Vulnerability and household livelihoods in small scale fishing areas in Africa: An asset-based approach

Rudolf Witt
Institute of Development and Agricultural Economics,
Leibniz University of Hannover, Königsworther Platz 1, 30167 Hannover, Germany
Phone: +49 (0)511-762-5414
Fax: +49 (0511-762-2667
Email: witt@ifgb.uni-hannover.de

Levison S. Chiwaula
Institute of Development and Agricultural Economics,
Leibniz University of Hannover, Königsworther Platz 1, 30167 Hannover, Germany
Phone: +49 (0)511-762-2668
Fax: +49 (0511-762-2667
Email: chiwaula@ifgb.uni-hannover.de

Hermann Waibel
Institute of Development and Agricultural Economics,
Leibniz University of Hannover, Königsworther Platz 1, 30167 Hannover, Germany
Phone: +49 (0)511-762-2666
Fax: +49 (0511-762-2667
Email: waibel@ifgb.uni-hannover.de

Abstract

This paper assesses the relationship between vulnerability to poverty and livelihood choices in small-scale fishing areas. The use of an asset-based vulnerability framework allows to decompose poverty, and hence identify different poverty profiles, such as chronic and transient poverty, but also structural and stochastic poverty. The paper uses primary cross-section data that was collected through a household survey in April and May 2007 in Cameroon and Nigeria.

We find that transient poverty is more prevalent in both study sites, among which a major part is affected by low expected income (structural poverty), while other households are found to be transiently poor due to negative shocks (stochastic poverty). In view of policy implications, this differentiation implies that for the structurally poor, simply reducing risk would not have a lasting impact on poverty reduction. Instead, there is a need to influence the accumulation of productive assets and improvements in the productivity of those assets by technological change. The stochastic-transiently poor households, to the contrary, mainly require policies that protect them from negative income shocks.

Key words: Vulnerability, asset-based poverty, small-scale fisheries, Africa

Introduction

Rural communities depending on natural resources for their livelihoods, such as fishing, are often marginalized or ignored in national and regional development policies due to a relative dearth of information about the conditions of poverty, the specific elements contributing to it, and the factors governing vulnerability, which results in rather tentative and speculative assessments of poverty. Up to now, very few studies on fisheries have been conducted on household level, the majority mainly focusing on macroeconomic and market analyses. Repeatedly, development organizations have therefore called for the generation of adequate information and assessment of the extent, nature, causes and dynamics of poverty in fishery-dependent communities (McFadyen and Corcoran 2002, FAO 2005, 2006).

Scientific research on poverty in the last decades displays many different approaches, each focusing on certain aspects and characteristics of poverty. One important factor that has been incorporated into poverty analysis is its dynamic nature. In the past, the FGT measures (Foster et al. 1984) have been widely used in many studies. However, these measures are static and do not account for the time dimension of poverty. But introducing time into poverty measurement and analysis is a major conceptual challenge (Addison et al. 2008). Many empirical studies in the past have concentrated on measuring the extent of chronic versus transient poverty, or on predicting poverty levels by use of the vulnerability to poverty approach. In most cases, well-being was defined in the space of consumption or income. However, some authors (e.g. Carter and Barrett 2006) have argued that standard poverty measures are limited in their ability to answer important questions concerning poverty. In view of the often requested need to influence the accumulation of productive assets by the poor and the returns of those assets, standard poverty measures should rather be defined over the asset space instead of just household expenditures or income.

This paper assesses the relationship between livelihood choices and vulnerability to poverty by use of an asset-based vulnerability framework. The empirical analysis makes use of primary cross-section data that was collected through a household survey in April and May 2007 in Cameroon and Nigeria. Although fishing is recognized to be a key element in the economic portfolio of the rural population in the study areas, case studies have shown that fishing is part of a flexible and strongly seasonal matrix of various and diversified activities (Sarch 1997, Neiland et al. 2000, Béné et al. 2003). Hence, a large variety of livelihood options exists for households living in fishing-dependent communities in the Lake Chad Basin, from households completely specialized in agriculture, fishing or livestock rearing, to households with a more diversified activity portfolio.

Due to the dependence on natural resources of these livelihood systems, and the role of asset endowments for income generation, an asset-based approach is more appropriate to vulnerability assessment. The dynamic framework employed in the analysis allows the identification of different poverty profiles, such as chronic and transient poverty, and also structural and stochastic poverty, which can yield valuable recommendations for the design and implementation of development projects in a large number of regions with comparable settings.

Analytical framework

Our analytical framework is introducing an approach to dynamic poverty analysis that combines the concept of vulnerability and the asset-based poverty framework.

