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Measuring Household Vulnerability in the Context of Poverty Education: Evidence from Uganda

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MEASURING HOUSEHOLD VULNERABILITY IN THE CONTEXT OF POVERTY ERADICATION: EVIDENCE FROM UGANDA

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Abstract

While it has long been demonstrated (Rosenzweig and Binswanger, 1993; Banerjee and Newman, 1994) that considerations of risk and uncertainty are key to understand the dynamics leading to and perpetuating poverty, it is only recently that policy makers have taken a more active interest in trying to incorporate considerations of risk and vulnerability into their strategies to reduce poverty (Christiaensen and Subbarao, 2001). The aim of this paper is to quantify the severity of vulnerability by generating the first quantitative assessment of vulnerability in Uganda, a country at the forefront of poverty analysis. The findings support the hypothesis that during the past decade, alongside sharp reductions in poverty, vulnerability to poverty in Uganda declined from 57% in 1992/93 to 25% in 1999/00. Such results highlight the importance for policy makers to distinguish between the effective implementation of poverty-prevention and poverty-reduction programmes.

JEL classification: I32, O12

Keywords: Poverty; vulnerability; risk; consumption expenditure

1.1 INTRODUCTION

This manuscript aims to extend Uganda's poverty diagnostic analysis by presenting the advantages of broadening the scope of poverty assessments to include an analysis of vulnerability to poverty. Within the framework of poverty eradication, vulnerability can be defined as the *ex–ante* risk that a household will, if currently non-poor, fall

below the poverty line, or, if currently poor, remain in poverty (Chaudhuri, 2002). Defined in this way, the notion of vulnerability is distinguished from the concept of poverty, which is an *ex-post* measure of a household's well-being – or lack thereof.

On the bases that poverty reflects deprivation on multiple fronts, vulnerability to poverty need also embrace a multidimensional construct. In order to empirically assess the extent to which various characteristics of households make them more or less vulnerable to poverty, however, the notions of poverty and vulnerability need to be made more concrete. In line with Uganda's long standing tradition of poverty analysis, this work focuses on poverty defined in terms of a single measure, namely current consumption expenditure. It follows that in this framework a household will be considered vulnerable if, and only if, it faces a high probability of experiencing future shortfalls in consumption expenditure.

Taken as a stochastic phenomenon, the current poverty level of a household may not necessarily be a good guide to the household's expected poverty in the future. Drawing on these arguments, broadening the scope of poverty assessments to include an analysis of vulnerability is beneficial on at least four accounts (Chaudhuri, 2003). First, a re-conceptualization in terms of vulnerability to poverty, which, by definition, has to be forward-looking, emphasizes the importance of risk and uncertainty in understanding the dynamics leading to and perpetuating poverty.

Second, a focus on vulnerability to poverty highlights the distinction between ex-ante poverty-prevention and ex-post poverty-alleviation interventions. As a common example, consider a situation where public health interventions are aimed at reducing

the national incidence of some disease. Information is available on both the incidence of disease in different regions, as well as on the fraction of the population in different regions that is at high risk of contracting the disease. On the one hand, funds for treatment of those already afflicted should clearly be directed to regions where the incidence of the disease is highest. On the other, funds for preventive measures (such as vaccinations) ought to be directed to regions where the fraction of the population at risk is the largest. Notably, these two sets of regions need not coincide. Regions with a higher incidence of the disease may also be regions where the risk of contracting the disease is concentrated among those afflicted. So the fraction of the population at risk may well be lower than in other regions where the incidence of the disease is lower.

Third, policies directed at reducing vulnerability to poverty will be instrumental in reducing poverty. In the absence of sufficient assets or insurance to smooth consumption, unpredicted shocks may lead to irreversible losses, such as distress sale of productive assets, reduced nutrient intake, or interruption of education that permanently reduces human capital (Jacoby and Skoufias, 1997), locking their victims in perpetual poverty. Vulnerable people often engage in risk mitigating strategies to reduce the probability of such events occurring. Yet, these strategies yield typically low average returns. By implication, when people lack the means to smooth consumption in the face of variable incomes, they are often trapped in poverty through their attempts to steer clear of irreversible shocks (Morduch, 1994; Barrett, 2001).

Last, but not least, vulnerability to poverty is an intrinsic aspect of well-being. Exposure to risk and uncertainty about the future adversely affects current well-being.

According to Bardhan and Udry (1999), people who live in the rural areas of poor countries must cope not only with severe poverty but with extremely variable incomes. This is most apparent for the majority who are directly dependant upon agricultural income. Weather variation, the incidence of disease, pests and fire, and a host of other less obvious factors cause family yields to fluctuate unpredictably. Variations in the price of marketed output can also cause farm profits to vary. Fluctuations in income can present an acute threat to people's livelihoods even if, on average, incomes are high enough to maintain a minimal standard of living. Occasional famines provide the most egregious examples of the consequences of risk in poor societies, but risk also generates more commonplace worries such as the consequences of a bad harvest for a family's ability to afford school fees for children, or the implications of a wage-earner's illness for the ability to provide a healthy diet for the household.

The structure of this paper is as follows: Section 1.2 reviews the literature, and outlines the empirical strategy. On account of the fact that vulnerability (as defined at the outset) is the risk that a household will experience consumption poverty in the future, while the poverty status of a household is concurrently observable, the level of vulnerability is not. We can estimate or make inferences about whether a household is currently vulnerable to future poverty, but we can never directly observe a household's current vulnerability level.

An assessment of vulnerability is, therefore, innately a more difficult task than assessing who is poor and who is not. To assess a household's vulnerability to poverty we need to make inferences about its future consumption prospects. Such efforts

require a framework for thinking explicitly about both the inter-temporal aspects and cross-sectional determinants of consumption patterns at the household level.

Over the last two decades, a large literature has developed which addresses precisely these issues (e.g. Deaton, 1992; and Browning and Lusardi, 1995 for excellent overviews). This literature suggests that a household's consumption in any period will, in general, depend on a number of factors, viz. the household's wealth, current income, expectations of future income (i.e. lifetime prospects), uncertainty attached to future income, and ability to smooth consumption in the face of various income shocks. Each of these will in turn depend on a variety of household characteristics, those that are observable and possibly some that are not, as well as a number of features of the aggregate environment (macroeconomic and socio-political) in which the household finds itself.

Section 1.3 presents the data, while describing trends and patterns of poverty in Uganda during the 1990s. Finally, section 1.4 discusses the key results, and section 1.5 summarizes the main conclusions of the analysis.

1.2 LITERATURE REVIEW

In much of the recent work on the vulnerability of different segments within a population (e.g. Glewwe and Hall, 1998; Cunningham and Maloney, 2000), vulnerability is defined in terms of exposure to either *adverse shocks to welfare*, or *poverty*.[1] The aim of this section is to review three separate approaches to assessing the extent of vulnerability: (i) Vulnerability as uninsured exposure to risk; and (ii) Vulnerability as losses due to poverty and risk exposure; and (iii) Vulnerability as the probability of becoming poor.

The fact that household consumption is sensitive to shocks means that a much larger number of households are actually vulnerable to poverty than typically recorded from the analysis of cross-section surveys (Dercon and Krishnan, 2000). Shocks may be covariant (e.g. rainfall) or idiosyncratic (e.g. illness) and, in the absence of effective risk management tools, they impose a welfare loss to the extent that they lead to a reduction in consumption.

Assessing vulnerability as uninsured exposure to risk has three major attractions: (i) It directly links vulnerability to specific shocks to losses in consumption; (ii) The estimated coefficients provide an estimate of the magnitudes of these impacts net of the mitigating role played by private coping strategies and public responses. By quantifying the impact of these shocks, this approach identifies which risks would be an appropriate focus of policy; and (iii) it can be applied to a variety of welfare measures, not just consumption.

[1] In a separate paper, Cunningham and Maloney (2000a) take a step towards bridging this gap by considering exposure to adverse shocks, weighted by a household's initial position in the distribution of welfare.

There are also some limitations that should be borne in mind. First, the approach is data intensive. Second, unlike methods that measure vulnerability as expected poverty, this approach does not produce a summary statistic determining that X% of the population is vulnerable. Third, vulnerability measures based on expected poverty attempt to predict (ex-ante) the probability that a household may become poor during a fixed time interval, whereas the degree of consumption insurance focuses on the extent to which households are successful (ex-post) at insulating their consumption from changes in their income opportunities and other shocks. It is possible, though perhaps not very likely, for an apparently non-poor household to be well insured, and yet be vulnerable to poverty.[2] For example, households may avoid taking risky but profitable opportunities or practice income smoothing as a substitute for consumption smoothing. This diversification may come at high cost. Walker and Ryan (1990) find that in semi-arid areas of India, households may sacrifice up to 25 per cent of average incomes to reduce exposures to shocks. Others may be able to smooth their consumption through coping strategies that deplete their assets, such as selling their livestock (Rosenzweig and Wolpin, 1993), withdrawing their children form school when there are shortfall in income (Jacoby and Skoufias, 1997), or using assets as a buffer for consumption (Deaton, 1992). As a consequence of all these risk management and risk-coping strategies, households may appear to be well insured, when in fact their vulnerability to future poverty may be increasing as a result of foregone investments and/or asset depletion.

[2] Along similar lines, it is also possible for a wealthy household to be quite vulnerable to risk and yet not vulnerable to poverty.

On a different (yet related) note, in a framework where vulnerability depends on both mean and variability of consumption, Ligon and Schecter (2002) define vulnerability as the sum of losses due to poverty and risk exposure. The authors use monthly data from the Bulgarian Household Budget Survey to estimate their vulnerability measure. They also decompose the contribution of various components to overall vulnerability, using both total and food consumption. In doing so, they find that 53% of total vulnerability is attributable to poverty, while the remaining 47% is due to risk. More specifically, 23% of losses due to risk are caused by aggregate shocks, 2% are explained by idiosyncratic risk, and 75% is the result of unexplained risk.

The biggest attraction of this approach rests in its ability to correctly capture the effects of risk on household welfare, unlike other measures of vulnerability derived from the Foster-Greer-Thorbecke (1984) poverty measures. Notably, however, the need to assume a particular form of the utility function places a heavy burden on the analysis. Yet another cost is the need for panel data, although the requirements for panel data are similar to those estimating vulnerability to risk exposure.

The third and final approach views vulnerability as the risk that a household will fall into poverty in the future (Chaudhuri et al., 2002; Christiaensen and Subbarao, 2001; and Pritchett et al., 2002). This strand of the literature includes among the vulnerable, households who are currently poor and have a high probability of remaining poor even if they do not experience any large adverse welfare shocks. On the other hand, it excludes those households among the non-poor who face a high probability of a large adverse shock but are currently well-off so that even if they were to experience such a shock, they would still remain non-poor.

This methodology deviates from Ligon and Schecter's (2002) analysis by not limiting the analysis to a specific formulation of the utility function. Greater flexibility, however, comes at the cost of being unable to explicitly control for the depth of expected poverty. There is nothing novel in this critique of a headcount measure of vulnerability; it applies equally to the headcount measure of poverty. To illustrate, consider two households both of whom are vulnerable (i.e. we know with certainty that both will be poor in period $t+1$). Suppose that we were to transfer sufficient consumption from one household to the other such that the recipient household will not be poor in period $t+1$. According to a headcount measure, we have reduced vulnerability by making a poor household even poorer, thus increasing the poverty gap.

To avoid this problem, Kamanou and Morduch (2002) introduce a slightly different approach. The authors are not concerned with expected poverty *per se*, but with expected *changes* in poverty. Hence, they define vulnerability in a population as the *difference* between the expected value of a poverty measure in the future and its current value, where the poverty measure is not restricted to the headcount measure. Notably, while Kamanou and Morduch (2002) do not restrict their discussion to a specific measure of poverty, their empirical application is for the headcount measure.

1.2.1 THE EMPIRICAL STRATEGY

The existing literature provides many definitions of vulnerability, and seemingly, no consensus on its definition or measurement. Choosing the most appropriate approach to measure vulnerability, therefore, becomes inherently a function of the settings at

hand and the type of data available. In line with Hoddinott and Quisumbing (2003), in the case of Uganda, focusing on the notion of vulnerability as the probability of experiencing poverty in the future appears advantageous on three separate accounts. First, it produces a number analogous to Uganda's widely recognised measure of the incidence or severity of poverty. Comparability between the two types of analysis can be especially helpful in cases where poverty is low but a substantial proportion of households have consumption just above the poverty line. Indonesia in the mid 1990s provides a good example. In this scenario, governments (and development partners) might become complacent, under the assumption that poverty has been 'solved'. Nevertheless, if these households lying just above the poverty line are vulnerable to shocks, summary measures of vulnerability will be much higher, indicating that such complacency is misplaced. Second, it sheds light on the relationship between poverty and vulnerability. If the characteristics of the vulnerable were to differ significantly from those of the poor, targeting poverty (for example, by using a proxy means tests that focuses on the determinants of poverty) would miss a significant group of households that are vulnerable to declines in living standards. Third, this approach can also be implemented using a single round of cross-sectional data. This is particularly important on the bases that aside from the two wave panel utilised in this analysis, no subsequent rounds of panel data are available for Uganda. It follows that individual cross-sections are the only available tools to replicate this analysis in order to assess the long(er)-term trends and implications of vulnerability.

