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Vulnerability and Poverty Dynamics in Uganda, 1992-1999

By

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Abstract

This paper uses a panel data set of 1309 households in Uganda to measure vulnerability to poverty between 1992/93 and 1999/2000 and to estimate the impact of household characteristics on vulnerability. The likelihood of future poverty is estimated based on the expected mean and variance of household consumption. Education, spatial characteristics, and access to community infrastructure are found to have important impacts on vulnerability. Specifically, the reduction in vulnerability to poverty increases with higher education attainment of the household head. Also households resident in northern Uganda are about 60 percent more vulnerable compared to their counterparts in central Uganda. The study also finds that causes of vulnerability in Uganda are similar to causes of poverty and therefore policies to raise the earning capacity of poor households would help both vulnerability and poverty.

Keywords: vulnerability, poverty dynamics, Uganda.

JEL *classification code***:** I 32

1. Introduction

The availability of nationally representative household surveys, some which follow the same households over time, has spurred analytical inquiry into poverty dynamics in the developing world (Carter and May 2001; Jalan and Ravallion, 2000; Christensen and Boisvert, 2000; Dercon and Krishnan, 2000; World Bank, 2000). Renewed interest in household welfare dynamics is a result of the realization that some households witness changes in their welfare status especially as their environment changes. Although much of the attention on household welfare movements has focussed on poverty spells of chronic and transient poverty, some studies have focused on the likelihood of future poverty or what is commonly referred to as vulnerability to poverty (Chaudhuri et al., 2002; Christiaensen and Subbarao 2004).

Investigating vulnerability to poverty has both an instrumental and intrinsic importance (Chaudhuri, 2003). Vulnerability has instrumental value in the sense that so many households are faced with shocks, which render their incomes volatile. In the absence of adequate insurance against risks, as is the case in most developing countries, households may adopt strategies to manage risks that perpetuate the vicious cycle of poverty. On the other hand, vulnerability has intrinsic value because individuals should not only have sufficient resources today but also their future welfare expectations should be favourable. Specific to Uganda, evidence from

participatory poverty assessments indicates that many households not necessary poor are worried of becoming poor, and this affects their behaviour (UPPAP, 2003).

Most attempts to explain household welfare movements in Uganda have focussed on a select category of issues. These include widening inequality (Ssewanyana et al. 2004), transient poverty (Okidi and McKay, 2003), and chronic poverty (Okidi and Mugambe, 2002; Lawson et al. (2003); Bird and Shienkwa, 2005). What is missing from almost all the above studies is an explicit consideration of vulnerability to poverty. Only, the study by Deinienger and Okidi (2003) goes beyond cataloguing which households moved out or stayed in poverty, to quantitatively examine the determinants of observed welfare changes. Even then, this study does not explicitly address the issue of vulnerability since it considers the changes in household welfare *ex-post after* they have occurred.

Using panel data from two representative national household surveys, this study estimates vulnerability to poverty for both poor and non-poor households. According to Chaudhuri (2003) vulnerability can be a result of low mean household consumption or high volatility in consumption, consequently this study also inquires about the source of vulnerability for Ugandan households. In addition, household characteristics can impact on vulnerability by either increasing or decreasing the mean and variability of consumption. In order to determine this impact, we simulate *vulnerability derivatives*—which estimate the quantitative effect of particular household conditions after controlling for all other factors.

This study is organised as follows. The next section reviews the literature on poverty dynamics in Uganda, and justifies the need for an explicit focus on vulnerability to poverty. Section three describes the analytical framework employed, while the subsequent section, describes the data used. The same section highlights some of the challenges encountered in the measuring of vulnerability, and describes our measure of household welfare. Section five presents the main results of the determinants of vulnerability to poverty. Finally, section six contains a discussion of some of the results and the conclusion.

2. Literature Review—Poverty Dynamics in Uganda

Due to the availability of datasets that follow the same households over time, a number of studies have analysed changes in household welfare in Uganda (See e.g. Mijumbi and Okidi, 2001; Okidi and Mugambe, 2002; Okidi and McKay, 2003; Lawson et al, 2003; Deininger and Okidi, 2003; Bird and Shinyekwa, 2005; Kappel et al. 2005). Notwithstanding the differences in the methodologies employed, the results from these studies suggest that movements out of poverty favoured households that were close to the poverty line or households that were able to accumulate significant asset bases.

