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Characterising Real Estate Value as Co-Determinant of Housing Choice Optimality in Nigeria

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Abstract

Nigeria remains classified as a lower middle-income nation. Among middle-income households (MIHs), there exists an idea that real estate value is central to housing well-being, but the significance of the anecdote has not been empirically established.The principal aim of this study is to characterise real estate value (REV) as a co-determinant of optimality, the adopted proxy for housing well-being, through regression modelling of selected MIHs in Abuja and Minna, Nigeria. This study examined the impact of REV as well as the effects of four other pertinent variables (household income, commuting cost, workplace distance and household activity pattern) on housing choice optimality in Nigeria. Using primary and secondary data from purposively selected MIHs in Abuja and Minna, the study employed multiple regression to explore the relationships among the variables. The results show that the housing optimality model has a reasonable predictive explanation of approximately 57–77% for the explanatory variables. The study's findings also reveal that household income, real estate value and activity patterns have significant effects on housing choice optimality, albeit with varying magnitudes across the two cities. It is worth noting that the t-statistic ranges between -5.20 (Abuja) and 2.12 (Minna), thus implying that REV impacts optimality negatively and that REV is a burden which households must bear in order to secure the right to an apartment of their choices. The study concludes that given the real estate value, the consequential housing choice optimality could be predicted across different housing markets in Nigeria as a decision-support guide for rental seekers. Furthermore, given the consistency of these results with earlier studies, this work provides greater knowledge on the lifecycle of housing choices and realities in Nigeria. By adapting and extending the optimality idea to real estate, this study has made an important contribution to the discourse of optimal rental housing.

Keywords: Housing Choice Optimality; Real Estate Value; Multiple Linear Regression; Nigeria

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1. Introduction

Over the last ten years, Real estate had been the single most productive and important economic asset to most middle-income households (MIHs) in Nigeria, a nation classified by the World Bank (2020) reports as a lower middle income country (LMIC) among 50 nations ; thus, one dominant aspiration of households during their lifecycles is to obtain optimal housing along with non-housing consumptions, subject to budget constraints (Zabel, 2004; Oktay et al., 2014). However, the notion of optimisation is subjective, given its multiple dimensions and household's idiosyncratic preference. Consequently, most households' current utility functions are only partially optimised.

Against this background, many international scholars of housing economics have examined the drivers of a households' location choices: commuting cost and workplace distance (Zax & Kain, 1996; Stutzer & Frey, 2004b), household demographic factors (Cinar, 2014), activity pattern (Ben-Akiva et al., 2006; Bocarejo et al., 2017) and property value (Nechyba and Strauss, 1997; Maclennan & O'Sullivan, 2012). Additionally, Bratt (2002) and Grzeskowiak (2006) study housing and family well-being based on owner-occupiers' perceptions. In Nigeria specifically, studies by Olatubara (1994, 1998), Arimah (1997), Jiboye (2009) and Olatunji (2013; 2017) are notable representative articles on real estate value and residential location choice. In a nutshell, this means that REV is a factor for the housing-specific well being of the typical household: an empirical study is therefore imperative to reveal the nature and extent of REV's contributory role in the housing choice process.

Given the centrality of real estate value in the literature and all real estate decisions, the study examines this concept in Nigerian rental housing markets. At present, no known research has focused on this nexus– revealing the impact of REV and its ability to predict housing well-being or optimality in Nigeria through empirical and comparative evidence. As part of this objective, the paper examines variables of interest and optimality as well as the impact of four other applicable variables: household income, commuting cost, workplace distance and activity pattern (AP). These were investigated in the cities of Minna and Abuja, to ascertain housing choice optimality and add to the literature.

1.1. Rationale for focusing on rental housing over owner-occupancy

Durrand-Laserve (2002) asserts that globally, rental housing and owner-occupancy among others are easily considered the most common means of access to urban housing. It is logical to expect that homeownership would be more attractive owing to its comparative security and investment advantages over rental housing; but budgetary constraint is its limiting factor. Nevertheless for many Nigerians, renting is the popular option en route to the ultimate goal of owning a house. This could be an underlying reason for global attention on homeownwership by world bodies especially the World Bank in the recent past. Olatunji (2010) argues that rental housing and owner-

occupancy are the two most common forms of access to property rights in Nigeria. Debates often arise as to their performances or competitive efficacy as solutions to housing delivery in Nigeria and more generally Africa as a distinct region. Contributing to the discussion to identify which option is more people-centric, Olatunji (2014: p.100-101) asserts that:

> *"The populist goal of the UN that promised housing for all by the year 2000 eventually turned out to be abortive. The goal expired with the year 2000 without fulfilment, at least in Nigeria, where the housing deficit as at 2010 was put at 16 million houses. Perhaps it is on the strength of these failures that Durrand-Lasserve (2002) asserted variously that the homeownership approaches had achieved limited results because the goals are rarely attainable and are not always desirable. Opportunities for medium-term and long-term interests in rental housing are a viable alternative route to tenure security for the urban poor. Universal homeownership should not be pursued rigidly by governments because other opportunities are available in the rental housing subsector"*

In line with the above, this research focuses on rental behaviour given its frequency in Nigeria. Rental is a more viable avenue for tenure security given circumstantial variables and the persistent nature of housing deficit in Nigeria as of 2019. This has been suggested over the past decades by researchers, for example Adebayo (2007) and Tibaijuka (2013).

2. Literature Review

2.1. *Theoretical background of housing location choice and optimality*

The theoretical work on housing location dynamics is deeply rooted in utility maximisation. Random utility theory assumes that individuals exhibit self-interest behaviour and tend to maximise their total utility subject to demand, time and budget constraints (Ortuzar & Willumsen, 2001; McFadden, 2002; Handy, 2005). Households, based on their discrimination capability (Ben-Akiva & Lerman, 1985; Ben-Akiva & Bowman, 1998) weigh housing alternatives with other enumerative non-housing factors (socio-demographic characteristics, commuting cost, living and workplace, activity nodes and the cost of housing) to decide on location. Ultimately, households select the alternatives that best optimise their overall household utility function (McFadden,1978; Zabel, 2004; Oktay et al., 2014). In most cases, a household's actual utility is observed in the housing market as a partial optimisation due to bounded rationality. For instance, the spatial fixity and heterogeneous nature of housing imply that households suffer from information asymmetry, which constrains their housing choices to their immediate activity spaces or neighbourhoods (Adams, 1969).

Households typically do not possess the technical capacity to gather and process the information they need for making optimal house choices. For example, they may have information on income, but not on distance. They may not be able to calculate appropriately the family activity pattern (AP) or

the superficial dimensions of plots and lettable spaces for analytical purposes. They may have little or no time nor the patience required to take these actions and conclude them logically. Thus, trained professional real estate advisory becomes imperative. Behavioural theories also suggest that most households have a limited cognitive ability to process large sets of information simultaneously and therefore act under hierarchical decision making (Kahn et al., 1987; Olatunji, 2017).

