnDMR	–0.0890	–0.0688	–0.0884
		0.0000 ***	0.0000 ***	< 2e–16 ***
	DSH1	0.0025	–0.0068	0.0040
		0.0140 *	0.0012 **	0.0000 ***
	NSMYes	0.1197	–0.0228	0.0269
		0.0673 .	0.6351	0.5350
	NMKYes	0.0692	0.0028	0.0225
		0.0828 .	0.9177	0.3763
	NBAYes	–0.0683	–0.0371	–0.0640
		0.0235 *	0.1220	0.0021 **
	NWPYes	0.0208	0.0048	0.0132
		0.4065	0.8108	0.4476
	NGTYes	–0.0406	0.0292	–0.0113
		0.1805	0.2273	0.5904
	NSLYes	–0.1007	–0.0277	–0.0536
		0.0005 ***	0.2263	0.0071 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; p values are given in brackets have negative effects while duration of stay and distance to CBD have positive effects on rental values.

4.4 The effect of house characteristics and interaction variables

The fixed effect for house characteristics and interaction variables are presented in Table 6. It shows that owners would pay higher in response to larger floor area (LnTSR), not having a garden, the interactions of income and family size and income and lack of skills. In the downward direction rent-per bedroom responds to bedroom size (ABS), lack of backyard (SBR), the interaction between number of bedrooms and age of the respondents and between income and lack of a garden. Tenants' rent-per-bedroom increases with BBR, LnTSR, a dining (SDR) and a kitchen (SKR) and the interactions of income and family size. It falls in response to ABS, having a living room (SLR), a store (SSR), lack of a backyard (SBR), water (AWS), electricity (AES) and the interaction between family size and income. In the combined model rent per bedroom are higher in response to NBR, LnTSR, lack of kitchen, store and garden. It is also higher in response to the interaction of family size and income. Rent-per-bedroom declines with ABS, lack of backyards and other spaces (SOR), lack of water, electricity and garden and the interactions between; NBR and AGE; NBR and CFS and LMI and lack of garden.

5 Discussion and Conclusion

Despite a high level of informality in developing countries, house-types can be identified. Furthermore, given the possibility of spatial clustering, demand analyses can be carried out under the assumption that clustering by housing types form neighbourhoods/submarkets. This study suggests that housing submarkets in Kinondoni municipality can best be understood by combining house-types and household income. Based on that classification, it has been observed that, residents in AUs dominated by Swahili houses pay higher rent potentially in response to higher income, having many rooms and living closer to the CBD. Neighbourhoods dominated by house-types other than Swahili are located in the outskirts where households have fewer bedrooms and lower incomes. Residents in mixed neighbourhoods pay higher rent in response to higher income and tend to own on average less NBR. These observations can be explained in terms of residential mobility where the ease with which household can change residency, allows households to change house-types as income increases at a relatively lower opportunity cost in mixed than in other types of neighbourhoods. Households in these AUs will pay higher marginal rent-per-bedroom as income increases because the probability of moving into a modern house within the same neighbourhood increases with income. This mobility will more likely be within the same neighbourhood because of the need to protect social networks (Limbumba, 2010). The above generalisation is supported by the local nature of urban housing markets as observed in other studies (Wyman, Worzala, Elaine, & Seldin, 2013).

A higher proportion of Swahili houses in any AU has therefore an equivalent higher marginal rent-per-bedroom in response to the positive effects of both income and number of bedrooms while a lower share of Swahili houses has lower marginal rent in response to the negative effect of both income and number

Table 6. *LME Model Results for Housing and Interaction Variables' Fixed-effect.*