The methodology of poverty analysis has been advancing in different ways. For example, it has been acknowledged that a difference has to be made between population groups that are only temporarily affected by negative welfare outcomes (transient poverty), and those that are permanently under spell (chronic poverty) (Gaiha and Deolaiker 1993, Lipton and Ravallion 1993, Jalan and Ravallion 2000, McKay and Lawson 2003; Duclos et al. 2006; Baulch and Hoddinott 2000, Dercon and Calvo 2006). While these approaches succeed in identifying differences in the nature and causes of poverty, they have some challenges and weaknesses. First, they require panel data of sufficient length. Second, they are backward looking, or ex-post assessments of poverty. Little can be said about the development of the poverty profiles in the future. In addition, some authors (e.g. Carter and Barrett 2006) argue that these poverty measures based on income or consumption fluctuations cannot distinguish between very distinctive sorts of poverty transitions – structural and stochastic. A common finding across a number of studies is that transitory poverty comprises a large share of overall poverty. But this group can represent different experiences. Some households may be poor because of bad luck. Their transition to the non-poor state simply reflects a return to an expected non-poor standard of living (stochastic poverty transition). For others, poverty may be structural, i.e. they are expectedly poor as a result of their asset base, which does not allow them to improve their economic situation in the long run. These households may also be characterized as economically immobile (Baulch and Hoddinott 2000).

To account for the differences between structural and stochastic poverty, Carter and May (1999, 2001) as well as Barrett and Carter (2005) and Carter and Barrett (2006) developed an asset-based methodology of poverty analysis. This asset-based framework can yield information on the expected levels of well-being based on the asset endowment of the

respective households. It is assumed that income depends in a functional way on the productive asset stock of a household. Basically, every attempt to explain income and variation in income assumes the functional relationship between assets, such as capital, labor, land or knowledge, and the livelihood outcome, e.g. household income. Thus, each bundle of assets maps into a distribution of possible livelihood outcomes (Carter and May 1999), with a first moment of the distribution: the ex ante expected income; as well as the second moment: the variance, or standard deviation of income. The asset poverty line is simply the level of assets that predicts a level of well-being equal to the poverty line. Those households that find themselves below this asset threshold are considered as structurally poor. Households that are above the asset poverty line are at most stochastically poor. However, while this approach incorporates structural asset poverty, it does not explicitly consider the concept of vulnerability to poverty.

More prominent in the last years are efforts to develop a single ex-ante intertemporal measure of poverty, usually classified as vulnerability measures. A steadily developing strand of literature has been dealing with vulnerability to poverty (Chaudhuri et al. 2002, Christiansen and Subbarao 2004, Ligon and Schechter 2002, Calvo and Dercon 2007, Elbers and Gunning 2003 and 2006, Hoddinott and Quisumbing 2003, Kamanou and Morduch 2002, Pritchett et al. 2000, Günther and Hattgen 2006, Günther and Maier 2008). Vulnerability is mostly defined as the ex-ante probability that a household will be poor in the future, which is generally assumed to depend on the exposure to risks and the household's ability to cope with these risks.

Based on the insights from asset-based poverty approaches we assume that household livelihood outcomes (e.g. income) are functionally dependent on the endowment with productive assets of the respective household and some stochastic event. Following Carter and Barrett (2006), households with a given asset bundle below the asset poverty line can be considered as not being in the position to escape poverty in the long run, even if by some stochastic event they may achieve an income above the poverty line at any point in time (see Figure 1). These households can be characterized as structurally poor. In contrast, households may find themselves below the income poverty line temporarily, but they dispose of a livelihood system, which has a welfare-generating capacity to improve their economic position in the long run. These households are considered to be stochastically poor. This framework also fits the differentiation made by Baulch and Hoddinott (2000) between poverty dynamics in the short term, i.e. changes in the household welfare measure that cause households to move in or out of poverty by crossing a fixed but essentially arbitrary poverty

line, and economic mobility, i.e. the longer-term processes via which households change their position in the entire welfare distribution.

Figure 1 here

This framework shows that any household income data from a survey is composed of a structural component (ex ante expected income) and a stochastic component (Kurosaki 1995). Making a distinction between the stochastic and the structural components therefore gives a more accurate picture of the economic situation of households.

In order to account for the stochastic variability of income, the framework is further expanded by introducing the second moment of the income distribution – its standard deviation.

