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Factors Affecting House Ownership in Nigeria; A Probit and Heteroscedastic Probit Model Approach

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ABSTRACT

With a rapid rate of urbanization in Nigeria, almost half of the population already lives in cities thereby putting great pressure on the country's urban settlement. Fundamental to this problem is the decision to become a homeowner which is an issue of financial and social decision. Thus, this study investigates the nexus between house ownership and socio economic variables of the household head. The study makes use of nation-wide cross-sectional data of the 2015/2016 General Household Survey (GHS) conducted by the Nigeria Bureau of Statistics. Results show that the main determinants of house ownership in Nigeria are: Occupation, household size, education level, marital status, income and age of household head. The study, therefore, suggests that policies that are targeted at maintaining moderate or lean household size and promoting non-farming occupation along gender-oriented development policies should be advocated and promoted by policy makers, since these variables are considered critical to increasing house ownership among households in Nigeria.

1.0. INTRODUCTION

Nigeria is rapidly becoming urbanised with almost half of the population already living in cities and this is anticipated to increase to 75 percent by 2050 (CAHF, 2016 and Burgoyne, 2008), the increase in urban settlement is directly proportional to the demand for housing. The World Bank estimated Nigeria's population to be 200 million, accounting for approximately 47% of West Africa's population, with 64% of the population living below the poverty line (World Bank, 2018). Poverty remains highest in rural areas, remote communities and among female headed households. The decision to become a homeowner seems to be an important financial and social decision, and individual choices regarding whether to own a house or to rent are important consumer behaviours (Çağlayan, 2012 and Silver, 1988). The housing census conducted last in Nigeria counted 28, 197, 085 households in 2006, of which 51% of these are flats, 9% in semi-detached houses, 14% rented a room in someone's house, and 1% lived in informal houses.

83% of Nigerians owned the houses in which they lived, while 11.04% rented 3.01% occupied rents free, 2.01% owned but had not yet fully paid off, and 0.52% squatted (NBS, 2006 and CAHF, 2016).

Household Heads characteristics has been identified as the most important factors that determine home ownership in some empirical studies(Çağlayan, 2012, Campbell and Cocco, (2007), Constant *et al*. (2006), Case *et al*., 2005;Boehm and Schlottmann, 2004 and Deng *et al*., (2003), and it was anticipated that their studies determined that the characteristics of the Household Head such as gender, income level, household size, age, marital status, and educational background are influential in the decision to buy a house. Other studies indicated that income level has both a direct and indirect impact on home ownership. Çağlayan, (2012) indicated that besides the demographic characteristics of the head of the household, education, employment, and income are also influential factors in regard to home ownership, with the choice to live in either rural or urban areas also having a significant impact. In studies examining home ownership status, qualitative preference models e.g. Çağlayan, 2012, Gurise*t al*., (2011), Capeau *et al*., (2003), Li (1977) are commonly used among others.

Hence, this study focuses on the heteroscedasticity problem in Probit model by aiming at determining the factors affecting the probability of owning a house in Nigeria. Data from the 2015/2016 General Household Survey (GHS) conducted by the Nigeria Bureau of Statistics was used for the study. Heteroscedasticity can cause problems such as incorrect standard errors, biased and inconsistent parameters, which are ignored in many studies. This study is unique in this methodology because the determinants of home ownership using the heteroskedastic Probit model as well as the standard Probit model will be examined. In the empirical literature, there have been some studies conducted which have applied the Heteroscedastic Probit models, such as Alvarez and Brehm (1995, 1998), Busch and Reinhart (1999), Krutz (2005), Litchfield *et al*. (2011) Çağlayan, 2012, among others.

This paper is organized as follows: The following section includes the introduction. Section 2 presents both the methodology (standard Probit and Heteroscedastic Probit models). The data and variables are introduced in Section 3. Section 4 reports the estimation results. The final section presents the conclusion

2.0. METHODOLOGY

2.1. Heteroscedastic Probit Model

The Heteroscedastic Probit model is a generalization of the Probit model because it allows the scale of the inverse link function to vary from observation to observation as a function of the independent variables. For a Probit model, the binary Probit model is based on the assumption that a latent variabley^* is linearly related to the observed $X's$

$$y_i^* = X_i\beta + \varepsilon \quad \text{..., (1)}$$

The standard probit model assumes that the error distribution of the latent model has a unit variance. The heteroskedastic probit model relaxes this assumption, and allows the error variance to depend on some of the predictors in the regression model.

