# EVALUATION OF INTERNATIONAL BORDER AREAS ON HOUSING CHARACTERISTICS IN OGUN STATE, NIGERIA

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**BY**

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## Abstract

Settlements at international border especially those connecting developing countries exhibit unique spatial arrangement due to inhabitants sharing similar socioeconomic and cultural features. However, study linking these factors with housing development patterns at international border is limited or non-available. Hence, this provides crux of the current study. Through application of scientific method, a sample size of 361 was carefully selected among the residents in three towns at Nigeria-Benin Republic international border. Every $5^{th}$ household head was systematically sampled to obtain opinions through well-structured questionnaire instrument. At initial stage of the empirical analysis, the study employed Ripley's K – Function to investigate housing formation pattern in the study area where it was discovered that housing development pattern at Nigeria-Benin Republic international border generally followed a clustered pattern. Socio-economic and cultural factors responsible for such pattern style were examined with the use of Spatial Probit Regression (SPR). From findings, it was discovered that ethnic group, income, occupation, commercial space demand, and education were significant factors as socio-economic and cultural factors that determine housing formation pattern in the study area. Therefore, the study affirmed that socio-economic and cultural factors largely determine the way housing structures are organized in neighbourhoods and, thus, have far reaching implications for sustainable housing development in international borders. Since ethnic group belonging was found as most significant factor through findings, the study recommends that there is need for government to set up joint and consultative forums for educating the predominant ethnic groups in the Nigeria-Benin Republic international border towns.


**Keywords: Evaluation, Boarder, Housing Characteristics, Development**

## Introduction

The settlements along Nigeria-Republic of Benin border experience rapid economic activities. Cross border economic activities encourage people to settle at border towns (Taylor, Banda-Thole & Mukuwa 2015 Bonchuk 2013). The assessment of socio-economic characteristics of border residents focused on the household income, marital status, income, household size, education at background and occupation (Gbakeji and Rilwani 2009). Economic growth and increase in population are inseparable elements that foster development. The international border is faced with the reality of high economic activities but shortage in supply of infrastructure facilities. It was attributed to locational problem. The problem of border area in Ogun State related to lack of industries. Therefore, the peripheral area depends on the high number of unemployed due to location of industries in the cities centre (Raubar, 1990).

The border settlements have unique spatial arrangement because the inhabitants share similar socioeconomic activities that prompt physical characteristics. The economic activities of border towns attract the diverse population; it also improves the economic growth. Increase in population creates diversion in socioeconomic activities, the residents are homogenous in nature and economic activities are related to smuggling of goods and services from neighbouring countries. According to Adeyinka (2014), the porosity of border increase smuggling activities and influx of contraband goods in to Nigeria.

The location of settlement shows the socioeconomic approach of the inhabitants;therefore, activities and resources revealed the structure of the settlements. Rudiarto (2018) emphasised that better understanding of the socioeconomic development in an area requires data relating to socioeconomic characteristics and equally be analysed. Border physical environment comprises of many structures and influenced by socioeconomic of the people (Adams & Okoampa, 2011). The issue of socioeconomic development in an area always related to available resources that expand productivity and accomplished by available infrastructure (Mustatea, 2013). This paper presents the analysis of housing characteristics and socioeconomic in international border communities in Ogun state, Nigeria. It is an important consideration towards determining the influence on the wellbeing of the inhabitants and generality of the border area.

**Literature review and theoretical framework**

Ye & Liu (2013) concluded that socioeconomic development of fringe settlements in the central region of China reconstructed the areas.Housing is very important in life of man, the components of housing requires money, and these determines types and nature of building (Aluko, 2012). The distribution of household income revealed the housing characteristics. Socioeconomic statusplays vital role on neighbourhood patterns (Kinzig, et.al 2005). Residents with low income may not be able to build house according to the stipulated standard.

The socioeconomic characteristics of border inhabitants undergoes changes that influences housing requirements and formation (Ekop, 2012). Housing characteristics is a complex issue, the complexity of housing development pattern, a pattern of settlement identifies socio cultural characteristics of residents, the pattern can be nuclear or

clustered, even dispersed different ethnic group is identified with particular neighbourhood formation. It demonstrates choice of residing by individual (Tompking county comprehensive plan 2015). The infiltration of people into a settlement affect the size and geo-cluster of the area (Ye & Liu 2013). The border towns are strategic areas that influence by migration of people that focus on socioeconomic growth. The pattern found in international border attributed to uncontrolled migration (Pecoud & DeGuchteneine 2006).

