Fishing Folks' Access to Early Warning and Post Flood Assistances in Lagos State, Nigeria: Application of Seemingly Unrelated Bivariate Probit (SUBP) Regression

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Abstract: Flooding is a serious environmental challenge in most part of Lagos State due to extension of residential buildings to flood prone wetlands as population explosion takes the deepest toll on the Nigeria's foremost industrial centre. The situation is more pathetic for coastal fishing folks who sometimes have their houses built directly on slow flowing waters. This study analyzed utilization of early warning and access to post flood assistance by fishing folks in Lagos. Data were collected with structured questionnaires using simple random sampling. Descriptive Methods and Seemingly Unrelated Bivariate Probit (SUBP) regression were used for data analysis. Results showed that 86.2% of the respondents were males while 69.2% were <40 years old. Also, 72.3% had fishing as primary occupation and 47.9% had <5 years fishing experience. Furthermore, 88.3% had experienced flooding with 13.8% relying on savings as post flood coping method. Only 21.2% had access to warning signals 61.7% never got assistance after flooding. Also, 12.8 and 11.7% of the respondents got assistance from government and associations, respectively. Religious organizations assisted 8.5% while 4.3% got assistance from family members. The SUBP regression results indicated that that being helped during flooding increased the probability of seeking for early warning while being assisted during flooding is only significantly influenced by income (p<0.10). It was concluded that more sensitization on the need to follow media reports about pending environmental hazards like flooding is needed among the fishing folks.

Key words: Early warning, assistance, flooding, fishing folks, Lagos

INTRODUCTION

The Northern and Southern parts of Nigeria were amalgamated as a country in 1914 by the British colonial authority with Lagos as the Federal Capital. Ever since then, Lagos had grown in leap and bound to become a dynamic city with indescribable political, administrative, economic, industrial, commercial, financial and socio-cultural influences (Rasaki, 1988). Industrialization and its associated economic affluences have consolidated socio-economic vibrancy in Lagos, though rapid population growth is now beyond ordinary administrative capacities of the local municipalities. The geographical position of the state as a coastal city classifies it among the Nigerian cities that are extremely vulnerable to flooding. As the foremost industrial hub in the country, the pressure on Lagos' fragile land and water resources had long exceeded the carry-capacity due to uncontrolled influx of people. Therefore, associated environmental degradation and the utmost need to survive have made livelihood activities and residential buildings of poor households to be located in low-lying areas of extreme vulnerability to flooding. This is further aggravated by

persistent climatic change in the form of sea-level rise which recently threatens the lives of several people that reside close to the coast or any major water channels.

Similarly, human induced environmental pollution activities in form of illegal disposal of wastes account for significant part of flooding problem in Lagos State. These issues were on ground before the state was created in 1967. Also, weaknesses in environmental policy implementation portend serious risk of flooding in Lagos because some residents build their houses along drainage channels and natural water courses. Due to insufficient number of environmental sanitation and urban development staff, some private developers have taken charge of estate development. In most instances, their objectives are at variance from that of government as emphasized in the urban development agenda and land use policy. This may also send some vital signals of over-population which is obviously out of the ambient of Lagos state legislative arms to address (Rasaki, 1988).

Globally, Lagos is among 50 cities that were classified to be vulnerable to extreme sea level rise. The impact of future flooding as a result of this can be imagined because the city's population is projected to increase by >800% in

the 2070s (Adelekan, 2010). The sporadic rise of Lagos population from 5.725 million in 1991 to 9.113 million in 2006 (NBS, 2009) signals some severe flooding risks for the future because many more residents are encroaching land areas of high risks for residential buildings and other production activities. Therefore, over the past few decades, extreme cases of flooding that resulted in losses of lives and properties had been annually reported. It is therefore important that adaptation measures be taken in order to minimize the associated risks of persistent environmental degradation which often culminates into severe tragedies.

Adaptation to climate change connotes adjustments or interventions that are taken in order to reduce households' vulnerability (McCarthy, 2001). This is sometimes an unconscious response mandated by the need to reduce welfare losses incurred from adverse climatic exposures. In its utmost simplicity, adaptation sets the barricade to unwholesome impact of climate change and thereby discharges some impact cushioning responses. Adaptation is therefore visualized as a veritable option for mitigating the impacts of climate change. Depending on socio-economic status and cultural inclination of the households, adaptation mechanisms may require adjustments to lifestyles or information seeking behavior. In some instances, the former had promoted migration or permanent change to people's livelihoods while the latter compels behavior change in form of socialization and relentless efforts to understand the happenings in ones community.