Heteroscedastic Probit model is a generalization of the Probit model; Lety_j; j = 1…, N, be a binary outcome variable taking on the value 0 or 1. In the probit model, the probability that y_j takes on the value 1 is modelled as a nonlinear function of a linear combination of the k independent variables x_j = (x_{1j}, $x_{2j}, \dots, x_{kj}$)

$$\Pr(y_i=1)=\phi(x_j b) \quad \text{..., (2)}$$

in which ϕ () is the cumulative distribution function (CDF) of a standard normal random variable, that is,a normally distributed (Gaussian) random variable with mean 0 and variance 1. The linear combination of the independent variables,$x_j b$, is commonly called the index function, or index.

Heteroscedastic Probit generalizes the Probit model by generalizing $\phi$to a normal CDF with a variance that is no longer fixed at 1 but can vary as a function of the independent variables. Heteroscedasticity Probit models the variance as a multiplicative function of these m variables

$$z_j = (z_{1j}, z_{2j}, \dots, z_{mj}) \quad \text{..., (3)}$$

Following Harvey (1976),

$$\sigma_j^2 = \{\exp(z_j\gamma)\}^2 (4)$$

Thus the probability of success as a function of all the independent variables is

$$\Pr(y_i=1)=\phi\{(x_j b/\exp(z_j\gamma)\} \quad \text{..., (5)}$$

From equation (5) above, it is clear that, unlike the index$x_j b$, no constant term can be present in $z_j\gamma$if the model is to be identifiable.

Suppose that the binary outcomes y_j are generated by thresholding an unobserved random variable, w, which is normally distributed with mean $x_j b$and variance 1 such that

$$y_i=\begin{cases}1 & if w_j > 0\\ 0 & if w_j \le 0\end{cases} \quad \text{..., (6)}$$

This process gives the Probit model;

$$Pr(y_i = 1) = Pr(w_j > 0)=\phi(x_j b) \quad \text{..., (7)}$$

Now suppose that the unobserved wj are heteroskedastic with variance,

$\sigma_3^2=(\exp(z_j\gamma)\}^2$ ..., (8)

$Pr(y_i = 1) = \phi\{x_j b/exp(z_j\gamma)\}$ ..., (9)

Relaxing the heteroscedastic assumption of the Probit model in this manner yields our multiplicative heteroscedastic Probit model;

The log-likelihood function for the heteroscedastic Probit model is;

$$InL = \sum_{j\epsilon S} w_j \, In\Phi\left\{\frac{x_j\beta}{\exp(z\Upsilon)}\right\} = \sum_{j\notin S} w_j \ln[1 - \Phi\left\{\frac{x_j\beta}{\exp(z\gamma)}\right\}] \quad ..., (10)$$

Where S is the set of all observations j such that $y_j \neq 0$ and $w_j$denotes the optional weights. $lnY$is maximized for the model (Blevins and Khan, 2013, Greene, 2012).

For this study, household head owned house is an indicator function of ownership of house as follows (Glewwe, 1991);

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon \quad (11)$$

Y is the dependent variable; ownership of house, it takes the value of 1 or 0. (1= if the household head owned house and 0= otherwise)
X_1 = Gender of the household head (1 if male; 0, if otherwise)
X_2 = Age of household head (Years)
X_3 = Education household head (Years)
X_4 = Household size
X_5= Occupation of household head (1 if farming; 0, if otherwise)
X_6 = Marital Status (1=married, 0=otherwise)
X_7 = Monthly income household head
ε= Error term

3.0. Data Source and Sampling Technique

Data for this study was extracted from the third wave (2015/2016) of the General Household Survey Data (GHS) conducted by the Living Standard Measure (LSM) and the Nigeria Bureau of Statistics. The data set had a household response status of 99.72% (4987 out of 5000 respondents interviewed). Farm households constituted 65% of the respondents, amounting to about 3000 respondents in year 2010, 2012 and 2015 respectively (NBS, 2016).

