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Vulnerability to Poverty: A Survey

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Vulnerability to Poverty: A Survey*

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Abstract

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Keywords: Vulnerability to poverty; risks; poverty alleviation policy

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1. Introduction

The substantial mobility of people into and out of poverty in modern societies makes the dynamics of poverty an intriguing topic of study to many empirical researchers. Such movement in and out of poverty is very common, particularly in developing countries (Jadotte, 2010). These movements depend on a wide variety of economic and social deprivations that are mostly dynamic in nature. It implies that poverty is not necessarily a stagnant state for an individual or a group of individuals. Thus, a complete appraisal of poverty requires incorporation of these dynamic aspects in the concept and measurement of poverty. The recognition of this fact has led to the concept of 'vulnerability to poverty (henceforth VP)'. The static poverty measures are ex-post in nature and, therefore, imperfect to shed light on poverty dynamics. Thorbecke (2004) argues that there are many unresolved issues of poverty analysis which are related to the dynamics of poverty. The dynamic aspect of poverty takes into account the change of welfare attributes over time. According to the static approach, it is difficult to have a sense of poverty incidence in near future. Thus, measures based on the static approach are inadequate guide to imminent poverty status which is important for policy makers. The concept of VP has been put forward as a solution to this problem that policy makers face.

A household is considered to be 'vulnerable to poverty' if it is likely to be poor in near future. It is now widely recognized that the dynamic aspect of poverty is the important ingredient of any poverty alleviation program. Poverty analysts advocate that the forward-looking approach of poverty measurement deals more with people's well-being than does the static approach. The latter approach is criticized on the ground that it ignores the risk and uncertainty that a human being faces while maintaining its income or consumption at the minimum sustainable level. In contrast, the forward-looking approach recognizes that that the experience of negative shocks can make the endowment level volatile leading to permanent poverty. Studies on VP shed lights on the sources and types of risks that households face, which help them prepare strategies to mitigate or reduce risks.

Poverty alleviation programs can reduce temporary poverty through aid but to address vulnerability to poverty, prevention, mitigation and coping mechanism are more important (Jha and Dang, 2010). Poverty alleviation measures target those who were poor in the previous period based on poverty threshold of income or consumption. This may lead to the failure of poverty alleviation program as it may provide income support to those who may no longer be 'poor' in the current year as they are out of poverty. In contrast, the program may leave out those 'non-poor' in the previous

period who may have slipped into poverty in the current period due to some shocks. Therefore, an appropriate poverty alleviation policy should target those who are currently poor as well as those who are not poor but likely to be poor in near future due to their exposure to some shocks. Vulnerability to poverty makes a clear distinction between ex-ante poverty prevention and ex-post poverty alleviation measures. There are many scholars who have tried to articulate the concept of VP and its measurement. But there has been no consensus. This paper is an attempt to summarize the definitions and measurements of VP that have been proposed by different scholars. Further, findings of some key studies have also been reported.

The paper is divided into five sections. Section 2 presents the conceptual issues related to poverty and vulnerability as well as the meaning of VP. Measurement of VP is discussed in section 3 where approach based and data related measurement issues are explained. Section 4 describes the summary of results from empirical study. The last section includes our concluding remarks.

2. Conceptual Framework: Poverty and Vulnerability

The link between poverty and vulnerability has been widely recognized in theory and practice (Banerjee and Newman, 1994; Morduch, 1995; Chaudhuri et al., 2002). In order to understand this link, we will first explore the concept of poverty and its relation with uncertainty. Poverty is often defined as either chronic or transitory. It is chronic if a household is poor in every period of the sample under consideration. In case of chronic poverty, both household's income, I, and consumption, C, are less than the defined poverty line, Z. This implies that $I < Z$ as well as $C < Z$. In contrast, transitory poverty arises when a household fails to control the stochastic elements that lower the consumption of the household in any period over the sample. As stochastic elements are the sources of poverty, it is also called stochastic poverty. In this case, $C < Z < I$. In most low income countries, the transitory or stochastic poverty is synonymous with chronic poverty. There are two reasons. First, as the income earner in a household falls sick, it reduces its earning capacity and, consequently, its permanent income drops. Second, it is not even possible for the household to borrow against future earnings as there is no well-developed financial system nor any social insurance institutions available. These structural sources of poverty are often more important than the inherent aspects of the income process in low income countries (Walker and Ryan, 1990; Morduch, 1994).