Type	Variable	Owners	Tenants	Combined
House Specific Attributes	NBR	0.0254	0.2909	0.1049
		0.3565	0.0013 **	0.0000 ***
	LnTSR	0.5263	0.5337	0.8640
		0.0000 ***	< 2e–16 ***	< 2e–16 ***
	NOB	–0.0004	0.0226	0.0066
		0.9853	0.2748	0.6625
	ABS	–0.0389	–0.0374	–0.0598
		0.0000 ***	0.0000 ***	< 2e–16 ***
	HTFOthers	–0.0922	–0.1234	–0.0466
		0.3434	0.3551	0.4434
	HTFSwahili	–0.0358	–0.1368	–0.0455
		0.6770	0.2644	0.4140
	SLR1Not available	–0.0220	–0.1025	–0.0124
		0.5328	0.0411 *	0.6461
	SDR1Not available	0.0414	0.1244	–0.0106
		0.2309	0.0019 **	0.7026
	SKR1Not available	–0.0225	0.1724	0.1040
		0.5159	0.0001 ***	0.0001 ***
	SSR1Not available	0.0642	–0.0772	0.1224
		1.9390 .	0.0001 ***	0.0000 ***
	SBR1Not available	–0.0837	–0.1295	–0.0944
		0.0015 **	0.0068 **	0.0000 ***
	SOR1Not available	–0.0998	–0.2120	–0.1379
		0.0684 .	0.0000 ***	0.0005 ***
	AWSNot available	–0.0077	–0.1041	–0.0467
		0.7930	0.0000 ***	0.0095 **
	AESNot available	–0.0199	–0.2721	–0.0635
		0.4966	< 2e–16 ***	0.0013 **
	AGSNot available	1.5200	1.5560	1.8180
		0.0048 **	0.0020 **	0.0000 ***
Interaction Variables	NBR:AGE	–0.0007	–0.0011	–0.0011
		0.0287 *	0.4624	0.0001 ***
	NBR:CFS	0.0008	–0.0063	–0.0100
		0.7208	0.4087	0.0000 ***
	NBR:HTFOthers	0.0121	0.0413	–0.0050
		0.5472	–0.8260	0.7339
	NBR:HTFSwahili	–0.0058	0.0679	–0.0132
		0.7456	0.6415	0.3082
	CMS1Not married:CFS	–0.0046	–0.0166	–0.0054
		0.6872	0.1984	0.4964
	CFS:LMI	0.0189	–0.1232	0.0542
		0.0152 *	0.0024 **	< 2e–16 ***
	LMI:AGSNot available	–0.1221	0.0054	–0.1436
		0.0030 **	0.4557	0.0000 ***
	HHS1Unskilled:LMI	0.0905	0.0251	0.0156
		0.0092 **	0.3308	0.4469

NB: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; p values are given in brackets of bedrooms. Furthermore, marginal rent-per-bedroom is shaped similarly by household characteristics but not by house-specific attributes. This provides some evidence that the market under consideration is conducted along social networks which could be an explanation for the poor quality of private rental housing in the municipality.

In terms of fixed-effect coefficients, marginal price per bedrooms seem to move in the same direction as the number of bedrooms supporting the view that demand for housing is more of an expansion path of expenditures with respect to income (Jimenez & Keare, 1984). Having a kitchen, store or a garden may be associated with a discount on the price-per-bedroom possibly because renting decisions are based on the house as a whole rather than the parts (Anim-Odame, Key, & Stevenson, 2010b). The presence of a garden has a negative effect because many houses with a garden are outside the city where they command relatively lower rent. Further evidence from this study suggest that many neighbourhood attributes are not significant determinant of rent which is also consistent with some previous studies such as Gulyani and Talukdar, (2008) and Aluko, (2011). One of the major reasons for this observation could be the fact that the majority of households in developing countries live in formerly informal houses where positive amenities are lacking or are at the verge of extinction (Penrose, de Castro, Werema, & Ryan, 2010; Nguluma, 2003; Manaster, 1968).Alternatively, the effect of environmental quality on rent-per-bedroom is possibly captured in ward population density which was negative and significant throughout the implemented models.