As a word of caution, in a single cross-section, one can only estimate the variability of consumption expenditure *across* households. This is not to be confused with the variability of consumption expenditure *over time*. According to Chaudhuri et al.

(2002) estimating the standard deviation of consumption using a single cross-section implies that cross-sectional variability proxies inter-temporal variation. The implications are far reaching. For instance, consider Tesliuc and Lindert's (2002) risk and vulnerability assessment of Guatemala. The qualitative fieldwork indicated that natural disasters are a particularly serious risk in Guatemala. Some individuals reported that they had never fully recovered from losses incurred in the aftermath of the 1976 earthquake, while others reported significant damage incurred in 1998 by Hurricane Mitch. However, there were neither serious earthquakes nor hurricanes in the survey year that the authors used to examine vulnerability. In this context, using cross-sectional variation from a "non disaster" year understates the level of consumption vulnerability. Conversely, had a household survey taken place in a particularly "bad" year, one might have erroneously overestimated the incidence of vulnerability.

On the premise that this paper focuses on vulnerability to poverty defined in terms of current consumption expenditure, the vulnerability level of a household *h* at time *t* is defined as the probability that the household will find itself poor at time *t +1*:

$$v_{ht} = \Pr(c_{h,t+1} \leq z^*) \qquad \textbf{[1.1]}$$

where, $c_{h,t+1}$ is the household's per-adult equivalent[3] consumption level at time $t+1$ and z^* is the absolute poverty line, which in Uganda's case is anchored to the cost of meeting basic needs, with a focus on caloric requirements (Appleton et al., 1999).

[3] While it is standard practice to use per-capita consumption figures to measure household welfare, there is a large literature supporting the estimation of equivalence scales. Previous poverty work on Uganda uses adult equivalent scales, with male adults between 18 and 30 years of age as the reference

In this framework, the level of vulnerability at time *t* is defined in terms of the household's consumption prospects at time *t+1*. This implies that the probability that a household will find itself poor depends on its expected (i.e. mean) future consumption, and on the volatility of its consumption stream (i.e. variance). Hence, to determine the ways in which certain household characteristics are associated with vulnerability, we need to estimate not only how the expected consumption level of a household varies with these characteristics, but also how these characteristics affect the variance (and possibly higher moments) of consumption.

Following Chaudhuri et al. (2002), Christiaensen and Subbarao (2001), and Pritchett et al. (2002), constructing the vulnerability level of a household entails three steps:

STEP 1

Assume that consumption is determined by the following stochastic process:

$$\mathrm{Ln}c_h = \beta \mathbf{X_h} + \mathrm{e_h} \qquad \textbf{[1.2]}$$

where, Lnc_h is log consumption expenditure (per adult equivalent) of household h; $\boldsymbol{X_h}$ is a vector of strictly exogenous household and community characteristics, including household demographic composition, characteristics of the head, non-income indicators of the household's socio-economic status, and community infrastructure; β is a vector of parameters to be estimated and e_h is a disturbance term with mean zero. The variance of the disturbance term (σ^2_{eh}) is determined by:

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group. For the sake of consistency and comparability with previous research on poverty in Uganda, this paper adopts this approach. For more details refer to Appleton (2001b).

$$\sigma^2_{eh} = \tau \mathbf{X_h} \qquad \textbf{[1.3]}$$

where τ is also a vector of parameters. Three-step feasible generalized least squares (Amemiya, 1977) are used to estimate values of β_{hat} and τ_{hat}. These parameters, together with $\boldsymbol{X_h}$ can be used to calculate expected log consumption and the variance of log consumption:

$$E[\ln c_h \mid \mathbf{X_h}] = \mathbf{X_h}\, \beta_{hat} \qquad \textbf{[1.4]}$$

and

$$Var[\ln c_h \mid \mathbf{X_h}] = \sigma^2_{eh\,hat} = \mathbf{X_h}\, \tau_{hat} \qquad \textbf{[1.5]}$$

STEP 2

Assume that consumption is log normally distributed,[4] and identify the poverty threshold, z^*, which in Uganda's case corresponds to the absolute poverty line. With this assumption, we can estimate equation **[1.1]**, the probability that a household with characteristics $\boldsymbol{X_h}$ will experience consumption shortfalls within a one year time period. This is equivalent to the definition of vulnerability:

$$v_{ht} = Pr(\ln c_{h,t+1} < \ln z^* \mid \mathbf{X_h}) = \Phi\, [(\ln z^* - \mathbf{X_h}\, \beta_{hat}) / \sqrt{\mathbf{X_h}\, \tau_{hat}}] \qquad \textbf{[1.6]}$$

[4] This corresponds to what is typically found in the data. In addition, log normal distributions are completely determined by two parameters: their mean and variance. Thus, it suffices to estimate the conditional mean and variance of a household's future consumption to obtain an estimate of its ex-ante distribution (Christiaensen and Subbarao, 2001).

STEP 3

Assume some threshold probability value above which a household is considered vulnerable.[5] The choice of a vulnerability threshold is ultimately quite arbitrary. A natural candidate, however, is the observed current poverty rate in the population. This is so on account of the fact that the observed poverty rate represents the mean vulnerability level in the population. Hence, anyone whose vulnerability level lies above this threshold faces a risk of poverty that is greater than the average risk in the population.

This method presents two important points of departure from most poverty assessments. First, it introduces considerations of risk and uncertainty in explaining the dynamics leading to and perpetuating poverty. Risk refers to uncertain events that can damage the wellbeing of people (e.g. the risk of a drought); risk exposure involves to the probability that a household will be affected by such risky events. For instance, a household living in a drought prone area whose primary source of income comes from non-farm activities will only be marginally exposed to the risk of a drought. The same goes for households who irrigate their crops. Farmers deriving their livelihood from rain fed agriculture, however, will be highly susceptible to such shocks. In addition to risk exposure, vulnerability reflects the lack of ex-post coping capacity with a shock. According to Christiaensen and Subbarao (2001), it concerns the ex-ante potential of a decline in wellbeing in the future, and is a function of the risk characterization of a household's immediate environment – the nature, frequency and severity of the shocks the household is exposed to, its exposure to these risks as well as its ability to cope with them when they materialise. This, in turn, is determined

[5] Reducing vulnerability to a 0-1 may be problematic, in just the same way as reducing poverty.

by the household's asset endowments and its ability to self-insure (formally or informally). For comparison purposes, poverty is usually treated in static, non-probabilistic terms (Ravallion, 1996). It generally refers to not having enough now, while vulnerability is about having a high probability now of suffering a shortfall in the future. While the poor are in practice often also vulnerable, both groups are typically not identical (Baulch and Hoddinott, 2000).

Second, in poverty assessments, the disturbance term is implicitly thought of as stemming from measurement error or some unobserved factor that is incidental to the main focus of the analysis. It follows that most poverty assessments, rather than specifying a separate equation such as **[1.3]** to allow the variance of e_h to be a function of household characteristics, take this variance to be the same for all households.

On this note, there are two problems associated with the assumption that the variance of the disturbance term (and of log consumption) is the same for all households. First, it is too restrictive in that it forces the estimates of the mean and variance of consumption to be monotonically related across households. This categorically rules out the possibility that a household with a lower mean consumption may nevertheless face greater consumption volatility than a household with a higher average level of consumption. Both formal and anecdotal evidence points to high levels of income and consumption volatility for poor households.

Second, in purely statistical terms, unlike in other settings where failure to account for heteroskedasticity results in a loss of efficiency but need not bias the estimates of the

main parameters of interest, here, the standard deviation of the disturbance term enters directly (see **[1.6]** above). A biased estimate of this parameter will therefore lead to a biased estimate of the probability that a household is poor. Recognizing this point, some poverty analyses do explicitly model the variance of the disturbance term (e.g. Elbers et al., 2001), but this step is seen as just a necessary heteroskedasticity correction with little economic relevance beyond that.

1.3 THE DATA

The data come from the two wave panel (covering 1,309 households) formed by the Integrated Household Survey (IHS) 1992/93 and the Uganda National Household Survey (UNHS-I) 1999/00. The IHS and the UNHS-I both aim at collecting data on all socio-economic aspects of the household comprising household characteristics. Both are spread over a period of 12 months adopting IPNS design (Interpenetrating Network of Sub-samples), and draw on a large sample of approximately 10,000 households. The wide coverage of different sites is a particular strength of the data. In turn, the IHS 1992/93 and the UNHS-I 1999/00 cover 1,018 and 1,400 communities.

Notably, the panel sample was designed to cover 1,398 households as a sub-sample of the 9,924 and 10,687 households that were surveyed in 1992/93 and 1999/00, respectively. Failure to re-interview 89 out of the originally sampled households indicates an attrition level of 6.4%.

In the likely case that the pattern of attrition is non-random, inclusion of a panel component in a multi-purpose household survey will not necessarily yield a nationally representative sample even if the original survey was designed to be representative (Demery and Grootaert, 1993). As this danger increases with the time elapsed between the two survey periods, it could be of particular relevance to this Ugandan panel.

In a recent publication on growth and poverty reduction in Uganda, Deininger and Okidi (2003) run a probit regression where the probability of being included in the panel is a function of household characteristics. Their results suggest that the

probability of attrition is systematically correlated with geographical and a number of other household characteristics, viz. household size, education, and assets. Notably, however, the authors conclude that, even though descriptive data derived from the panel will not be representative of the population as a whole, use of the panel element to identify behavioural relationships is unlikely to impose unreasonable bias.[6]

Similarly, in a paper on poverty dynamics in Uganda, Okidi and McKay (2003) investigate the seriousness of the representativeness issue by comparing within each year the consumption expenditures for the panel households with those that were excluded from the panel. The authors report that the mean differences are not statistically different from zero at the standard levels of significance, and conclude that sample statistics based on expenditure data from the panel and non-panel observations do not significantly differ.

1.3.1 A DESCRIPTIVE ANALYSIS

Table 1.1 juxtaposes consumption expenditure per adult equivalent and overall poverty in 1992/93 and 1999/00 for the two wave panel described above. Generally, the 1990s were characterised by significant increases in consumption expenditure per adult equivalent and sharp reductions in poverty. This conclusion holds true for most of the country, with the exception of the northern region. While consumption expenditure per adult equivalent increased by 62%, 54%, and 45% in the central, eastern, and western regions, respectively, during the same period it merely recorded an increase by 6 percentage points in the northern region. This trend is clearly reflected in the northern region's poor performance in poverty reduction, which

[6] For an extension of this discussion on other household surveys, see Alderman et al. (2001).

remains below the national average. While nationwide poverty declined from 50% to 30% between 1992/93 and 1999/00, during the same period it fell from 62% to 58% in the northern region. Such disparities are even more pronounced within the northern region, between rural and urban areas. On the one hand, northern urban Uganda experienced a 27% increase in consumption expenditure per adult equivalent together with a 22% reduction in poverty between 1992/93 and 1999/00; on the other hand, northern rural Uganda suffered a 1% decline in consumption expenditure per adult equivalent, resulting in a 1% increase in poverty.

In order to get a better understanding of the dynamics of poverty during the period under examination, table 1.2 illustrates poverty transitions at the national level, and by location, economic activity of the household, dependency ratio, and sex of the household head. According to the data, the majority of households who were poor in 1992/93 moved out of poverty by 1999/00 (61%), and the majority of those who were not poor in the first period remained so by the end of the decade (79%). This conclusion holds true even at the regional level, with the exception of the northern region. In northern Uganda, 35% of households who were poor in 1992/93 moved out of poverty by 1999/00, and barely half of those who were not poor in the first period retained their economic status by the end of the decade. This feature of northern Uganda is more pronounced in rural areas.

In addition, non-agricultural households, who are on average less likely to be poor than their agricultural counterparts (representing the majority of households), found it relatively easier to move out of poverty between 1992/93 and 1999/00. Similarly, households with a low dependency ratio, and female headed ones found it

considerably easier than their respective counterparts to improve their economic status. More specifically, 72% (58%) of households with a low (high) dependency ratio steered away from poverty during the past decade, and 69% (59%) of female (male) headed households who were poor in 1992/93 became non-poor by 1999/00.

On a related note, table 1.3 suggests that whereas in 1992/93 the welfare level of the richest 20% was approximately five times that of the poorest 20%, by 1999/00 such a disparity had risen to a scale factor of six both at the national and regional levels.

Table 1.3 also uses relative means of consumption expenditure per adult equivalent to show that, while urban welfare increased from a scale factor of 1.35 of the national average in 1992/93 to 1.66 in 1999/00, rural welfare dropped over time from 94% of the national average in 1992/93 to 89% in 1999/00.

Regionally, the central region, with the highest rate of urbanization, registered the highest increase in welfare from a scale factor of 1.10 of the national average in 1992/93 to 1.20 in 1999/00. In contrast, the northern region experienced the highest decline in welfare from 84% of the national average in 1992/93 to 60% in 1999/00. The corresponding figures for the eastern and western regions do not present the same degree of fluctuation in relative mean welfare. The eastern region registered a mild increase from 94% of the national average in 1992/93 to 98% in 1999/00, while the western region experienced a minimal fall from a scale factor of 1.03 in 1992/93 to 1.02 in 1999/00.

