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A Logit Regression Analysis of Homeowners in Nigeria

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A Logit Regression Analysis of Homeowners in Nigeria

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Abstract - This paper studied the application of logit regression analysis to homeownership in Ado-Ekiti area of Ekiti State (Nigeria). The performance of the logit model in terms of classification of homeowners with respect to the average monthly income of some individuals was examined. The data of homeownership and income was fitted to the model by the WLS techniques. Result showed that the odds ratio in favour of owning a house by an individual whose average monthly income is 0.158 (N Million) was 1.0387. Also the probability of owning a house by the individual was 0.51. *Keywords : logit regression, home ownership, average monthly income, odds ratio, WLS-weighted least*

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I. INTRODUCTION

Feeding, clothing and shelter constitute the fundamental human needs. Among the three, shelter is the most complex, challenging and expensive. Apart from providing shelter, housing is a sure way of creating jobs, eradicating poverty, ensuring social security and propagating sustainable economic development.

In Nigeria, the housing sector is the second highest employer of labour next only to agriculture. Research has consistently shown the importance of the housing sector on the economy and the long social and financial benefits to individual homeowners.

Homeownership brings substantial social benefits for families, communities and the country as a whole. Because of these benefits, policy makers have promoted homeownership through a number of channels. Homeownership has been an essential element of the Nigerian dream for decades and continues to be even today.

Homeownership has significant impact on social outcomes, specifically educational achievement, civil participation, health benefits, public assistance, property maintenance and improvement.

In general, research supports the view that homeownership brings substantial social benefits. Because of these extensive social benefits, policies that support homeownership are well justified.

Apart from all these advantages, homeownership also provides one with pride of ownership, freedom of control, privacy, strong credit base, financial stability, appreciating asset to mention a few.

The immense economic benefits of homeownership are also well documented. For instance, United Nations Centre for Human Settlement estimate Nigeria's current housing deficit at 16 million units. Considering that an average household is between five and six persons, it is inferred by experts that 80 - 96 million housing units will be achieved within

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a period 30 - 50 years provided construction of 200,000 - 250,000 new housing units is carried out yearly. This is disheartening in the view of the fact that current national housing production figures stand at less than 10,000 per year, not to mention the estimated cost which runs into tens of trillions of Naira.

Inspite of the growing trend of homeownership in Nigeria, certain impediments such as high unemployment rate and moderate GDP growth of between 7% and 9%, inflation and high interest rate which all degenerate from unwholesome macro-economic environment and lack of financing systems are still lingering.

Land use acts, high cost of building materials, high cost of land in urban areas, poor quality of construction are also impediments to homeownership.

II. THE LOGIT REGRESSION MODEL

The logit regression analysis is a technique which allows for estimating the probability that an event occur or not by predicting a binary dependent outcome from a set of independent variable(s). The applications of the logit model to different areas had been previously seen in sources such as Ojo (1989), Gujarati (2003), Ogunleye and Fagbohun (2009) and others too many to mention.

Let x_i be a random variable (say income) and y=1 indicating an individual owns a house y=0 if otherwise, then

$$P_i = E(Y = 1 \mid X_i) = \frac{1}{1 + e^{-(\beta_1 + \beta_2 X_i)}}$$
(1)

for simplicity, we set $Z_i = \beta_1 + \beta_2 X_i$,

$$P_i = \frac{1}{1 + e^{-Z_i}} = \frac{e^{Z_i}}{1 + e^{Z_i}}$$
(2)

(2) is called the cumulative logistic distribution function,

where Z_i ranges from $-\infty$ to $+\infty$, P_i ranges from 0 to 1, called the probability of owning a house.

 P_i is non linearity related to Z_i and β_i 's are the model coefficients.

Since P_i is the probability of owning a house, then

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \tag{3}$$

called the probability of not owning a house. Then, we write

$$\frac{P_i}{1-P_i} = \frac{1+e^{Zi}}{1+e^{-Zi}} = e^{Z_i}$$
(4)

called the odds ratio in favour of owning a house (the ratio of the probability that an individual will own a house to the probability of not owning a house). Taking the natural logarithm of (4), we get

$$L_i = ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \beta_1 + \beta_2 X_i + \mu_i$$
(5)

 N_{otes}

called logit model. L_i is called the logit and μ_i is the stochastic error term.

III. Estimation

The estimate of model coefficient of logit regression models depends on the data at hand. This is categorized as follows.

Case I

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Suppose the data at hand is on individuals, the OLS technique becomes infeasible since if we have $P_i=1$, if an individual owns a house, and $P_i=0$, if he does not, then the logit

$$L_{i} = \begin{cases} ln\left(\frac{1}{0}\right), \text{ if an individual owns a house} \\ ln\left(\frac{0}{1}\right), \text{ if an individual does not own a house} \end{cases}$$
(6)

Clearly, these expressions are meaningless and hence such data cannot be used in estimation of (5) by the OLS method.