In Nigeria, recent environmental tragedies have compelled involvement of key stakeholders and institutions in sending out some warning signals based on climatic forecasts. This is considered a veritable option because it enhances people's preparedness to face some environmental challenges. In Lagos State, one of the major efforts towards safeguarding the lives and properties of people living very close to the coast is by offering timely predictions of weather which can alert fishermen and other residents of impending dooms and prevent unnecessary economic losses. However, the degree of access to this information and compliance with media warning is a function of people's idiosyncrasies and socio-economic characteristics which more often reflects their thrusts and confidence in information provider. It is therefore important to assess the factors explaining access to flooding early warning information. Also, important is ability and willingness of people to render assistance to victims of environmental tragedies so that losses are objectively minimized and impact reduced. This study therefore explored the nature of environmental

losses sharing by provision of post flood assistance assistance to the victims. The findings from such study will guide policy discussions in order to ensure zero exposure to severe environmental risks by coastal fishing folks in Lagos.

MATERIALS AND METHODS

Area of study and sampling methods: Epe is a coastal town with excellent economic and cultural splendors. The division administratively lies 89 km North East of Lagos with geographical coordinates of 6°35'N and 3°59'E. In the 2006 Census, Epe local government area had a total population of 181734 people (NBS, 2009). Most of the inhabitants of the division engage in fishing and farming as viable sources of livelihood. Agricultural activities thrive in the area with great diversity in crop grown. Primary data were used for this study. Respondents were selected using simple random sampling. Participating communities were selected based on degree of fishing activities and proximity to water source. Out of the questionnaires that were distributed, only 188 were properly filled. The communities where data were collected include Owode and Olowo market. These were chosen because of high degree of fishing activities.

Estimated model: Modelling of binary dependent variable is usually accomplished with the Probit or Logit Model. This is due to violation of classical assumptions of Ordinary Least Square (OLS) regression which subjects estimated parameters to being biased and inconsistent (Greene, 2003). However, the Seemingly Unrelated Bivariate Probit (SUBP) had been proposed as the best approach to use when two equations are to be estimated and the dependent variable of one of them is an explanatory variable in the other. In this situation, estimated parameters from ordinary Probit regression will not meet the conventional conditions for being Best Linear Unbiased Estimate (BLUE). Therefore, estimation of the equations simultaneously is required as discussed by Maddala. The general form of the Probit Model can be presented as:

$$\operatorname{Pr} ob\left(Y = \frac{1}{X}\right) = \phi(X\beta) \qquad (1)$$

where, ϕ is the cumulative standard normal distribution. The estimated structural equations can be presented as:

$$Y_i = \alpha + \varpi Z_i + \beta_i \sum_{i=1}^{n} X_i + \nu_i \qquad (2)$$

$$Z_i = \gamma + \delta_i \sum_{i=1}^{n} X_i + z_i \qquad (3)$$

Y and Z are the latent variables of having access to early flooding warnings and being given assistance, respectively. These variables are dummy variables with values of 1 if having access or receiving assistance and 0 otherwise. Also, γ, α, β, ω and π are the estimated parameters and X_i are the explanatory variables. Included explanatory variables were received help after flooding (yes = 1, 0 otherwise), sex of household head (male = 1, 0 otherwise), age of household heads (in years), income of respondents (measured in thousand naira), dummy estimated marital status (married = 1, 0 otherwise), years of education of household head, years of fishing experience and membership of association (yes = 1, 0 otherwise). The error terms of the model are dependent and distributed as a bivariate normal such that: $E(v_i) = E(z_i) = 0$, var $(v_i) =$ var $(z_i) = 1$ and $\rho =$ cov (v_i, z_i). The Wald test which is reflected by statistical significance of ρ was used to determine whether the models would be best estimated jointly in a recursive manner or not.