Since these stochastic elements are uncertain in nature, it is important to understand the link between poverty and uncertainty that highlights the dynamic aspects of poverty. Although the economics of poverty and of uncertainty are well developed, the intersection between these two has been discussed only recently. Even the most established poverty measure by Foster, Greer and Thorbecke (FGT, 1984) evaluates the poverty status of households in a static sense and ignores the dynamic aspects. As a result, if we go with this measure it is difficult to know whether the poverty is because of structural causes (e.g. low endowments) or due to large fluctuations in income caused by uninsured risks (Gunther and Harttgen, 2009). From a policy perspective, it is important to know the distinction between poverty caused by low endowments and poverty caused by volatility in endowments due to some shocks. Morduch (1994) views that the unexplored interaction between poverty and uncertainty may be due to practical as well as conceptual reasons. The practical difficulty of exploring the link is a lack of availability of longitudinal data on income, consumption, and risk in most developing countries. Conceptually, it is difficult to explore the link as transitory poverty may be due to structural causes and risk may not play any role.

Stating the importance of stochastic elements as a source of poverty, Tendon and Hasan (2005) view that poverty should not only be understood in terms of monetary and social deprivations but also in terms of exposure to shocks faced by households. In the same line, Ligon and Schechter (2003) argue that household's well-being is affected not just by income or expenditure but also by the shocks that household faces. In the 1990s, some researchers tried to examine the effect of shocks on consumption that provides an indication of vulnerability (e.g. Ravallion, 1988; Morduch, 1994; Ravallion et al., 1995; Grootaert et al., 1997; Glewwe and Hall, 1998). In poverty due to uninsured or partially insured risk, lies the meaning of VP.

The theoretical link between poverty and vulnerability is based on two observations: (i) generally the poor are most exposed to diverse risks and (ii) the poor do not have enough resources to mitigate these risks (Holzmann and Jørgensen, 2001). Exposure to these risks reduce household well-being by permanently lowering human capital formation and income (Morduch, 1994; Jacoby and Skoufias, 1997; Dercon, 2001, 2004 & 2006; Ligon and Schechter, 2003; Kasirye, 2008). Studies show that households and individuals could sometimes mitigate or partially insure these risks (Morduch, 1995; Townsend, 1994). However, even the uninsured part of the risks could be a cause of poverty (Dercon, 2004). Dercon (2001) presents a schematic approach (see Table 1) to illustrate the links between risk and well-being. His approach is comprehensive in listing all different types of assets and incomes that

are potentially at risk and showing how they affect the household's ability to acquire capabilities that determine well-being. Recognizing the effects of enormous and diverse risks faced by the poor, policy makers, development practitioners, and researchers are of the opinion that risk management should be an integral part of poverty-reducing strategies (Holzmann and Jørgensen, 2001; Christiaensen and Subbarao, 2004).

Table 1. Link between risk and well-being

Assets	Incomes	Well-being -"Capabilities"
• Human capital, labor • Physical/Financial capital • Commons and Public goods • Social capital	• Returns to activities and assets • Returns from asset disposal • Savings, credit and investment • Transfers and remittances	Ability to obtain (inter alia) • Consumption • Nutrition • Health • Education
Examples of risk (a) • Loss of skills due to health and unemployment • Land tenure insecurity, uncertain titles to other assets • Asset damage due to climate, war or disaster • Access to commons and unclear commitments and trust • Loss in value of financial assets or pension funds linked to inflation, stock market or exchange rate collapses	Examples of risk (b) • Output risk due to climate shocks, disease, conflict • Output price risk • Covariance in incomes and asset prices • Risk in asset returns from savings and investment including inflation) • Uncertain access to inputs or cash flow support during production • Imperfect enforcement of contracts, such as payment for goods and services rendered • Uncertainty about enforcement of informal arrangements, including informal protection-for example, transfer and remittances may not materialize • Uncertainty regarding rationing in public support, for example, risk of exclusion from safety net	Examples of risk (c) • Price risk in food markets • Food availability and rationing risk • Uncertain quality of public provision in health and education • Uncertainty about rationing scheme employed in health or education • Imperfect knowledge about health and nutrition 'production' (uncertainty about right answer)