Notably, according to Dercon and Krishnan (2000), although it is rarely addressed in any study of poverty in developing countries, the hypothesis that much of the poverty fluctuations observed in the data may be linked to measurement error cannot be easily dismissed a priori. Measurement error is particularly worrying for measuring mobility or transient poverty. If consumption or income is measured with independently distributed errors, then poverty status changes will be overestimated (Atkinson et al., 1988; Ashenfelter et al., 1986). To address this issue convincingly, one would need to collect alternative data to check the validity of the variables measured (e.g. Bound and Krueger, 1991). Table 1.2 shows that observed mobility accounts for 61% of the poor and 21% of the non-poor. To show that at least some of the movement in consumption is genuine, we constructed a mobility matrix by quintiles and calculated the percentage of households that remain in the same quintiles across the two periods using predicted rather than actual consumption. The model predicts that approximately 50% of households move to another quintile. On the bases that over 40% of the total population experienced some kind of mobility, it is possible to conclude that the model explains most observed mobility.

1.4 ESTIMATION AND RESULTS

Following Chaudhuri (2002), the basic idea underlying the empirical strategy developed in section 1.2.1 is that to determine the ways in which certain household characteristics are associated with vulnerability, we need to estimate not only how the expected consumption level of a household varies with these characteristics (which is the main focus of most poverty assessments), but also how these characteristics affect the variance (and possibly higher moments) of consumption.

Clearly, the extent to which this can be done depends on the type of data available. As it was mentioned at the outset, our data come from a two wave panel covering 1,309 households. Panel data permit the estimation of vulnerability within a more general framework, allowing for the inclusion of time-invariant household-level and dynamic effects. In addition, panel data enable to explore the evolution of vulnerability over time.

Table 1.4 contains the empirical definitions and summary statistics of the variables used in this analysis of household vulnerability to poverty. All chosen household characteristics are fixed, or non-manipulable. In other words, these variables are exogenous, at least in the short-run, and for clarity of exposition have been grouped in the following three categories:

i. Household demographic composition

Household size is an important determinant of vulnerability on the basis that the Uganda Participatory Poverty Assessment Projects (UPPAP, 2000, 2002) documents large families stretching scarce household resources. UPPAP (2000, 2002) also points

to the vulnerable status of women and elderly men. As such, the age of the household head, the proportion of female members of the household, and the gender of the household head have been singled out in the empirical specification of the model. Finally, the dependency ratio features in view of the fact that the higher the number of dependants, the fewer resources per person.

ii. Non-income indicators of the household's socio-economic status

Education unequivocally accounts for one of the main factors determining a household's well-being status (UPPAP, 2000, 2002). Notably, our specification differentiates between adult male and female mean years of education to account for stark gender divides in educational attainment. An additional non-income indicator of the household's socio-economic status is provided by the household's main economic activity. To this effect, a dummy variable was created to reflect whether a household derives its main source of income from agriculture.

iii. Community characteristics

A key lesson from the empirical literature is the significance of infrastructure variables on household growth opportunities (Deininger and Okidi, 2003). To assess the importance of such community characteristics, it is possible to include a number of variables capturing the distance a household needs to travel to access public roads, transport facilities, credit institutions, and local markets.

Moving on to the empirical estimation, step one involves the estimation of a household consumption model (i.e. **Eq. [1.2]**), and the variance of its disturbance term (i.e. **Eq. [1.3]**). The choice of estimation technique is a direct function of data

availability. An interesting option involves estimating vulnerability from the first wave of the panel and use it as a prediction of poverty in the second survey. This approach, however, is constrained by the lack of specific data on different types of shocks experienced by each household in 1992/93 and 1999/00. Alternatively, we opt for a pooled GLS estimation. The implicit advantage of this technique stems form the fact that our resulting estimates originate from a two wave panel of approximately 1,300 households with the advantage that changes in outcome levels include actual information about shocks experienced by households (Dercon, 2001).

The choice of a pooled GLS is further supported by the evidence generated in Annex I. The latter juxtaposes two simple OLS models of consumption for 1992/93 and 1999/00, respectively, in an attempt to establish the extent to which the determinants of household consumption varied between these two periods. The models explain approximately 25-30% of the variation in consumption, as measured by the R^2s. Most importantly, however, the general correspondence in the estimated coefficients of these models confirms the hypothesis of existing similarities in the underlying structural features of the economy between 1992 and 1999, at least in so far as the determinants of household consumption are concerned.

Relying on Appleton et al.'s (1999) formulation of Uganda's regional poverty lines,[7] **Eq.s [1.2]** and **[1.3]** are estimated separately for each of the eight administrative regions of Uganda (i.e. central rural, central urban, eastern rural, eastern urban, northern rural, northern urban, western rural, and western urban). The main advantage

[7] National and regional poverty lines as derived by Appleton et al. (1999) correspond to Uganda's official poverty lines. Appleton et al.'s (1999) poverty analysis is anchored to the cost of meeting basic needs with a focus on caloric requirements. As such, it is derived on the basis of caloric requirements adjusted for age, sex, and daily activities as laid out by WHO (1985).

of doing so is that it allows for some heterogeneity in the structural parameters underlying the consumption process of households in different areas of the country.[8] The results are presented in Tables 1.5a and 1.5b, respectively.

This analysis points to a number of differences and similarities across all regional specifications of the model. Interpreting our estimated coefficients, however, remains tangential to this section's underlying objective of computing Uganda's first quantitative vulnerability profile. Moreover, an exhaustive discussion of the determinants of consumption poverty is provided in Angemi (2011).

In step 2, **Eq. [1.6]** yields the probability that, in both 1992/93 and 1999/00, a household with the characteristics specified in **Eq. [1.2]** will be poor within a one year time period. Figures 1.1 and 1.2 illustrate the distribution of estimated vulnerability for the population as a whole for 1992/93 and 1999/00. By comparison, the distribution of the latter period is visibly more left-skewed than the former one. This evidence indicates that, between 1992/93 and 1999/00, the proportion of Ugandans with zero probability of becoming poor in the next period increased from 5-6% to approximately 26% of the population.[9]

[8] In a discussion of the issue of national vs. regional poverty lines, Appleton (2003) finds the level of poverty in Uganda as a whole to be fairly robust to the choice of poverty line and sensitivity in the spatial pattern of poverty, even after using regional poverty lines adjusted for income differentials between regions. The author concludes that preference for national or regional poverty lines depends on how one conceives welfare. By adopting the regional formulations of the poverty line, this section remains consistent with our estimation of vulnerability, which by doing so allows greater flexibility in the estimation of the cross-partials of the functions capturing the effects of various household characteristics on the mean and variance of consumption expenditure (Chaudhuri, 2002).

[9] Juxtaposing the distribution of consumption expenditure per adult equivalent between 1992/93 and 1999/00 reveals stark similarities. This evidence suggests that figures 1.1 and 1.2 differ so much as a direct result of growth and poverty reduction.

In addition, figures 1.3 and 1.4 depict the estimated aggregate distribution of vulnerability for the population as a whole, and by poverty status in 1992/93 and 1999/00, respectively. In doing so, they plot the incidence of vulnerability at vulnerability thresholds ranging from 0 to 1 – measured along the horizontal axis. By construction, as the threshold increases, the incidence of vulnerability (i.e. the fraction of the population that has an estimated probability of being poor higher than the threshold) declines. At a threshold of zero everyone is vulnerable, while at a threshold of one no one is vulnerable. It follows that for any given threshold, the incidence of vulnerability is higher for the poor than for the population as a whole, which in turn is higher than the incidence of vulnerability amongst the non-poor. Moreover, figures 1.3 and 1.4 suggest that for a wide range of thresholds, poverty and vulnerability are significantly different from each other. To provide a clearer illustration of this diagrammatic representation, in 1999/00 at a threshold of 0.40 nearly 50% of the poor were also vulnerable. At the same threshold, merely 20% of the total population and approximately 10% of the non-poor were vulnerable in the sense that they faced the risk of falling into poverty within a one year period.

Finally, step three is a simple matter of computation, whereby a household is classified as vulnerable if the probability to be poor in the next period is greater than the incidence of poverty in the population observed in table 1.1.[10] Table 1.6a shows

[10]According to Chaudhuri (2002), the presence of measurement error associated with most consumption (and income) measures drawn from household surveys can lead to significant overestimates of the variance of consumption. An advantage of the methodology outlined above is that it yields a consistent estimate of the true variance of consumption even when consumption is measured with error. This is because the measurement error in consumption shows up in the error term of **Eq. [1.3]**. Unless the measurement error systematically varies with household characteristics, the estimate of consumption variance, **Eq. [1.5]**, will not be contaminated by the measurement error.

One might worry that in developing economies measurement error might in fact be correlated with some observable characteristic of the household. For instance, it is much more difficult to accurately measure the consumptions of rural households because a large part of their consumption is derived

that much in the same way that the 1990s were characterised by sharp reductions in poverty, they also embraced a 56% decline in the population with an estimated probability of experiencing poverty within a one year period greater than the average risk of poverty (i.e. the observed incidence of poverty). Between 1992/93 and 1999/00, Uganda witnessed a significant fall in vulnerability to poverty from 57% to 25%.

Table 1.6a also reveals that: (i) vulnerability declined from 61% to 27%, and from 33% to 17%, between 1992/93 and 1999/00, in rural and urban areas, respectively; and (ii) at the regional level, while vulnerability was successfully reduced in the central, eastern, and western regions, it increased in the northern region. Moreover, within the northern region, while urban areas experienced a 12% reduction in vulnerability between 1992/93 and 1999/00, rural areas suffered a 9% increase.

Among the vulnerable, table 1.6b distinguishes between the relatively vulnerable (i.e. those who have an estimated vulnerability level greater than the observed incidence of poverty but less than 0.5) and the highly vulnerable (i.e. those with an estimated vulnerability level greater than 0.5). The period between 1992/93 and 1999/00 marked a sharp fall in the fraction of Ugandan households highly vulnerable to poverty. By 1999/00 the relatively vulnerable constituted approximately one third of the vulnerable and 9% of the overall population, while the highly vulnerable made up 16% of the overall population.

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from their own agricultural production and hence does not appear in any records of market expenditures. It is possible, therefore, that the measurement error in consumption would be correlated with an indicator for whether a household resides in rural or urban areas. This possibility can be adequately dealt with by carrying out the estimation separately for rural and urban households, or for more disaggregated groups. These types of concerns about systematic measurement error provide further support for our choice to estimate **Eq.s [1.2]** and **[1.3]** separately for each administrative region.

1.4.1 CROSS-VALIDATION EXERCISE

The aim of this section is to assess the reliability, and evaluate the predictive power of our vulnerability estimates. The first step involves exploring the relationship between our vulnerability index derived by modelling household consumption vis-à-vis the intuitive alternative of estimating **Eq. [1.6]** directly from a discrete dependent variable model by means of a probit (i.e. poverty function). Figure 1.5 plots our estimated index of vulnerability (i.e. Vconsumption) against the one derived from the direct estimation of **Eq. [1.6]** by means of a poverty function (i.e. Vprobit) in 1992. This simple exercise provides an informal check for consistency between both measures of vulnerability. Clearly, both sets of vulnerability estimates are positively related.

More rigorously, using Ordinary Least Squares (OLS), **Eq. [1.7]** tests for statistical equality between the two estimates of vulnerability presented above. The null hypothesis of statistical equality implies that $\alpha = 0$ and $\beta = 1$. The results from table 1.7 clearly reject the null hypothesis of statistical equality between these two (positively and significantly related) estimates of vulnerability [$F_{(2, 1307)} = 529.54$***].

$$V_{probit} = \alpha + \beta V_{consumption} + \varepsilon_v \qquad \textbf{[1.7]}$$

Notwithstanding the consistency between both indices of vulnerability, their statistical inequality points to the choice of one index over the other. According to Appleton (2002), poverty functions are open to the criticism that it would be better to model household consumption per se since this is the behavioural variable underlying the definition of poverty. Moreover, poverty functions disregard information about the

distribution of household consumption. On the bases of the ease of specification of our consumption function, the remainder of this discussion will focus on the vulnerability index estimated by means of modelling household consumption.

In an additional attempt to validate the predictive power of our estimates of vulnerability, table 1.8 reports mean vulnerability levels for four groups of households classified by the poverty status in both 1992/93 and 1999/00. Notably, the mean vulnerability estimate for the group that is non-poor in both periods is considerably lower than the mean for the group that ends up poor in 1999/00, despite being non-poor in 1992/93. Similarly, the mean vulnerability for those who are poor in both 1992/93 and 1999/00 is substantially higher than the mean for those among the poor in 1992/93 who exit poverty between 1992/93 and 1999/00. Therefore, the results show that our vulnerability estimates succeed in identifying those among the non-poor who are less vulnerable and hence likely to remain non-poor, and those among the poor who are more vulnerable and hence likely to remain poor.