**Socio-Economic Theory of Residential Segregation**

The theory of socioeconomic segregation is very vital to the study. The model was formulated by Hawley in 1950 to describe families with similar socio-economic characteristics located in the same neighbourhood. The major indicators in the theory focused on income, tribe and commercial activities. Fossett (2011) studied the pattern of residential segregation with ethnicity and socio-economic level, the pattern of growth and development focus on multiple conditions based on the people of similar characters. Housing composition and residential segregation do not support socio-economic interpretation (Lopez, 1982).

Sharp & Iceland (2013) emphasized the level of inequality in United States income that led to racial segregation in housing. Muhammad, Kasim, Martin, Mohammed, & Adamu (2015) evaluated factors influencing residential segregation as collective socio-economic approach and personal choice of neighbourhood thereby showing that there is a relationship between the choice of residence and occupation. Variations in patterns of land use determine the residential location within an area (Galster & Cutsinger, 2007). Hao (2015) compared residential segregation and physical patterns of housing development. The pattern of intermarriage among immigrant segregated them within the neighbourhood (Tammaru, Stromgren, Vanham & Danzer, 2016). Morais, Cruz & Oliveira (2005) investigated the relationship between residential segregation and social exclusion in Brazilian housing market and concluded that low-income group housing through self-construction results in informal settlements. Land use regulation has impact on segregation of residential areas. The diversity in economic activities of certain tribes relates to changes in the choice of housing and residential location (Garner & Bhattacharyya, 2011). The dynamics and implications of residential segregation in

Nairobi rest on the socio-economic differences, inadequate infrastructures and social amenities (Akumu & Olima, 2007; French, 2008). The evolution of neighbourhood contributes to the segregation formation and influence economic composition (Yin, 2009). The residential segregation in Delhi is heterogeneous in nature both in socio-economic patterns and in differences on setback by Town Planning and Housing Policy (Dupont, 2004).

**Research methodology**

**Model Specification**

This current study applies socio-economic model of residential segregation as housing development theory to spatial modelling in order to empirically investigate the spatial housing development patterns in international border towns of Ogun State. The essential model of spatial dependence was formulated by Cliff and Ord (1981) and Anselin (1988) allows for spatial dependence in the dependent variable or in the error component. The use of spatial model is informed by the influence of space/location among observations in geography which the model can effectively capture (Anselin, 1988, 1995; Haining, 1990; and Stieve, 2012). There is always a factor responsible for the housing organisation in a particular area.

In this study, the spatial probit model applies to the issue of housing characteristics in international border areas of Ogun State, Nigeria. These areas include Ilara, Idiroko, and Ohunbe. This type of spatial probit model is a less restrictive form of traditional spatial models with the assumption degree of correlation for all cross-sectional units. The study usesspatial correlation because geographic region is different and demonstrate that reducing restrictions on spatial correlation coefficients can result in significant gains in model power. In addition, the study allows spatial effects to differ between neighbouring and non-neighbouring communities. Thus, this analysis suggests significant differences and reveals that estimates from spatial models can be sensitive to the spatial structure imposed.

$$\mathbf{Log(P)} = \sum_{k=1}^{N} \sum_{i=1}^{T} \{Yi \log[\phi\,[Xi\beta] + (1 - Yi) \log(1 - \phi[Xi\beta])\}$$

WhereLog (P) = likelihood of housing development pattern in the study area; $X_i$ = vector of socio-economic and cultural factors as explanatory variables;$\beta$ = vector of explanatory variables coefficient parameters and $\phi$ is the cumulative distribution function (c.d.f.) of a standard normal distribution. Setting $p$= 0 or $\lambda$= 0 allows estimation of the spatial lag or spatial error lag model, respectively, and setting $p = \lambda$= 0 gives the log-likelihood for the standard probit model., traditional probit model analysis was employed as a basis of comparison with the study model results for more robustness check in order to account for an improvement. More importantly, marginal effect analysis would be considered for the interpretation and investigation of the impact of housing development patterns in the study area.