	• Imperfect information and knowledge about opportunities • Risks in policy environment-credibility and commitment to continue policies	

Source: Dercon, 2001. P.17

There are diverse scenarios associated with the meaning of VP in the literature. In general, VP is the probability that a household will fall below the poverty line (typically defined by a threshold of income or consumption) in future if the household is currently 'non-poor'. It is also the probability that a currently 'poor' household will remain in poverty or will fall deeper into poverty in future. VP is an ex-ante position i.e. the knowledge about the actual shocks beforehand while poverty is the ex-post situation where outcome is observed after the experience of the shocks. The vulnerable households not only include those that are already poor but also those who are currently above the poverty line and are subject to possible risk with little resources to mitigate such risk (Holzmann and Jørgensen, 2001). The degree of vulnerability depends on the characteristics of risk, socio-economic factors, and the household's ability to respond (Alwang et al., 2001, Dercon, 2001, Christiaensen and Boisvert, 2000). The household's ability to cope with shocks is shaped by local conditions as well as human and physical endowments (Khandker, 2007). Calvo and Dercon (2005), Calvo (2008) and Calvo and Dercon (2013) argue that household well-being is jeopardized not only by severe consumption deficits but also by a wide variety of social deprivations. The feeling of insecurity is one of the main sources of deprivation that affects well-being. The 2000-01 World Development Report also emphasizes the importance of 'security' in the framework for poverty alleviation, which further stimulates the study of risk and it's mitigation at the core of the anti-poverty campaign. Supporting Sen's (2000) view that freedom from vulnerability to poverty is an important dimension of well-being, Dercon (2001) argues that it is both an end and a mean to development.

3. VP Measurement

3.1 Theoretical approaches to VP measurement

In general, there are three approaches to measure vulnerability in the literature: vulnerability as expected poverty (VEP), vulnerability as expected low utility (VEU) and vulnerability as uninsured

exposure to risk (VER). Irrespective of different approaches, vulnerability is a function of expected mean and variance of household's consumption. The expected mean of household consumption is determined by various individual and community characteristics while the variance is affected by idiosyncratic and covariate shocks as well as individual's capacity to use different strategies against these shocks (Gunther and Harttgen, 2009).

In contrast to VEU and VER that mostly use panel or pseudo panel data, VEP is the most suitable approach to estimate vulnerability in developing countries as VEP can be calculated with cross-section data. Researchers like Pritchett et al. (2000), Chaudhuri et al. (2002), Christiansen and Subbarao (2004), Gunther and Harttgen (2009) and Jadotte (2010) use the VEP approach. According to this approach, vulnerability is measured by comparing future consumption with an exogenously given poverty threshold that is essentially a socially defined poverty line. According to VEP proposed by Chaudhuri et al. (2002), vulnerability of a household '*h*' at time '*t*' is the probability that household's per capita consumption at 't+1' will fall below the poverty line at '*t*'.

$$V_{ht} = \Pr(C_{h,t+1} < Z) \tag{1}$$

where V_{ht} is the vulnerability index of household h at time t. $C_{h,t+1}$ is the household's per capita consumption level at time $t+1$ and Z is the socially defined poverty line. The higher the value of vulnerability index, the greater is the level of vulnerability of household h and *vice versa*.