The search for optimality is traced back to Pareto, the Italian economist who introduced the concept of Pareto optimality and Pareto 80-20 rule. They are two different economic concepts. Pareto optimality, also known as Pareto efficiency has to do with efficiency in the allocation of public resources in a manner that does not leave one person worse off to make another better off. On the other hand, the 80-20 rule inspires decision makers to identify the most dominant 20% efforts that determine 80% of the results of an endeavour, and direct their resources parsimoniously towards the dominant factors. The usage of the term has since been applied to housing choice by Limbumba (2007) and housing well-being by Olatunji (2013; 2017) to determine the respective dominant factors. Limbumba (2007) poses a rhetorical question as to whether renters do seek optimality. Bratt (2002) argues that housing well-being (or optimality) is dependent on six factors: decency, safety, space, affordability, investment and security. Similarly, Coleen et al. (2002) and Arimah (1997) study the notion of tenure choice between ownership and rental. From their perspectives, the determinants of housing can be jointly summarised as income, investment motive, number of children, the gender of house head, stage in lifecycle, length of stay in city and access to land. Another study by Sirgy et al. (2005) explains housing preferences and choice based on two factors– social and psychological determinants. For instance, the image or status of the homeowner and functional aspects are the major determinants considered by tenants or homeowners in choosing a house. Grzeskowiak et al. (2006) present a model of six factors (which are quite distinct from Bratt, 2002) linked to housing satisfaction and perceived quality of life (QOL). In terms of conceptual basis, residential research has relied almost exclusively on peoples' perceptions, opinions, axioms and popular notions. Olatubara (1994), Guo (2004), Fernandez et al. (2005), Grzeskowiak (2006) and Jiboye (2009) are some examples of this research methodology. Cultural and communal heritage suggested by van Duijn et al. (2013) are not measurable directly in quantitative terms for empirical study. Olatunji (2014, 2017) provides empirical responses from the context of Minna and Abuja and develops a simulation framework for assessing optimality, following Bolton's (2005) utility optimisation modelling.

In summary, three major themes are reflected in the literature: first, the methodology is either qualitative (perception and logits) or quantitative (regression). Second, the variables identified and used are either quantitative or qualitative. Lastly, the focus of the studies is split between owner-occupancy or rental housing. There is no clear position as to which theme is most commonly adopted. The adoption of mixed methods, variables and foci are observed in past studies. This present study employs quantitative methods and variables with a focus on rental housing. The decision is supported by the

facts that the variables are directly measurable in units well known to market participants especially household respondent, since rental housing is more popular with MIHs. A critical reflection on the reviewed literature revealed a gap in knowledge about determinants of optimal housing choice for middle income households.

2.2. Housing choice outcome: Real estate value, income, workplace, commuting, and activity patterns

Several studies investigate the factors influencing household's preference and residential choice optimisation (Olatubara, 1994, 1998; van der Straaten & Rouwendal, 2010; Marsh & Gibb, 2011; Dunning & Grayson, 2014; Spickermann et al., 2014; Sinniah et al., 2016). Within the scope of this research, housing choice outcome represents the result of a combined set of variables (income, real estate value, workplace distance, commuting cost, and activity pattern) on a given household.
Housing choice optimality framework was developed as an assistive tool to assess the choices that a seeker is confronted with, based on 5 variables including REV. In the opinion of Ifediora (2009) value considerations are central to all real estate decisions. To underscore the importance of REV, valuers believe that some of the major real estate decisions such as mortgage, sale, purchase, transfer, taxation, leasing, compensation and insurance should hardly ever be resolved without determining value professionally. Floyd and Allen (2005) put it succinctly that a key requirement for making effective real estate decisions is having a clear understanding of how REVs are determined. This understanding is central to all aspects of real estate, including consumption (as per rental housing) and investment decisions. In the same vein, the Appraisal Institute (2013) argues that residential optimality and REV are expected to have reciprocal effects on each other, but the nature and magnitude of these effects need to be scientifically established to guide MIHs in the process of optimal housing choice decision making. This is more so because real estate decision is characteristically capital-intensive and so, an inordinate choice could lead a household to a decline in well being.

Concerning income-effects on residential choice location, Dunning and Grayson (2014) suggest that homeowners maximise their lifetime utility subject to wealth and borrowing constraints for optimal housing and non-housing consumption. Similarly, Priemus and Maclennan (2011) highlight the importance of available finance and associated interest rates in housing decisions. Ball and Harloe (2005) note that income distribution has become more polarised in most countries, and this has a significant impact on individuals' housing standards. In a 2002 study, Srour et al. highlight that a household’s income level is a vital index of the status of a household and its lifecycle stage (Kauko, 2006). The literature also emphasises the effect of activity patterns (AP) on residential choice. A household’s AP includes not only its movements but interactions with peoples and spaces. It is seen to constrain access to socioeconomic opportunities (Paez et al., 2010; Bocarejo and Oviedo, 2012; Bocarejo et al., 2017). APs are linked to urban form/land patterns, location and the range of travel to access socioeconomic activities (van Wee et al., 2001; Ben-Akiva et al., 2006; Wu and Hine, 2008; Bocarejo

et al., 2014). Srour et al. (2002) argue that workplaces and residences are not always coterminous, and the degree to which both activity nodes are linked is defined by accessibility as well as cost. Weisbrod et al. (1980) hypothesise that household activity occurs in spaces which are connected by transport systems. Consequently, commuting influences residential location choice, with households making a significant trade-off between housing costs and travel time. These findings support both microeconomic theory (Alonso 1964; Muth, 1969; Olsen, 1969) as well as 'New Urban Economics' (Beckmann, 1973) which analyses the housing market based on the assumption that housing and accessibility are jointly purchased in a residential choice location. The study by Pagourtzi (2003), however, finds contrary evidence to this theoretical explanation. Looking to Nigeria specifically, Olatubara (1994) studies two groups (736 households) whose residential decisions are classified as 'convenient' or 'inconvenient'. The findings from the step-wise discriminant analysis show that households optimise their residential locations to ensure convenience to activity areas. Also, AP such as longer commuting distance, poor knowledge of the urban structure and the need to change workplace contributed to a household's move from an 'inconvenient' residence. In a follow-up study, Olatubara (1998) examines the factors of residential location decisions within Ibadan City.

The determinants of housing choice decision have also been partly explained by a reflection of commuting cost and workplace distance across locations in space (Fujita, 1989; Marsh and Gibb, 2011; Aditjandra, 2012). Donacby et al. (2005) examine the driving forces and response behaviour of households over space and time. Based on the theory of constant time budget, Kung et al. (2014) emphasise that a rational household may relocate its workplace and residence or alter its commuting behaviour to maintain a reasonable commuting time. Contrastingly, Stutzer and Frey (2004a) note that there is no systematic relationship between a household's utility level and commuting cost. Instead, they argue that in the short run individuals in a perfect housing market are not adequately compensated for their travelling costs, either by lower rents or higher wages. Lim and Kim (2019), nonetheless, observe that the relationship between commuting and relocation from sub-optimal housing is not always straightforward. Housing heterogeneity, dispersal of employment opportunities and other contextual factors can reshape the visible pattern of interaction (Kim & Hewings, 2013; Kim, 2014). Looking to Europe, Stutzer and Frey (2004b) report that a 19 minute increase in a German household's commuting time reduces subjective well-being by 12%. Vanderstraaten and Rouwendal (2010) examine the co-location problem of educated and working households who require a residence within a reasonable commuting distance of the multiple workplaces in the Netherlands. The authors conclude that households who commute only to a single workplace are willing to pay €919 per year to live 1km closer to a large labour market. In contrast, households who commute between two jobs are willing to pay €6,046 per year.