Due to the focus by policy makers on persistently poor households, the Ugandan literature on poverty dynamics has concentrated more on chronic poverty. Okidi and Mugambe (2002) using a panel dataset of 800 households surveyed during the 1992-1996 period define the chronically poor as the poorest 20 percent of the population. They find that 76 percent of the chronically poor derive their livelihood from the agricultural sector. On the other hand, Lawson et al. (2003) make a first attempt to marry qualitative poverty assessments with quantitative household survey data in order to understand factors driving poverty transitions and persistence. Both sets of inquiry point to a growth in household asset bases as the key factor driving welfare improvements for Ugandan communities during the 1990s.

Deininger and Okidi (2003) is the most closely related work to the current study, but the current study represents some improvements. Using panel data, Deininger and Okidi (2003) investigate the determinants of changes in welfare status. Utilizing a multinomial logit model, the authors probe factors behind the changes in poverty states—that is escaping poverty or falling into poverty. They find agricultural output (coffee) prices to be the main drivers of income growth and poverty reduction. Also the study simulates various policy experiments and finds a high elasticity of poverty with respect to assets. For example, an increase in the average household asset holding from US$ 2000 to US$ 3000 leads to a 10 percent reduction in headcount poverty. Even then, this study does not explicitly address vulnerability since it considers changes in household welfare status *ex post*—after they have occurred.

In this paper, we focus on expected poverty *ex-ante* for household currently poor and non-poor. Following the framework of Subbarao and Christiansen (2004) and Chaudhuri *et. al*. (2002) and, this study estimates vulnerability based on the expected mean and variance of household consumption. Furthermore, unlike earlier studies investigating poverty dynamics in Uganda, we incorporate information on shocks—both at the household and community level to account as much as possible for the variation in consumption. This stems from the fact that all factors unaccounted for are captured by the error term and consequently these are bound to affect the estimates for the variance in consumption. Finally, the current study stimulates the likely impact of a change in household variables on vulnerability through the estimation of vulnerability derivatives. These are partial correlations of regressors with vulnerability after controlling for all the other household characteristics. The derivatives provide information on the effects of a change in a particular household characteristic on the probability of being poor.

3. Analytical Framework

This section describes the analytical framework for measuring vulnerability. Christiaensen and Subbarao (2004) and Chaudhuri et al. (2002) have argued for vulnerability analysis that account for households risks, risk exposure and coping capacity, in order to account for all information that may lead a household to fall bellow the poverty line. Vulnerability is defined as the probability of being poor in the future and intrinsically can take on two forms. It is either the ex-*ante* risk that a household that is currently not poor will fall below the poverty line or the risk that a household that is currently poor will remain poor. This can be formally expressed as:

$$V_t = \Pr ob(C_{(t+1)} < Z) \tag{1}$$

where the vulnerability of a household during the current period V_t is depended on the probability that future household consumption $C_{(t+1)}$ will be less than poverty line Z. Thus, estimating vulnerability involves determining the probability distribution of future household consumption. Assuming that the probability distribution is log normal, then estimating the mean and variances of future consumption effectively

determines this distribution. Following earlier studies utilising the same methodology (such as Christiaensen and Subbarao, 2004; Chaudhuri, 2003), the future household consumption distribution is hypothesed to depend on: risks faced by the household as well as the coping capacity or ability of the household to smooth consumption once faced by risks. Such a consumption generating process can be formally expressed as:

$$\ln C_{t+1} = X_t\beta + S_{t+1}\gamma + \varphi S_{t+1}X_t + \theta + e_{t+1}h^{1/2}(X_t;\alpha) \tag{2}$$

where X_t are household characteristics at time t, S_{t+1} are observable locally covariant and idiosyncratic shocks experienced by the household at time t+1, θ are time invariant unobservable household and environmental characteristics. The other parameters β, γ, and φ are time invariant coefficients to be estimated. The interactions between shocks faced by the households and its conditions are meant to measure a households coping ability.

In order to get unbiased estimates of the mean and variance of future consumption, a three step procedure proposed by Amemiya (1977) that produces feasible generalized least squares estimators, is employed. The first step involves estimating **Eq. (2)** above using the ordinary least squares to generate residuals. In the second step, the squared residuals from **Eq. (2)** are regressed on household condition X_t to generate estimates for the expected variance as specified in **Eq. (3)** below.

$$V(\ln C_{t+1} \mid X_t) = \hat{v}_t = \sigma_e^2 h(X_t;\alpha) \tag{3}$$

In the third and final step, household consumption is regressed on household conditions, shocks, and interactions of shocks with other household characteristics to generate an efficient estimate for the mean of expected consumption as:

$$E\left(\frac{\ln C_{i(t+1)} \mid X_{it}}{\sqrt{\hat{v}}}\right) = \hat{c}_t = \left(\frac{X_{it}}{\sqrt{\hat{v}}}\right)\beta + \phi S_{i(t+1)}\left(\frac{X_{it}}{\sqrt{\hat{v}}}\right) + \mu_{t+1} \tag{4}$$