RESULTS AND DISCUSSION

Fishing folks' socio-economic profile: Table 1 presents the frequency distribution of fishing folks' socio-economic characteristics. It shows that majority (86.2%) were males. This indicates that fishing is mostly carried out by males though females play a greater role in processing and marketing. Similar findings had been reported by Haakonsen (1992) and Jinadu (2003). The Table 1 also shows that most of the respondents (69.2%) were <40 years old. This implies that most of them were in their active phase of life. Specifically, fishing is carried out by energetic men due to the need for canoe paddling while on the water. Table 1 further shows that most of the respondents had household sizes of <6 members. The table reveals that most of the fisher folk lack formal education and only a small fraction managed to attend tertiary institutions. Also, 14.9% claimed to have non-formal training in certain activities accrued from apprentice work, extension and other services in addition to fishing. Furthermore, fishing was the primary occupation of 72.3% and majority 47.9% were just entering the business with <5 years fishing experience.

Perceptions on climate change and flooding: Table 2 shows that 88.3% of the respondents indicated to have experienced flooding. This implies it was a problem that affected many fishing folks. Also, 48.9% strongly agreed with the question that climate is changing while 43.6% agreed. Similarly, 38.3% strongly agreed with the

Table 1: Socio-economic profile of fishing folks

Variables	Frequency	Percentage
Sex of household heads		
Males	162	82.6
Females	26	13.8
<30	80	42.6
30-39	50	26.6
40-49	28	14.9
50-59	26	13.8
≥60	4	2.1
Household size		
2-4	80	42.6
5-6	50	26.6
7-8	28	14.9
8-10	26	13.8
>10	4	2.1
Marital status		
Single	46	24.5
Married	112	59.6
Separated	8	4.3
Widowed	18	9.6
Divorced	4	2.1
Total	188	100.0
Household heads' education		
None	46	24.5
Primary	40	21.3
Secondary	50	26.6
Tertiary	16	8.5
Adult education	8	4.3
Non-formal	28	14.9
Primary occupation		
No response	2	1.1
Fisherman	136	72.3
Teaching	2	1.1
Trader	14	7.4
Okada rider	4	2.1
Artisan	12	6.4
Student	4	2.1
Clerk	2	1.1
Farmer	6	3.2
Civil servant	4	2.1
Sand loader	2	1.1
Fishing experience		
0-5	90	47.9
6-10	33	17.6
11-15	20	10.6
16-20	26	13.8
>20	19	10.1

Table 2: Experience of flooding and climate change responses

Variables	Frequency	Percentage
Ever experienced flooding		
Yes	166	88.3
No	22	11.7
Climate is changing		
Disagree	4	2.1
Undecided	10	5.4
Agree	82	43.6
Strongly agree	92	48.9
Temperature is hotter		
Strongly disagree	2	1.1
Disagree	22	11.7
Undecided	46	24.5
Agree	46	24.5
Strongly agree	72	38.3
Torrential rain and sea level rise cause flooding		
Don't know	10	5.3
Yes	176	93.6
No	2	1.1
Total	188	100.0

statement that temperature is hotter while 24.5% disagreed. Also, 93.6% indicated that torrential rainfall and sea level rise caused excessive flooding. These findings are pointing to the fact that the fishing folks were also observant of changes in climate change. Table 3 shows the other coping methods that were used by households to cope during flooding. Only 13.8% relied on savings whenever flood disrupts normal economic activity while 7.4% would manage whatever is available. Also, 21.3% depended on borrowing. The results have pointed at low coping mechanisms by the fishing folks. Specifically, 48.9% could not identify any means of coping. This implies that they are absolutely vulnerable to flooding.

Table 4 presents the suggestions that were given by the fishing folks for reducing the impact of flooding. Specifically, 21.3% indicated that government should provide financial aids and swimming coats. Also, 18.1% indicated that effective drainage and flood barriers should be constructed. However, only 1.1% saw the need for timely warning about flooding.

Table 5 shows that 21.2% of the respondents had access to warning signals. However, majority of those that obtained warning signals got it from radio. Some of them used indigenous knowledge that had been acquired over to decode some flood warning signals. However, the table further shows that 61.7% of the respondents never got assistance after flooding. Also,12.8 and 11.7%

of the respondents got assistance from government and associations, respectively. Religious organizations assisted 8.5% while 4.3% got assistance from family members.