Relating to workplace distance, empirical research suggests that as the distance between housing, workplaces and other services potentially increases, a household's gravitation to such houses starts to decrease (Cinar,

2014). Cram (2005) notes that the growth of long-distance work journeys has partly resulted in a household's choice of housing location based on accessibility to a potential workplace. (Spickermann et al., 2014). Similarly, Friedman (1981) analyses the impact of local public goods and community attributes on the residential location choice of 29,000 households in San Francisco bay. Using a conditional logistic model, Friedman argues housing services, longer time and distances to one's workplace significantly impact on residential choice decisions of the households.

Most importantly, it is commonly acknowledged that urban dwellers are exposed to several burdens of housing insecurity challenges which make optimal housing choice a crucial issue especially for the renters. Home owners and renters in Minna and Abuja have an intuitive idea that among other considerations, value is central to all real estate decisions including the choice of an apartment. In spite of being conversant with this intuition, there was no assistive mechanism available to the rental house seeker who desires optimal house choice. The main issue on the ground is that in the two study areas, anecdotal evidences point to agitations by MIHs for improved well-being and standard of living. In particular the extortionate behaviour of landlords is an issue of regular enquiry. The summary of these challenges suggests that the choice set available, the process of choice and the characteristics of the factors guiding peoples' choices, particularly REV, needed to be empirically investigated as attempted in this study.

3. Methodology

3.1. Study Area

Nigeria's real estate value is concentrated in Abuja, Lagos and Port Harcourt. Of the three cities, Abuja's property and rental prices are the highest. Many features of a property boom are noticeable in Abuja's medium-density neighbourhoods like Durumi I and II, Utako, Gudu, Wuye and Mbora (Fig. 1). Here, rents are increasing, and properties are let shortly after becoming available. Rental practices such as apartment sharing (housemate practice) and the under-consumption of housing rights (overcrowding) continue to rise as people prefer lesser space than they trully need in order to reduce housing cost. Concurrently, contrasting features of property depression are not uncommon in Abuja. For one, the over-consumption of housing spaces by tenants in some neighbourhoods forces landlords to deliberately delay the lettings of their properties in anticipation of higher rent offers from desperate prospective tenants. Optimal residential choice issues emerge prominently with these fluctuations– property booms and depressions. Rural-to-urban migration is a global phenomenon and its impacts on housing conditions do not exclude Abuja. The continued influx of workers and urban dwellers to Abuja (the country's administrative and federal capital city) requires both public and private interventions so that housing stock grows with the populous need.

Overcrowding in Abuja is a feature of underconsumption of housing rights: as more persons are admitted into the fixed lettable space, lesser space is available for letting per capita and people demand less space than they need

in a bid to reduce housing cost. In another vein, lower level tenants paying lesser rents for high-valued properties represent over-consumption of housing rights. In such cases, landlords prefer to have their properties kept vacant for as long as it takes for a new tenant to emerge, whose status and capacity to pay are commensurate with the REV. This explains the reason for massive vacant houses that abound in many residential neighbourhoods of the city. Given these features and points of interest, Abuja is included in the study.

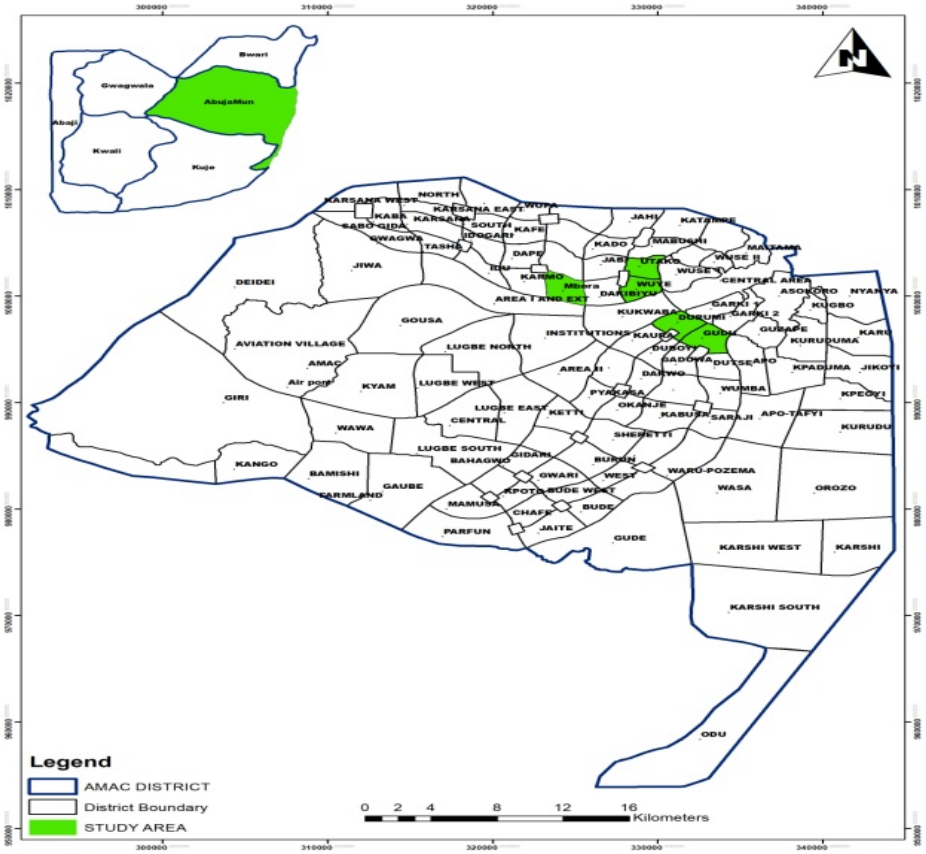

Figure 1: Abuja Study Area

Source: Abuja Municipal Area Council (2020)

Minna, the Niger State capital, is a city of social, political and economic significance. The social structure of the city, cultural diversity, population size and its physical expanse make it suitable for location analysis. At present, Minna houses the government of Niger State as well as many federal establishments; banks, multi-media broadcasting stations, a university, major transport networks, the national headquarters of the National Examinations Council (NECO) and a host of other vital institutions. The city's status as a ready and expanding market for real estate services draws many private and public economic investments. For these reasons, Minna is often categorised alongside Kaduna, Lokoja and Jos as one of the satellite cities of Abuja. The four cities are State capitals and approximately equidistant from Abuja to the north-west, north, south and north-east directions respectively. They are geographically the closest to Abuja of all the 36 State capitals in Nigeria. By reason of proximity, diverse linkages are frequent among the four cities.