The findings of this study suggest that proximity to workplaces has lower marginal rent-per-bedroom. Households are likely to combine workplace proximity and residencies as long as rents are lower otherwise the desire for home ownership and the opportunity cost of renting is likely to separate the two (Alananga, 2015). As a result, tenants will shift their residencies towards areas of lower rents leading to the observed negative relationship between marginal rent-per-bedroom and work-within-ward chances. Further it has been observed that proximity to a bar is negatively related to rent as expected possibly because of noise and disturbances created by bar users to residents in the neighbourhood. Proximity to public schools, commands lower rent due to either disturbances caused by pupils, or congestion and poor-quality settlements closer to many public schools which attracts only low-income households (Tinsley, 1993). The effect of distance to any nearby road or CBD is positive, suggesting that being further away from a road or the CBD commands a premium. This, though might seem contradictory, could be true for roads provided in informal areas which are very close to houses thus increasing the risk of accidents (Wu, Gyourko, & Deng, 2012). Similarly, the affluent may have chosen to live in quiet neighbourhood in the periphery, thus paying higher rent.

In terms of income elasticity of bedroom demand, it is observed that rental housing demand is relatively inelastic at individual level (income elasticity of bedroom demand ranges approximately between 0.2–0.6). This observation is consistent with Sobrino (2014) where the income elasticity among poor household was observed to be 0.1–0.6. The price elasticity of rental housing demand in response to changes in the number of bedrooms is also relatively inelastic due to the larger share of bedroom dominated rental submarkets. In these markets, landlords can only increase rental revenues by producing more low-quality Swahili houses (rooms) rather than increase rent. Constructing such houses (common through housing transformation (Nguluma, 2003)) in the market like the one under this study is cheaper due to informality, which contribute to severe housing congestion (Rose, 2006; Field, 2003). Generally, this study has established that tenants and owners weigh similar personal and neighbourhood attributes in rent determination but significantly differ on the marginal rental weights attached to housing attributes. These observations signify either the relative importance of own characteristics and neighbourhood attributes, or the omission of some important variables in the model. If the quality of tenants and landlords are the most important determinants of rent, then these observations are consistent with findings in other developing countries where property transactions take place along social networks leading to limited attention to housing attributes, thus further fuelling the deterioration of housing quality.

In terms of policy, the observations of this study call for renewed interest in rental housing through the private sector. Although traditional Swahili houses have been provided as low rise detached housing units, experimentation with a similar model in high rise buildings is yet to be done. The housing units could partially be developed through a developer-built approach and completed through the self-built approach to deter unexpectedly higher price of finished ultra-modern houses. Such an approach could provide leeway in solving the rental housing shortages in the municipality. This is because, the Swahili housing typology has a simple structure which is relatively flexible and can accommodate many tenants at a relatively lower rent compared to modern houses. Providing self-builders with unfinished flat spaces may motivate owner initiated designs such as the Swahili type within the multi-storey building context which is far better than the currently provided low-rise detached modern housing units in the outskirt. When Swahili houses are located in the outskirt, they attract less rent because most outskirt renters are relatively poor financially. From a self-builder's point of view it makes a lot of sense to supply traditional Swahili rental housing units closer to the CBD than in the outskirt. If the government is to boost the private rental housing market, it must eliminate the current low-rise Swahili houses closer to the CBD by either directly replacing them with unfinished flats to allow self-builders to complete the housing units through their own initiatives or encourage the private sector to do the same through partnership with current owners of Swahili houses closer to the CBD. The role of the government or a private developer in the proposed rental housing construction model is only to provide the building structural frame with the necessary floors and allow the self-builders to accomplish the rest. Providing massive developer-built rental housing may not address the rental housing shortage facing low income households in the municipality, incremental housing approaches need to be considered as well.

References

Alananga, S. (2015). Intra-urban residential mobility and tenants' workplace choices in Kinondoni municipality. *Habitat International, 49* (2015), 45–55.