Referring to the common definition of vulnerability as the probability to be poor in the future, we define a household to be vulnerable, if the probability that it's expected (or structural) income falls below the poverty line is greater than zero. In order to arrive at the household-specific vulnerability estimates we then compute the share of each household's expected (structural) income interval below the poverty line (see Figure 2), and define vulnerability as:

$$\upsilon_h = \Pr(I_h \le z) = \begin{cases} 0 & \text{if } \left[\hat{E}(I_h) - \sqrt{\hat{V}(I_h)}\right] \ge z \\ \dfrac{z - \left[\hat{E}(I_h) - \sqrt{\hat{V}(I_h)}\right]}{2\sqrt{\hat{V}(I_h)}} & \text{if } \left[\hat{E}(I_h) - \sqrt{\hat{V}(I_h)}\right] < z < \left[\hat{E}(I_h) + \sqrt{\hat{V}(I_h)}\right] \\ 1 & \text{if } \left[\hat{E}(I_h) + \sqrt{\hat{V}(I_h)}\right] \le z \end{cases} \quad (1)$$

where I_h denotes the per capita household income, z the poverty line, $\hat{E}(.)$ the expected income, and $\hat{V}(.)$ the predicted variance of income. For the sake of comparability of the results between the two countries, poverty was defined in absolute terms using the "dollar-a-day", or more precisely, the $1.25 per capita per day poverty line at 1993 consumption purchasing power parity (PPP), adjusted for inflation using the local consumer price indices of April 2007. Consumer price indices data was obtained from the IMF's International Financial Statistics. The calculated PPP exchange rates are 281.88 FCFA and 127.55 Naira for Cameroon and Nigeria, respectively.

This straightforward and simple way of estimating vulnerability levels for each household yields a measure that reflects the *structural* probability of being poor. It shows the expected vulnerability level of a household based on the respective asset bundle. For the chronically poor the vulnerability level is set to 1, since the expected stochastic variation in income does

not allow them to achieve an income above the poverty line. Analogically, the non-poor (and non-vulnerable) are assumed to have vulnerability levels equal to zero.

Figure 2 here

Thus, a clear difference can be deduced between two distinct dynamic poverty profiles. One pertains to the conventional chronic versus transient poverty, which reflects the persistence of low-income levels. The other is related to poverty as being structural or stochastic. Commonly used vulnerability measures (Christiaensen and Subbarao 2004, Chaudhuri et al. 2002) manage to distinguish between the structurally and stochastically poor (by considering households with a probability to be poor of at least 50 per cent as vulnerable) but they fail to distinguish the chronically and transitorily poor. Incorporating the concept of vulnerability to poverty into the asset-based framework allows us not only to identify the structurally and stochastically poor, but also the chronically and transiently poor.

This framework is particularly relevant for vulnerability analysis in fishery-dependent communities, since we hypothesize that the productive asset base of households has an effect on structural poverty and vulnerability levels.

We also hypothesize that diversification of household income has a positive effect on welfare outcomes, allowing households to cope with negative shocks. However, a differentiation has to be made between the effect of diversification on expected income and variance of income. While the effect of diversification on expected income may be more important for the structurally poor, resulting decreases in variability of income would be preferable for the stochastically poor.

Empirical estimation

Based on Chaudhuri et al. (2002) we estimate the expected income $\hat{E}(\ln I_h)$ and the predicted variance of income $\hat{V}(\ln I_h)$ by use of a three-step feasible generalized least squares (FGLS) procedure (Amemiya 1977). This methodology is assuming that the disturbance term, accounting for the unexplained variance in income, captures idiosyncratic factors that contribute to different income levels for households that are otherwise observationally equivalent. Despite some criticism and weaknesses of the approach of Chaudhuri et al. (2002) (e.g. that cross-sectional variability proxies intertemporal variation), this method has been widely used, due to its applicability to single-period data, as well as to the easy interpretation of the results.

The model for estimation of expected household income was specified as follows:

$$\ln I_h = f(\ln L_h, \ln AGR_h, \ln FISH_h, \ln LS_h; Z) \quad (2)$$

where

I = Total income per capita per day [in US$PPP]

L = farm size [in ha]

AGR = value of productive agricultural assets per capita [in US$PPP]

FISH = value of productive fishing assets per capita [in US$PPP]

LS = value of livestock per capita [in US$PPP]

Z = vector of control variables that include household size, dependency ratio, age of household head, education of household head, ethnicity and regional dummies.

This specification presents a form of a short-run household level 'production function' that captures the livelihood activities in a natural resource based productive system. This model includes assets used for different livelihood activities, instead of using an aggregated asset measure in order to control for the differences in asset endowments and respective contributions to household income. Hence, four distinct variables have been considered, i.e. (1) land and (2) other productive assets in agricultural production, (2) the value of productive fishing assets (e.g. canoe, fishing nets etc.) and (4) livestock value.

Household size and dependency ratio have been included to capture the household's demographic structure. In addition, some control variables have also been included in the model, such as the education level of the household head (0-no formal education, 1-elementary education, 2-secondary education), and the age of the household head.