A significant consideration for households is optimal residential location. Both cities, in response to rapid investment in physical infrastructure in the housing sector have witnessed massive housing development and a subsequent upswing in housing market activities, especially rentals. Thus the housing choice sets available to house seekers have been widened and choice has become an urban problem.

Together, this concept and these study areas present an opportunity to test some of the well-known theories (such as location and rent theories) against empirical factors that influence optimality in both study areas. Comparatively, it is worth noting that the private development of housing stock in Minna occurs at a lower positive rate than in Abuja. Despite this, it is common to hear statements such as 'times are hard' among urbanites in both cities. Other comparative considerations include size; Minna covers an approximate land area of 148km2 while Abuja is approximately 8,000km2. In terms of regional location, two cities are both located in the North-Central geopolitical zone of Nigeria and assumed to be coterminous with functional housing markets. In terms of regional strategic importance, the two cities lie approximately 112km apart and provide a gateway to the Northern and Southern parts of Nigeria.

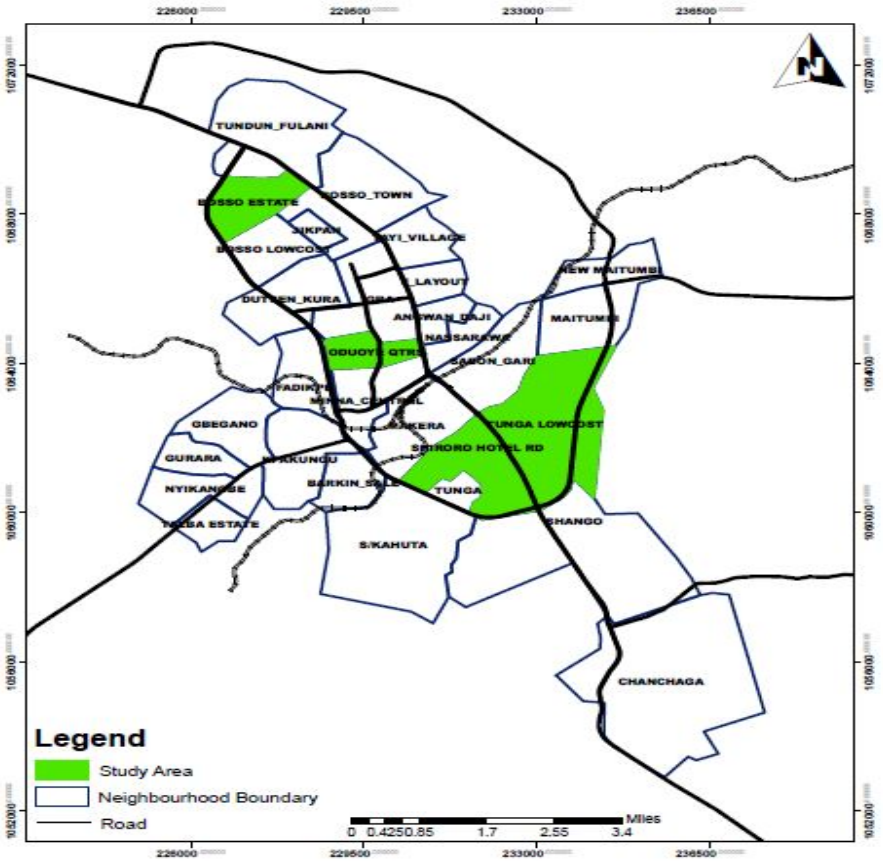

Figure 2: Minna Study Area

Source: Niger State Min of Lands and Housing (2020)

3.2. Data collection and measures

The data used in this study is sourced from earlier work by Olatunji (2013; 2017). This includes household surveys conducted in the city of Minna and Abuja, but also independent field surveys and observations conducted in 2019. Despite the time gap, spatial variables (workplace distance, activity pattern, house size and plot size) have remained substantially unaltered. Where substantial differences were observed, and the purposive selection criteria was not met, respondents' details were excised. It is noteworthy that Nigerian household incomes have since experienced upswings in both the private and public sector. Rental values in medium-density neighbourhoods, where middle-income earners predominantly reside, are presumed to have equally moved upwards even at a greater rate than incomes. In Nigeria, incomes rarely move upwards unless employers are compelled by strikes and industrial actions. The Nigerian Labour Congress was on industrial action for much of 2019, and Academic Staff Union of Universities were on similar strike action for the first half of year 2020. Conversely, rents are not subject to such trappings. An affirmation of this rental trend is made by Adeogun et al. (2017), and still largely persists. As depicted by a leading online property bulletin based in Abuja, PropertyPro, rents in medium density neighborhood of Durumi now tops ₦2 million per annum for a well-finished 3-bedroom apartment.

Secondary data from Olatunji (2017) was originally obtained from 282 households; 159 in Abuja, and 123 in Minna. For the optimality survey of this study, only the households that met three specific criteria were purposively selected and analysed in this present study. The first criterion was a positive response by respondents to a ‘choice problem’ regarding residence, this indicates that the respondent specifically had an encounter with the choice problem while in search of accommodation. The second criterion was whether that decision had occurred three years before the study, it is reasonable to assume that decisions taken more than 3 years earlier may be unreliable due to the passage of time. Third, was the disclosre of household income. Income was the most significant variable in earlier studies. Respondents who did not explicitly disclose their incomes would not qualify for further analysis. In all the criteria were formulated to ensure that the respondents were competent for the survey.

In line with these criteria, there were 107 matches– 56 in Abuja and 51 in Minna. It is noteworthy that these 107 selected cases, by stochastic spontaneity, cut across all neighbourhoods within the study area, signifying that the criteria are reasonably justifiable. The criteria seem to have a fair spread in the sense that quite unexpectedly and without researcher interference, the said respondent-cases were found pervading all neighbourhoods without exception; their distribution did not exclude any of the selected neighbourhoods. By pooling data from the two study areas, a valid basis is laid for generalised findings. This approach is consistent with the views of Badu et al. (2012), who supports purposive sampling when specified data is needed for a clear objective. Furthermore, Blaxter et al.

(2010) assert that purposive sampling is appropriate where the frame of a target population is not readily established.

Owing to the peculiarity of this study, a multi-scale sampling approach was adopted involving stratification, randomisation and purposive techniques. The choice of a middle-income sample group was premised on the fact that Nigeria has been recognised as a lower-middle-income country (World Bank, 2009). Given the low purchasing power of this subgroup in any urban setting, these households are likely to be associated with consciousness for optimality in their housing choice decisions but also representative of the housing market for this present analysis. Furthermore, the residential neighbourhoods in the two cities were stratified along density lines into low, medium, mixed and high-density neighbourhoods to determine where relevant subjects were residing. The MIH subgroup, unlike the low income class, has the capacity to exercise choice, but must be guided towards optimality because members are incapable of the luxury of high-end choices like holiday houses or weekend resorts associated with high income subgroup. MIHs were dominant yet not exclusively found in medium-density neighbourhoods. From 11 medium density neighbourhoods of Minna, five were randomly chosen to represent 20%, and from 32 in Abuja, six were randomly selected, representing 19%. These neighbourhoods are Tunga Low Cost, Tunga Interior, MI Wushishi, Shiroro Hotel Road I and II in Minna, and Utako, Durumi I and II, Wuye and Mbora, Gudu in Abuja. See Figure 1 and Figure 2.