Aliyu, M. A. (2012). *Valuing Water and Electricity Supply Using Hedonic Pricing Model.* Retrieved September 01, 2014, from editorialexpress.com: https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=CSAE2012&paper_id=443

Aluko, O. (2011). The Effects of Location and Neighbourhood Attributes on Housing Values in Metropolitan Lagos. *Ethiopian Journal of Environmental Studies and Management, 4* (2), 69–82.

Anim-Odame, W. K., Key, T., & Stevenson, S. (2010b). Residential Market Development in SubSaharan Africa",. *International Journal of Housing Markets and Analysis, 3* (4), 308–326.

Anim-Odame, W. K., Key, T., & Stevenson, S. (2010). The Ghanaian Transaction Based Residential Indices. *International Journal of Housing Markets and Analysis, 3* (3), 216–232.

Arash, E. H., Mohsen, G. S., & Abbasian, M. S. (2011). An Econometric Panel Data Based Approach for Housing Price Forecasting in Iran. *International Journal of Housing Markets and Analysis, 4* (1), 70–83.

Arnott, R. (2008). *Housing policy in Developing Countries : The Importance of the Informal Economy.* Washington, DC: World Bank.

Babawale, G. K., Koleoso, H. A., & Otegbulu, C. A. (2012). A Hedonic Model for Apartment Rentals in Ikeja Area of Lagos Metropolis. *Mediterranean Journal of Social Sciences, 3* (3), 109–120.

Bajari, P., & Kahn, M. (2008). Estimating Hedonic Models of Consumer with an Application to Urban Sprawl. In A. Baranzini, J. Ramirez, C. Schaerer, & P. Thalmann (Eds.), *Hedonic Methods in Housing Markets* (pp. 129–155). New York: Springer Science+Business Media, LLC .

Buchel, S., & Hoesli, M. (1995). A Hedonic Analysis of Rent and Rental Revenue in the Subsidised and Unsubsidised Housing Sectors in Geneva. *Urban Studies, 32* (7), 1199–1213.

Cellmer, R. (2012). The Use of Geographically Weighted Regression for the Real Estate Market Analysis. *Folia Oeconomica Stetinensia, 2012*, 1932.

Chen, Z., Cho, S.-H., Poudyal, N., & Roberts, R. K. (2007). Forecasting Housing Prices under Different Submarket Assumptions. *American Agricultural Economics AssociationAnnual Meeting.* Portland.

Choumert, J., Stage, J., & Uwera, C. (2014). Access to Water as a Determinant of Rental Values: A Hedonic Analysis in Rwanda. *La série des Etudes et Documents du CERDI est consultable sur le site, Etudes et Documents n° 01.*

Day, B. (2001). *The Theory of Hedonic Markets: Obtaining Welfare Measures for Changes in Environmental Quality using Hedonic Market Data.* University College London, CSERGE. London: eftec.

Dougherty, C. (2007). *Introduction to Econometrics* (Third ed.). New York: Oxford University Press.

Durand-Lasserve, A., Durand-Lasserve, M., & Selod, H. (2013). *A Systemic Analysis of Land Markets and Land Institutions in West African Cities Rules and Practices: The Case of Bamako, Mali.* Research Support Team. Washington: The Word Bank.

Eliwaha, M. D. (2011). *Land Acquisition for Urban Expansion: Process and Impacts on Livelihoods of Peri Urban Households, Dar es Salaam, Tanzania.* Licentiate Thesis, Swedish University of Agricultural Sciences, Reports Department of Urban and Rural Development, Uppsala.

Fekade, W. (2000). Deficits of Formal Urban Land Management and Informal Responses under Rapid Urban Growth, an International Perspective. *Habitat International, 24* (2000), 127–150.

Field, E. (2003, 11). Property Rights and Household Time Allocation in Urban Squatter Communities: Evidence from Peru. *Research Program in Development Studies Working Paper*, p. 42.

Follain, J. R., & Jimenez, E. (1985). Estimating the Demand for Housing Characteristics; A Survey and Critique. *Regional Science and Urban Economics, 15*, 77–107.