Data and sample description

The study site in Nigeria covers a part of the Hadejia-Nguru wetlands which forms part of the Komadugu-Yobe basin. The wetland is located in northeastern Nigeria and is characterized by a distinct dry and rainy season. Most of the rainfall occurs in three to four months from June to September the wettest month being August. This rainfall pattern dictates the flooding regimes of the wetland most of which happens between August and September. The estimated area of the wetland is 3,500 km^2 and the estimated population in 2005 was at about 1 million (Schuyt 2005).

In Cameroon, the study site is the Logone floodplain in the Far-North province of Cameroon. This area is also characterized by annual flood cycle (August to December) due to the

overflow of the Logone River and temporary flows of the rivers of the nearby Mandara Mountains. The floodplain covers about 8,000 km^2 and is part of the bigger Logone-Chari sub system in the Lake Chad Basin, which supplies 95% of Lake Chad's total riverine inputs and has a basin area of approximately 650,000 km^2 (UNEP 2004). This area is relatively densely populated and is characterized by intensive fishing activities, as well as irrigated and rainfed rice and millet production.

A two-step weighted random sampling procedure was employed to identify the sample households. In the first step, 14 villages were randomly selected out of 88 in Cameroon, and 11 villages out of 121 in Nigeria. The final sample size is 295 in Cameroon and 267 in Nigeria.

The main data collection method was a structured household questionnaire based on recalls. The recall period covered in the survey was the past year (May 2006 - May 2007) and the data cover different aspects of the livelihoods and household economics, categorized in four sections: (1) household composition, shocks and health, (2) production data, including agriculture, fisheries, livestock and non-farm work, (3) housing, productive and convertible assets, and (4) food and non-food expenditures.

Empirical results

Demographic and productive characteristics

Table 1 presents some demographic and productive characteristics that have been included in the income estimation model.

Table 1 here

The household demographic characteristics show that households in Nigeria are on average larger and show a higher dependency ratio than in Cameroon. Educational attainment for household heads in both cases is very low. Concerning asset endowment, Table 1 suggests that households in Cameroon rather focus on fishing and livestock rearing, while in Nigeria agriculture plays a more dominant role. Thus, the average land holding size for Nigeria is almost twice that of Cameroon while the average value of fishing assets and livestock owned is several times higher for Cameroonian compared to Nigerian households. This is showing a significant dissimilarity in the dependence on different livelihood activities between the two countries.

Concerning household income, incomes from the respective activities are presented in per capita values in order to account for differences in the demographic structure of households. The income distribution between activities shows the same pattern as for the asset endowments. Although the larger share of total income is derived from agriculture in both countries (50% and 57% for Cameroon and Nigeria respectively), fishing and livestock play a more important role in Cameroon in terms of income generation.

Poverty and vulnerability profiles

As already hypothesized in the analytical framework, observed income levels are assumed to contain a stochastic element, resulting from changing external conditions such as rainfall, quality of production inputs and other factors. In order to predict expected (or structural) income levels a 3-FGLS model has been applied to both data sets.

The results of the income model (last stage of 3-FGLS) are presented in Table 2.

Table 2 here

The results of the income models are consistent with our expectations and the models have good explanatory powers. Despite the fact that the study was conducted in fishing areas, we find that assets, used for agricultural and livestock production, also have a significant positive impact on household income. This agrees with earlier findings, that fishing is part of a diversified portfolio of activities. From this equation, we predicted the expected income and the variance of the expected income which we used to estimate household-specific vulnerability levels.

To check the validity and consistency of the proposed vulnerability measure with traditional measures of vulnerability as expected poverty (using the standard normal distribution to estimate the probability to be poor) the estimates from the two measures were plotted in a scatter as shown in Figure 3 below.

Figure 3 here

The scatter plot shows that the vulnerability estimates from the approach proposed in this paper are consistent with the findings of standard estimates but provides additional information. The difference in the two measures is observed in the tails of the plot which clearly identifies the chronically poor and the never poor households within a population. This is a piece of information that the traditional expected poverty measures fail to explicitly show.

The estimated mean and variance of expected income are presented in Table 3. Like in most studies on vulnerability, the results show that the vulnerable-poor ratio is greater than one, i.e. more people are vulnerable than poor. Due to lower expected income and the variance of income, the expected poverty head count ratio (equal to the vulnerable head count ratio with a threshold of 0.5) is higher than the observed head count ratio. Apparently, the study period covered a relatively favorable year resulting in high reported income levels.

Most of the poverty in the study areas is found to be transient with 74 and 85 per cent of the sampled population in Cameroon and Nigeria, respectively. Among the transiently poor, structural poverty is the most prevalent. Only about one fourth of the total sample is stochastically poor, while over 50 per cent of the households are found to be poor due to structural reasons.

Comparing the two countries, we find that the sampled households in Cameroon are poorer than in Nigeria. Especially chronic poverty is more prevalent in Cameroon (20% compared to 8% in Nigeria).