Again, there was an application of a non-parametric technique, Kernel method (famously referred to as *Ripley's K* function – *K (h)* or *K (t)*) to predict the kind of housing development pattern in the study area. Kernel method enables analysis of wide variety of patterns (Pisati, 2012; Shawe-Taylor and Cristianini, 2004). The use of *K (h)* function for a homogenous Poisson process like housing development pattern in the current research is known as Complete Spatial Randomness (CSR). The simplest use of Ripley's *K (h)* function is to test CSR,if the observed events are consistent with a homogeneous poisson process (Smith, 2016). The formula for *K (h)* function as suggested by Smith

$$\boldsymbol{K\,(h) = \frac{1\,(\lambda\pi h)^2}{\lambda} = \pi h^2}$$

Where $h$ = distance; $\lambda$ = the density (number per unit area) of housing structures; $\pi = \frac{22}{7}$

Distance *(h)* is determined through the application of Euclidean Distance function in ArcGIS software. Euclidean Distance is used regularly as an effective function with same applications (Zhang, Xia, Shortridge, and Wu 2014). According to Zhang et al (2014), if $q$ (a building) is the nearest point on a geographic element of interest (e.g., housing development pattern) for settlement point $p$ (town), and the location of $p$ and $q$ are $(p_1, p_2)$ and $(q_1, q_2)$, then the distance $D_{(p, q)}$is given by:

$$\boldsymbol{D_{(p, q)} = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2}}$$

$\lambda = \frac{N}{A}$; where $N$= the observed number of points and $A$= the area of the study region.

*K* – Function was applied to test CSR hypothesis. Thus, by standardizing with respect to density approach and rejectingborder effects as recommended by Zhang et al (2014) the K-function reduces simply to areaunder the CSR Hypothesis. When *K (h) > 0*, this implies a mean point counts higherthan would be expected under CSR, and hence indicates some degree of clustering at scale *h*. Similarly, a value *K* (*h*) < 0 implies mean point counts reducesas expected under CSR, and hence indicates some degree of dispersion at scale *h*. The Monte Carlo technique was used to test CSR through Ripley's K function with 95% significance level. Monte Carlo simulation is very important to provide empirical models of uncertainty by which the statistical significance of results can be quantified (Zhang *et al*, 2014; Atkinson, Foody, Gething, Mathur, and Kelly, 2007). Large of the spatial point pattern is undertaken by Monte Carlo simulation because of the complexity of spatial point processes (Zhang *et al*, 2014; Saizen, Maekawa, and Yamamura, 2010).

**Study areas**

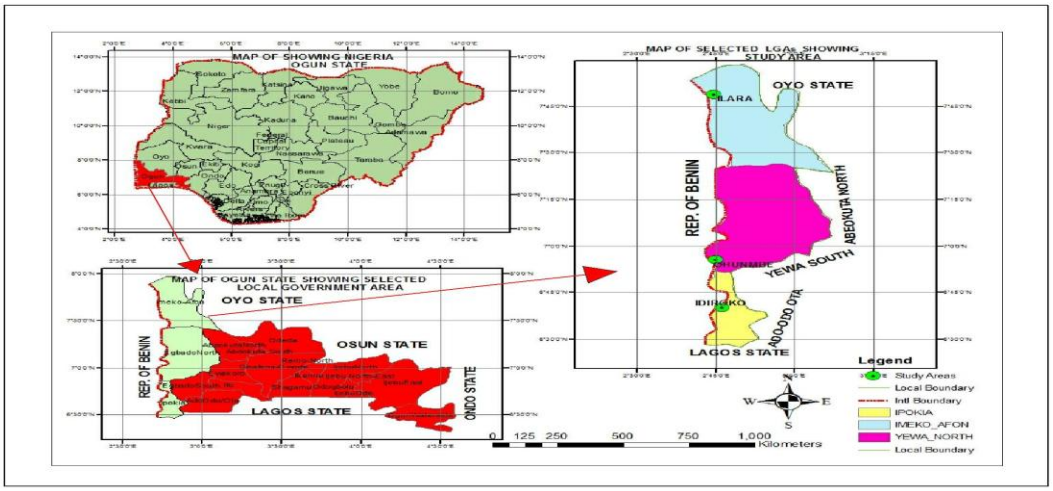
Ogun State is situated in the southwest region of Nigeria. It lies approximately between latitude 6.2°N and 7.8°N and longitude 3.0 $^{o}$E and 5.0°E. Its land area of about 16,762 square kilometres represent approximately 1.8 per cent of Nigeria's total land mass of 924,000 square kilometres. Ogun State is ranked as the 24th largest of the 36 States in Nigeria in terms of land mass. It is bounded to the west by the Republic of Benin, to the south by Lagos State and a 20 kilometre stretch of the Atlantic Ocean; to the east by Ondo and Osun States; and to the north by Oyo State. Geographically, the State is divided into four regions: *Yewa* to the east, the *Egbas* and *Remos* in the Central core and the *Ijebus* to the east. Ogun State has twenty (20) Local Government Areas (LGAs) but only the local government areas with international boundaries were considered for the purpose of the study. Ogun-Benin Republic international border was selected as a representative international border field because it is a large border area with a moderate growth rate and it has followed the national trends of increasing suburbanization of jobs and people which result in more commuting within border towns (OGRSP, 2015). The study results should, therefore, be fairly typical of large Nigeria border town areas. The three Local Government areas with international boundaries are Ipokia, Imeko Afon and Yewa North local government. In other words, these three local government areas form the