Follain-Jr, J. R., Lim, G.-C., & Renaud, B. (1982). Housing Crowding in Developing Countries and Willingness-To-Pay forAdditional Space; The Case of Korea. *Journal of Development Economics, 11* (1982), 249–272.

Friedman, J., Jimenez, E., & Mayo, S. K. (1988). The Demand for Security of Tenure in Developing Countries. *Journal of Development Economics, 29* (1988), 185–198.

García, J. A., & Hernández, J. E. (2008). Housing Demand in Spain According to Dwelling Type: Microeconometric Evidence. *Regional Science and Urban Economics, 38* (2008), 363–377.

Goodman, A. C. (1988). An Econometric Model of Housing Price Permanent Income, Tenure Choice and Housing Demand. *Journal of Urban Economics, 23*, 327–353.

Gulyani, S., & Talukdar, D. (2008). Slum Real Estate: The Low-Quality High-Price Puzzle in Nairobi's Slum Rental Market and its Implications for Theory and Practice. *World Development, 36* (10), 1916–1937.

Gundimeda, H. (2005). *Hedonic price method – A Concept Note.* Retrieved September 03, 2014, from Madras School of Economics: http://coe.mse.ac.in/dp/hedonic%20price.pdf

Herath, S., & Maier, G. (2010, March). The Hedonic Price Method in Real Estate and Housing Market Research. A Review of the Literature. *SRE - Discussion Papers 2010/03* .

Hoek-Smit, M. (1991). *The urban housing sector in Tanzania.* Dar es Salaam: Unpublished.

Jimenez, E., & Keare, D. H. (1984). Housing Consumption and Permanent Income in Developing Countries: Estimates from Panel Data in El Salvador. *Journal of Urban Economics, 15* (1984), 172–194.

Kironde, L. J. (2000). Understanding Land Markets in African Urban Areas: The Case of Dar Es Salaam, Tanzania. *Habitat International, 2000* (24), 151–165.

Kryvobokov, M. (2013). Hedonic Price Model: Defining Neighbourhoods with Thiessen Polygons. *International Journal of Housing Markets and Analysis, 6* (1), 79–97.

Lancaster, K. J. (1966). A New Approach to Consumer Theory. *The Journal of Political Economy, 74* (2), 132–157.

Lim, J., & Lee, J. H. (2013). Demographic Changes and Housing Demands by Scenarios with ASFRs. *International Journal of Housing Markets and Analysis, 6* (3), 317–340.

Limbumba, T. M. (2010). *Exploring Social-cultural Explanations for Residential Location Choices The Case of an African City - Dar es Salaam* . Royal Institute of Technology, Department of Urban Planning and Environment. Stockholm: KTH.

Lupala, J. M. (2002). *Urban Types in Rapidly Urbanising Cities Analysis of Formal and Informal settlements in Dar es Salaam, Tanzania.* Royal Institute of Technology, Department od Infrastructure and Planning. Stockholm: TRITA-ARK-Akademiska avhandling 02-030.

Manaster, K. A. (1968). The Problem of Urban Squatters in Developing Countries: Peru . *Wisconsin Law Review, 23* (1968), pp. 23–61.

Mayo, S. K. (1981). Theory and Estimation in the Economics of Housing Demand. *Journal of Urban Economics, 10* (1981), 95–116.

McCluskey, W. J., & Borst, R. A. (2011). Detecting and Validating Residential Housing Submarkets: A Geostatistical Approach for Use in Mass Appraisal. *International Journal of Housing Markets and Analysis, 4* (3), 290–318.

Mosha, L. H. (2012). Housing and land challenges in Tanzania. *Prime Journal of Social Science (PJSS), 1* (6), 113–120.

National Bureau of Statistics -Tanzania. (2014). *Key Findings 2011/2012 Household Budget Survey Tanzania Mainland.* Dar es Salaam: National Bureau of Statistics.

National Bureau of Statistics -Tanzania. (2013). Population of Kinondoni Municipal Council Number of Household. *Census 2012* . Dar es salaam, Tanzania.