Table 3 here

Vulnerability and household livelihood

In order to test the effect of asset endowments as well as the level of diversification on vulnerability to poverty, an econometric procedure was used, regressing the vulnerability estimates on a number of explanatory variables including assets and diversification. Diversification was measured by the Simpson Index of Diversity (SID) which captures the number of income sources and the distribution of income among them. The SID was computed by the following equation:

$$\text{SID} = 1 - \sum_{n=1}^{N} \left(\frac{I_{nh}}{I_h} \right)^2 \qquad (3)$$

Where I_{nh} is household income from activity n and I_h is the total household income from all income sources. The income portfolio is made up of a maximum of 7 and 10 activities for Cameroon and Nigeria, respectively. This includes fishing, livestock, different crops cultivated by the household, and other activities (encompassing all non-farm income sources, such as salaried job, trade, sale of assets or remittances).

However, SID was suspected to be endogenous. To control for endogeneity, the identification of good instruments was necessary. For the Cameroonian data set, the proportion of income from livestock and a dummy variable for pirogue ownership were used as instrumental variables. For the Nigerian sample, instruments were the proportion of income from livestock

and the value of food consumption from own production. The value of fishing assets in Cameroon was highly collinear with the diversification index and was dropped during estimation. Robust standard errors were obtained to control for heteroscedasticity. The results of the estimations are presented in Table 4 below:

Table 4 here

Looking at the goodness-of-fit statistics, the results show that the model fits both data sets well. Concerning the variables of interest, the household endowment with productive assets, and diversification of the activity portfolio, the estimated coefficients have the expected sign and are mostly highly significant. However, there are some country-specific differences.
For example, while farming assets are playing a more important role in vulnerability reduction in Nigeria than in Cameroon, the reverse is true concerning livestock value. This is reflecting differences in livelihood strategies between the two countries, as shown in Table 1.

By plotting the first and second moments of the income distribution (expected income and standard deviation) on the total value of productive assets by use of lowess curves, the negative relationship between assets and vulnerability becomes clearer (Figure 4):

Figure 4 here

The graphs agree with the regression results as well as with apriori expectations concerning the functional relationship of income and productive assets presented in the theoretical framework. Assets not only affect expected income, but also the variance of income. Although the risk-reducing effect is not as clear in Nigeria as in Cameroon, nevertheless, a negative effect is observed.

The other variable of interest, diversification of income generating activities, also significantly reduces household vulnerability to poverty. To have a clear assessment on the mechanisms through which diversification affects vulnerability, we again plotted lowess curves of expected income, standard deviation of income, and vulnerability estimates on SID.

Figure 5 here

The plots clearly confirm the negative relationship between diversification and household vulnerability to poverty. Decomposing vulnerability into its components, the expected income as well as the variance of income, shows that diversification has a double effect on vulnerability. It is simultaneously increasing household expected income as well as decreasing the variance of expected income. Figure 5 also suggest that reduction of vulnerability due to diversification is mainly resulting from the variance decreasing effect in Cameroon, while income increases play a more important role for vulnerability reduction in Nigeria. Further, the curves show that at lower levels, the impact of diversification on all these variables is negligible.

Conclusions

The main objective of this paper was to determine the linkages between livelihood choices and vulnerability to poverty in rural fishing communities. The methodology used here is simple to use and allows a plain theoretical interpretation. Integrating the concept of vulnerability into the asset-based poverty approach, we show that it is possible to conduct a dynamic poverty analysis by use of cross-section data, and to establish a link between poverty dynamics (chronic and transient poverty) and vulnerability by considering productive assets in poverty and vulnerability analysis. Moreover, we are able to show that the commonly used vulnerability threshold of 0.5 is indeed marking a line between the structurally and stochastically poor.

The findings of this study suggest that household welfare, measured by expected income, is significantly depending on the asset endowment of the respective households. The accumulation of productive assets results in increasing income and decreasing variability of income. Similarly, diversification has a positive effect on expected income and reduces the variance of income. Both effects reinforce the reduction of vulnerability. The significance of these, however, is dependent on country-specific productive opportunities.

In contrast to other studies on vulnerability, which mostly present aggregated vulnerability estimates for different population categories, this paper uses vulnerability estimates to decompose poverty. This approach yields a clearer picture of the extent, nature and causes of poverty among rural fishery-dependent households. We find that transient poverty is more prevalent in both study sites. Disaggregating transient poverty gives us a better insight into the causes of poverty. While a major part of the transiently poor is suffering from low expected income (structural poverty), other households in the sample are facing negative shocks, although their expected income is above the poverty line (stochastic poverty). In view of policy implications, this differentiation is important. It has been suggested that different forms

of poverty need different policy strategies, for example risk prevention for the transiently poor and financial help for the structurally poor (Jalan and Ravallion 2000, Lipton and Ravallion 1993, Duclos et al. 2006). This study, however, shows that transient poverty can also be structural. For this group, simply reducing risk would not have a lasting impact on poverty reduction. Instead, there is a need to influence the accumulation of productive assets and improvements in the productivity of those assets by technological change. The stochastic-transiently poor households to the contrary, mainly require policies that protect them from negative income shocks.