Lastly, and for the sole purpose of validating further the predictive power of our estimates, **Eq. [1.6]** can be used to formulate vulnerability with a three year time horizon. In this framework, **Eq. [1.8]** re-defines the level of vulnerability at time *t* in terms of the household's consumption prospects at time *t+3*. In other words, it describes the probability that a household will experience poverty at least once within a three year period.

$$v_{ht}=1 - [1 - \Pr(\ln c_{h,t+1} < \ln z^* \mid \mathbf{X_h})]^3 = 1- \prod^3_{t=1} [1 - \Pr(\ln c_{h,t+1} < \ln z^* \mid \mathbf{X_h})] \quad \textbf{[1.8]}$$

This algebraic manipulation allows us to use the 1999/00 component of the data to predict household poverty in 2002/03. The choice of 2002/03 as a reference year is due to the availability of a nationally representative household survey documenting poverty levels both at national and regional level.

Figure 1.6 juxtaposes 2002/03 predicted poverty rates (i.e. mean estimated vulnerability levels from 1999/00) and 2002/03 actual poverty rates by region derived from the Uganda National Household Survey (UNHS-III) 2002/03. Our predicted poverty rates replicate Uganda's actual poverty diagnostics in so far as recognising that the burden of poverty remains higher in rural areas. Our estimates are also in line with the actual regional poverty rates. Finally, they reproduce the ordinal properties of the true distribution of poverty across geographic regions.

Part explanation for the fact that our predicted values are consistently higher than actual poverty rates is due to the fact that our estimates cannot account for the potential impact of beneficial policy reforms. To Uganda's merit, between 2000 and 2003 government has gradually taken important measures to increase the quantity, and enhance the quality of service delivery. This was especially so in the health sector with the successful abolition of user fees.

1.4.2 SOURCES OF VULNERABILITY

Having generated our vulnerability estimates, and cross-checked their reliability, it is possible to look further into some of the sources of household vulnerability. Households with similar levels of vulnerability may be vulnerable for very different reasons. For some, vulnerability may stem primarily from low long-term consumption

prospects. For others, consumption volatility may be the main source of vulnerability to poverty. From a policy perspective it will be important to distinguish between these two possibilities. For instance, vulnerability due to high volatility may call for ex-ante interventions that reduce the risks faced by households or insure them against such risks. On the other hand, to address vulnerability due to low endowments transfer programmes may yield more effective results (Chaudhuri et. al, 2002).

Clearly, the two possibilities presented above represent stylised extremes which can be potentially intertwined. For instance, it may be that with inadequate risk management instruments at their disposal, households forego risky but, on average, high return investments in favour of safer but lower earning opportunities. In this case, while household vulnerability may appear to be due to low endowments, the true source of vulnerability may lie in the household's inability to cope with risk and uncertainty.

Figures 1.7 and 1.8 plot the mean and standard deviation of consumption for households with selected levels of vulnerability in 1992/93 and 1999/00, respectively. These combinations of mean consumption and standard deviation of consumption for the same levels of vulnerability generate a set of iso-vulnerability curves. When mean consumption is above the poverty line, increasing the variance increases the probability of poverty and the level of vulnerability. Starting from a given level of mean consumption, an increase in the variance of consumption has to be offset by an increase in mean consumption if the level of vulnerability is to remain unchanged. Hence, the upward slope of the iso-vulnerability curves to the right of the vertical line corresponding to the poverty line.

When mean consumption is below the poverty line, increasing the variance reduces the probability of poverty and the level of vulnerability. To illustrate, consider the extreme case where a household's consumption is fixed at some level below the poverty line with no volatility. Such a household is guaranteed to experience poverty in the next period. The introduction of some variability in consumption opens a small window of opportunity to escape from poverty, which (by definition) reduces household vulnerability. By implication, for a low enough initial level of mean consumption, an increase in variability has to be offset by a reduction in mean consumption to maintain the same level of vulnerability. It follows that when mean consumption is below the poverty line the iso-vulnerability curves are negatively sloped.

Consider the cluster of points associated with vulnerability level of 0.40 in 1999/00. This is slightly above the threshold level of vulnerability of 0.30 above which we categorized a household as vulnerable. All the households represented in this iso-vulnerability curve have estimated levels of vulnerability in the range 0.395-0.405. Yet the normalized mean consumption levels estimated for these households (i.e. the ratio of estimated mean consumption to the poverty line) range from 1.004 to 1.01. Therefore, within this group, some households are vulnerable because they have low levels of mean consumption whereas others are vulnerable because their consumptions are more volatile.

Figures 1.7 and 1.8 also illustrate that the mean and standard deviation of consumption need not be monotonically related across households. For instance,

amongst households with an estimated vulnerability level of 0.25 in both 1992/93 and 1999/00, the households with the highest estimated standard deviation of consumption have both a higher estimated standard deviation of consumption and a lower estimated mean level of consumption than several of the households with lower estimated levels of vulnerability.

This finding highlights the importance of keeping the estimation strategy adequately flexible for the mean and variance of consumption to be separately estimated. Moreover, it provides a clear point of departure between our analysis and most poverty assessments, where the possibility for a household with a lower mean level of consumption to face greater consumption volatility is generally not allowed.

1.4.3 POVERTY VIS-À-VIS VULNERABILITY

On the relationship between poverty and vulnerability, table 1.9 presents selected characteristics of the poorest and most vulnerable 25% of the population. Clearly, the characteristics of the vulnerable are consistent with the characteristics of the poor: large family size, high dependency ratios, location in communities with low provision of public services, and residence in poorer regions of the country.

While the foregoing discussion focuses on similarities between the poor and the vulnerable, a clear distinction between the notion of vulnerability and the concept of poverty exists. There may be some households whose ex-ante probability of poverty (i.e. vulnerability) may be high who are nevertheless observed to be non-poor; conversely, there may be some households who are observed to be poor, whose vulnerability level is, nevertheless, low enough for them to be classified as non-

vulnerable. Of the 50% and 70% of the population observed to be non-poor in 1992/93 and 1999/00, respectively, 41% and 15% were vulnerable to poverty. Amongst the poor, 26% and 51% were non-vulnerable to poverty in 1992/93 and 1999/00, respectively.

Poor, non-vulnerable households are likely to have temporarily fallen into poverty as a result of an unexpected shock. Their non-vulnerable status implies that they are in a position to bounce back out of poverty. Non-poor, vulnerable households (on the other hand) are at risk of falling into poverty, possibly as a result of a series of events unaccounted for in the estimation of our consumption model. These residual unobserved factors anticipating household poverty, when they are not observed to be, are the likely result of an omitted variable problem in the estimation of consumption.

On a related note, table 1.10 ranks Uganda's administrative regions distinguishing between poverty and vulnerability. Notably, when regions are ordered in terms of the incidence of vulnerability rather than the observed incidence of poverty, their rankings do not always coincide. To illustrate, whilst retaining its position as the fifth poorest region in the country, between 1992/93 and 1999/00 central rural Uganda emerges as the region least affected by vulnerability. In the spirit of distinguishing between regions in need of ex-ante poverty prevention interventions from others requiring ex-post poverty alleviation interventions, this finding provides sound justification for increasing the focus of poverty alleviation in the mix of policies directed at central rural areas.

Another important instrument to investigate the relationship between poverty and vulnerability, also included in table 1.10, is the ratio of the vulnerable to the poor population (i.e. *Vul/Poor*). This ratio provides a useful measure of how dispersed vulnerability is in the population. In general, for any given vulnerability threshold, a higher vulnerability to poverty ratio indicates a more dispersed (i.e. egalitarian) distribution of vulnerability, whereas a lower ratio suggests that vulnerability is concentrated among a few. To illustrate, table 1.10 points to widespread vulnerability in northern Uganda vis-à-vis a high degree of concentration of vulnerability among a few in the central region. Further, focusing on rural areas, while between 1992/93 and 1999/00 the *Vul/Poor* ratio increased from 1.25 to 1.38 in the northern region, it decreased in western, eastern, and most dramatically in central Uganda.

On this note, it seems important to touch upon one of Uganda's driving factors behind government's quest to improve the quality of life of the population: the Plan for Modernization of Agriculture (PMA). The PMA seeks to raise the incomes of the poor, primarily by increasing agricultural productivity and market share for subsistence farmers through interventions such as agricultural advisory services, rural finance, and agro-processing. The overall aim is to transform subsistence agriculture into commercial agriculture. Poor targeting, however, appears to have resulted in benefiting primarily economically active and progressive farmers with existing assets and good links to both agricultural extension agents and the local government officials responsible for delivering the programme, as it is more likely to be the case in central rural Uganda.

The combination of poverty and vulnerability diagnostics provides a wealth of information regarding the structure and features of the Ugandan population. Figures 1.9 and 1.10 plot poverty vis-à-vis vulnerability during the period under examination, and provide a diagrammatic illustration of the marginalization of the northern region alluded to in the previous discussion. Notably, in spite of consistent south-west movement registered for Uganda's western, eastern, and central regions, northern areas continue to be depicted in the figures' upper right hand quadrants.

Persistence of high poverty and vulnerability levels, coupled with increasing *Vul/Poor* ratios in northern Uganda bring into question the government's commitment to end cattle-raiding and rebel insurgency, together with the PMA's design and its ability to move poor and isolated Ugandan farmers out of poverty.

1.5 DISCUSSION AND CONCLUSION

This paper uses panel data to estimate household vulnerability by generating predicted probabilities of poverty for households with different sets of characteristics. In doing so, it defines vulnerability at the household level, within the framework of poverty eradication, as the possibility that a household, regardless of whether it is poor today, will be poor tomorrow (Chaudhuri et al., 2002).

Our results suggest that during the past decade, alongside sharp reductions in poverty, vulnerability to poverty in Uganda declined from 57% in 1992/93 to 25% in 1999/00. At regional level, vulnerability was successfully reduced in the central, eastern, and western regions, and it increased in the northern region.

Whilst encouraging on many accounts, these findings suggest that the benefits from Uganda's gradual and sustained economic growth were unequally distributed. As the central region experienced a dramatic reduction in the incidence of vulnerability, its northern counterpart suffered from severe stagnation. Focusing on rural areas, on the bases that over 90% of the chronic poor live in rural areas, and that the majority of them are employed in agricultural activities, the incidence of vulnerability in northern and central Uganda increased and decreased by 9 and 52 percentage points, respectively.

Section 1.4.2 highlights the importance of keeping the estimation strategy adequately flexible for the mean and variance of consumption to be separately estimated. In turn, this methodology marks our point of departure from most poverty assessments, which

tend to be constructed in such a way that forces the estimated variance of consumption to increase with higher estimated mean consumptions.

Section 1.4.3 shows that the characteristics of the vulnerable are consistent with the characteristics of the poor: large family size, high dependency ratios, location in communities with low provision of public services, and residence in poorer regions of the country.

The key message emerging from these findings is that while poverty and vulnerability are closely related, there remain important distinctions between the two and neither is a subset of the other. In other words, not all the poor are vulnerable, while a significant proportion of the non-poor are vulnerable. These observations may enable policy makers to distinguish between the effective implementation of poverty-prevention and poverty-reduction programmes. For the former group, interventions that reduce consumption volatility by reducing exposure to risk or by enhancing ex post coping capacity could be sufficient. However, for the latter, risk-reducing interventions alone may be inadequate, and must be accompanied by interventions to increase mean consumption (Chaudhuri and Christiaensen, 2002).

In conclusion, vulnerability is of growing concern for policy makers. The term is used to denote events that threaten or seriously damage one or more aspects of well-being (Tesliuc E. and Lindert K., 2002). In a shock-free environment, characteristics correlated with poverty provide the necessary information to implement a targeted intervention. In an environment characterised by frequent shocks, however, effective

intervention requires a deeper understanding of who is exposed to the risk of experiencing poverty within a clearly defined time period.

Our estimates of vulnerability proved successful in identifying those among the non-poor who are less vulnerable and hence likely to remain non-poor, and those among the poor who are more vulnerable and hence likely to remain poor. Further, the model's predictive power was confirmed by the finding that if in 1999/00 we chose to predict regional poverty levels for 2002/03, our results would have coincided with the actual ordering of poverty rates that was observed in 2002/03.

Table 1.1: Poverty trends and patterns

	1992/93			1999/00	
	N	Mean consumption expenditure per adult equivalent (Ugandan shillings)	Poverty (%)	Mean consumption expenditure per adult equivalent (Ugandan shillings)	Poverty (%)
Nation	1,309	6,959	50	10,277	30
Rural	1,115	6,539	52	9,096	32
Urban	194	9,377	39	17,065	18
Central	403	7,619	44	12,366	22
Eastern	302	6,507	54	10,021	28
Northern	201	5,849	62	6,176	58
Western	403	7,192	46	10,426	26
Central rural	329	7,094	50	10,874	24
Central urban	74	9,955	38	18,995	15
Eastern rural	263	6,209	57	8,528	29
Easter urban	39	8,515	33	20,087	18
Northern rural	164	5,543	63	5,500	64
Northern urban	37	7,203	54	9,174	32
Western rural	359	6,726	48	9,525	28
Western urban	44	10,996	32	17,778	9

Note: N is the number of observations in the relevant group.