Assuming that the probability distribution of future consumption is log normal, substituting the predicted mean and variance in the probability distribution specification (**Eq.1**) yields the estimates vulnerability to poverty as;

$$\hat{V}_t = \Pr ob(\hat{C}_{t+1} < z) = \Phi\left(\frac{z - \hat{c}_t}{\sqrt{\hat{v}_t}}\right) \tag{5}$$

where Φ is the cumulative density of the standard normal distribution, $\hat{c}_t$ and $\hat{v}_t$ are the predicted mean and variance of consumption respectively.

4. Data

4.1 The Panel dataset

This study makes use of the Uganda Integrated Household Survey 1992 (IHS, 1992) and the Uganda National Household Survey 1999/2000 (UNHS 1999) data sets collected by the Ugandan Bureau of Statistics. The two surveys are similar in the scope of data collection, sampling design, and coverage. The similarity in the sampling and questionnaire design facilitates comparisons of poverty trends for the two periods. Furthermore, the sampling design in both surveys is based on the two stage stratified random sampling. For both surveys, in the first stage, the principal sampling unit was the Enumeration Area (EA) based on the 1991 census as the sampling frame. In the second stage, households were the main sampling unit, with 10 households being randomly selected from each EA.

Equally important, the sample size in both full surveys is large—more than 9800 households in the IHS 1992 and about 10,690 in the UNHS 1999. This large coverage ensured that the data are also representative at the regional level and also allows for detailed analysis. In addition, both surveys provide a rich set of information at the household and community level. The socio-economic module provides detailed information on household incomes and consumption expenditures in addition to a wide range of variables such as health, education, and land holdings. Likewise the community module provides information on local demographic structure as well as infrastructure and social services available in the localities. In addition, the UNHS

1999 captured information relating to major shocks faced by the household and the communities since 1990. The UNHS 1999 was designed to be a longitudinal survey forming a panel with the IHS 1992. As such 1398 households were common in both surveys. These households constitute our panel sample for estimating vulnerability.

For the UNHS 1999 survey, the Uganda Bureau of Statistics set out to cover 1400 EAs, that is 637 from panel EAs and 773 from a new independent sample. Due to logistical and financial constraints, the total number of EAs was proportionally reduced to about 1100. As a result 518 panel EAs and 563 new EAs were retained for the survey. In the 518 panel EAs, 1398 households from the 1992 survey were targeted for possible re-interview. However, the bureau was able to successfully re-interview only 1309 households. The 89 households left out in the panel provide an attrition size of 6.3%. No specific reason cited for failure to interview these households. An examination of consumption expenditures in 1992 for panel households reveals that households that dropped out of the panel tend to have higher expenditure levels than those that remained. Furthermore, a study by Deininger and Okidi (2003) using this dataset found that urban, northern and eastern households were underrepresented in the panel. Thus the pattern of attrition is non-random, which suggests that the sample is non-representative of the whole population. However, as noted by Alderman *et al*., (2001) using such a panel sample to describe household behaviour does not impose unreasonable bias to the poverty estimates.

4.2 Variables included in the analysis

The study used a number of variables. In order to capture household demographic composition, the following household characteristics were used: household size in its linear and quadratic terms, gender of the household head, and age of the household head and its square. Other variables included non-income indicators of household socio-economic status such as education attainment of the household head, and household landholding. Also included were spatial characteristics of the households such as the regions and the urban-rural location. Other variables were characteristics of the community in which the household resides, which comprised: access to electricity in the community, distance to product market, and source of water during the dry season.

Finally, the study included five community and two household shocks, in a bid to account for as much as possible the variance of household consumption. The community shocks included: community experiencing famine during 1992-1999, community experiencing coffee diseases during 1992-1999, community experiencing cassava diseases during 1992-1999, community experiencing cattle diseases during 1992-1999, and community experiencing drought during 1992-1999. The household shocks were illness or injury of one month or longer for the household head, and the death of an adult household member aged 18-60 years during 1992-1999.