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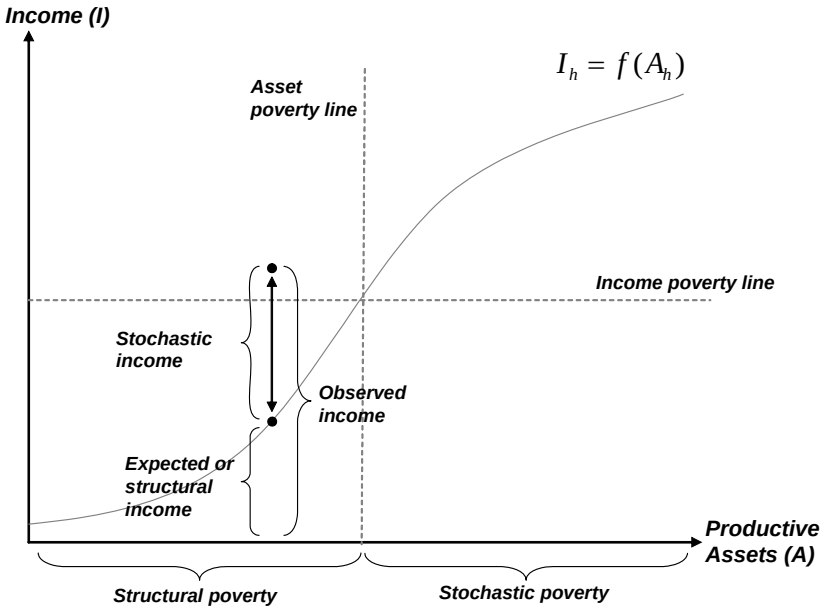

Figure 1:Structural and stochastic income components

Source: adapted from Carter and Barrett (2006)

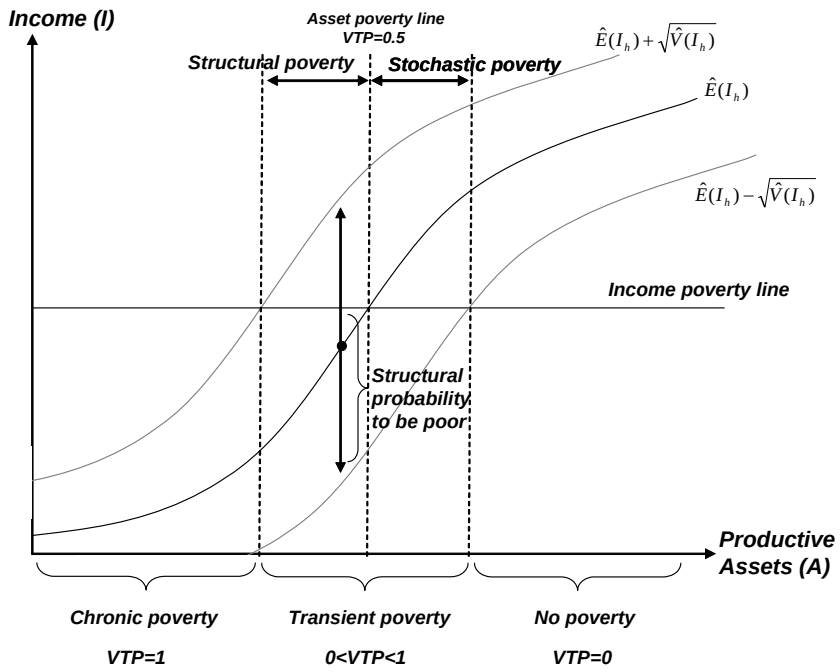

Figure 2:Chronic and transient poverty

Source: adapted from Carter and Barrett (2006)

Table 1: Demographic and productive characteristics for Cameroon and Nigeria

	Cameroon		Nigeria	
	Mean	Std. Err.	Mean	Std. Err.
HH Characteristics				
HH size	4.57	0.16	7.35	0.21
Dependency ratio (%)	0.20	0.02	0.50	0.01
Age of HH head (years)	44.29	0.91	42.14	0.89
Education of HH head [0-2]	0.42	0.03	0.33	0.04
Production Characteristics				
Simpson diversification index	0.46	0.01	0.69	0.01
Value of fishing assets (USD PPP)	310.81	28.48	26.50	3.59
Value of agriculture assets (USD PPP)	80.30	11.11	127.58	8.31
Value of livestock (USD PPP)	2066.67	206.26	661.73	65.72
Land holding size (ha)	3.91	0.81	6.90	0.41
Income from fishing per capita (USD PPP)	145.80	261.56	119.81	293.82
Income from agriculture per capita (USD PPP)	252.03	270.92	331.71	392.51
Income from livestock per capita (USD PPP)	96.87	204.59	25.22	62.92
Income from other activities per capita (USD PPP)	11.79	43.03	101.18	118.86
HH income per capita (USD PPP)	506.49	488.83	577.93	587.75
N	295		267	