Field data for this 2019 study obtained from individual households in Minna and Abuja, are compressed into Tables 1 and 2. The data is analysed to present the mean decision variables. The data include the monthly household income (₦ per month), workplace distance (km), commuting cost; all out-of-pocket expenses related to commuting by all members (₦ per month), activity pattern (km per month), and real estate value (monthly rentals in four components: plot size, house size, land price attributable to neighbourhood quality, and house price). The optimality index (OPTi) is derived for each respondent based on all the above variables. In Table 2, REV components and optimality indices for the two areas are isolated from other variables for clarity and easier comparison.

Table 1: Comparative Profile of Mean Decision Variables for Minna and Abuja

	Y= Income (₦)*	D= Distance (km)	REV= Real Estate Value (₦)*	C= Community Cost (₦)*	AP= Activity Pattern (km)*	OPTi**
Minna	190,060	7.064	21,011.55	24,746.2	142.8	0.5114
Abuja	603,156.30	6.46	134,947.9	32,433.71	259.75	0.5711

***** Amounts *shown are per month*
****** *OPTi is the Optimality Index*

Table 2: Real Estate Value and Optimality Isolated from Other Variables

	Real Estate Value (₦)*	PH= House Price (₦'000/hectare)*	PL**	H= House Size (m^2)	L= Plot Size (hectares)	OPTi*
Minna	21,011.55	2,488.4	118.2	139.8	0.039	0.5114
Abja	134,947.9	6,675.833	1707	149.19	0.044	0.5711

** Amounts shown are per month*
*** PL= Price attributed to neighbourhood quality (₦'000 per hectare per month)*
Source: Field Survey (2017).

The survey provides information about each household's income, average commuting cost, tenure status (owner-occupancy and rental holding), plot size, property type, non-work AP, OPTi and REV (actual and imputed rents). The data on REV was supplemented with information from Estate Surveyors and Valuers (ESVs). They act as real estate advisors and specialists in the management of rented and owner-occupied residential properties. In total, seven firms were chosen from Abuja and four from Minna. Furthermore, the dataset from households was augmented by estate firms to enhance the level of accuracy. This included the addition of distances to key points of accessibility, location quality indicators as well as instrument-backed and geo-referenced distance measurements.

A review of the data further reveals that the housing OPTi (dependent variable) was developed from a computer simulation framework - an iterative process for modelling the best choice of a house available to a willing and able household from a range of alternatives. The derived OPTi for a house h, at location *i,* to a household j, lay in the range between -1 <OPTi≤ 1. The values represent the levels of housing optimality. An OPTi index of 1.00 is the highest value, depicting that the household choice being assessed attains the best optimality as a result of the combination of the variables chosen. Hence, the OPTi of 1 represents the idealized optimality, a condition that portrays a perfect house choice; it is largely unachievable, but the closer the assessed index is to OPTi of 1.00, the better for the well-being of the subject household. Conversely. OPTi of 0.00 is the lowest value and it depicts the poorest level of optimality which no rational household would wish to experience or endure. Table 3 provides further description of the variables and data sources used in this study.

Table 3: Data Description and Data Sources for the Study

Variable	Description	Source
Dependent Variable:		
Housing Optimality	Index of the level of household's well-being or fulfilment derived in the choice of a house from a range of alternative (denoted as a per centum)	Household
Independent Variables:		
Household Income	Individual household income (₦)	Household
Commuting Cost	Commuting Cost (₦)	Household
Real Estate Value	Real estate value (₦)	Household & ESV Firms

Activity Pattern	Household non-work activity pattern (km)	Household
Workplace Distance	Home-workplace distance (km)	Household & Google Maps

The OPTi entails survey details and observations that require rigour and costs in the data collection process. These arose from (i) physical survey of the plot (ii) physical survey of the house (iii) a physical survey of workplace distance (iv) AP (observation of spouses' workplaces, children's schools as well as frequented markets, places of worship, health centres and recreation). These criteria assisted the selection process of the cases while the purposive specimen for the ensured that the OPTi respondents were seen to be competent for the survey. It is important to note that the category AP represents non-work activity areas regularly frequented by the household. The cumulative distance covered by each respondent in the course of performing these activities over one month is adopted as a proxy for the AP. For each household, the AP is calculated by adding the distances between the present home and the stated activity nodes in km per month. This was assisted using handheld GPS, in conjunction with Google Earth and Google maps to establish the total network distances and employment of survey assistants. An electromagnetic distance measurement device (EDM) was also used for faster data collection. No signs are ascribed to AP as it is obtained through practical observations.

3.2.1 Deriving the Optimality Index (OPTi)

Olatunji (2017) provides an exhaustive derivation of the OPTi. To avoid running the risk of replication, only an abridged version of the process is attempted in line with the Cobb-Douglas utility function as modified by Bolton (2005). Olatunji (2014) critiques Bolton's (2005) model for six main weaknesses and later develops a modified utility function in 2017.

According to Olatunji (2017), the development of the housing choice optimality model and simulation programme begins with the transformation and adaptation of the existing Cobb-Douglas utility functions and decision variables. The functions are utility function, land price function, and the commuting cost function. Each has its own set of variables and identifiable parameters. Olatunji's (2014) critique of the Bolton (2005) states the critical weaknesses in his work are the absence of any scientific basis for the selection of decision variables and the omission of variables that might prove crucial in household residential choice decisions in the study area (house attributes, neighbourhood quality and tenure choice). Other weaknesses include the erroneous specification of a key variable, so unique as land, as a typical consumer article, the lack of empirical data upon which the simulation technique could be tested and monotonous transformation inherent in Cobb-Douglass and Marshallian demand functions. Thus, the modified utility function is derived from a series of equations and algorithms, a modified utility function which adressed all the stated weaknesses was developed in Olatunji(2017), as well as in reference to the Cobb-Douglas utility function which critiques of Bolton's (2005) version of the development of optimality index. Remediation of the Bolton's (2005) weaknesses resulted in new modified utility function presented in Equation i.

$$U_{ijc} = A.L_{jc}^{\alpha}.E_{jc}^{\beta}.H_{jc}^{\theta} - gD_{wc}^{\gamma} \quad \text{(i)}$$

Where Ljc is the plot size of location j, Ejc is the size of the essential pack, Hjc is the size of the house chosen, and D_{wc} is the distance between workplace (w) and house chosen (c). The parameters α, β and θ, are indices depicting the trade-off between the three goods/services to be selected by a household. Their proportions represent the marginal rate of substitution between the three distinct goods that are concurrently demanded. Still, since the household income is fixed, the proportion allocated to each will vary according to the choice of the household. Their values cannot be negative as depicted by the relationships $\alpha, \beta, \theta > 0$; and their sum is always between 0 and 1, thus: $0 < \alpha + \beta + \theta < 1$.