research case study. Moreover, a total number of twelve towns are situated along the international border, four (4) from each local government: Ipokia (Idi-iroko, Ogosasa, Ibatefin, Ilashe); Yewa North (Ohunbe, Tobolo, Igbokoto, Ibayun,) and Imeko Afon (Ilara, Idofa, Oke Agbede, Iwoye), Ogun State Regional Plan (2005). Population wise, three towns were purposively selected from each of LGAs. These are Idi-iroko (25,415) Ilara, (11,905) and Ohunbe (2,935) (OSRP, 2005).

Each of the selected towns has the highest population and presence of government activities along the border within their jurisdictions. The existing base map of the settlements was generated through google earth (2019) which shows that Idi-Iroko has 4,111 buildings; Ilara with 1,905 buildings and Ohunbe housing 1,331 buildings. However, a pilot survey was conducted to identify habitable dwelling on the map and to pre-test the study schedule in order to validate the process and research instruments. In addition, pilot survey as a preliminary study was also used to re-examine study variables (Asika,2005; Fawole, Egbokhare, Itiola, Olajide & Olayinka, 2006). Therefore, the available habitable buildings were identified in the process.

The number of habitable dwelling identified in each town are Idi iroko- 3,802; Ilara - 1,480; and Ohunbe- 821 respectively. In other words, the population of the study comprises of 6,103 habitable dwelling in the three selected towns at the Ogun State international border. Moreover, the map below depicts both three local governments and three towns selected for the study, hence, study area map. First arrow signals the caving out of Ogun State map from the country map and second arrow illustrates the derivation map of the three local governments at the international border between Nigeria and Repulblic of Benin. The map of the study area reveals the three selected towns for the study; Ilara (blue) in Imeko-Afon Local Government; Ohumbe (purple) in Yewa North Local Government; and Idi-Iroko (yellow) in Ipokia Local Government.

**Figure** 1: Map of Nigeria and Ogun State showing 20 local governments and Subject site, 2017




**Source**: Survey and Geo-informatics Department, Federal Polytechnic, Ilaro. Ogun State.

To ensure true representation of the population and enhancing the realization of the set objectives for the study, the systematic random sampling technique was adopted, with first randomly selected and then with every fifth housing unit. The use of this random or probabilistic sampling technique guarantee the study sample to be representative of the whole population (Cochran, 1963; Kish, 1965) because it grants each element in a study areahave equal chance of being selected and as such ensures true experiment (Kish, 1965). In order to determine appropriate sample size for this study, the study follows the two way statistical approaches theorised by Cochran (1977) for finite population given the study population of 6,103 habitable dwelling. The sample sizes were calculated by two stages formulae. Firstly, by formula for calculating sample size when the population is infinite this is given as thus;

$$n_0 = \frac{z^2 pq}{e^2} \quad \text{..... (1)}$$

Where, $n_o$is the sample size, $z$ is the selected critical value of desired confidence level, $p$ is the estimated proportion of an attribute that is present in the population, $q$ = 1 - $p$ and $e$ is the desired level of precision (Cochran, 1977).