Table 2: Results of the 3-FGLS income estimation model

	Cameroon		Nigeria	
	Coef.	P>t	Coef.	P>t
ln (land per capita)	**0.07**	0.00	**0.68**	0.00
ln (farm assets)	-0.01	0.68	**0.03**	0.00
ln (fishing assets)	**0.13**	0.00	**0.04**	0.00
ln (livestock value)	**0.19**	0.00	0.01	0.25
ln (HH size)	**-0.82**	0.00	**-1.32**	0.00
ln (Age of HH head)	-0.02	0.91	-0.06	0.66
Kotoko / Hausa	0.11	0.40	**-0.24**	0.00
Education level of HH head	0.05	0.49	0.09	0.12
Dependency ratio	0.08	0.61	0.22	0.39
ln (HH size), squared			**0.39**	0.00
Zone1	**0.66**	0.00		
Constant	-0.69	0.15	1.49	0.00
Observations	295		267	
R2	0.32		0.41	

Note: *** denotes significance at 1%; ** denotes significance at 5%; and * denotes significance at 10%

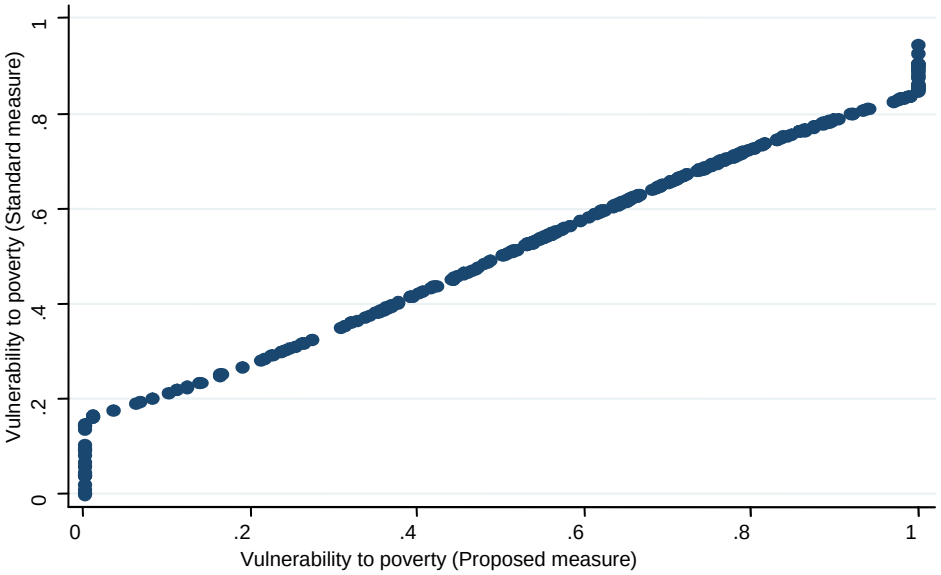

Figure 3: Scatter plot for the proposed and standard measures of vulnerability

Table 3: Poverty profiles in the study areas in Cameroon and Nigeria

	Cameroon		Nigeria	
	Mean	Std. Dev.	Mean	Std. Dev.
observed income [US$PPP]	1.39	1.34	1.56	1.59
expected income [US$PPP]	1.09	0.76	1.23	0.68
observed PHCR	0.59	0.49	0.53	0.50
expected PHCR (VHCR)	0.71	0.46	0.68	0.47
standard deviation of income	0.80	0.19	0.67	0.08
average vulnerability level	0.64	0.31	0.58	0.29
chronic poverty	0.20	0.40	0.08	0.28
transient poverty	0.74	0.44	0.85	0.36
structural (VTP>0.5)	*0.51*	*0.50*	*0.60*	*0.49*
stochastic (VTP<0.5)	*0.23*	*0.42*	*0.25*	*0.43*
never poor	0.06	0.24	0.07	0.26