4.3 Measuring Vulnerability empirically.

Based on the standard procedures of measuring poverty by Foster et al. (1984), the measurement of vulnerability requires defining an indicator of welfare; establishing a threshold to separate the vulnerable from the non-vulnerable (similar to a poverty line); and finally, generating a summary statistic to aggregate the probability distribution of expected welfare. In line with other studies analysing poverty dynamics, consumption expenditure is used as the household welfare measure. Although the IHS 1992/93 and UNHS 1999/00 surveys capture both household income and consumption, consumption expenditures were preferred due to being more stable than income, which fluctuates from year to year. In addition, Uganda being a predominantly agricultural country, the likelihood of understating income is high. Consequently, we proxy household income by consumption expenditures adjusted for household composition was our measure of household socio-economic status (See Appleton, 2001 regarding details for derivation of the consumption aggregate). Finally, similar to earlier studies measuring vulnerability, we adopted a vulnerability threshold of 0.5, which indicates that a household is more likely than not be poor in the future.

The GLS procedure was used to estimate the expected mean and variance of consumption. Based on the assumption of normality, the two parameters are then used to aggregate a vulnerability distribution. As earlier mentioned, in order to account for as much as possible the variations in expected consumption, the specifications for GLS regressions included, among other regressors, shocks faced by the household and community in 1999 as well as interactions of shocks with household characteristics.

However, the shock covariates turned out to contribute only a very small proportion of the total variance of expected consumption (Table2)—contrary to findings from other studies using a similar methodology such as Christiaensen and Subbarao (2004). Also, in order to account for cluster specific heterogeneity, we experimented with region-by-region hetroskedacity regressions and found no significant differences between separate regressions. Consequently, we settled for hetroscadicity regressions for the entire sample with a region dummy included instead

5. Results

5.1 *Changes in household welfare 1992-1999*

We first present descriptive data on welfare mobility in Uganda segregated by per capita consumption deciles. Table 3 shows that mean consumption per adult equivalent increased by 55 percent during the period 1992/93 to 1999/2000 for panel households. This is equivalent to an average annualised rate of 8 percent; a figure higher than the observed changes in per capita consumption for the full 1992/93 and 1999/2000 samples (5.3% per annum). Also, the above panel estimates are higher than the national accounts estimates which show that growth in private consumption per capita averaged 5.3 percent over the 1991/92-1999/2000 period (Appleton, 2001). Overall, although mean consumption increased for all consumption deciles in 1992, the increments were not equally distributed with the top decile registering the largest gains.

The table also shows that growth in mean consumption was higher in urban than rural areas. The big gap in spatial welfare gains can be partly explained by the widening inequality between urban and rural households. Inequality estimates for panel households show that the Gini for urban households increased from 0.34 to 0.49 compared to an increase from 0.30 to 0.33 for rural households. On the other hand, estimates using the full 1992/93 and 1999/2000 surveys samples indicate a less drastic changes especially for urban households, with the Gini coefficient for urban households increasing from 0.36 to 0.42 while that of rural households slightly increased from 0.326 to 0.332 (Ssewanyana et al. 2004). The differences in the figures not with standing, both sets of inequality estimates show a very significant increase in welfare inequality in urban areas.

Results from the above table should be interpreted with caution since households that were poorest in 1992 were not necessary the poorest in 1999. Indeed, this welfare dynamism is confirmed in the next table where mobility among the different expenditure quintiles is analysed. Table 4 presents a transition matrix, which shows the extent of welfare mobility based on household consumption per adult equivalent quintiles in 1992 and 1999. There are substantial movements of households from one quintile to another; only 26 percent of the households remained in the same quintile in 1999, as was the case in 1992. Furthermore, 38 percent moved to a higher expenditure quintile while 36 percent moved to a lower quintile. For the households that experienced movements in their welfare quintiles, average welfare mobility was relatively short range with 51 percent ending up in the neighbouring quintile. Also welfare mobility is more particularly pronounced in the poorest quintile, where more than 74 percent of households moved to higher quintiles. The above results underlies what is classified in the poverty literature as "churning poverty"—there are gainers and losers at all levels as households moved from one welfare state to another (Ravallion, 2001).

However, the above results should be interpreted with caution since the observed welfare movements may actually be due to measurement error. Previous studies analysing poverty dynamics find that poverty transitions are often overstated due to measurement error (Boozer and Goldstein, 2003). No attempt is made to investigate the effect of measurement error on the above poverty outcomes due to lack of validation surveys for household survey data in Uganda.