Prices are specified for each variable in the function as follows: the price of land in Equation ii, price of composite good in Equation iii, price of housing and price of commuting in Equation iv.

$$PLj = Pw \exp(\delta D) + N \quad \text{(ii)}$$

Where PLj is the price per hectare of the plot located at j. Pw is the price per hectare of workplace location (also the rack-rent/ bid-rent for w by household i), and N is the market value of the quality of location j.

From Bolton (2005), PEjc is the unit price of a composite good upon which the remainder of the household income is spent.

$$PEjc = 1 \quad \text{(iii)}$$

The commuting cost function remains as specified, thus:

$$C = vD^{\eta} \quad \text{(iv)}$$

However, the parameters **v** and **η** are to be fixed within their feasible ranges.

The price of housing structure ($P_{Hc)}$ is market-determined rather than a function of the unit price of housing structures which tends to be spatially stable for the same specifications and property attributes for most intra-urban locations. This position is more realistic, especially when housing market data is available. The study areas now have a growing property market data in terms of sales, rentals, and tenure (type, terms and length).

3.2.2 The Optimality Index (OPTi)

The index is a representation of the level of optimality that a household stands to obtain from the given household choice. It also can measure the reallocation efficiency of a housing choice for a household. The utility obtained (Uijc) represents the satisfaction level achieved, as indicated by the factors mentioned above.

The utility obtainable (Uiwc) represents the highest satisfaction possible for the household, given the combination of factors, variables and parameters that exercise control over a household choice. It is the highest figure of utility,

and, from this study, it tends to occur at, or close to D=0, if the workplace and house choice are coterminous. The OPTi, is derived from the simple relationship:

$$\text{OPTi} = (\text{Utility Obtained})/(\text{Utility Obtainable})$$

$$\text{OPTi} = Uijc / Uiw \qquad (v)$$

OPTi is a measure of the level of fulfilment, contentment or satisfaction that a household (i) whose primary workplace is (w), stands to achieve from a house choice (c) in a neighbourhood (j). Uijc is the utility obtained by a household (i) from house choice (c) in a neighbourhood (j). Uiwc is the highest possible utility obtainable by a household (i) from house choice (c) at workplace (w) or at any other location for that matter.

At the peak of any choice, Uijc will equate Uiwc. This implies that the maximum OPTi, which represents the optimal choice, is 1. Under extremely adverse conditions, utility obtained or obtainable could be negative, thus rendering OPTi negative. Any values less than 1 can be construed or interpreted as sub-optimal choices. Thus, the range of possible values of OPTi extends from the maximum of +1, to the minimum of negative results. Given these attributes, the OPTi scale shares common features with the Kappa-Test, which is also a coefficient used for statistical measurement of performances. Details on these statistics are available from StatData-Pro-Nigeria and the Analyse-it-Leeds-UK Course Manual (2011) accessible at www.stat-DataPro.com.

3.3. Model

The study employed a multiple regression model to analyse housing optimality variations due to the influence of REV. The formulation of the multiple linear regression analysis underlying the current empirical study takes the following form:

$$\text{Housing Optimality} = \alpha + \beta 1\ \text{Household Income} + \beta 2\ \text{Commuting Cost} + \beta 3\ \text{Real Estate Value} + \beta 4\ \text{Activity Pattern} + \beta 5\ \text{Workplace Distance} + \varepsilon \qquad (vi)$$

In Equation vi, the household's well-being, arising from a revealed or stated residential choice from a range of available options, is denoted as housing optimality. is the constant term, are the estimated regression coefficients and ε is the uncorrelated residual term.

4. Findings and Discussion

4.1. Demongraphic profile of the sampled middle-income households

Table 4 provides a summary of the statistics used in the study. They suggest that a typical middle-income household in Minna city that resides in an apartment house commanding a market value of ₦21,000[1] earns a monthly

[1] Equivalent to US$ 54.6 as per https://cbn.gov.ng/rates as at 15/04/2020

income of about ₦211,000, but commutes an average distance of 6.6km to work and 159km to other non-work activity destinations at the cost of ₦25,207. That household would have housing well-being of 0.51. In Abuja, a middle-income household living in a house with a market value of approximately ₦21,000 and with an average income of about ₦589,000, but commutes a distance of 6.8km to work and 200km to other non-work activity destinations at an average cost of ₦33,500, has a housing well-being of 0.57. Apart from the household income and REV variables, the values of the mean in the two samples exhibit similar patterns. In terms of the variability of the distribution, any observed differences in analyses cannot be aligned to any unsystematic oddity in the original data. (All values are denoted on monthly terms).

Table 4: Summary of Descriptive Statistics for the Samples

Variable	Mean	Standard Deviation	Minimum	Maximum
Minna				
Dependent variable:				
Housing Optimality	0.51	0.43	-0.81	0.98
Independent variable:				
Household Income (Monthly)	₦211,279.90	₦62,140.11	₦100,000.0	₦358,333.30
Commuting Cost (Monthly)	₦25,207	₦9,9371.93	₦11,500	₦45,000.00
Real Estate Value (Monthly)	₦21,011.55	₦3,867.15	₦847.76	₦26,495.87
Activity Pattern (Monthly)	159.59	5.62	85.00	246.00
Workplace Distance	6.64	3.17	0.72	14.60
Number of Sample	51			
Variable	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Abuja				
Dependent variable:				
Housing optimality	0.57	0.42	-0.96	0.97
Independent variable:				
Household Income (Monthly)	₦589,211.90	₦195,811.50	₦360,000.0	₦1,300,000.00
Commuting Cost (Monthly)	₦33,517.86	₦7,906.25	₦15,000.00	₦46,000.00
Real Estate Value (Monthly)	₦142,389.63	₦124,727.15	₦17,430.56	₦565,347.22
Activity Pattern (Monthly)	200.79	43.99	72.00	300.00
Workplace Distance	6.79	2.78	0.90	11.55
Number of Sample	56			

Source: Olatunji (2017)

4.2. Preliminary check on the parsimony of the housing optimality model

A diagnostic check on the parsimony of the multiple regression model shows a high level of predictive explanation for the independent variables (R2 = 0.773 for the Minna city and R2 = 0.571 for Abuja city). This range of R2 values supports the assertion that multiple regression can be used to predict housing choice optimality in the urban market. The low standard error of the estimates (0.213 and 0.397 respectively) reveals a high level of statistical

precision for both housing optimality models. Furthermore, the Durbin-Watson statistics of 1.40 and 2.26 surpass lower critical values and thus are rejected at 5% level of significance. This suggests that the error term of the regression is uncorrelated. Lastly, the F-statistic of 30.74 for the Minna city model and 11.06 for Abuja model imply that the regression coefficients are statistically different. In other words, the null hypothesis of parameter equality is rejected at 5% significance. This outcome was further affirmed by examining the Variance Inflating Factor (VIF) presented in Tables 5 and 6. VIF was used to detect the extent of collinearity among variables, which in turn explains why it is used by researchers as an indicator of multicollinearity. Typically, if the VIF of any variable exceeds nine, that variable is adjudged high on a collinearity scale. None of the variables used in the models have a VIF that violates the stated rule. Specifically, VIF for REV is 1.021 (Abuja) and 1.164 (Minna) while that of the commuting cost, the highest is 5.576 (Abuja) and 5.281 (Minna). Though the VIF for the commuting cost (CC) is relatively higher than the others, it is still well within statistically accepted range; VIF for workplace distance is 4.922 (Minna) and 4.861 (Abuja). Again, though it is reasonable to assume that workplace distance is collinear with commuting cost, these results do not violate regression rules for collinearity.