Table 1.2: Poverty transition, 1992/93-1999/00

	Non poor 1992-93 / Non poor 1999-00	Non poor 1992-93 / Poor 1999-00	Total	Poor 1992-93 / Non-poor 1999-00	Poor 1992-93 / Poor 1999-00	Total
Nation	519 (78.64)	141 (21.36)	660 (100)	398 (61.33)	251 (38.67)	649 (100)
Rural	412 (76.16)	129 (23.84)	541 (100)	345 (60.10)	229 (39.90)	574 (100)
Urban	107 (89.92)	12 (10.08)	119 (100)	53 (70.67)	22 (29.33)	75 (100)
Central	194 (85.46)	33 (14.54)	227 (100)	120 (68.18)	56 (31.82)	176 (100)
Eastern	106 (76.26)	33 (23.74)	139 (100)	113 (69.33)	50 (30.67)	163 (100)
Northern	41 (53.25)	36 (46.75)	77 (100)	43 (34.68)	81 (65.32)	124 (100)
Western	178 (82.03)	39 (17.97)	217 (100)	122 (65.59)	64 (34.41)	186 (100)
Central rural	152 (83.98)	29 (16.02)	181 (100)	99 (66.89)	49 (33.11)	148 (100)
Central urban	42 (91.30)	4 (8.70)	46 (100)	21 (75)	7 (25)	28 (100)
Eastern rural	83 (73.45)	30 (26.55)	113 (100)	104 (69.33)	46 (30.67)	250 (100)
Easter urban	23 (88.46)	3 (11.54)	26 (100)	9 (69.23)	4 (30.77)	13 (100)
Northern rural	28 (46.67)	32 (53.33)	60 (100)	31 (29.81)	73 (70.19)	104 (100)
Northern urban	13 (76.47)	4 (23.53)	17 (100)	12 (60)	8 (40)	20 (100)
Western rural	149 (79.68)	38 (20.32)	187 (100)	111 (64.53)	61 (35.47)	172 (100)
Western urban	29 (96.67)	1 (3.33)	30 (100)	11 (78.57)	3 (21.43)	14 (100)
Agricultural household	338 (74.78)	114 (25.22)	452 (100)	310 (60.08)	206 (39.92)	516 (100)
Non-agricultural households	181 (87.02)	27 (12.98)	208 (100)	88 (66.17)	45 (33.83)	133 (100)
High dependency ratio	332 (77.93)	94 (22.07)	426 (100)	287 (58.10)	207 (41.90)	494 (100)
Low dependency ratio	187 (79.91)	47 (20.09)	234 (100)	111 (71.61)	44 (28.39)	155 (100)
Female headed household	122 (78.71)	33 (21.29)	155 (100)	106 (69.28)	47 (30.72)	153 (100)
Male headed household	397 (78.61)	108 (21.39)	505 (100)	292 (58.87)	204 (41.13)	496 (100)

Note: Figures are absolute numbers, and percentages are presented in parentheses.

Table 1.3: Quintile decomposition of consumption expenditure per adult equivalent

	Welfare quintiles					
	Poorest 20%	Lower middle	Middle	Upper middle	Richest	Total
1992/93						
Nation	2,604	4,365	5,940	7,961	13,369	6,959 (1)
Rural	2,609	4,354	5,932	7,897	12,707	6,539 (0.94)
Urban	2,546	4,438	5,996	8,367	15,174	9,377 (1.35)
Central	2,699	4,334	5,924	7,958	13,573	7,619 (1.10)
Eastern	2,591	4,327	5,998	7,956	12,697	6,507 (0.94)
Northern	2,516	4,406	5,852	8,008	12,271	5,849 (0.84)
Western	2,622	4,403	5,945	7,949	13,997	7,192 (1.03)
Central rural	2,712	4,307	5,938	7,894	12,831	7,094 (1.02)
Central urban	2,547	4,479	5,839	8,311	15,197	9,955 (1.43)
Eastern rural	2,624	4,331	5,957	7,913	12,734	6,209 (0.89)
Easter urban	2,233	4,241	6,260	8,328	12,601	8,515 (1.22)
Northern rural	2,500	4,425	5,822	7,876	11,709	5,543 (0.80)
Northern urban	2,637	4,335	5,997	8,557	13,708	7,203 (1.04)
Western rural	2,610	4,381	5,944	7,899	12,893	6,726 (0.97)
Western urban	2,856	4,601	5,959	8,349	18,293	10,996 (1.58)

Table 1.3 (continued): Quintile decomposition of consumption expenditure per adult equivalent

	Welfare quintiles					
	Poorest 20%	Lower middle	Middle	Upper middle	Richest	Total
1999/00						
Nation	3,476	5,533	7,596	10,256	21,680	10,277 (1)
Rural	3,473	5,536	7,583	10,252	18,640	9,096 (0.89)
Urban	3,514	5,500	7,723	10,270	29,711	17,065 (1.66)
Central	3,652	5,547	7,698	10,249	23,341	12,366 (1.20)
Eastern	3,767	5,597	7,593	10,263	21,764	10,021 (0.98)
Northern	3,213	5,492	7,506	9,746	17,705	6,176 (0.60)
Western	3,577	5,496	7,552	10,402	20,158	10,426 (1.02)
Central rural	3,643	5,537	7,671	10,223	20,403	10,874 (1.06)
Central urban	3,790	5,612	8,166	10,344	30,475	18,995 (1.85)
Eastern rural	3,774	5,638	7,600	10,294	16,211	8,528 (0.83)
Easter urban	3,644	5,120	7,514	10,054	34,721	20,087 (1.96)
Northern rural	3,199	5,465	7,406	9,664	16,489	5,500 (0.54)
Northern urban	3,370	5,678	7,824	9,899	18,574	9,174 (0.89)
Western rural	3,575	5,496	7,561	10,385	18,187	9,525 (0.93)
Western urban	3,614	5,498	7,421	10,495	27,856	17,778 (1.73)

Table 1.4: Variables definition and summary statistics

	1992/93		1999/00	
	Mean	S.D.	Mean	S.D.
Dependent variable				
Consumption expenditure per adult equivalent (Uganda shillings)	6,959.18	4,490.66	10,277.15	13,148.88
Household demographic composition				
Average household size	5.35	3.08	5.77	3.21
Dependency ratio	1.35	1.15	1.51	1.13
Proportion of female adult members of the household	0.29	0.19	0.29	0.21
Age of the household head	43.07	15.51	49.87	15.44
DV=1 if female household head	0.24	0.42	0.28	0.45
DV=1 if widow household head	0.11	0.31	0.20	0.40
Non-income indicators of the household's socio-economic status				
Female adult mean years of education	3.18	3.21	4.10	11.67
Male adult mean years of education	5.09	3.96	6.32	15.43
DV=1 if agricultural household	0.74	0.44	0.80	0.40
Community characteristics				
Average distance to tarred road (Km)	27.52	32.95	26.21	32.25
Average distance to bus or taxi stop (Km)	11.30	16.27	10.46	15.26
Average distance to bank (Km)	23.36	21.81	25.76	22.66
DV = 1 if produce market available in the village	0.06	0.23	0.06	0.23

Table 1.5a: GLS estimation of consumption [Dependent variable: Ln(Consumption expenditure per adult equivalent)]

	Central rural	Central urban	Eastern rural	Eastern urban	Northern rural	Northern urban	Western rural	Western urban
Household demographic composition								
Average household size	**-0.061*** ** **(-2.63)**	**-0.154*** ** **(-3.77)**	**-0.120*** ** **(-6.26)**	**-0.248** ** **(-2.27)**	**-0.235*** ** **(-4.69)**	**-0.258*** ** **(-3.20)**	**-0.159*** ** **(-4.42)**	-0.109 (-1.48)
(Average household size)^2	**0.003*** **(2.20)**	**0.007*** ** **(3.91)**	**0.004*** ** **(4.96)**	**0.015** ** **(2.08)**	**0.012*** ** **(3.95)**	**0.010** ** **(2.55)**	**0.007*** ** **(3.03)**	0.002 (0.67)
Dependency ratio	0.008 (0.34)	**0.125** ** **(2.28)**	-0.012 (-0.39)	-0.108 (-1.19)	-0.015 (-0.31)	0.066 (0.77)	**0.050*** **(1.88)**	0.049 (0.51)
DV=1 if no adult member of the household	-0.007 (-0.05)	0.395 (1.62)	-0.067 (-0.59)	0.695 (1.49)	-0.192 (-1.02)	-0.503 (-1.16)	0.229 (1.60)	-0.141 (-0.29)
DV=1 if female household head	0.019 (0.29)	**-0.259*** **(-1.86)**	**-0.152*** **(-1.88)**	**0.394*** **(1.85)**	-0.126 (-1.37)	-0.072 (-0.27)	**-0.119*** **(-1.65)**	0.028 (0.12)
Proportion of female adult members of the household	**0.424** ** **(2.26)**	0.417 (1.20)	0.093 (0.46)	-0.879 (-1.45)	0.140 (0.44)	0.339 (0.54)	**0.353*** **(1.81)**	0.139 (0.23)
Age of the household head	0.005 (0.69)	0.005 (0.28)	-0.006 (-0.80)	0.072 (1.56)	0.017 (1.10)	0.054 (1.31)	-0.004 (-0.51)	-0.016 (-0.55)
(Age of the household head)^2	-0.00008 (-1.01)	-0.00004 (-0.24)	0.00002 (0.32)	-0.001 (-1.28)	-0.0002 (-1.40)	-0.0003 (-0.67)	0.00002 (0.19)	0.0002 (0.75)
Non-income indicators of the household's socio-economic status								
Female adult mean years of education	**0.004*** **(1.76)**	0.003 (1.38)	0.005* (1.78)	**0.075*** ** **(2.56)**	**0.032** ** **(2.27)**	**0.050*** **(1.91)**	**0.007*** **(1.76)**	0.014 (0.64)

Table 1.5a (continued): GLS estimation of consumption [Dependent variable: Ln(Consumption expenditure per adult equivalent)]								
DV=1 if missing obs. for female adult mean years of education	**0.431*** **	0.121	-0.018	0.032	0.259	-0.170	0.086	-0.190
	(3.82)	(0.45)	(-0.13)	(0.07)	(0.96)	(-0.41)	(0.61)	(-0.43)
Male adult mean years of education	0.002	0.003	**0.004** **	0.028	0.003	0.022	0.002	**0.113*** **
	(0.97)	(1.27)	**(2.00)**	(1.37)	(1.17)	(1.00)	(0.72)	**(5.14)**
DV=1 if missing obs. for male adult mean years of education	-0.046	0.213	0.128	0.216	0.043	-0.261	-0.085	**0.860*** **
	(-0.51)	(1.34)	(1.12)	(0.66)	(0.29)	(-0.72)	(-0.81)	**(2.73)**
DV=1 if agricultural household††	**-0.144** **	**-0.425*** **	**-0.211*** **	-0.255	-0.107	**-0.531*** **	**-0.153*** **	-0.102
	(2.50)	**(3.93)**	**(-3.53)**	(-1.40)	(-1.07)	**(-2.58)**	**(-2.65)**	(-0.73)
Community characteristics								
Average distance to tarred road	0.001	0.005	0.002	**-0.028** **	**-0.003*** **	0.005	-0.0004	0.002
	(0.85)	(1.28)	(1.05)	**(-2.35)**	**(-2.66)**	(1.50)	(-0.54)	(0.79)
DV=1 if missing obs. for distance to tarred road	0.305	**1.353*** **	0.061	0.070	**-0.174** *	0.352	0.170	0.524
	(1.30)	**(3.76)**	(0.50)	(0.14)	**(-1.65)**	(1.42)	(0.79)	(1.56)
Average distance to bus or taxi stop	**-0.003** *	**0.011** **	-0.002	-0.084	-0.002	-0.015	**-0.006** **	-0.002
	(-1.67)	**(2.21)**	(-1.49)	(-0.79)	(-0.80)	(-1.23)	**(-2.20)**	(-0.24)
DV=1 if missing obs. for distance to bus/taxi stop	-0.152	**-2.465*** **	-0.175		0.152	-0.233	0.438	
	(-0.65)	**(-3.86)**	(-0.60)		(1.02)	(-0.68)	(1.06)	
Average distance to bank	-0.001	-0.003	**-0.005*** **	0.013	0.001	0.002	**0.003*** **	0.003
	(-1.16)	(-1.08)	**(-2.85)**	(1.33)	(0.36)	(0.29)	**(2.65)**	(0.30)
DV=1 if missing obs. for distance to bank	**0.393** **	**1.227*** **	0.093	-0.163	0.180		**-0.300** **	-0.535
	(2.35)	**(2.85)**	(0.73)	(-0.43)	(1.26)		**(-2.42)**	(-1.19)

Table 1.5a (continued): GLS estimation of consumption [Dependent variable: Ln(Consumption expenditure per adult equivalent)]								
DV = 1 if produce market available in the village	0.020 (0.17)	**-0.533*** **(-1.84)**	-0.057 (-0.62)	-0.304 (-0.87)	-0.145 (-0.51)	0.047 (0.13)	-0.049 (-0.53)	-0.351 (-0.40)
DV=1 if missing obs. for produce market available in the village	**-0.924**** **(-2.32)**		-0.242 (-0.90)		-0.355 (-1.31)		-0.392 (-0.80)	
DV = 1 if year 1992/93ᵀᵀ	**-0.407***** **(-11.47)**	**-0.503***** **(-6.32)**	**-0.429***** **(-10.24)**	**-0.331***** **(-2.63)**	**-0.115**** **(-1.96)**	-0.231 (-1.53)	**-0.402***** **(-10.52)**	**-0.432***** **(-3.70)**
Constant	**9.272***** **(41.33)**	**9.740***** **(21.83)**	**9.938***** **(43.47)**	**7.963***** **(6.64)**	**9.275***** **(23.74)**	**7.804***** **(8.38)**	**9.748***** **(42.43)**	**9.217***** **(10.15)**
R^2	0.2353	0.5526	0.2977	0.6081	0.2706	0.5350	0.2292	0.5912
Total number of groups	329	74	263	39	164	37	359	44
Total number of observations	658	148	526	78	328	74	718	88

ᵀᵀ Omitted category: Non-agricultural household, Year 1999/00.