Based on the FGT measure of poverty, vulnerability is expressed as:

$$V_{\alpha,ht} = F(z)\int_{c}^{z}\left(\frac{z - c_{h,t+1}}{z}\right)^{\alpha}\frac{f(c_{h,t+1})}{F(z)}dc_{h,t+1} \tag{2}$$

where $F(c_{h,t+1})$ and $f(c_{h,t+1})$ denote the cumulative distribution and density functions of $c_{h,t+1}$ respectively. a is an integer that taking the values: 0, 1, 2 etc. Household consumption in period t depends on a number of factors:

$$C_{ht} = c(X_h, \beta_t, \alpha_h, e_{ht}) \tag{3}$$

where X_h represents the household's observable characteristics, β_t is the vector of parameters describing the state of the economy at time t and a_h and e_{ht} are unobserved time-invariant household fixed effects and idiosyncratic shocks respectively. Substituting (3) in (2) gives the household vulnerability at time t as:

$$V_{ht} = E\left[P_{\alpha,h,t+1}\left(c_{h,t+1}\right) \mid F(c_{h,t+1} \mid X_h, \beta_h, \alpha_h, e_{ht}\right] \quad (4)$$

Two problems may be encountered with this procedure. One is the measurement error that overestimates the variance of consumption and the other is the assumptions of capturing temporal variability through cross-section variability and that the disturbances for all households have the same variance. The measurement error is critical as it contributes 1/3 to ½ to total variance (Pritchett et al. 2000). Chaudhuri et al. (2002) control the measurement error through multiplicative adjustment of estimated variance but allow the latter problem to exist. To correct for unobserved heterogeneity, Kamanou and Morduch (2002) and Kuhl (2003) propose a non-parametric approach that uses Monte-Carlo bootstrapping to estimate the distribution of future consumption. Although this approach is quite promising, it is not entirely free from the heteroskedasticity problem. A combination of parametric and non-parametric methods could provide a good solution (Chaudhuri, 2003).

Instead of estimating household vulnerability for only the next period i.e t +1 , Pritchett et al. (2000) extends the time horizon and assume that a household may be vulnerable at any time over a relatively long span of time. They argue that vulnerability (or risk represented by *R*(.)) of household *h* for *n* periods is the probability of observing at least one episode of poverty (based on poverty line, PL) for *n* periods, which is 1 minus the probability of no episodes of poverty.

$$R(n, Pl) = 1 - \left[\{(1 - P(e_{h,t+1} < Pl).....(1 - Pe_{h,t+n} < Pl)\}\right] \quad (5)$$

Now, based on the poverty line threshold Z, they define that a household *h* is vulnerable if the risk in *n* periods is greater than *z*. That is,

$$V_{ht}(Z, n, p) = I\left[R_{ht}(Z, n) > Z\right] \quad (6)$$

where *I* (.) is the indicator function equal to 1 if the condition on the right hand side of (6) is true and zero, otherwise.

Incorporating the effect of shocks on consumption and household's coping capacity or ability to smooth consumption in the face of shocks, Christiaensen and Subbarao (2004) and Kasirye (2008) extend the VEP method developed by Chaudhuri et al. (2002). They use repeated cross-sections with information on shocks and estimate the relative contribution of idiosyncratic and covariant shocks to vulnerability. They formulate the following consumption function with a heteroskedastic specification:

$$\ln C_{t+1} = X_t\beta + S_{t+1}\delta + S_{t+1}X_t\varphi + \gamma + e_{t+1}h^{1/2}(X_t;\alpha) \quad (7)$$

where S_{t+1} are observable, locally covariant, idiosyncratic shocks faced by households at time $t+1$, γ is a vector of time invariant unobservable household and environmental characteristics. The household's coping ability is represented by the interaction between shocks faced by the household and its observable characteristics. The last term allows consumption variance to differ across households depending on their characteristics and locality of shocks.