5.2 Vulnerability Estimates

The estimates from the GLS regressions (reported in Table 5) are were used to generate an index of household vulnerability as specified in **Eq. (5).** Table 6 shows the summary statistics for the vulnerability distribution based on observed poverty status in 1992. Mean vulnerability is 0.395 indicating that about 2 out of 5 Ugandan households in 1992 were likely to be poor in 1999. Vulnerability characteristics of the poor households are not much different from the non-poor households, with poor households having a mean vulnerability of 0.41 compared to 0.37 for non-poor households. On the other hand, when we adopt the standard vulnerability threshold of 0.5, only 14 percent of the panel households are classified as vulnerable. The

corresponding rates for the poor and non-poor households are 18.0 and 9.0 percent respectively. These former results indicate that the proportion of Ugandan households likely to become poor in 1999 were higher than the proportion actually poor in 1999 (the head count poverty index for panel households in 1999 was about 27.5 percent). This finding is in line with results from earlier studies using the same methodology, which also find that the proportion vulnerable is greater than the proportion of households actually poor (See for example Chaudhuri et al. 2002; Christiaensen and Subbarao, 2004).

5.3 Sources of Vulnerability

Following Chaudhuri et al. (2002), we categorize the households into three distinct groups in order to identify the sources of vulnerability for the households. The first category is the "non-vulnerable group"—estimated vulnerability level is below our set threshold of 0.50. The next category is the "high volatility vulnerability group"—estimated vulnerability level is above the threshold of 0.5 but also mean household consumption is above the poverty line. Finally, we have the "low mean vulnerability group"—estimated vulnerability is above the threshold and the mean household consumption is below the poverty line (this was the group that was then currently poor and stayed poor). Using the above demarcation, it can be seen from Table 7 (last two rows) that vulnerability is mainly caused by low mean consumption. Specifically, for the 14 percent of the households considered vulnerable, at least two-thirds of these can be attributed to low consumption.

5.5 Impact of Household Characteristics on Vulnerability

While the above results shed light on the extent of vulnerability by the different household characteristics, they are not very informative with regard to the effects of a change in a particular household characteristic on the probability of being poor. To measure this impact, vulnerability derivatives are calculated. As earlier mentioned, the *vulnerability derivatives* are simulations of the partial correlation of a regressor with vulnerability after controlling for all the other household characteristics. Based on the underlying assumption that a regressor has an impact on vulnerability through its effects on both the expected mean and variance of consumption, the vulnerability impacts are measured by taking partial derivatives of the change in the expected mean and variance of that particular characteristic with respect to vulnerability as:

$$\frac{\partial \hat{V}}{\partial x_j} = \frac{\partial \Phi\left(\frac{z-\hat{c}}{\sqrt{\hat{v}}}\right)}{\partial x_j} = \frac{\partial \Phi(a)}{\partial x_j} = \phi(a)\frac{\partial a}{\partial x_j} = \phi(a)\left(-\frac{1}{\sqrt{\hat{v}}}\cdot\frac{\partial \hat{c}}{\partial x_j} - \frac{1}{2}\cdot\frac{\left(z-\hat{c}\right)}{\left(\hat{v}\right)^{1.5}}\cdot\frac{\partial \hat{v}}{\partial x_j}\right) \quad (6)$$

By the repeated application of the chain rule, we get

$$\frac{\partial \hat{V}}{\partial x_j} = \phi(a)\left(-\frac{1}{\sqrt{\hat{v}}}\cdot\beta_j - \frac{1}{2}\cdot\frac{\left(z-\hat{c}\right)}{\left(\hat{v}\right)^{1.5}}\cdot\gamma_j\right) \quad (7)$$

Where b_j is the coefficient on X_j in the mean expenditures equation (stage3), g_j is the coefficient on X_j in the variance equation (stage2) and $\phi(a)$ is a standard normal.

5.5.1 Results for impact of household characteristics on vulnerability

Table 8 presents estimates of vulnerability derivatives, which show the rate of change of vulnerability as the particular household characteristic changes holding other factors constant. Changes in household size are positively related to vulnerability with each additional household member increasing vulnerability by about 1.3 percentage points. The results also suggest that increased educational attainment of the household head strongly affects vulnerability. In addition, access to community infrastructure such as electricity or improved water sources reduces vulnerability by about 2% and 5% respectively.

On the other hand household land holding exhibits weak impacts on vulnerability. Specifically, one-acre increase in household land holdings results in only 0.2 percent reduction in vulnerability. It is not clear why household landholding is not important for future poverty given that land is one of most important assets—especially for poor households in rural areas. One explanation could be that, even in rural areas, land is still an abundant resource and consequently it is not yet a binding constraint to household agricultural production activities.

Also according to Table 8, households residing in the northern region are 62 percentage points more vulnerable than households resident in central Uganda. The corresponding rates for eastern and western Uganda are 10.6 and 7.9 percentage points respectively. These results are to be expected given the higher level of household welfare and corresponding higher consumption in central Uganda relative to the other regions of the country. On the other hand, results for urban areas indicate that households resident in urban areas are more about 10-percentage points less vulnerable compared to rural households.