National Housing Corporation. (2010). National Housing Corporation Strategic Plan for 2010/2011 - 2014/2015 (Executive Summary). *Parliamentary Presentation.* Dodoma: NHC.

Nguluma, H. M. (2003). *Housing Themselves: Transformations, Modernisation and Spatial Qualities in Informal Settlements in Dar es Salaam, Tanzania.* Royal Institute of Technology, Department of Infrastructure. Stockholm: Royal Institute of Technology.

Oktay, E., Karaaslan, A., Alkan, Ö., & Çelik, A. K. (2014). Determinants of Housing Demand in the Erzurum province, Turkey. *International Journal of Housing Markets and Analysis, 7* (4), 586–602.

Osland, L. (2013). The Importance of Unobserved Attributes in Hedonic House Price Models. *International Journal of Housing Markets and Analysis, 6* (1), 63–78.

O'Sullivan, A. (2012). *Urban Economics* (Eigth ed.). London, United States: McGraw-Hill Education Europe.

Parashar, D. (2014). The Government's Role in Private Partnerships for Urban Poor Housing in India. *International Journal of Housing Markets and Analysis, 7* (4), 524–538.

Penrose, K., de Castro, M. C., Werema, J., & Ryan, E. T. (2010). Informal Urban Settlements and Cholera Risk in Dar es Salaam, Tanzania. (A. I. Ko, Ed.) *PLoS Neglected Tropical Diseases, 4* (3).

Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D., & R Core Team. (2014). nlme: Linear and Nonlinear Mixed Effects Models R package version 3.1-117,. <URL: http://CRAN.R-project.org/package=nlme>.

Rose, S. E. (2006). *Tenure Security and Household Labor Decisions: The Effect of Property Titling on Labor Force Participation in Urban Ecuador.* Georgetown University, Graduate School of Arts and Sciences. Washington, DC: Georgetown University.

Rosen, S. (1974). Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *The Journal of Political Economy, 82* (1), 34–55.

Selod, H., & Tobin, L. (2013). *City Structure and Informal Property Rights in West Africa: Theory and Evidence.* Paris School of Economics. Paris: Unpublished.

Sheppard, S. (1999). Hedonic Analysis of Housing Markets. In P. Cheshire, & E. S. Mills, *Handbook of Regional and Urban Economics* (pp. 1595–1635). Elsevier.

Sobrino, J. (2014). Housing Prices and Submarkets in Mexico City: A Hedonic Assessment. *Estudios Económicos, 29* (1), 57–84.

Takeuchi, A., Cropper, M., & Bento, A. (2008). Measuring the Welfare Effects of Slum Improvement Programs: The Case of Mumbai. *Journal of Urban Economics, 64* (2008), 65–84.

Takeuchi, A., Cropper, M., & Bento, A. (2006). *The Welfare Effects of Slum Improvement Programs: The Case of Mumbai.* World Bank.

Teck-Hong, T. (2011). Neighborhood Preferences of House Buyers: The Case of Klang Valley, Malaysia. *International Journal of Housing Markets and Analysis, 4* (1), 58–69.

Teixeira, M. C., Caridad, J. M., & Ceular, N. (2010). *Hedonic Methodologies in the Real Estate Valuation.* Retrieved September 7, 2014, from repositorio.ipcb.pt: http://repositorio.ipcb.pt/bitstream/10400.11/412/1/paper85_%20MME.pdf

Tinsley, E. A. (1993). *The Mechanics of Informal Land and Housing Markets: A Theoretical Exposition.* Massachunsset: MIT.

Tiwari, P., & Parikh, J. (1997). Demand for Housing in the Bombay Metropolitan Region. *Journal of Policy Modeling, 19* (3), 295–321.

Vincent, O. O. (2009). *Exploring Spatial Growth Pattern of Informal Settlements through Agent-based Simulation.* Enschede: ITC.