To reduce unexplained heterogeneity, Gunther and Harttgen (2009) and Jadotte (2010) decompose the unexplained variance of consumption into household and community level. Thus, consumption of household h in community j can be represented as a function of household-specific idiosyncratic and community-specific covariate shocks.

$$\ln C_{hj} = \{(\beta_{00} + \beta_{01} M_j) + (\alpha_{10} + \alpha_{11} M_j) X_{hj}\} + \{(\mu_{0j} + \mu_{1j} X_{hj}) + \varepsilon_{hj}\} \quad (8)$$

where the first and second part represent deterministic and stochastic component respectively. μ_{ij} and ε_{hj} represent unexplained community and household variance. The interaction term $M_j X_{hj}$ represents cross-section level interactions between variables at the household and community level. The bias due to overestimation of covariate shocks is controlled by introducing multilevel (or hierarchical) data structure.

In most methods discussed above, vulnerability is estimated assuming 0.50 as the vulnerability threshold and consumption follows a log-normal distribution. Zhang and Wan (2008) show that the use of 50 percent as the vulnerability line is a better identification of vulnerability rather than the head count ratio. Besides, they find that, with the assumption of log-normal distribution, weighted average of past incomes is preferred to instrumented income as an estimate of permanent income.

The utility based approach known as VEU proposed by Ligon and Schechter (2003) is based on the concept of risk aversion. It provides a clear disaggregation of vulnerability due to either poverty or uninsured risk. The risk component can be further divided into idiosyncratic, covariate and unexplained components. When a household faces with comparable returns, it is likely to use the less risky alternative with same utility. Using the concave utility function of risk-aversion, vulnerability of household h can be represented by:

$$V_h = U_h(Z) - EU(C_h) \quad (9)$$

where Z is the consumption level at poverty line or certainty-equivalent consumption equal to or above which people is considered as 'non-vulnerable'. EU stands for expected utility. Equation (9) can be rewritten as:

$$V_h = [U_h(Z) - U_h(EC_h)] + [U_h(EC_h) - EU(C_h)] \quad (10)$$

The first term on the right hand side is the utility gap measure (i.e. poverty) and it satisfies all axiomatic requirements placed on FGT poverty measure. The second term represents a shock faced by the household and it can be divided into two components: idiosyncratic and covariate shocks.

$$V_h = [U_h(Z) - U_h(EC_h)] + \left[\left\{EU_h(EC_h \mid \bar{X}\right\} - EU_u(C_h\right] + \left[\left\{U(EC_h) - EU_h(C_h : \bar{X}\right\}\right] \quad (11)$$

Again, considering that consumption is likely to be measured with error, the authors further divide the idiosyncratic part into time varying household characteristics and unexplained risk as well as measurement error.

$$\begin{aligned} V_h = [U_h(z) - U(EC_{ht})] + \left[EU_h\left\{E(C_{ht} \mid \bar{X}\right\} - EU_h\left\{E(C_{ht} \mid X, \bar{X}_{it}\right\}\right] + \\ \left[U_h(EC_{ht}) - EU\left\{E(C_{ht} \mid \bar{X}\right\}\right] + \left[EU_h\left\{E(C_{ht} \mid X_t, \bar{X}_{it}\right\} - EU_h(C_{ht})\right] \end{aligned} \quad (12)$$

where the 2nd, 3rd and 4th term on the right hand side represent idiosyncratic, covariate and unexplained as well as measurement error component respectively. As before, the first term is the utility gap measure.

Now, to measure vulnerability, the four terms in Equation (12) are to be estimated following the steps below:

1. The first part can be derived by assuming a simple form of the utility function: $U_h = \frac{C^{1-\gamma}}{1-\gamma}; \gamma > 0$ and estimating $EC_h = \frac{1}{T}\sum C_{ht}$. Ligon and Schechter (2003) normalize C assuming that the average of consumption over all households in all periods equals 1 which also represents inequality.

2. $E(C_{ht} \mid \bar{X}_{ht})$ and $E(C_{ht} \mid \bar{X}_t \mid X_{it})$ of the 2nd, 3rd and 4th term can be estimated by regressing consumption on household and community characteristics.