Note: * denotes statistical significance at 10%, ** significant at 5%, *** significant at 1%.

Table 1.5b: GLS estimation of the variance of the disturbance term [Dependent variable: Ln(σ^2_{eh})]

	Central rural	Central urban	Eastern rural	Eastern urban	Northern rural	Northern urban	Western rural	Western urban
Household demographic composition								
Average household size	0.165 (1.39)	-0.015 (-0.08)	-0.001 (-0.01)	0.303 (0.59)	0.099 (0.48)	0.457 (1.14)	0.045 (0.28)	0.410 (1.28)
(Average household size)^2	-0.005 (-0.78)	-0.003 (-0.34)	0.002 (0.47)	-0.014 (-0.40)	-0.006 (-0.43)	-0.022 (-1.23)	0.005 (0.46)	**-0.027*** **(-1.76)**
Dependency ratio	-0.076 (-0.65)	0.062 (0.24)	0.082 (0.66)	-0.113 (-0.25)	0.014 (0.07)	-0.036 (-0.09)	-0.096 (-0.80)	0.517 (1.29)
DV=1 if no adult member of the household	0.167 (0.28)	-1.107 (-1.01)	0.349 (0.74)	**4.210*** **1.81**	-0.510 (-0.65)	**-3.735*** **(-1.83)**	0.381 (0.60)	2.074 (0.98)
DV=1 if female household head	-0.262 (-0.80)	0.073 (0.12)	-0.164 (-0.49)	0.557 (0.54)	**0.985***** **(2.65)**	-0.448 (-0.31)	0.277 (0.89)	-0.223 (-0.24)
Proportion of female adult members of the household	0.969 (1.00)	-0.065 (-0.04)	0.392 (0.47)	0.672 (0.23)	0.875 (0.67)	3.133 (1.02)	0.457 (0.52)	**4.463*** **(1.75)**
Age of the household head	-0.033 (-0.84)	0.092 (1.21)	-0.039 (-1.23)	0.182 (0.82)	-0.054 (-0.87)	-0.296 (-1.40)	-0.018 (-0.52)	-0.039 (-0.31)
(Age of the household head)^2	0.0003 (0.73)	-0.001 (-1.27)	0.0003 (0.96)	-0.002 (-0.90)	0.001 (1.04)	0.003 (1.37)	0.0002 (0.63)	0.0002 (0.14)
Non-income indicators of the household's socio-economic status								
Female adult mean years of education	0.014 (1.23)	-0.005 (-0.48)	-0.002 (-0.22)	0.007 (0.06)	-0.033 (-0.59)	0.008 (0.06)	0.026 (1.44)	**-0.183**** **(-2.02)**

Table 1.5b (continued): GLS estimation of the variance of the disturbance term [Dependent variable: $Ln(\sigma^2_{eh})$]								
DV=1 if missing obs. for female adult mean years of education	**1.192**** **(2.03)**	1.073 (0.88)	0.826 (1.41)	-0.099 (-0.05)	1.224 (1.11)	1.829 (0.86)	0.254 (0.41)	0.667 (0.36)
Male adult mean years of education	0.014 (1.27)	-0.010 (-1.06)	0.009 (1.01)	0.061 (0.64)	-0.001 (-0.08)	-0.121 (-1.07)	-0.001 (-0.08)	0.128 (1.43)
DV=1 if missing obs. for male adult mean years of education	0.466 (1.00)	-0.490 (-0.66)	0.216 (0.45)	-0.345 (-0.22)	-0.912 (-1.49)	-0.252 (-0.14)	-0.009 (-0.02)	-0.411 (-0.32)
DV=1 if agricultural household††	-0.122 (-0.42)	0.074 (0.15)	-0.202 (-0.82)	**1.580*** **(1.81)**	-0.063 (-0.15)	-0.401 (-0.40)	-0.295 (-1.18)	-0.509 (-0.85)
Community characteristics								
Average distance to tarred road	-0.0002 (-0.05)	0.009 (0.53)	0.010 (1.57)	0.003 (0.05)	0.001 (0.25)	0.013 (0.77)	0.001 (0.26)	-0.001 (-0.09)
DV=1 if missing obs. for distance to tarred road	-0.926 (-0.79)	0.002 (0.00)	0.275 (0.56)	-2.380 (-1.13)	0.281 (0.68)	-0.084 (-0.06)	-0.923 (-1.05)	
Average distance to bus or taxi stop	0.002 (0.30)	0.023 (1.14)	**-0.013**** **(-2.06)**	-0.235 (-0.53)	0.005 (0.56)	-0.072 (-1.24)	**0.021**** **(1.97)**	0.002 (0.06)
DV=1 if missing obs. for distance to bus/taxi stop	1.326 (1.14)	2.206 (0.80)	**-3.147***** **(2.59)**		-0.682 (-1.15)	-1.193 (-0.58)	**-3.342**** **(-1.99)**	0.433 (0.35)
Average distance to bank	0.002 (0.43)	0.008 (0.59)	-0.002 (-0.23)	-0.052 (-0.99)	-0.007 (-1.05)	0.027 (0.70)	-0.008 (-1.56)	0.057 (1.46)
DV=1 if missing obs. for distance to bank	-0.541 (-0.72)	**-3.713**** **(-2.20)**	0.276 (0.53)	0.162 (0.10)	0.058 (0.10)		0.736 (1.42)	-0.284 (-0.17)

Table 1.5b (continued): GLS estimation of the variance of the disturbance term [Dependent variable: $Ln(\sigma^2_{eh})$]								
DV = 1 if produce market available in the village	-0.330 (-0.62)	-0.309 (-0.26)	0.231 (0.62)	1.746 (1.17)	1.019 (0.91)	-3.014 (-1.42)	0.480 (1.28)	-4.524 (-1.16)
DV=1 if missing obs. for produce market available in the village	-0.184 (-0.10)		1.539 (1.38)		-0.640 (-0.60)		**3.854*** **(1.93)**	
DV = 1 if year 1992/93ᵀᵀ	0.078 (0.37)	0.159 (0.38)	0.250 (1.37)	0.492 (0.73)	0.382 (1.51)	-0.167 (-0.24)	0.146 (0.79)	0.285 (0.52)
Constant	**-3.168***** **(-2.85)**	**-4.883**** **(-2.55)**	**-1.974**** **(2.09)**	-8.496 (-1.52)	-2.488 (-1.56)	2.244 (0.46)	**-2.829***** **(-2.82)**	-4.619 (-1.25)
R^2	0.0240	0.1273	0.0571	0.2272	0.0677	0.1760	0.0406	0.2198
Total number of groups	329	74	263	39	164	37	359	44
Total number of observations	658	148	526	78	328	74	718	88

ᵀᵀ Omitted category: Non-agricultural household, Year 1999/00.

Note: * denotes statistical significance at 10%, ** significant at 5%, *** significant at 1%.

Table 1.6: Vulnerability

Table 1.6a: Vulnerability Trends and Patterns (%)

	N	1992/93 Vulnerability	1999/00 Vulnerability
Nation	1,309	57	25
Rural	1,115	61	27
Urban	194	33	17
Central	403	50	4
Eastern	302	61	27
Northern	201	76	80
Western	403	52	17
Central rural	329	55	3
Central urban	74	26	10
Eastern rural	263	65	29
Easter urban	39	31	15
Northern rural	164	79	88
Northern urban	37	62	46
Western rural	359	55	18
Western urban	44	23	7

Table 1.6b: Relative vs. High vulnerability (%)

	N	1992/93		1999/00	
		Relatively vulnerability	High vulnerability	Relatively vulnerability	High vulnerability
Nation	1,309	-	57	9	16
Rural	1,115	-	61	11	16
Urban	194	-	33	4	13
Central	403	-	50	3	1
Eastern	302	-	61	16	11
Northern	201	-	76	7	73
Western	403	-	52	13	4
Central rural	329	-	55	2	1
Central urban	74	-	26	4	6
Eastern rural	263	-	65	18	11
Easter urban	39	-	31	3	12
Northern rural	164	-	79	7	81
Northern urban	37	-	62	9	37
Western rural	359	-	55	14	4
Western urban	44	-	23	2	5

Note: N is the number of observations in the relevant group.

Table 1.7: Testing the equality of Vconsumption and Vprobit (1992)

	Vprobit
Vconsumption	**0.544*** **
	(37.83)
Constant	**0.208*** **
	(23.91)
H_0: $\alpha = 0$ and $\beta = 1$ $[F_{(2, 1307)}]$	529.54***
R^2	0.5317
No. of observations	1309

Note: * denotes statistical significance at 10%, ** significant at 5%, *** significant at 1%. In addition, all reported standard errors are robust (White H., 1980; 1982).

Table 1.8: Mean vulnerability level in 1992/93 by observed poverty status in 1992/93 and 1999/00

		Poverty Status in 1999/00		
		Non-poor	Poor	All
Poverty Status in 1992/93	Non-poor	0.229	0.489	0.285
	Poor	0.444	0.687	0.538
	All	0.322	0.616	0.410

Table 1.9: Selected characteristics of poor and vulnerable households

	1992/93			1999/00		
	Full sample	Poorest 25%	Most vulnerable 25%	Full sample	Poorest 25%	Most vulnerable 25%
Household characteristics						
Average household size	5.35	6.19	7.13	5.77	6.69	7.21
Fraction with high dependency ratio	0.70	0.79	0.88	0.73	0.81	0.86
Fraction with female household head	0.24	0.22	0.25	0.28	0.25	0.27
Community characteristics						
Average distance to tarred road	27.52	33.68	36.79	26.21	34.82	37.84
Average distance to bus or taxi stop	11.30	13.84	16.43	10.46	12.55	12.46
Average distance to bank	23.36	28.35	28.49	25.76	31.73	32.09
Fraction with produce market	0.06	0.09	0.07	0.06	0.05	0.08
Location						
Central rural	0.25	0.21	0.12	0.25	0.17	0.03
Central urban	0.06	0.02	0.03	0.06	0.02	0.02
Eastern rural	0.20	0.25	0.27	0.20	0.19	0.23
Easter urban	0.03	0.02	0.03	0.03	0.02	0.02
Northern rural	0.13	0.19	0.29	0.13	0.29	0.44
Northern urban	0.03	0.03	0.05	0.03	0.02	0.05
Western rural	0.27	0.27	0.20	0.27	0.28	0.20
Western urban	0.03	0.01	0.01	0.03	0.01	0.01

Table 1.10: Ranking of poverty and vulnerability by administrative region

	Poverty rate (Poor)		Fraction vulnerable to poverty (Vul)		
	Rank	Rate (%)	Rank	Fraction (%)	$\frac{Vul}{Poor}$
1992/93					
Northern rural	1	63	1	79	1.25
Eastern rural	2	57	2	65	1.14
Northern urban	3	54	3	62	1.15
Western rural	4	48	4	55.2	1.15
Central rural	5	45	5	55.0	1.22
Central urban	6	38	7	26	0.68
Easter urban	7	33	6	31	0.94
Western urban	8	32	8	23	0.72
1999/00					
Northern rural	1	64	1	88	1.38
Northern urban	2	32	2	46	1.44
Eastern rural	3	29	3	29	1
Western rural	4	28	4	18	0.64
Central rural	5	24	8	3	0.13
Easter urban	6	18	5	15	0.83
Central urban	7	15	6	10	0.67
Western urban	8	9	7	7	0.78