The study assumes the maximum variability to be 50% (p =0.5) and taking 95% confidence level with ±5% precision, the calculation for required sample size as follows;

$p$ = 0.5 and hence $q$ =1-0.5 = 0.5; $e$ = 0.05; $z$ =1.96

So, $n_0 = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2} n_0 = 384$

Given the fact that *no* derived is greater than 5% of the population size (6,103). This, however, brings the need to use correction formula to calculate the final sample size. The theorist, Cochran, points out that if the population is finite, then the sample size can bereduced slightly. This is due to the fact that a very large population providesproportionally more information than that of a smaller population (Cochran, 1977). He proposed acorrection formula to calculate the final sample size which is given below as;

$$n = \frac{no}{1+\frac{(no-1)}{N}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{equation 2}$$

Here, $n_o$= 384 is the sample size derived from equation (1) and $N$ = 6,103 is the population size.By interpolation, equation (2) becomes;$n = \frac{384}{1+\frac{(384-1)}{6,103}} n = 361$

Therefore, in this case the representative sample size for the study is 361. This represents the number of habitable dwellings sampled through questionnaire from a sampling frame of 45 communities (being 20 from Idi-Iroko; 15 from Ilara; and 10 from Ohumbe respectively) by the residents; with housing unit as unit of analysis. Accordingly, the study employed proportional allocation method propagated by Bowley (1926) to determine sample size for each of the three towns under study. The formula is given as;

$$n_i = n\frac{Ni}{N}$$

Where $n$ represents sample size (361), $N_i$ represents population size of the $i^{th}$ town (3,802 buildings in Idi-Iroko; 1,480 in Ilara; and 821 buildings in Ohunbe) and $N$ represents the population size (6,103). Systematic sampling method was employed where every $5^{th}$ observation was selected after the first observation has been randomly picked. Moreover, to further ensure fair representation of respondents, weights were attached to each selected observation in each community of the study area. The weights are determined by taking the inverse of probability of observation inclusion in the survey process; however, weight derived depends on the relative size of the town.

**Table 1:Summary of Sample size of Residents by Towns**

| S/N | Local Govt. Area | Settlements/ Towns | Population of buildings | Sample Sizeof Residents |
|---|---|---|---|---|
| 1 | Ipokia | Idi-Iroko | 3,802 | 224 |
| 2 | Imeko-Afon | Ilara | 1,480 | 87 |
| 3 | Yewa-North | Ohunbe | 821 | 50 |
| | **TOTAL** | | **6,103** | **361** |

**Source:Field Survey, 2019**

Confirmatory Factor Analysis (CFA), Pearson's Correlation, Median test and Crosstabs, are the statistical tools used for the analyses as well as the multi-variate analysis involving Structural Equation Model (SEM); Spatial Probit Regression and Traditional Probit regression. CFAhasbeenusedtoassessthemultidimensionalityandthefactorialvalidityoftheconstructs of the theoretical model (Byrne, 2001; Alsheri, 2013).SEMisusedtotesttheoreticalmodels (Hair*etal*.2006),sothistechniqueisconsideredadequate fortheinvestigationcarriedoutbythisstudy.SEMisafairlynewtechniquefortestingmodels and theories thathavealreadybeenvalidated,orfortestingmodelswhichhaveastrongtheoreticalbasis.Thus,SEMishelpfulasaconfirmatorytechnique,withstrongmathematical and statistical grounds (MacCallum & Austin, 2000).