Wu, J., Gyourko, J., & Deng, Y. (2012). Evaluating Conditions in Major Chinese Housing Markets. *Regional Science and Urban Economics, 42* (2012), 531–543.

Wyman, D., Worzala, Elaine, & Seldin, M. (2013). Hidden Complexity in Housing Markets: A Case for Alternative Models and Techniques. *International Journal of Housing Markets and Analysis, 6* (4), 383–404.

Young, G. F., & Flacke, J. (2010). Agent-based Model of the Growth of an Informal Settlement in Dar es Salaam, Tanzania: An Empirically Informed Concept. In D. A. Swayne, W. Yang, A. A. Voinov, A. Rizzoli, & F. T (Ed.), *International Congress on Environmental Modelling and Software* (p. 8). Ottawa: International Environmental Modelling and Software Society (iEMSs).

Appendix 1: Linear model results

	Coefficients	Estimate	Std. Error	t value	Pr(>|t|)	Sig.
	(Intercept)	4.580	0.579	7.909	0.000	***
Household Specific Attributes	LMI	0.230	0.037	6.197	0.000	***
	AGE	0.008	0.001	6.593	0.000	***
	HWC	–0.016	0.003	–4.837	0.000	***
	AHS	–0.079	0.076	–1.042	0.298	
	PDK	–0.014	0.001	–9.555	< 2e–16	***
	CFS	–0.661	0.062	–10.724	< 2e–16	***
	CMS3Not Married	–0.002	0.037	–0.061	0.951	
	HSE3Selfemployed	0.069	0.018	3.772	0.000	***
	HEC3Basic education	0.031	0.058	0.528	0.598	
	HEC3Secondary education	0.118	0.060	1.985	0.047	*
	HEC3Tertiaty education	0.164	0.066	2.494	0.013	*
	HEC3Vocational education	0.060	0.067	0.905	0.366	
	GHH3Yes	–0.063	0.030	–2.077	0.038	*
	HHS3Unskilled	–0.093	0.260	–0.360	0.719	
Distance and Neighbourhood Attributes	LnDCBD	0.070	0.025	2.762	0.006	**
	LnDNR	0.051	0.008	6.545	0.000	***
	LnDMR	–0.087	0.008	–10.735	< 2e–16	***
	DSH3	0.004	0.001	3.985	0.000	***
	NSMYes	0.022	0.044	0.512	0.608	
	NMKYes	0.020	0.025	0.797	0.426	
	NBAYes	–0.066	0.021	–3.156	0.002	**
	NWPYes	0.010	0.017	0.560	0.576	
	NGTYes	–0.009	0.021	–0.409	0.682	
	NSLYes	–0.054	0.020	–2.701	0.007	**
House Specific Attributes	NBR	0.100	0.018	5.618	0.000	***
	LnTSR	0.866	0.036	24.081	< 2e–16	***
	NOB	0.006	0.015	0.411	0.681	
	ABS	–0.060	0.003	–19.796	< 2e–16	***
	HTFOthers	–0.121	0.057	–2.123	0.034	*
	HTFSwahili	–0.105	0.057	–1.823	0.068	.
	SLR3Not available	–0.012	0.027	–0.443	0.658	
	SDR3Not available	–0.017	0.028	–0.595	0.552	
	SKR3Not available	0.103	0.026	3.894	0.000	***
	SSR3Not available	0.123	0.027	4.579	0.000	***
	SBR3Not available	–0.096	0.018	–5.402	0.000	***
	SOR3Not available	–0.143	0.040	–3.619	0.000	***
	AWSNot available	–0.042	0.018	–2.340	0.019	*
	AESNot available	–0.061	0.020	–3.081	0.002	**
	AGSNot available	1.875	0.367	5.104	0.000	***
Sub-markets	KRN232%–46%	0.105	0.045	2.345	0.019	*
	KRN246%–56%	0.244	0.051	4.817	0.000	***
	KRN256%–64%	0.266	0.050	5.350	0.000	***
	KRN264%–86%	0.349	0.065	5.387	0.000	***