Access to early warning and post-flood assistance: Table 6 shows the results of the SUBP regression. It reveals that the model produced a good fit of the data with the Wald Chi-square statistics being statistically significant (p<0.10). Statistical significance of the Likelihood-ratio test of rho implies that the model is appropriately estimated with SUBP Method. The access to early warning model has the parameters of received help during flooding being statistically significant (p<0.01). It shows that being helped during flooding increased the probability of seeking for early warning on flooding. However, membership of association reduced the probability of accessing information on early flooding warnings (p<0.05). Being assisted during flooding is only significantly influenced by income (p<0.10). This implies

Table 3: Other coping methods used by fishing folks after flooding

Coping methods	Frequency	Percentage
None	92	48.9
Remittance from my children	2	1.1
From savings	26	13.8
Sell things gotten from the forest like fruit, firewood, etc.	4	2.1
Borrow	40	21.3
Depend on wife's earning	2	1.1
Have deep breath	2	1.1
Relax	4	2.1
Earning from transportation of people across the river	2	1.1
Manage what I have	14	7.4
Total	188	100.0

Table 4: Suggested recommendations on how the impact of flooding can be reduced

Recommendations	Frequency	Percentage
None	86	45.7
To provide financial aid and swimming coats	40	21.3
To give us outboard (motor) engines for the canoes	6	3.2
Clear water weed	12	6.4
To provide good road, developed market and extension officer	8	4.3
Construct effective drainage and flood barrier	34	18.1
They should give us warning before flooding starts	2	1.1
Total	188	100.0

Table 5: Distribution of respondents' according to access to warning signals and post-flood assistance

Variables	Frequency	Percentage
Access to warning signal		
Yes	38	21.2
No	150	79.8
Sources of warning		
None	150	79.8
Radio	24	12.8
NGO representatives	2	1.1
From overtime experience	12	6.4
Sources of post-flood help		
Government	24	12.8
Associations	22	11.7
Religious organizations	16	8.5
None	116	61.7
Family	8	4.3
Cooperative	2	1.1
Total	188	100.0

Table 6: Results of SUBP Model

Variables	Access to early warning			Received post-flooding assistance		
	Parameters	SE	z	Parameters	SE	z
Received help	1.1180***	0.36670	3.05	-	-	-
Sex	0.2117	0.50850	0.42	-0.4977	0.6488	-0.77
Age	0.0098	0.02270	0.43	-0.0482	0.0343	-1.40
Marital status	-0.1056	0.22860	-0.46	0.2243	0.3109	0.72
Household size	0.0681	0.05730	1.19	0.2149	0.1375	1.56
Education	0.0202	0.02820	0.72	-0.0046	0.0349	-0.13
Income (₦000)	0.0034	0.00390	-0.86	0.0332*	0.0180	1.85
Fishing exp	0.0005	0.01840	0.03	-0.0083	0.0247	-0.34
Association	-0.9165**	0.40560	-2.26	-0.3234	0.4844	-0.67
Constant	-2.2826**	0.81020	-2.82	2.0711*	1.0680	1.94
Athrho	-17.1521	1064.241	-0.02	-	-	-
Rho	-1	5.67e-12	-	-	-	-

Likelihood-ratio test of rho = 0: $\chi^2(1) = 4.32534$**; Wald $\chi^2(17) = 25.74$*;
Log likelihood = -55.969261; ***Statistically significant at 1%, **Statistically significant at 5% and ***Statistically significant at 10%

that those households with high income were readily assisted after being exposed to flooding. This is expected because sometimes, the rich has friends while the poor is sometimes abandoned.

CONCLUSION

Flooding is a critical environmental problem in Lagos State. The problem is further aggravated by other environmental and urban planning issues which have gone beyond the control of the local government authorities. Attitudinal issues and disregard for environmental safety often brings unimaginable losses after hazards had struck. The platforms for ensuring that citizens are assisted in resolving some environmental issues are often jettisoned because of pervasive poverty, illiteracy and sometimes selfish doggedness in pursuing some unprofitable and risky form of livelihoods. This study had found that many of the coastal fishing folks were at the risk of flooding. It was also noted that although fishing folks were aware of changes in some climatic parameters, only very few could explore the opportunities provided by the media to be warned ahead of such tragedies. Collective efforts in assisting victims of flooding existed, although with some indication of biasness toward the rich. It can be concluded that preparedness and ability of fishing folks to cope with the consequences of flooding is very low, although government had often come to assist. The fishing folks noted that provision of more financial aids will go a long way in helping them find alternative means of livelihoods that would be less risky. In addition to this, sensitization on the need to follow media reports about pending environmental hazards like flooding should be taken seriously. Although, this may not always be easily accomplished as individuals due to several infrastructural constraints, the objective can be explored by some existing groups that fishermen belong.

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