6. Discussions and conclusions

The results investigating the source of vulnerability indicate that vulnerability is predominantly caused by low mean consumption. This result suggests that efforts to reduce vulnerability among Ugandan households should place more emphasis on increasing long-term household welfare. Given that the causes of vulnerability in Uganda are similar to the causes of poverty, policies and studies that focus on poverty will actually do a good job of addressing vulnerability. Consequently, in addition to income transfers (which would be difficult to administer in Uganda), policies to raise the earning capacity of poor households would help both vulnerability and poverty.

The large impacts of household head educational attainment suggest higher education attainment has an increasingly large payoff. The vulnerability results for household head education are also consistent with poverty results. For example, estimates by Appleton (2001) show that educated households benefited most from the growth in household consumption witnessed during 1992-1999, and that education is one of key factors driving inequality. Previously, in line with the millennium development goals, the education policy in Uganda has focussed on Universal primary education, and the country has managed to attain over 90 percent enrolments in primary school. However, the above results indicate that this will have only a small impact on vulnerability—universal secondary education would have a much bigger impact. Consequently, the proposed introduction of *Universal Post Primary Education and Training* program, starting in 2007, is a step in the right direction.

The positive household size coefficient suggests that bigger family sizes increase the likelihood of future poverty. Indeed, a number of studies find that larger households tend to be poorer. Specific to Uganda, the larger household sizes and consequently high dependency ratios may be explained by the very high population growth rates (3.0 percent per annum in 2002) coupled with a high fertility rate (6.9 children per woman in 2001). This ensures that the population pyramid has a very large base. Thus, from the vulnerability perspectives, the high population growth rates and high fertility rates bode ill for Uganda's future. Therefore the Uganda government's efforts to control population growth should be intensified—possibly through increased access for women to family planning services and increased female education particularly to levels higher than primary school.

The spatial results highlight the plight of households living in northern Uganda. An explanation for the huge imbalance with regard to the north's higher likelihood of future poverty could be the presence of conflict in this part of the country. Northern Uganda has experienced civil war and resultant civil unrest since 1987 and this has rendered a big proportion of the northern population displaced and unable to engage in most productive activities. Consequently, most households in this part of the country rely on aid to meet most of their basic needs including consumption. Overall the above results point to an urgent need to increase resources to the north not only to mitigate the effects of war, but also to boost overall household consumption. On the other hand, results for urban areas are also consistent with poverty findings.

With regard to infrastructure, having electricity in the community reduces a household's vulnerability to poverty. An explanation for this can be that the presence of presence of electricity in the community may allows different kinds of productive activities thereby reducing the variance of income or consumption. However, despite a number of reforms in the energy sub sector in Uganda, less than 10 percent of households have access to electricity. The proportion of households having electricity for lighting increased from 6.7 percent in 1992 to 7.3 percent in 1999 and more recently to 9.4 percent in 2003 (UBOS, 2003). Two factors can explain the low electricity coverage: remoteness, and cost of electricity. The latter factor is most important since most rural households are not connected to the national grid due to high and increasing electricity tariffs.

The above results show the extent of vulnerability and how it varies with household characteristics for Ugandan households. The source of vulnerability to poverty is identified (low mean consumption), and factors are the most important for preventing future poverty are investigated. This information is important for policy makers as it sheds light on where public resources could be targeted to reduce future poverty. Future research should investigate the specific policy responses required to address vulnerability in Uganda.

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Table 1: Descriptive Statistics for panel households in Uganda in 1992

Variable	Mean	Standard Deviation
Consumption expenditure (Ushs) per adult equivalent 1999		
Female headed household (1=yes)	0.228	0.0003
Age of household head	43.09	0.0114
Household size	5.39	0.0022
Head has no education	0.295	0.0003
Head has primary education	0.429	0.0004
Head has secondary education	0.209	0.0003
Head has higher than secondary education	0.06	0.0002
Landholdings (acres) by the household	4.35	0.0130
Community has electricity (1=yes)	0.153	0.0003
Non Availability of cooperatives within 10kms	66.2	0.0003
Availability of cooperatives in the community (LC1)	8.2	0.0002
Availability of cooperatives in the community within 5kms	16.5	0.0002
Availability of cooperatives in the community within 10kms	9.1	0.0002
Community water source during the dry season is surface water	48.3	0.0003
Community water source during the dry season is unprotected wells	28.6	0.0004
Community water source during the dry season is protected well	19.3	0.0003
Community water source during the dry season is tap water	3.8	0.0002
Distance to product markets (kms)	3.95	0.0003
Urban dummy (1=yes)	0.060	0.0002
Central	0.309	0.0003
Eastern	0.258	0.0003
Northern	0.145	0.0002
Western	0.287	0.0003
Community experienced coffee diseases between 1992 and 1999	0.232	0.0003
Community experienced cassava diseases between 1992 and 1999	0.449	0.0003
Community experienced drought between 1992 and 1999	0.535	0.0004
Community experienced cattle diseases between 1992 and 1999	0.225	0.0003
Community experienced famine during 1992 and 1999	0.266	0.0003
Household head experienced illness in 1999	0.079	0.0001
Household experienced death of an adult member	0.066	0.0001
Number of observations	1310	