<table>
<tr><th></th><th>Coefficients</th><th>Estimate</th><th>Std. Error</th><th>t value</th><th>Pr(>|t|)</th><th>Sig.</th></tr>
<tr><td rowspan="16">Interaction Variables</td><td>AGE:NBR</td><td>–0.001</td><td>0.000</td><td>–4.042</td><td>0.000</td><td>***</td></tr>
<tr><td>NBR:CFS</td><td>–0.010</td><td>0.002</td><td>–5.489</td><td>0.000</td><td>***</td></tr>
<tr><td>NBR:HTFOthers</td><td>0.002</td><td>0.012</td><td>0.167</td><td>0.867</td><td></td></tr>
<tr><td>NBR:HTFSwahili</td><td>–0.010</td><td>0.009</td><td>–1.159</td><td>0.246</td><td></td></tr>
<tr><td>CMS3Not Married:CFS</td><td>–0.006</td><td>0.008</td><td>–0.709</td><td>0.478</td><td></td></tr>
<tr><td>CFS:LMI</td><td>0.055</td><td>0.005</td><td>11.208</td><td>< 2e–16</td><td>***</td></tr>
<tr><td>LMI:AGSNot available</td><td>–0.148</td><td>0.029</td><td>–5.165</td><td>0.000</td><td>***</td></tr>
<tr><td>HHS3Unskilled:LMI</td><td>0.010</td><td>0.020</td><td>0.476</td><td>0.634</td><td></td></tr>
<tr><td>HTFOthers:KRN232%–46%</td><td>0.211</td><td>0.067</td><td>3.173</td><td>0.002</td><td>**</td></tr>
<tr><td>HTFSwahili:KRN232%–46%</td><td>0.123</td><td>0.063</td><td>1.955</td><td>0.051</td><td>.</td></tr>
<tr><td>HTFOthers:KRN246%–56%</td><td>–0.006</td><td>0.077</td><td>–0.071</td><td>0.943</td><td></td></tr>
<tr><td>HTFSwahili:KRN246%–56%</td><td>0.024</td><td>0.064</td><td>0.367</td><td>0.713</td><td></td></tr>
<tr><td>HTFOthers:KRN256%–64%</td><td>0.016</td><td>0.072</td><td>0.219</td><td>0.827</td><td></td></tr>
<tr><td>HTFSwahili:KRN256%–64%</td><td>0.047</td><td>0.062</td><td>0.750</td><td>0.454</td><td></td></tr>
<tr><td>HTFOthers:KRN264%–86%</td><td>–0.014</td><td>0.095</td><td>–0.146</td><td>0.884</td><td></td></tr>
<tr><td>HTFSwahili:KRN264%–86%</td><td>0.020</td><td>0.068</td><td>0.299</td><td>0.765</td><td></td></tr>
<tr><th></th><th></th><th></th><th colspan="2">df</th><th colspan="2">p–value</th></tr>
<tr><td colspan="2">Residual standard error</td><td>0.4375</td><td colspan="2">3351</td><td colspan="2"></td></tr>
<tr><td colspan="2">Multiple R–squared</td><td>0.8417</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Adjusted R–squared</td><td>0.8389</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">F–statistic</td><td>302</td><td colspan="2">59 and 3351</td><td colspan="2">< 2.2e–16</td></tr>
<tr><td colspan="7">Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1</td></tr>
</table>

*lm(formula = LnPPB ~ SLR3 + SDR3 + SKR3 + SSR3 + SBR3 + SOR3 + TAS + LnTSR + ABS + LnDCBD + LnDNR + LnDMR + HWC + AHS + PDK + NOB + AWS + AES + DSH3 + GHH3 + HHS3 + HSE3 + HEC3 + NSM + NMK + NBA + NWP + NGT + NSL + AGE * NBR + CMS3 * CFS + CFS * NBR + LMI * AGS + NBR * HTF + CFS * LMI + HHS3 * LMI + KRN2 * HTF, data = Comb)*