Chaudhuri (2003) and Calvo and Dercon (2005) argue that their proposed vulnerability measure is in fact similar to the measure developed by Ligon and Schechter (2003) though they use different forms of utility functions. Although the VEU approach is conceptually sound and attractive, due to non-availability of panel or repeated cross-section data and methodological issues, the estimation of individual risk preferences through VEU for developing countries is a formidable task. Furthermore, VEU can lead to overestimation of risk aversion if the utility function curvature is entirely attributed to observed risk response (Just and Pope, 2003). Christiaensen and Subbarao (2004) choose not to use the utility based approach to measure vulnerability. According to them, it is hard to estimate risk attitudes empirically and, even if it could be, it is not obvious to consider risk attitudes to evaluate people's expected poverty. Moreover, as individuals are ill-informed about their preferences, it is difficult to assume that human knowledge can perfectly feel future hunger or pain.

The third approach, VER, is developed by Glewwe and Hall (1998), Amin et al. (1999), Dercon and Krishnan (2000), and Tesliuc and Lindert (2002). It differs from VEP in that it compares future consumption with an internal threshold set at the person's current consumption level. Using primarily panel data, VER makes an ex-post assessment of the extent to which welfare losses is caused by negative shocks. This approach measures vulnerability as the inability to smooth consumption in the presence of shocks. There are many methods that measure the change in well-being due to uninsured risk. In general, the following form of consumption function is used to measure vulnerability in this approach:

$$\Delta \ln C_{ht} = \beta X_h + \sum \delta D + \Delta \varepsilon_{ht} \tag{13}$$

Equation (13) represents change in consumption (consumption between t and t-1 period) as a function of household and community characteristics. D is the community dummy variable. Incorporating the effect of shocks, this equation can be rewritten as:

$$\Delta \ln C_{ht} = \beta X_h + \sum \alpha ID_t + \sum \gamma CV_t + \sum \delta D + \Delta \varepsilon_{ht} \tag{13}$$

where ID and CV are the idiosyncratic and covariate shocks respectively. Like in VEU approach, we can estimate relative contributions of idiosyncratic and covariate shocks to welfare loss. Moreover, this approach can be used to determine the share of shocks at different community level. One major disadvantage of this approach is that it doesn't produce a 'headline' vulnerability estimate (Hoddinott and Quisumbing, 2003). Chaudhuri (2003) criticizes this approach arguing that the assumption of symmetry of shocks is not acceptable. Calvo and Dercon (2005) criticize it as there is no role for

probability of occurring shocks in VER. It only focuses on reaction to shocks. Furthermore, Christiaensen and Subbarao (2004) criticize VER on the ground that poor who are generally placed in the lower tail of the distribution are not considered as vulnerable as they do not experience a large change in their consumption due to shocks although there may be a large change in consumption due to a small shock. For example, sickness of the family income earner can change household consumption level drastically. In contrast, non-poor are considered as vulnerable if their wealth are subject to high probability of adverse shocks (investment in stock market) though currently they are sufficiently well-off not to become poor.

The VEP and VEU approaches are primarily used for assessing household vulnerability although it is claimed that aggregate vulnerability could also be estimated by aggregating individual vulnerability. Calvo and Dercon (2013) oppose this view and are of the opinion that individual vulnerability is not enough to compose the aggregate picture. Based on the concept developed by Fleurbaey (2010), they argue that individual outcome may not be favorable to society. Considering 'ex-post' importance in welfare assessment, Calvo and Dercon (2013) argue that if we add up individual vulnerability to assess the aggregate, then widespread simultaneous poverty that a society face will remain unnoticed. Contrary to the existing approaches, they discuss aggregation by invoking axiomatic foundations of measures that take into account the social threat of widespread poverty. Calvo and Dercon (2005) define vulnerability from a different perspective rather than uncertainty faced by a household that changes its consumption level as stated by VEP, VEU and VER approaches. They define vulnerability as an exposure to 'threats' or 'downside risks'.