4.3. Findings from the multiple regression model on factors affecting housing optimality

The results of the multiple regression models for each city are reported in Tables 4 and 5. Turning to the interpretation of the results, the constant in Table 5 provides a useful starting point, as it represents the lowest level of housing well-being (measured by OPTi) which can be attained by a household with a relatively limited income, commuting cost, activity pattern, property value and distance to the workplace.

In Minna city, the constant shows that the minimum housing optimality for a typical household was 0.382 in contrast to 0.2057 for Abuja city. As a result, the sign and magnitude of the estimated constant coefficients are consistent with the theoretical considerations on the household utility function. Based on the results reported for Minna and Abuja city models (Tables 5 and 6), most of the five predictors of housing optimality (except for commuting cost for Minna and workplace distance for Abuja) are highly significant at a level of 5% significance with the sign of the coefficient estimates consistent with theoretical expectation.

Table 5: Minna City Multiple Regression Model for Housing Optimality

Variable	Coefficient	95% CI		SE	T-Stat	P-val	VIF
		Lower Bound	Upper Bound				
(Constant)	3.84E-01	-1.09E-01	8.77E-01	2.45E01	1.57	0.1237	
Household Income	4.23E-06	3.04E-06	5.42E-06	5.92E06	7.14	0.0010*	1.481
Commuting Cost	-5.42E-06	-2.08E-05	9.92E-06	7.62E06	-0.71	0.4802	5.576
Real Estate Value	-9.44E-07	-1.69E-07	1.50E-07	1.99E07	-2.12	0.0454*	1.021

Activity Pattern	1.67E-04	-1.45E-04	1.79E-04	8.05E04	2.07	0.0369*	1.143
Workplace Distance	-9.47E-02	-1.37E-01	5.21E-02	2.11E02	-4.48	0.0010*	4.922
R^2	0.773						
Adjust R^2	0.748						
Standard Error(SE)	0.213						
Durbin-Watson	1.40						
F-Statistic	30.74						
N	51						

*Notes: [a]Dependent variable: Housing Optimality; *P < 0.05; SE: Standard Error*

The AP variable has one of the most extensive coefficient estimates affecting housing optimality. Its coefficient of 0.000167 for Minna city, implies that an increase in a household's AP by 1km significantly increases the household housing optimality by 0.000167 on average. Comparatively, the coefficient of 0.00026 for AP in Abuja city, implies an increase in housing optimality by 0.00026 in Abuja city. By extrapolation using the standard deviations for both cities, 43.99km change in AP in Abuja increase the optimality by 0.0114. For Minna, a 40.14km shift in AP increases the optimality by 0.0067. This empirical finding on AP is reinforced by the work Olatubara (1998), who suggests that an AP is a better factor than transportation costs in predicting residential location choice decision. A possible explanation for this positive relationship could be that the activity levels of most households are geared towards ventures that are economically productive as well as socially and culturally beneficial. Activities considered under AP include trips to spouse's workplace, children's schools, market/health/recreation and worship centers. Nigerians and indeed Africans are faith-inclined peoples, so it is appropriate to factor in their faiths among other things into their house choice decisions.

The coefficient of the variable household income, which is a measure of individual household income is also significantly positive. It contributes 0.00000422 and 0.00000190 to housing optimality levels in Minna and Abuja city, respectively. This finding indicates that higher wages are associated with higher levels of housing optimality.

Table 6: Abuja City Multiple Regression Model for Housing Optimality

Variable	Coefficient	95% CI		SE	T-Stat	P-val	VIF
		Lower Bound	Upper Bound				
(Constant)	2.057E-01	-1.139E+0	1.550E+0	0.66951	0.31	0.759	
Household Income	1.901E-06	1.225E0-6	2.576E0-6	3.36E-06	5.65	0.0022*	1.646
Commuting Cost	8.241E-05	7.083E-05	2.357E-04	7.63E-05	1.08	0.0501	5.281
Real Estate Value	-6.455E-07	-8.95E-07	-3.96E-07	1.24E-07	-5.20	0.004*	1.164
Activity Pattern	2.600E-04	-7.80E-04	1.300E04	5.18E04	5.02	0.018*	4.881
Workplace Distance	-4.022E-02	-9.91E-02	1.864E-02	0.29306	-0.14	0.076	1.341
R^2	0.571						
Adjusted R^2	0.528						
Standard Error (SE)	0.397						
Durbin-Watson	2.26						
F-Statistic	11.60						

N	56						

*Notes: [a]Dependent variable: Housing Optimality; *P < 0.05 ; SE: Standard Error*

This result reflects previous research (Cinar, 2004; Ball & Harloe, 2005) which indicates that income has a significant impact on an individual's housing standards and overall expectation in the housing market.

Though commuting cost is not statistically significant in the regression model for the study areas, the negative sign of its coefficient is consistent with prior empirical evidence (van Ommeren et al., 1997; van Ommeren et al., 2000; Stutzer & Frey, 2004b) which depict that household utility function decreases with increase in commuting cost. The Abuja model, however, provides further insights. For example, the commuting cost is, by a narrow margin, not significant, but with a positive sign. This result can be attributed to the diversified nature and dispersal of employment opportunities in Abuja and its urban form. The coefficient of workplace distance for Minna is significant but negatively correlated with housing optimality. This signifies that with a 1km increase in workplace distance, housing optimality is expected to drop by approximately 0.00947. Similarly, in Abuja, housing optimality is expected to decline by 0.0402 with a 1km increase in distance to workplace. An increase in commuting distance to work logically and practically implies a loss of leisure-time but also reduced effective working hours. Thus, a work-distance-threshold for housing optimality arises. The results of this research, therefore, aligns with previous studies (Phe & Wakely, 2000; Guo and Bhat, 2007; Cinar, 2014) and gives context-specific information for Nigeria's residential market.

Concerning REV, its coefficient for Minna city is negative. This implies that an increase in REV by ₦1 significantly decreases, on the average, housing optimality by 0.00000094. Similarly, in Abuja, housing optimality tends to decline by 0.000000646 given ₦1 increase in REV. A clearer picture emerges if the figures of standard deviations of REV, (₦124,727.15; Abuja and ₦3,857.15; Minna per month respectively) are applied as illustrations under a condition of anticipatory increase in REV. In this manner, optimality would drop by -0.0805 and -0.0037 respectively, indicating that the rate of diminishing optimality in Minna is higher than Abuja. This implies that the burden of REV on medium-income households is more substantial in Abuja study area.