Source: Authors calculations from IHS1992 and UNHS 1999 datasets

Table 2: Contribution to Variance of expected consumption (for the specification with shocks)

	Mean	Standard Deviation
Total variance of household consumption	0.29902	0.12266
Total variance from errors	0.29809	0.12255
Total variance from household shocks	0.00009	0.00073
Total variance from community shocks	0.0083	0.00095

Source: Authors calculations from IHS1992 and UNHS 1999 datasets

Table 3: Mean Consumption per adult equivalent in 1992 and 1999: panel households by deciles

	Consumption per adult equivalent				% change
	1992/93	*s.e*	1999/00	*s.e*	
Deciles					
1	6721	4	9843	6	46.4
2	10080	2	14379	3	42.6
3	12644	2	17955	2	42.0
4	15200	2	21056	2	38.5
5	17838	2	24748	2	38.7
6	20650	2	28629	3	38.6
7	24564	3	32973	4	34.2
8	29460	4	40291	5	36.8
9	36319	6	51887	11	42.9
10	60677	47	116488	336	91.9
Rural	23073	10	35016	35	51.8
Urban	38670	83	70744	365	82.9
All panel households	23960	11	37180	40	55.2

Source: Authors calculations from: IHS 1992/93 and UNHS I 1999/2000.
Note: se stands for standard error of the mean

Table 4: Poverty transition matrix using per capita expenditure quintiles (%)

	Quintile (1999)						
	1	2	3	4	5	All	
1	25	31	18	15	10	100	(16)
2	20	18	28	17	16	100	(18)
3	17	22	20	24	17	100	(21)
4	14	16	21	25	24	100	(24)
5	8	13	19	23	37	100	(21)
Row %	(16)	(20)	(21)	(21)	(21)	(100)	(100)

Source: Authors calculation from IHS 1992 and UNHS 1999

Table 5: Generalized Least Squares regression results

Variable **Dependant Variable**	**Stage1** **Log (Con99)**	**Stage2** **Residual**	**Stage3** **Log (Con99)**
Head of household is Female	-0.006	-0.031	-0.021
Age of the head	0.008	0.014*	0.009
Age of head squared	0.000	0.000	0.000
Household size	-0.044***	-0.009	-0.038**
Household size squared	0.001	0.000	0.001
Head has Primary Education	0.001	-0.066	0.011
Head has Secondary Education	0.101*	-0.02	0.097*
Head has Higher than Secondary Education	0.478***	-0.067	0.362***
Acres of Land owned by the household	0.002	-0.001	0.004
Community has Electricity	0.172**	0.179**	0.182***
Availability of cooperative in the community (LC1)	-0.123*	-0.089	-0.153**
Availability of cooperative in the community (5 kms)	-0.200***	-0.127**	-0.199***
Availability of cooperative in the community (10 kms)	0.118*	-0.065	0.128*
Distance to product market	-0.013	-0.011	-0.017
Eastern Region	-0.165***	-0.06	-0.173***
Northern Region	-0.624***	-0.021	-0.620***
Western Region	-0.067	0.064	-0.075
Community water source is unprotected well	0.059	0.077	0.055
Community water source is protected well	0.074	0.018	0.084*
Community water source is tap water	0.347***	0.167	0.383***
Urban Dummy	0.229**	-0.113	0.221**
Community experienced coffee diseases in 1992-1999	-0.119*	-0.145*	-0.144*
Community experienced cassava crop diseases in 1992-1999	-0.119*	-0.037	-0.106*
Community experienced drought during 1992 and 1999	0.019	-0.014	0.008
Community experienced cattle diseases during 1992 and 1999	-0.013	-0.025	0.022
Community experienced famine during 1992 and 1999	0.069	-0.029	0.037
Household head experienced illness in 1999	0.261**	-0.009	0.230**
Household experienced death of an adult member	-0.031	0.016	-0.015
Interactions of shocks with household characteristics			
Land_coffee	0.007	0.003	0.006
Land_cassava	0.001	0.001	0.001
Land_drought	-0.007	0.006	-0.008
Land_cattle	0.007	-0.008	0.003
Land_famine	0.006	-0.005	0.005
Land_ illness	0.008	-0.01	0.003
Land_death	0.016	-0.002	0.015
Distance _coffee	0.008	0.02	0.014
Distance_cassava	0.014	0.004	0.007
Distance_drought	0.002	-0.01	0.009
Distance_cattle	-0.013	0.015	-0.021*
Distance_famine	-0.002	0.006	0.006
Distance_ illness	-0.016	0.009	-0.005
Distance_death	-0.007	0.002	-0.003
Constant	10.343***	0.107	10.325***