**Table 2: Breakdown Aggregate of Questionnaire Distribution and Retrieval**

| Town | Total Distributed Questionnaires | Total Retrieved Questionnaire | Retrieval Rate (%) |
|---|---|---|---|
| | Resident | Resident | Resident |
| Idi-Iroko | 224 | 174 | 77.7 |
| Ilara | 87 | 62 | 71.3 |
| Ohunbe | 50 | 38 | 76.00 |
| **Total** | **361** | **274** | **75.9** |

**Source: Field Survey, 2019**

**Table 3: Shapiro-Wilk W test for normal data (Socio-economic characteristics - SOECO)**

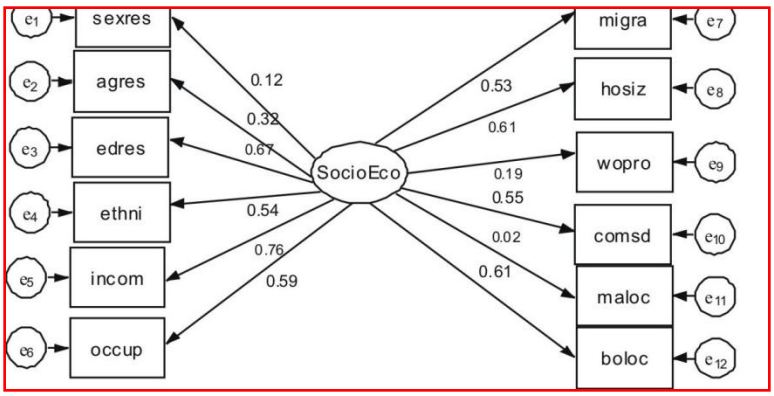
| Variable | Obs | W | V | z | Prob>z |
|---|---|---|---|---|---|
| sexres | 260 | 0.99692 | 0.578 | -1.277 | 0.00920 |
| agres | 260 | 0.99665 | 0.629 | -1.081 | 0.00013 |
| edres | 257 | 0.98216 | 3.314 | 2.792 | 0.00262 |
| ethni | 260 | 0.88697 | 21.221 | 7.121 | 0.00000 |
| incom | 258 | 0.95182 | 8.984 | 5.116 | 0.00000 |
| occup | 260 | 0.97361 | 4.955 | 3.731 | 0.00010 |
| migra | 189 | 0.61794 | 54.262 | 9.163 | 0.00000 |
| hosiz | 257 | 0.96144 | 7.165 | 4.588 | 0.00000 |
| wopro | 256 | 0.69114 | 57.198 | 9.426 | 0.00000 |
| comsd | 240 | 0.99563 | 0.764 | -0.625 | 0.00401 |
| maloc | 255 | 0.98212 | 3.301 | 2.781 | 0.00271 |
| boloc | 259 | 0.96544 | 6.466 | 4.350 | 0.00001 |

**Source: STATA 12 Outputs, 2019**

**Socio-Cultural and Economic Construct (SOECO)**

The SEM diagram in Figure 2displays the outcome of the confirmatory factor analysis conducted for socio-cultural and economic factors. From the diagram, some observed variables of SOECO construct were found to be above loadings of 0.5. However, only these factors were considered for further spatial analysis. These factors include education, ethnicity, income, occupation, migration, household size, commercial space demand, and border location. On the other hand, observed variables like sex, age,and work place proximity including market location have loadings below the p value which is 0.5 and therefore were removed. The result is diagrammatically presented as thus.

**Figure 2: CFA for SOECO as a Construct**




**Source: STATA 12 Outputs, 2019**

**Housing Formation Pattern Estimation**

A Kernel density function, otherwise known as Ripley's K – Function was employed to detect housing formation patterns in the three selected towns and overall study area. Procedurally, Monte Carlo method in STATA application was used to test CSR at 95% confidence level. The approach was employed to simulate randomly generated point patterns and it was assumed that the random number generated is satisfactory. This is consistent with previous study by Besag and Diggle (1977) as observed in Zhang *et al* (2014). Accordingly, if the value for K (h) is statistically greater than zero the structure of the pattern may be determined to be significantly more clustered or otherwise dispersed if value of K (h) is less than zero (Zhang *et al*, 2014); (Besag and Diggle, 1977) . The results of Ripley's K function from STATA 12 software are presented as thus in the following table;

**Table 4: Ripley's K function (Monte Carlo Simulations)**

| Town | Ripley's K (h) | p – value | Pattern |
|---|---|---|---|
| Idi- Iroko | 0.7647 | 0.0000 | Clustered |
| Ilara | 0.8315 | 0.0000 | Clustered |
| Ohunbe | -0.4292 | 0.0000 | Dispersed |
| Overall | 0.5334 | 0.0000 | Clustered |

**Source: Computation from STATA 12 Monte Carlo Simulations, 2019**

In reference to Table 4, a finding revealed that housing formation pattern in Idi-Iroko and Ilara generally followed clustered pattern while housing formation pattern in Ohunbe was predicted as a dispersed pattern. Overall, housing formation patterns in the study area generally followed a clustered pattern. More evidence from thematic maps and Plates of

housing formation patterns in the three selected towns further confirmed this finding. Again, this result is consistent with previous study by OGSRP (2005).