The GHS panel survey used a two-stage probability sampling. The primary sampling Unit (psu) were enumeration Areas (EA). These were selected based on probability proportional to size (Pps) of the total EAs in each state and FCT and the total households listed in those EAs. A total of 500EAs were selected using this method. Households were randomly using the systematic selection of ten (10) households per EA. This involved obtaining the total number of households listed in a particular EA, and then calculating a sampling interval (S.I) by dividing the total households by ten (10). The next step was to generate a random start 'r' from the table of random numbers which stands as the first selection. Consecutive selection of households was obtained by adding the sampling interval to the random start. In all, 500 clusters/EAs and 5000 households were interviewed. These samples were proportionally selected in all the states such that different states had different sample sizes. However, the selection covers all the Local Government Areas and all the states in Nigeria, the urban and rural areas were also included in the sample. Most of the explanatory variables used in the study are presented in table 1 below;

Table 1:

Variables	Abbreviations	Descriptions
House ownership***	OWNH	Own house=1, rented=0
Income	INC	Nigeria Naira
Age of Household Head	AGE	Year
Education	EDUC	Primary=0, Secondary=1 and Tertiary=2
Occupation of Hh Head	OCCUP	Agriculture=0, Non-agriculture=1
Marital Status	MSTAT	If married =1, otherwise (single=0)
Gender	GEN	Male=1, female=0
Household Size	HHSZ	Number of people in the households

Note: *** ***Dependent variable (House ownership)***

4. 0. RESULTS AND DISCUSSION

Table 2 below presents the results of the Probit regression and heteroscedatic model used to investigate the determinants of house ownership in Nigeria. House ownership which takes the value of one (1) if a household head owns the house and zero (0) if otherwise formed the dependent variable of the model. The marginal effect estimates of the explanatory variables are also presented alongside of the Probit and heteroscedastic Probit model on Table 2 respectively. The essence of presenting the two models is to facilitate comparison and based on the statistical tests conducted, chose the model that best explains the determinants of house ownership in the study area. Given the drawbacks, as highlighted in section 2.1 and the statistical tests conducted, the Probit model becomes more admissible for the analysis of the determinants of house ownership in Nigeria. This position is corroborated by the likelihood ratio chi-square value of 416.61 of the model with a p-value of 0.0000 which reveals that the Probit model as a whole is statistically significant at 1% level, and thus implies a good fit.

From Table 2, going by the Probit model, Age of the respondents has a positive effect on house ownership status and is statistically significant at 1%, and thus implies that the older an household is, the probability of owing a house. Nonetheless, while the coefficient of the model could be admissible, the marginal effect estimate of the model becomes more useful in providing direction of causality, and the extent to which this variable influences house ownership status. Therefore, the marginal effect estimates of Age of the household head reveals that a unit increase in Age increases the likelihood of owning a house by 0.1% and is statistically significant at 1%. Relatively, the marginal effect estimates of Age for the heteroscedastic Probit appears to be superior to the Probit model, as seen in its estimates (0.2%). This may be attributed to correction of variance in the skewed distribution of age and house ownership status that the model proffers.

Gender of the respondents is statistically significant at 1% level in explaining house ownership in Nigeria. The Probit model has a marginal effect of -0.069, and by implication means that gender reduces the likelihood of owning a house by 6.9%. This is a better estimate in providing direction of causality compared to the marginal effect estimate of the Heteroscedatic Probit model which shows that gender reduces the likelihood of owning a house in the study area by 6.6%. Further to this, it could further imply that being a male increase the probability of owning a house in Nigeria by 6.6% and vice-versa. Relatively to marginal effect estimates of other explanatory variables in the model, this as well indicates that gender is critical to determining ownership of house in Nigeria. Marital status has a positive relationship with house ownership status, and it is statistically significant at 1% level. The marginal effect estimates of the Probit model shows that marital status increases the likelihood of owning a house by 0.8%, and thus implies that married respondents are more likely to own a house in Nigeria. The heteroscedatic Probit model was also at a close call with a marginal effect estimate of 0.007, implying that marital status reduces the likelihood of being an house owner by 0.7%.