Source: Authors calculations from IHS1992 and UNHS 1999 datasets
Legend: * p<0.05; ** p<0.01; *** p<0.001

Table 6: Vulnerability Estimates

	Mean Vulnerability	Vulnerability > 0.50 (%)	Number of observations
All panel households	0.395	14.0	1292
Poor households in 1992	0.415	18.0	640
Non-Poor households in 1992	0.375	9.0	652

Source: Authors calculations from IHS1992 and UNHS 1999 datasets

Table 7: Sources of Vulnerability

	Overall	Amongst the non-poor	Amongst the poor	Amongst the non-vulnerable	Amongst the vulnerable	Amongst the high volatility vulnerable	Amongst the low-mean vulnerable
Mean cpae	23960	34144	13869	24677	19453	19772	18983
Fraction Poor	0.50	0.00	1.00	0.48	0.67	0.00	1.00
Mean Vulnerability	0.40	0.37	0.41	0.37	0.57	0.56	0.57
Fraction Vulnerable	0.14	0.09	0.18	0.00	1.00	1.00	1.00
Fraction high-volatility vulnerable	0.05	0.09	0.00	0.00	0.34	1.00	0.00
Fraction low mean vulnerable	0.09	0.00	0.18	0.00	0.66	0.00	1.00

Source: Authors calculations from IHS1992 and UNHS 1999 datasets

Table 8: Impact of Regressors on Vulnerability.

	Partial Derivatives $\frac{\partial \hat{V}}{\partial x_j}$	**Standard errors**
Head of household is Female	0.00399	0.00004
Age of the head	-0.00173	2.17e-06
Age of head squared	0.00001	1.85e-08
Household size	0.01288	7.25e-06
Household size squared	-0.00036	1.75e-07
Head has Primary Education	-0.03365	0.00006
Head has Secondary Education	-0.07143	0.00007
Head has Higher than Secondary Education	-0.17671	0.00015
Acres of Land owned by the household	-0.00168	8.28e-07
Community has Electricity	-0.01980	0.00010
Availability of cooperative in the community (LC1)	0.09785	0.00014
Availability of cooperative in the community (5 kms)	0.11648	0.00017
Availability of cooperative in the community (10 kms)	-0.09397	0.0001
Distance to product market	0.00495	3.39e-06
Eastern Region	0.10637	0.0001
Northern Region	0.61803	0.00016
Western Region	0.07907	0.00006
Community water source is unprotected well	-0.00760	0.00006
Community water source is protected well	-0.05211	0.00005
Community water source is tap water	-0.12221	0.00011
Urban Dummy	-0.09492	0.00019
Community experienced coffee diseases in 1999	0.04401	0.00020
Community experienced cassava crop diseases in 1999	0.06289	0.00006
Community experienced drought between 1992 and 1999	-0.01079	0.00002
Community experienced cattle diseases between 1992 and 1999	-0.02722	0.00003
Community experienced famine during 1992 and 1999	-0.03812	0.00005
Household head experienced illness in 1999	-0.12738	0.00010
Household experienced death of an adult member	0.01815	0.00010
Interactions of shocks with land		
Land_coffee	-0.00022	2.24e-07
Land_cassava	0.00363	1.66e-07
Land_drought	0.00215	1.04e-06
Land_cattle	-0.00233	1.06e-06
Land_famine	-0.00213	1.15e-07
Land_ illness	-0.00554	2.78e-06
Land_death	-0.00276	3.22e-06
Interactions of shocks with distance to product market		
Distance _coffee	-0.00221	1.41e-06
Distance_cassava	-0.00431	1.96e-06
Distance_drought	-0.00934	4.29e-06
Distance_cattle	-0.00130	1.17e-06
Distance_famine	-0.00285	1.32e-06
Distance_ illness	0.00140	6.49e-06
Distance_death	0.00191	9.44e-07

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