**Spatial Probit Regression (SPR)**

Spatial Probit Regression (SPR) analysis was used to examine the determinants of housing development patterns in the study area. Having established that there is spatial dependency through Ripley's K – function, this was inferentially analysed in lieu of residents' socio-cultural and economic characteristics. However, traditional probit regression analysis was initially conducted to show robustness of spatial probit regression. A binary variable taking a value of "1" or "0" was created for housing formation pattern purposely to ensure and facilitate the operation of probit regression. A clustered pattern was assigned a value of "1" while a dispersed pattern was attributed a value of "0".

There are two important sets of tests a researcher needs to look at before deciding which spatial regression to choose. The first set of tests is between Lagrange Multiplier (LM) which tests for the presence of spatial dependence andRobust LM which tests if either lag or error spatial dependence could be at work while the second set of tests is lag or error. The researcher estimated these two tests through statistical data analysis software application(STATA 12) and the result is presented in the table 5;

**Table 5: Estimation Results, Spatial *Probit* (Dependent Variable: PATTN)**

| Variable | Spatial Error Model | Traditional Probit Model |
|---|---|---|
| Constant | 5.932 | 3.634 |
| | (14.24) | (-7.24) |
| | (0.001)** | (0.000)** |
| Edres | 0.163 | 0.001 |
| | (-0.67) | (0.24) |
| | (0.000)** | (0.041)** |
| Ethni | -0.327 | -0.821 |
| | (5.38) | (-0.93) |
| | (0.000)** | (1.375)ns |
| Incom | 0.219 | 0.008 |
| | (1.35) | (-0.17) |
| | (0.000)** | (0.000)** |
| Occup | 0.210 | 0.010 |
| | (0.62) | (0.27) |
| | (0.003)** | (0.328)ns |
| Migra | -0.077 | -0.958 |
| | (4.41) | (-0.16) |
| | (0.692)ns | (2.682)ns |

| | | |
|---|---|---|
| Hosiz | -0.064 | -0.137 |
| | (1.07) | (-0.24) |
| | $(0.075)^{ns}$ | $(0.642)^{ns}$ |
| Comsd | 0.199 | 0.015 |
| | (2.76) | (0.18) |
| | $(0.000)^{**}$ | $(0.000)^{**}$ |
| Boloc | 0.051 | 0.211 |
| | (-11.69) | (-16.87) |
| | $(0.002)^{**}$ | $(0.065)^{ns}$ |
| MF's $R^2$ | 0.592 | 0.501 |
| Akaike Info Criterion | -391 | -371 |
| Schwarz Criterion | -392 | -365 |
| No. of Observations | 201 | 205 |
| $^{**}$ p < .05 (significance) | ns = non-significance | |

**Source: Author's Computation from STATA 12 Outputs, 2019**

The Table 5 presents the results of Spatial Probit Regression (SPR) and Traditional Probit Regression (TPR) analyses. In terms of both magnitude and statistical significance, the outcomes reveal that SPR is structurally more robust thanTPR. The MF's (McFadden) pseudo R-squared of the Spatial Error Model went up to 0.592. So, it shows that it is a stronger model. Again, the results of model selection criteria in form of Akaike info criterion (AIC)and Schwarz criterion (BIC) also went down and thus indicate that this test is more accurate than the Traditional Probit Model. This is informed by lowest values of AIC and BIC recorded for preferred model.More so, when the spatial weights are taken into consideration in the model (Spatial Error Model), the spatial regression becomes noticeably stronger in predicting housing development patterns than a traditional probit regression.

Furthermore, the standardized Beta coefficients from the Table 5 reveals that ethnic groupas a cultural factor was the greatest predictor of housing development pattern with (Beta = 0.327, p= .021), followed byincome (Beta = .219, p= .000); occupation (Beta = .210, p = .003), and commercial space demand (Beta= .199, p=.000). However, education (Beta = .163, p = .000) and border location (Beta = .051, p = .002) have least significant contributions towards housing characteristics in the study area.It is important to note that negative signs of the coefficients were ignored. This practice has been recommended by Pallant (2011) and Ge (2017).