With reference to occupation which is operationalized as farming and non-farming across the respondents, it reveals that occupation positively influences house ownership status. Table 2 jointly shows that being into non-farming activities increases the probability of owning a house in the study area. Also, the result of the marginal effect estimates of the Probit model show that a change from farming occupation increases the probability of owning a house by 5.8%. This result is highly comparable to the heteroscedastic model. Education level has a negative relationship with ownership of house status. It is statistically significant at 1% level. The marginal effect estimate of the Probit model reveals that education level reduces the probability of owning a house by 2.8%. This is the same estimate as obtained from the heteroscedastic Probit model.

Household size is estimated to negatively influence house ownership status in Nigeria. The marginal effect of the Probit model reveals that household size reduces the likelihood of owning a house by about 0.3%, and thus implies that the smaller the household size is, the higher the probability of being a house owner. This may be connected to the huge financial implication of maintaining large households, which must have eaten deep into the income of the household which could have being alternatively used in owning a house. This marginal effect estimates obtained from the Probit model appears superior to the heteroscedatic model, as it does not only present a more superior confidence interval, the estimates are also slightly better. Surprisingly, against a-priori expectation, income negatively influences house ownership in Nigeria. Both the Probit and heteroscedatic model reveals that as income of the household head increases, the likelihood of owning a house increases. This could be connected with the fact that house ownership increases with age, as earlier revealed from marginal estimates of age, a variable whose increase is always associated being economically active. The older the household, the farer he is from the agile and economic active cadre. Consequently, this category of household head is associated with low income.

Table 2: Determinants of House Ownership in Nigeria

Variables	Probit Model		Heteroscedasticity Probit Model	
		dy/dx		dy/dx
Age	0.014***	0.0012***	0.015***	0.002***
	(0.001)	(0.000)	(0.005)	(0.000)
Gender (Male=1; 0 otherwise)	0.603***	-0.069***	-0.602	-0.066***
	(0.091)	(0.011)	---	0.011
Marital Status (Married=1; 0 otherwise)	0.069***	0.008***	0.069	0.007***
	(0.020)	(0.002)	---	(0.003)
Occupation (Agriculture=0; 1 otherwise)	0.463***	0.053***	0.463**	0.051**
	(0.106)	(0.013)	(0.185)	(0.022)
Education Level	-0.228***	-0.026***	-0.228	-0.026***
	(0.028)	(0.003)	---	(0.005)
Household Size	-0.024***	-0.003***	-0.023	-0.0023***
	(0.008)	(0.001)	---	(0.001)
Income	-0.000***	-1.46e-06***	-0.00002*	1.44e-06
	(1.52e-06)	(0.000)	(5.66e-06)	(0.0000)
Constant	-0.618***		-0.618***	
	(0.150)		(0.200)	
No of Observation	3585			
LR Chi2	416.61***			
Pseudo-R-Squared	0.1100			
Homoskedasticity (LM Test)	233.18***			
Wald			237.19***	
Log- likelihood	1685.9006		-1685.9006	
Ln Sigma Square			57.88***	

*Source: Authors Computation, 2019 ***, **, * Sig at 1%, 5% and 10% respectively. Numbers in parenthesis are Standard Errors (SE)*

5.0. SUMMARY AND CONCLUSION

Most empirical studies are usually analyzed using Probit models among other methods, and are often done without testing the normality or/and the heteroscedasticity properties of the models.

The biasness and inconsistent of the standard maximum likelihood estimators is a major problem in Probit model, if the disturbances are abnormal or heteroscedastic.

Hence, we used heteroscedastic probit model and standard Probit model to examine the determinants of home ownership in Nigeria. The Wald statistics (237.19***) indicates that the explanatory variables in a model are significant, and they contribute meaningful to the result of the model. The high value of Sigma Square (57.88***) shows that the variance of the error term spread out very from the mean and highly significant. The nexus between socio-economic variables and house ownership status in Nigeria was explored in this study using Probit regression model and its variants. The Probit model was used to statistically identify the determinants of house ownership. The Probit model shows that age, gender, marital status, occupation, household size and income are the main determinants of house ownership in Nigeria. While in the Heteroscedasticity model, thesame variables were identified as the determinants of house ownership in Nigeria. Arising from the findings of this study, it is therefore suggested that policies that are targeted at maintaining modest or lean household sizes should be encouraged. Also, there should be promotion of non-farming occupations by policy makers in the country, since these variables are considered critical to increasing house ownership among households in Nigeria.

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