Table 7: Interpretation of Regression Results

Minna			**Abuja**		
1. Change in REV	**Coefficient of REV**	**Change in OPTi**	**1. Change in REV**	**Coefficient of REV**	**Change in OPTi**
₦ 1	-9.44E-07	-0.000000944	₦1	-6.46E-07	-0.000000646
₦3,867.15	-9.44E-07	-0.00365059	₦124,727.20	-6.46E-07	-0.08051137
2. Change in Income	**Coefficient of Income**	**Change in OPTi**	**2. Change in Income**	**Coefficient of Income**	**Change in OPTi**
₦1	4.23E-06	0.000004227	₦1	1.90E-06	0.0000019

₦62,140.10	4.23E-06	0.262666245	₦195,811.50	1.90E-06	0.37204185
3. Change in Activity Pattern	**Coefficient of AP**	**Change in OPTi**	**3. Change in Activity Pattern**	**Coefficient of AP**	**Change in OPTi**
1km	1.67E-04	0.0001667	1km	2.60E-04	0.00026
40.14km	1.67E-04	0.006691338	43.99km	2.60E-04	0.0114374

Source: Olatunji (2019)

Table 7 illustrates interpretive information in the regression results. It uses figures of standard deviation for the three significant variables: income, REV and AP, in that order. Standard deviation is a measure of statistical dispersion of a dataset depicting the pattern of deviation from the mean. The regression result is a generalisable set of outcomes that can be interpreted by observing marginal changes in the dependent variable explained by small changes in each independent variable. Table 7 indicates that a shift in ₦1 in REV in Minna will cause optimality to drop by 0.000000944. Comparatively, an increase of ₦3,867.15 in monthly rent would, on the average, cause optimality to drop by 0.0037. Likewise, a change of ₦1 in REV in Abuja would cause optimality to drop by 0.000000646. Hypothetically then, an increase of ₦124,727.20 in monthly rent in a medium-density neighbourhood of Abuja would, on average, cause optimality to decline by approximately 0.0805. This example result indicates that REV exerts a greater negative impact on optimality in Abuja than in Minna. In this case, MIHs should seek professional guidance for optimising choice, given that the risk and burden are more substantial when relocating to Abuja. Real estate advisors are trained in housing choice optimality services and could provide professional decision-making support. This relationship is important as many households lack the technical capabilities to gather and process relevant information when compelled to seek accommodation.

As shown by the regression results in Tables 5 and 6 and interpretation in Table 7, household income impacts optimality positively and significantly. An increase change of ₦1 in monthly income in Minna would drive optimality higher by 0.000004227 implying that if monthly income increases by ₦162,140.10 optimality would receive a boost by 0.2627. Corresponding figures for Abuja suggest that a change of ₦195,811.50 per month would result in 0.3720 rise in optimality. Changes in income produce a greater positive effect on optimality in Abuja. Furthermore, these results suggest a simultaneous increase in both variables that gives households in Abuja an edge in optimality. In other words, the negative impact of an upswing in REV could be mitigated by a concurrent rise in wages for middle-income families. This conclusion seems to align with reason and previous studies especially Lim and Kim (2019).

The implication of these findings is the recognition that REV represents a burden which the household has to bear to secure an apartment of its choice. Against the backdrop that most current housing choices in both study areas fall short of what is considered to be optimal. One of two scenarios would need to occur for households to attain optimal housing during their lifecycles.

The first is characterised by rental or price upswing accompanied by renovation, modernisation and aesthetical or functional improvements. In this case, both optimality and rental or market value could gravitate in the same direction, apparently contradicting the regression results, but confirming parts of the regression results for Abuja. However, this gravitation would not continue ad infinitum, but rather cease given unsustainable property value escalation as seen in Minna city. The second scenario occurs whereby optimality rises with REV, as seen by the positive side of the 95% confidence intervale (CI) in the two regression models. The latter scenario is made possible because rental value is partly a reflection of neighbourhood location qualities, and higher rental value reflects better environmental attributes. Thus, greater the locational qualities linked to optimality would incur higher rental values. Households striving for greater housing well-being would need to choose and accept higher rental or market values subject to the limit set by optimality. When this limit is attained, the household would probably be advised to seek an alternative. This explains why some apartments remain vacant and unlet for a long time after the last tenant has vacated until a new party emerges for whom the apartment is optimal. The same apartment may be let only at a lower rent, and, even then some incentives such as renovation, refurbishing and general retrofitting may have to be considered and added.

5. Conclusion

This study has established that household income and activity pattern are other critical co-determinants with significant impacts on housing choice optimality. This agrees with earlier studies which defined housing choice as a multivariate phenomenon. The paper explored the contributory influence of REV and other pertinent variables on housing optimality in two cities in Nigeria; Abuja and Minna. From the analysis and discussion, the findings support the contention that multiple regression can be employed in the urban housing markets to predict housing choice optimality. The models also provide empirical evidence among the studied population to support the anecdotal idea of households in the two study areas that real estate value is central to most real estate decisions. Thus, the hypothesis proven in this research, was that real estate value is next only to income, as a significant co-determinant of housing choice optimality. Additionally, this study has shown that REV is a significant negative predictor of a household's level of housing optimality/well-being in both Minna's and Abuja's housing markets. By pooling data from two study areas, a valid basis is laid for generalisation of findings.

An important implication of this finding is that REV is a burden households bear to secure the right to an apartment of choice. In both housing markets, households attain improved housing well-being in the long run by either moving to an alternative house with higher market value (subject to the limit set by optimality) or when a rental or price upswing is accompanied or preceded by renovation, modernisation and aesthetical plus functional improvements. The latter is temporary and unsustainable, even if such houses are affordable. Real estate professionals can appropriate this knowledge and guide households towards their optimal housing choice.

By adapting and extending the idea optimality to real estate, this study has made an important contribution to the discourse of optimal rental housing. It lessens the information-gap created by the paucity of literature in this area of study, particularly in emerging markets. The study has implications for real estate practice and research in Nigeria, and Africa more broadly. Real estate practitioners can better their optimality services to residential seekers and train in optimality software packages as a decision-support guide. Though, OPTi of 1.00 signifies an idealised housing condition or a perfect housing optimality (which is largely unachievable), it is indeed necessary that MIHs be guided towards improving their housing well-being when revealed by the index to be on the near-side of 0.00 or unacceptably low.

Admittedly, the study has limitations, as is commonly the case. Although it has established that quantitative variables do provide a useful insight into assessing optimality, it does not claim that non-quantitative variables are inapplicable. Nevertheless, the procedure can be adapted in other forms, and further research is necessary in this regard. Accordingly, the study suggests that future researchers should consider studying the application of variables that are not directly measurable such as familiarity, cultural and communal affinity, and others more measurable elements such as noise and air quality, conjointly with those tested in this study to model housing choice optimality.

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