As a result of this, the maximum likelihood method may be used.

Case II

For a grouped data on several individuals grouped according to income level and number of individuals owning a house at each income level X_i , there are N_i individuals, n_i among whom are homeowner $(n_i \leq N_i)$ so that

$$\hat{P}_i = \frac{n_i}{N_i} \tag{7}$$

This is the relative frequency which can be used as the true P_i corresponding to each X_i .

If N_i is fairly large, \hat{P}_i will be a reasonably good estimate of P_i using the estimated \hat{P}_i , the logit estimate in (5) can be obtained by

$$\hat{L}_{i} = ln \left(\frac{\hat{P}_{i}}{1 - \hat{P}_{i}} \right) = Z_{i} = \hat{\beta}_{1} + \hat{\beta}_{2} X_{i}$$

$$\tag{8}$$

which is a fairly good estimate of the true logit L_i assuming the N_i at each X_i is reasonably large.

Since the properties of the stochastic error term μ_i is unknown, and N_i is fairly large, X_i is independently distributed binomial variable so that

$$\mu_i \square N\left[0, \frac{1}{N_i P_i (1 - P_i)}\right] \tag{9}$$

which implies that μ_i follows the normal distribution with mean zero and variance $\frac{1}{N_i P_i (1-P_i)}.$

Consequently, the logit is estimated using the weighted least square (WLS) procedure to resolve the problem of heteroscedasticity.

This gives rise to

$$\sqrt{w_i} L_i = \beta_1 \sqrt{w_i} + \beta_2 \sqrt{w_i} X_i + \sqrt{w_i} \mu_i$$
(10)

which can be written as

$$L_i^* = \beta_1 \sqrt{w_i} + \beta_2 X_i^* + v_i \tag{11}$$

where weights $w_i = N_i P_i (1 - P_i)$, L_i^* is the weighted L_i , X_i^* weighted X_i and υ_i weighted μ_i .

The odds ratio in favour of owning a house by an individual with average income X_i is given by

$$\frac{\hat{P}_i}{1 - \hat{P}_i} \tag{12}$$

where ${\it P}_i$ is the estimated probability of owning a house, while the estimated logit is given by

$$ln\left(\frac{\stackrel{\wedge}{P_{i}}}{1-P_{i}}\right) \tag{13}$$

The probability of an individual with average monthly income X_i owning a house

$$\stackrel{\circ}{P_i} = \frac{e^{-L_i^*}}{1 + e^{-L_i^*}} \tag{14}$$

where L_i^* is as defined in (11).

IV. ANALYSIS

A questionnaire was administered to 100 inhabitants of different areas of Ado-Ekiti, Ekiti State.

These 100 respondents were classified into 5 groups of 20 individuals, each based on their average monthly income.

Out of each (N_i) 20 individual, 14, 7, 5, 6 and 9 were homeowners (n_i) giving rise to respective relative frequencies 0.70, 0.35, 0.25, 0.30 and 0.45.

The respective weights (w_i) are 4.20, 4.55, 3.75, 4.20 and 4.95 with corresponding average monthly income 0.19, 0.15, 0.15, 0.18 and 0.12 (N million).

These data was fitted to the logit model in (11) by the WLS technique using SAS 9.3 so that

$$L_i^* = -2.4979\sqrt{w_i} + 4.6432 X_i^* \tag{15}$$

is the estimated regression curve with coefficient of determination (\boldsymbol{R}^2) value 0.9228.

is

The odds ratio in favour of owning a house by an individual whose average income is 0.158(N million) is 1.0387 while the probability of owning a house by such individual is 0.51. Also, an estimated logit of 0.038 was also obtained.

V. Conclusion

The coefficient of determination value 0.9228 was an indication of a goodness of fit. This also indicates a strong relationship between the income and the probability of owning a house.

The calculated t-value of 32.44 is hugely in excess of the tabulated value of 5.01 and hence this leads to the conclusion that income of individuals will influence the probability of being homeowners.

The probability 0.51 of owning a house by an individual whose average monthly income is 0.158 (N million) was obtained. This shows that an increase in monthly income may increase the probability of owning a house.

The odds ratio of 1.0387 in favour of owning a house gives a slight advantage over the chance of not owning a house in the state.

VI. Recommendation

Government should make some amendments on the land use act to make more land available for residential purposes in certain 'newly created' states such as Ekiti. This will enhance rapid development in the state.

Government through its agencies should control the activities of land owners, middlemen, estate valuers and other play makers involved in land issues.

This will control the land prices and make more land available for residential purposes. This will also reduce cases of land disputes.

Non-governmental organisations, mortgage banks and other private investors should invest more into housing schemes in the state and the country at large.

This will make more people to become homeowners and make them enjoy the full benefits of home ownership.

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