Figure 1.1: Distribution of estimated vulnerability, 1992/93

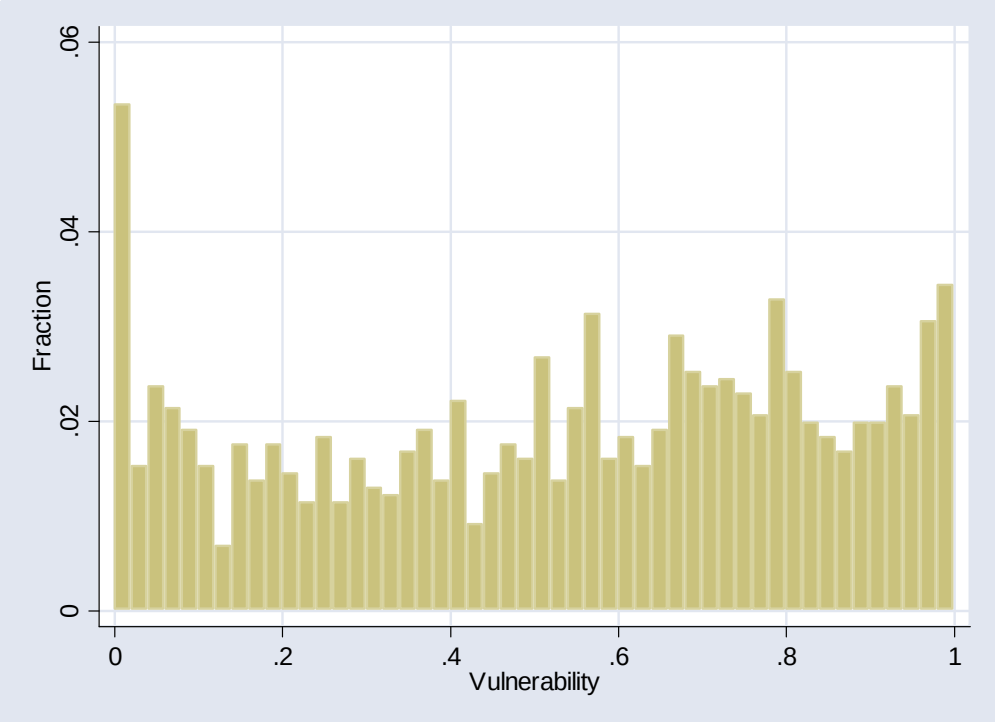


Figure 1.2: Distribution of estimated vulnerability, 1999/00

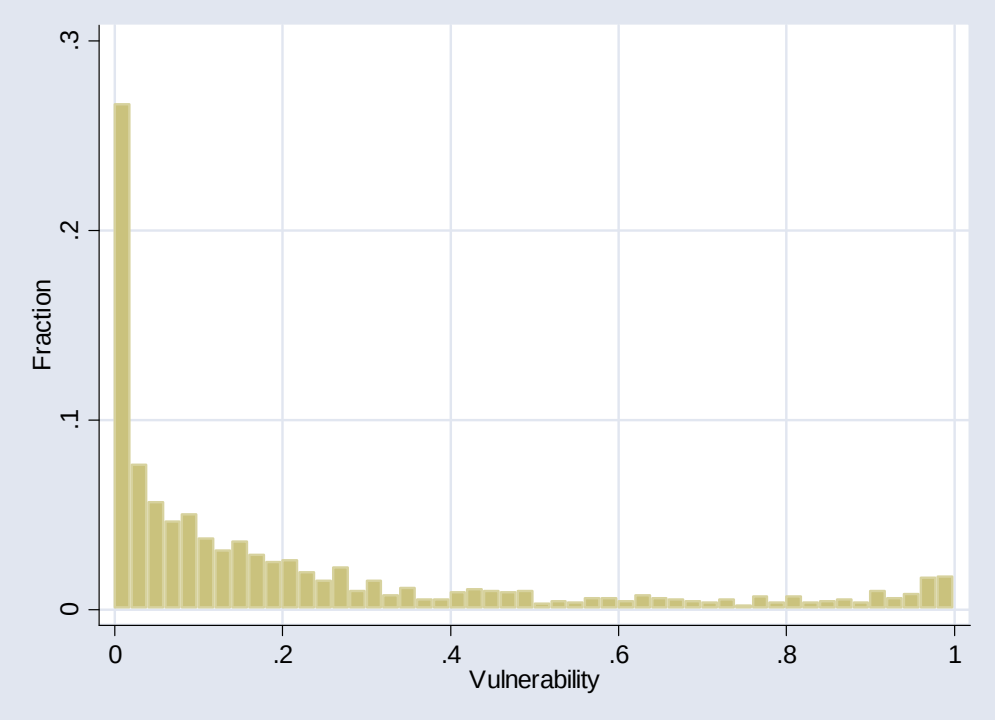


Figure 1.3: Cumulative distribution of estimated vulnerability, 1992/93

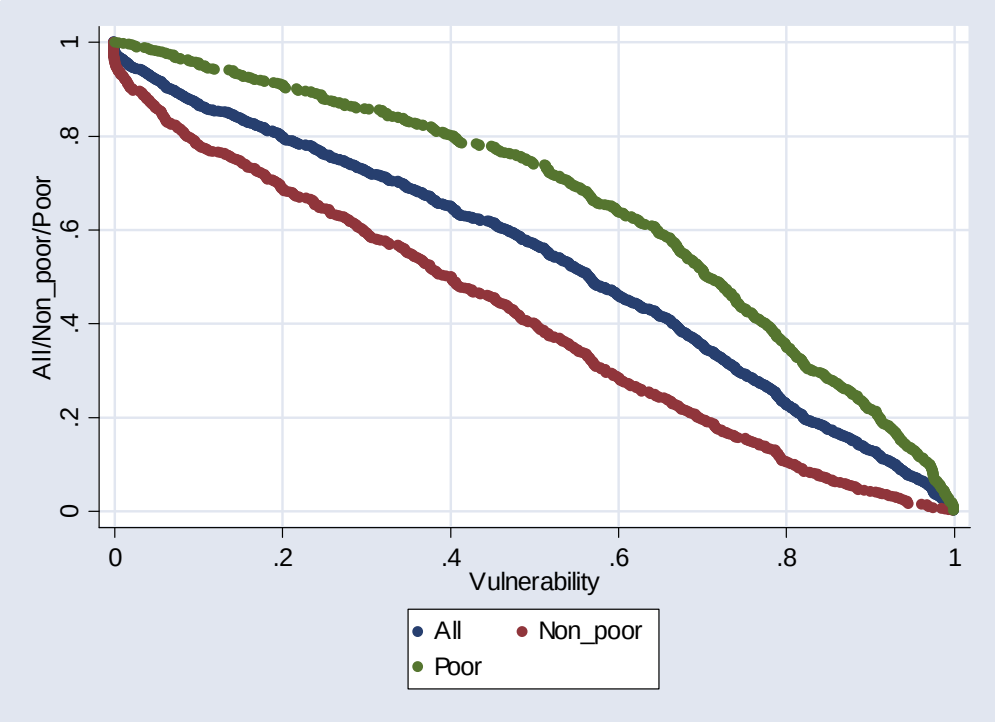


Figure 1.4: Cumulative distribution of estimated vulnerability, 1999/00

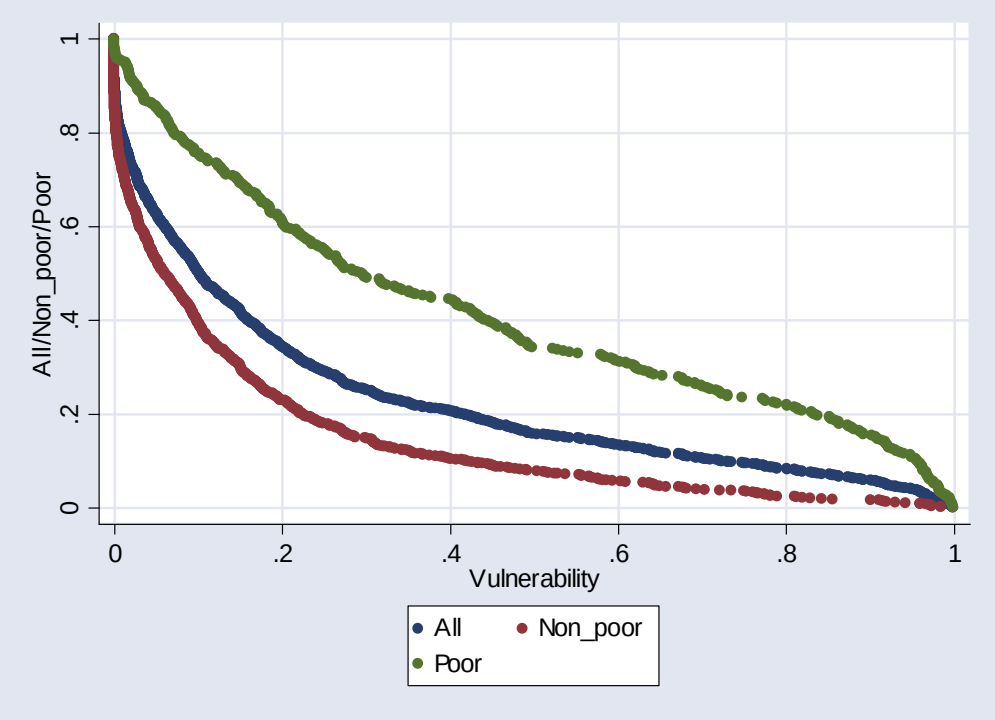


Figure 1.5: Distribution of estimated vulnerability, 1992/93

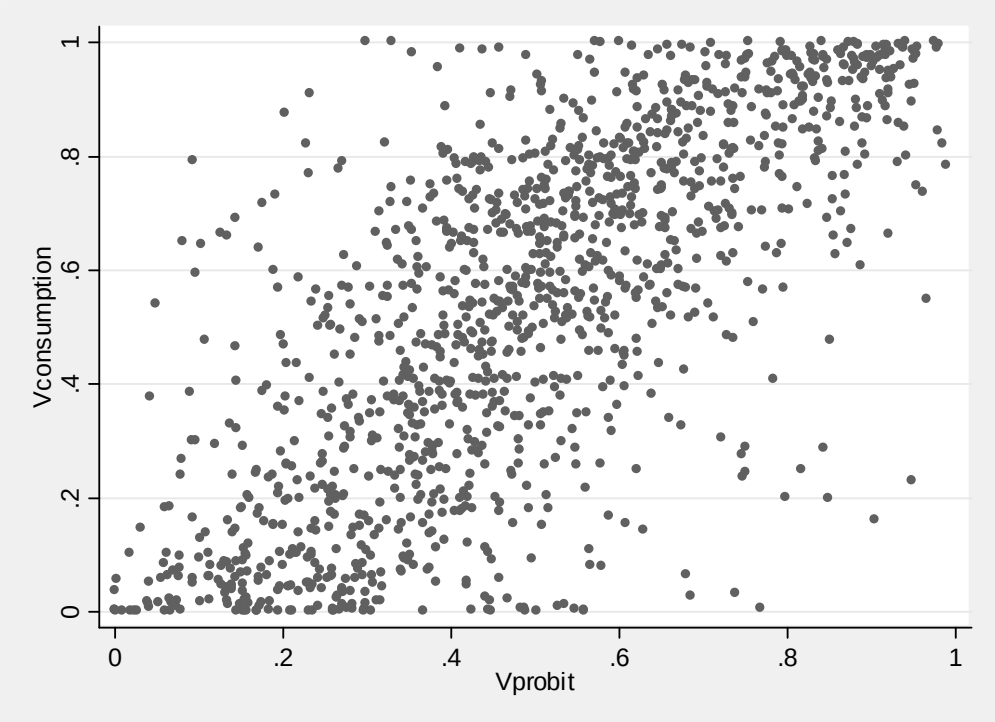


Figure 1.6: Predicted and actual 2002/03 poverty rates by region

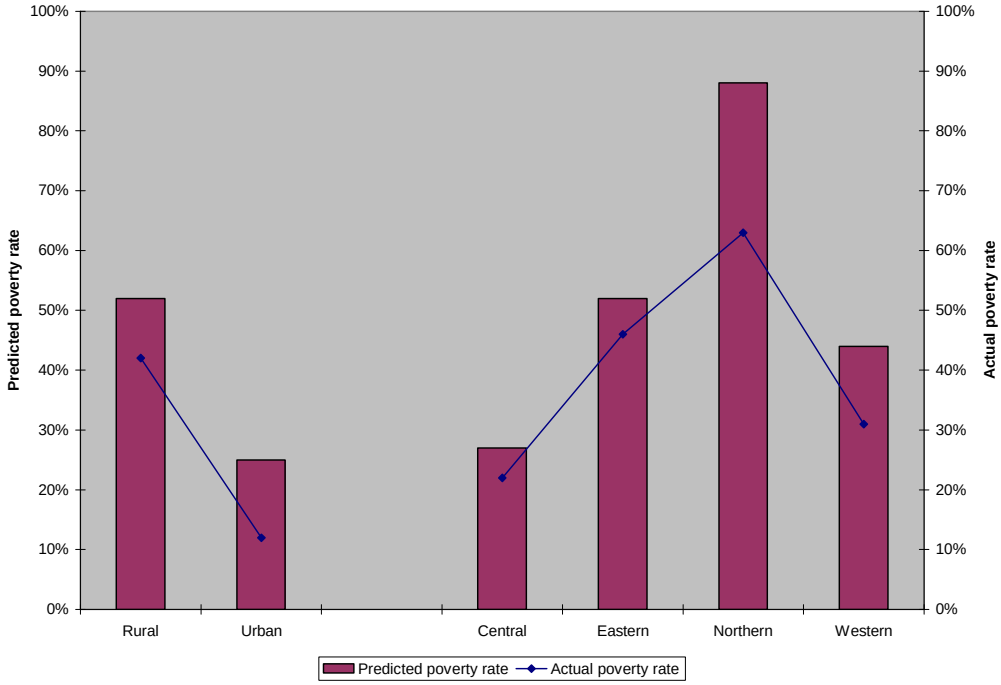


Figure 1.7: Mean and standard deviation of consumption for selected vulnerability levels (1992/93)