**Discussion of Result and Implication of Findings**

This current study considered an array of factors to evaluate socio-cultural and economic determinants of housing characteristics in the international border between Nigeria and Benin-Republic in Ogun State. Hitherto, it has been discovered that housing development in the three selected areas generally followed a clustered pattern. In line with this, factors such as sex, education, ethnicity, occupation, income, household size, market location, migration, work place proximity, commercial space demand, and border location were considered as predictors of housing formation patterns. A great number of researchers have considered these factors as predictors of housing development pattern e.g. Abou-Korin(2014); Amao and Ilesanmi(2013); Kasumovic and Jordan(2013); Suditu and Valceanu(2013); Omole(2010); Klapka *et al (*2010); Stasolla and Gamba(2007); Hooke(1996), and among others. However, given the outcome of factor analysis factors like education, ethnicity, occupation, income, migration, household size, and commercial space demand and border location were considered for empirical investigation. From the analysis, the current study discovered that education, ethnicity, occupation, income, commercial space demand and border location were significant factors as socio-cultural and economic variables that determine housing characteristics in the study area. In other words, this finding provides answer to research question that socio-cultural and economic factors determine housing characteristics in international border towns.This finding illustrates the relevance of Socio-Economic Model of Residential Segregation adopted for the current study and is consistent with Taylor *et al* (2015); Iranmanesh & Imantalab (2014); Abou-korin(2014); Amao & Ilesanmi(2013); Omole (2010);Adams and Ekoampa (2011); and Omole (2010).In terms of unique contributions, the study discovered that ethnic group has largest influence as a socio-cultural factor in predicting housing characteristics in the study area. This is followed by income of residents, occupation, commercial space demand, education of inhabitants, and border location respectively.

However, part of the finding by the current study revealed contrast result to study by Anabestani (2014). Unlike Anabestani, the current study found no significant association between movement of people into regional borders and housing characteristics. This might be connected with border control and management in the study area and possible down to different in studies geographical areas.Meanwhile, the current study strengthens

existing literature on socio-cultural and economic factors as determinants of housing characteristics in international borders. This is by taking into account full socio-cultural and economic framework of housing development patterns in the international borders. For instance, social and cultural status of people, employment, and education factors as investigated by Iranmanesh & Imantalab (2014) and Omole (2010) were analysed with other important socio-cultural and economic features like market location, border location and commercial space demand. In addition, the use of a more sensitive specific test for screening or diagnosis (Shapiro-Wilk Test) and a robust Spatial Probit ensured objectively assessed and clinically relevant results. However, the use of just three towns has attendance effect of potential bias but this was adequately controlled for the use of large sample. The three selected towns were the most physically accessible towns in the Nigeria-Benin Republic international border in Ogun State and more importantly these have high population settlements than other remote towns.

**Conclusion**

Housing is considered an essential necessity for existence of mankind. However, the way such housing is developed and formed is very crucial for policy formulation on housing development by government. It therefore necessitates investigating the spatial distribution of housing development in rural areas most especially international borders through socio-cultural and economic features.From the study, it was discovered that housing development patterns in the study area generally followed a clumsy pattern and are largely determined by residents' socio-cultural and economic factors. These includeethnic group, occupation, income, commercial space demand, and border location.In other words, the reason why housing development patterns in international border towns between Nigeria and Benin-Republic are clustered can be much explained by residents' socio-cultural and economic factors.

**Recommendations**

Based on the findings of the current study, the study recommends that:

i. There is need for government to set up joint and consultative forums for education of predominant ethnic groups in the international border. Since ethnic group

belonging shapes and influences locals kind of housing structure, this will go a long way in achieving a befitting housing development pattern in the study area.

ii. From the research study, inhabitants' occupation determines formation of housing pattern and most of these residents are self-employed. In other words, functioning governemt econmic policies are needed to boost economic activities of people in the country.

iii. Again, there is need for more governement investment in eductaional development in the areas covered by the study. Private sector involvement is also needed in this aspect.

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