Table 4: Determinants of vulnerability

Dependent variable: Vulnerability to poverty	Cameroon		Nigeria	
	Coef.	t-statistic	Coef.	t-statistic
SID	-0.9407	-2.63***	-0.8248	-2.14**
Ln (Farming assets)	-0.031	-1.52	-0.0291	-7.91***
Ln (Fishing Assets)			-0.021	-5.54***
Ln (Livestock value)	-0.0716	-6.00***	0.0068	1.44
Ln (land size)	-0.0428	-4.10***	-0.1074	-4.39***
Age of HH head	-0.0008	-0.72	0.0015	1.02
Ln (HH size)	0.5292	16.03***	0.3067	5.83***
Dependency ratio	-0.032	-0.69	0.1428	1.30
Education	-0.0615	-1.57	-0.066	-2.94***
Kotoko/Hausa	0.1691	2.68***	0.1285	3.54***
Zone1	-0.7183	-10.24***	-0.0631	-1.88*
Zone2	-0.1984	-2.35**		
Constant	1.1192	10.27***	0.5123	1.97*
N	292		267	
R	0.73		0.67	
F	65.84***		29.22***	

Note: *** denotes significance at 1%; ** denotes significance at 5%; and * denotes significance at 10%

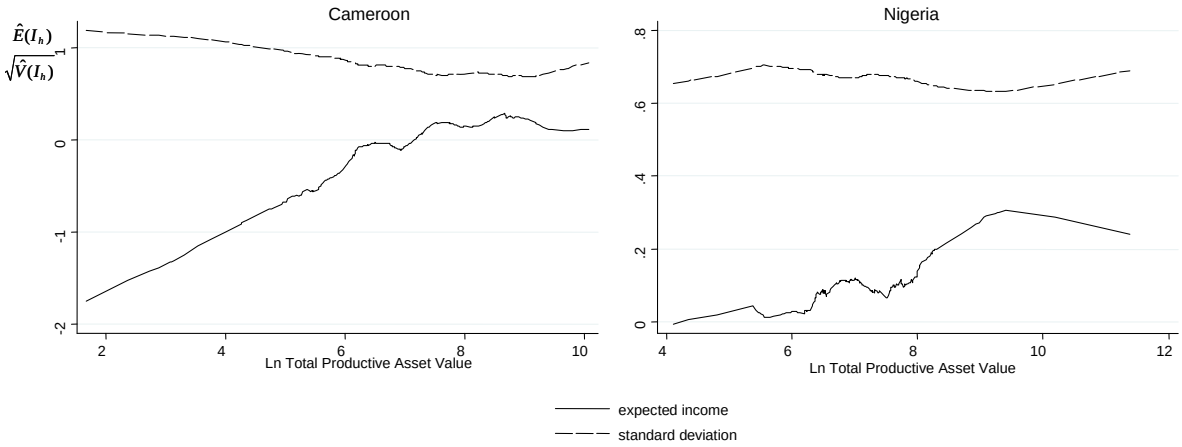

Figure 4: Lowess curves of expected income and standard deviation on value of productive assets

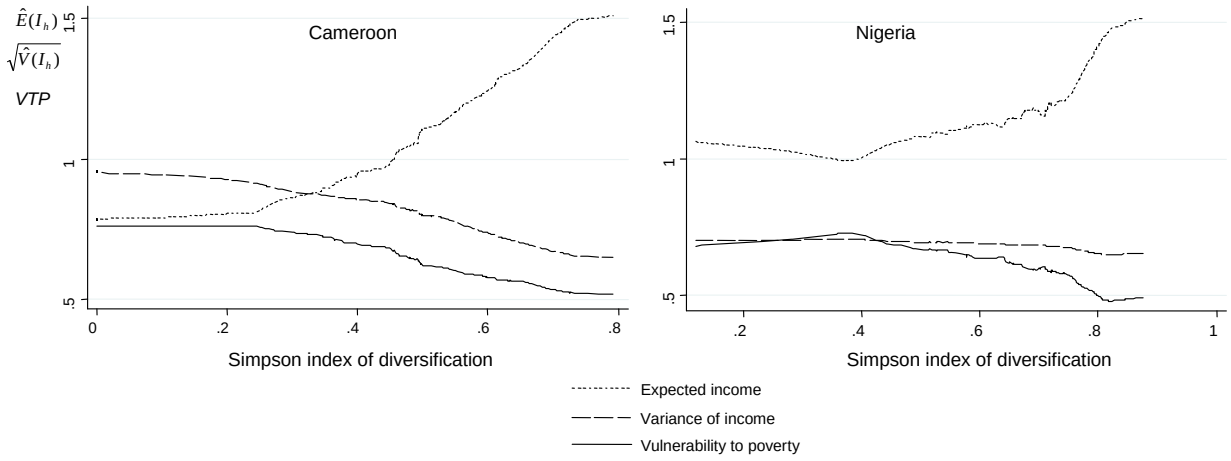

Figure 5: Lowess curves of expected income, standard deviation and vulnerability on SID