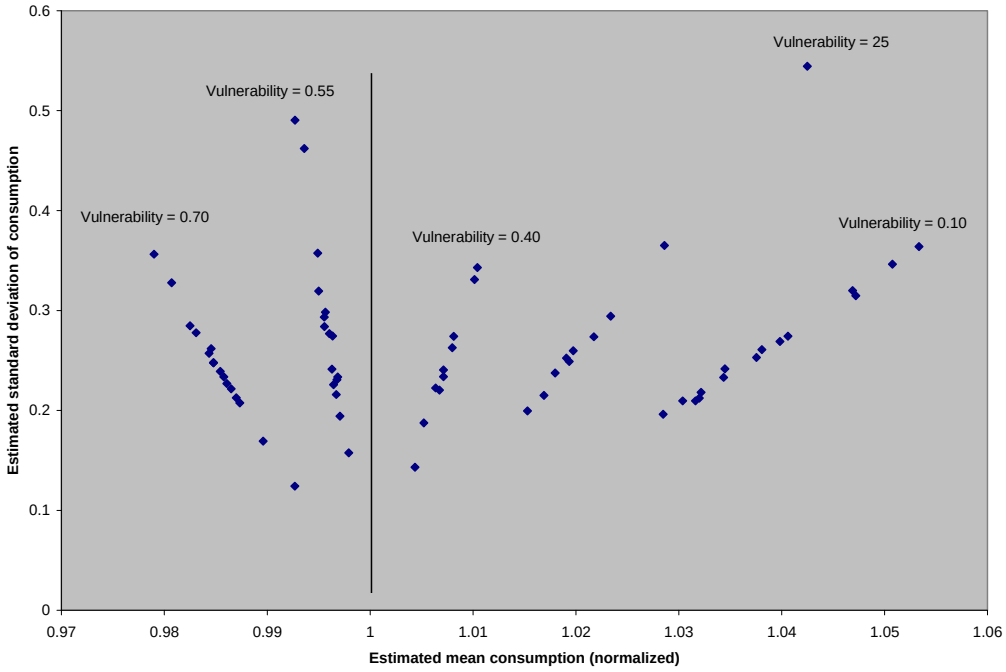


Figure 1.8: Mean and standard deviation of consumption for selected vulnerability levels (1999/00)

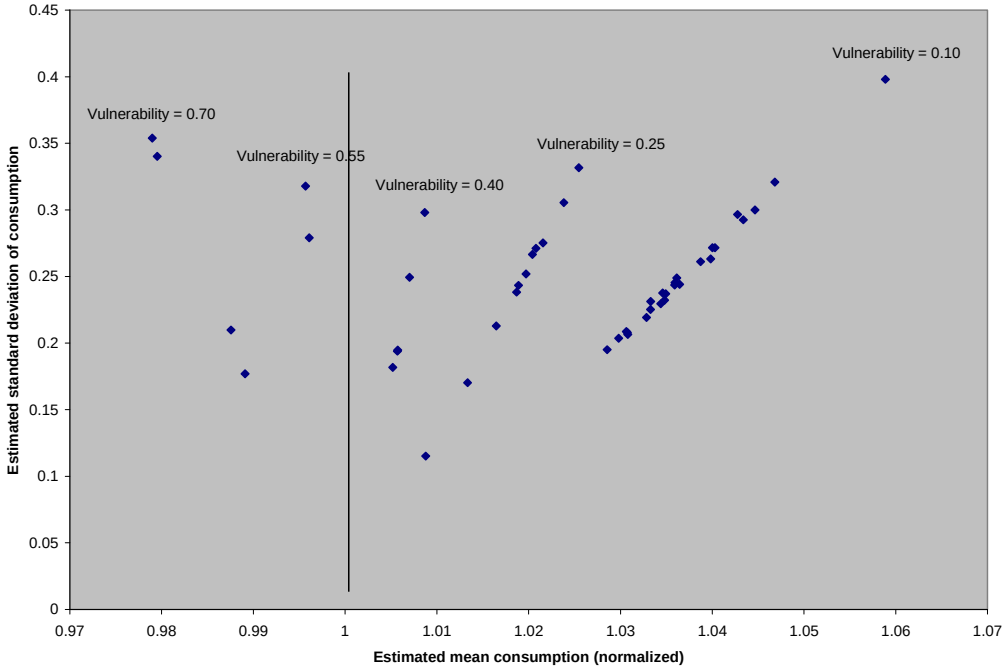


Figure 1.9: Poverty & Vulnerability, 1992/93

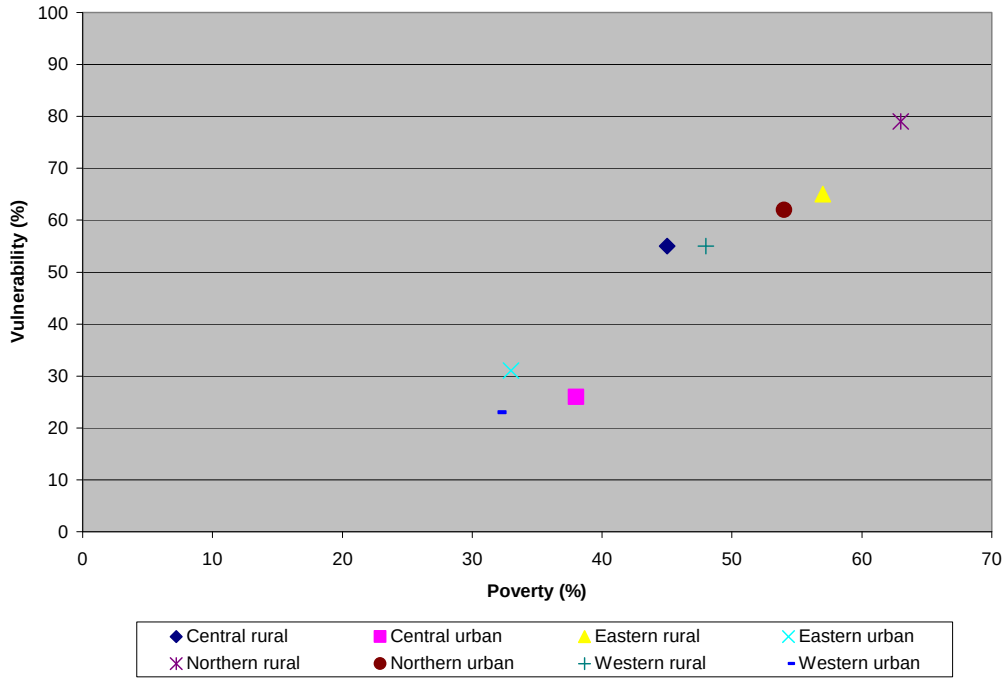
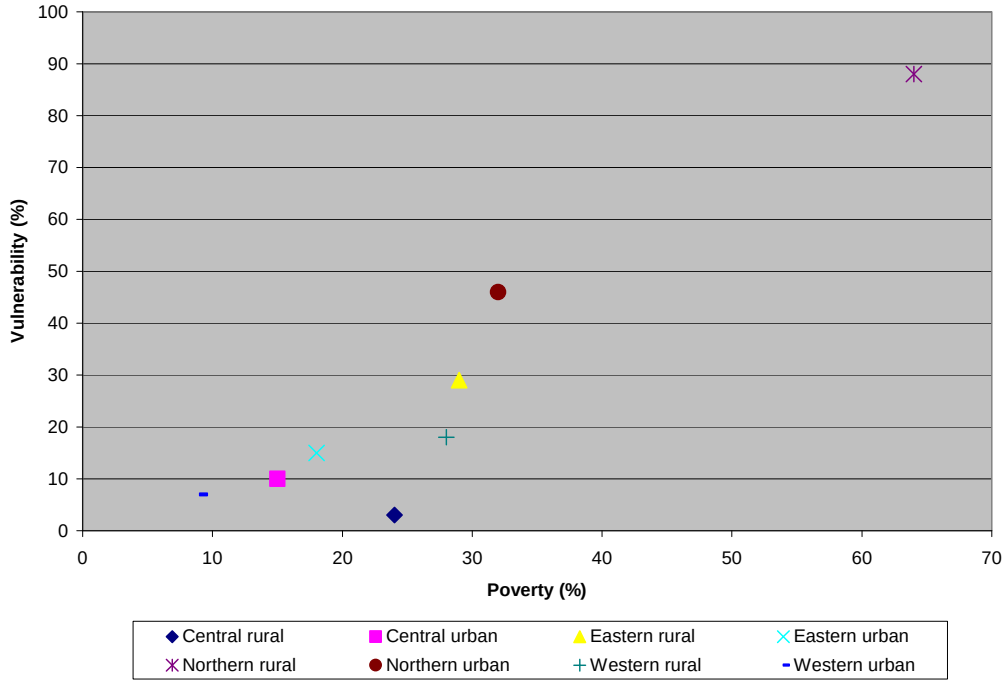


Figure 1.10: Poverty & Vulnerability, 1999/00



Annex I: OLS estimation of consumption

	1992/93	1999/00
	Ln(Consumption expenditure per adult equivalent)	**Ln(Consumption expenditure per adult equivalent)**
Average household size	**-0.125*** **	**-0.114*** **
	(-7.17)	**(-6.16)**
(Average household size)^2	**0.004*** **	**0.005*** **
	(5.06)	**(4.98)**
Dependency ratio	**0.036** **	-0.015
	(2.12)	(-0.88)
DV=1 if no adult members of the household	-0.127	-0.006
	(-1.26)	(-0.08)
DV=1 if female household head	**-0.131** **	-0.022
	(-2.57)	(-0.45)
Proportion of female adult members of the household	0.137	0.199
	(0.93)	(1.39)
Age of the household head	0.001	0.001
	(0.13)	(0.17)
(Age of the household head)^2	-8.97e-06	-0.00003
	(-0.16)	(-0.37)
Female adult mean years of education	**0.034*** **	**0.004** **
	(5.62)	**(2.34)**
DV=1 if missing obs. for female adult mean years of education	0.155	0.152
	(1.49)	(1.43)
Male adult mean years of education	**0.030*** **	**0.002** **
	(6.53)	**(2.12)**
DV=1 if missing obs. for male adult mean years of education	**0.209*** **	-0.039
	(2.85)	(-0.63)
DV=1 if agricultural household^{TT}	**-0.071***	**-0.257*** **
	(-1.83)	**(-5.42)**
Average distance to tarred road (Km)	-0.0003	-0.0003
	(-0.42)	(-0.43)
DV=1 if missing obs. for distance to tarred road	-0.132	**0.183** **
	(-1.42)	**(2.21)**
Average distance to bus or taxi stop (Km)	-0.001	-0.001
	(-0.96)	(-0.82)
DV=1 if missing obs. for distance to bus or taxi stop	0.036	**0.271** **
	(0.42)	**(2.43)**
Average distance to bank (Km)	-0.0004	-0.001
	(-0.39)	(-1.55)
DV=1 if missing obs. for distance to bank	0.010	0.083
	(0.08)	(0.80)
DV = 1 if produce market available in the village	**-0.204*** **	0.010
	(-2.61)	(0.12)
DV=1 if missing obs. for produce market available in the village	0.003	**-0.798*** **
	(0.02)	**(-4.27)**
Central rural^{TT}	-0.094	**-0.210** **
	(-1.02)	**(-2.45)**
Eastern rural^{TT}	**-0.242** **	**-0.402*** **
	(-2.55)	**(-4.88)**
Easter urban^{TT}	-0.174	-0.155
	(-1.53)	(-0.84)
Northern rural^{TT}	**-0.284*** **	**-0.811*** **
	(-2.77)	**(-8.17)**
Northern urban^{TT}	**-0.236***	**-0.573*** **
	(-1.66)	**(-4.91)**
Western rural^{TT}	-0.119	**-0.276*** **
	(-1.24)	**(-3.09)**

Annex I (continued): OLS estimation of consumption		
Western urban$^{\top\top}$	0.112	0.061
	(1.00)	(0.53)
Constant	**9.085*** **	**9.978*** **
	(53.26)	**(47.16)**
R^2	0.2435	0.3177
No. of clusters	349	334
No. of observations	1309	1309

$^{\top\top}$ Omitted category: Non-agricultural household, Central-urban.

Note: * denotes statistical significance at 10%, ** significant at 5%, *** significant at 1%. In addition, all reported standard errors are robust (White H., 1980; 1982), and adjusted to permit observations within clusters (primary sampling units) to be correlated (Deaton A., 1997).

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