3.2 Data related measurement issues

The measurement of vulnerability would be different for developing and developed countries. The reason is the inefficiency of financial markets or/and a lack of social insurance program that prevents people from managing idiosyncratic risks in developing countries (Jha and Dang, 2010). Moreover, non-availability of panel data could be one reason for the differences in vulnerability measurement although repeated cross-section and single cross-section studies are used to measure vulnerability in developing countries (Chaudhuri et.al., 2002; Chaudhuri, 2003; Gunther and Harttgen, 2009; Jadotte, 2010).

As said earlier, VP can be examined with the help of lengthy panel data on consumption or income (Holzmann et al., 2003). However, although such data are available for developed countries, they are rarely available for developing countries. In some cases, data are available either in the form of single cross-section or repeated cross-section (pseudo panel) having two or three waves. However, researchers have estimated household VP from single cross-sections (Chaudhuri et al., 2002; Tesliuc and Lindert, 2002; Suryahadi and Sumarto, 2003; Albert et al., 2007; Jamal, 2009; Gunther and Harttgen, 2009; Novignon, 2010; Jha and Dang, 2010; Jadotte, 2010). But researchers show that panel data in short waves could be useful to examine the effect of shocks on well-being. Townsend (1994) and Urdy (1995) did some pioneering work along this line by first using panel data to analyze households ability to insure consumption caused by idiosyncratic shocks (Gunther and Harttgen, 2009). Afterwards, various scholars have analyzed the effects of shocks on consumption over time (Glewwe and Hall, 1998; Jalan and Ravillion, 1999; Dercon and Krishnan, 2000 and 2006; Pritchett et al., 2000; Christiaensen and Boisvert, 2000; Ligon and Schechter, 2003; Dercon, 2004; Skoufias and Quisumbing, 2004; Christiaensen and Subbarao, 2004; Morduch, 2005; Kasirye, 2008; Calvo, 2008; Jha et al., 2010).

However, Gunther and Harttgen (2009) criticize these analyses on three grounds. *First*, in most of these studies, the scholars focus on the effect of selected shocks on consumption due to limited information on idiosyncratic and covariate shocks. As a consequence, the effects of the limited shocks on consumption are likely to be overestimated. *Second*, the impacts of shocks on consumption across households are often assumed to be the same. *Third*, there may be severe reverse causality problem as household's well-being could impact the possible effect of shocks on consumption. To tackle these problems, Gunther and Harttgen (2009) use a two-level hierarchical analysis to investigate the effect of idiosyncratic and covariate shocks on household's vulnerability based on cross-sectional data. Jadotte (2010) further extends this two-level hierarchical method to three-level hierarchical variance-components model to assess vulnerability from a single cross-section.

4. Summary of the results from empirical studies

This section highlights the major findings of the works related to vulnerability estimation and the relative share of idiosyncratic and covariate shocks. Appendix Table A.1 highlights the characteristics of some key studies. Applying the VEU approach to panel data for 1997-98, Christiaensen and

Boisvert (2000) estimate that 76% households are vulnerable in the northern part of Mali. They find that households with more children are more vulnerable while female headed households are less vulnerable to drought shocks partly due to community solidarity. Christiaensen and Subbarao (2004) also find that female headed households are less vulnerable in rural Kenya. In contrast, Chaudhuri et al (2002), Kuhl (2003), Jadotte (2010) find that female headed households are more vulnerable than their male-headed counterparts. Chaudhuri et al. (2002) use 1997 Family Income and Expenditure Survey (FIES) and 1998 Annual Poverty Indicator Survey (APIS) of Philippines to observe that bulk of male headed households are 'relatively vulnerable' while bulk of female headed households are 'highly vulnerable'. Most researchers find that education of the head of the household is negatively related to vulnerability (Tesulic and Lindert, 2002; Chaudhuri et al., 2002; Kuhl, 2003; Kasirye, 2008; Jadotte, 2010).

Comparing vulnerability between rural and urban households, researchers find that vulnerability to poverty is higher in rural areas than in urban areas (Chaudhuri et al., 2002; Jha and Dang, 2010; Jha et al., 2010; Jadotte, 2010). Using panel data from 1998 to 2002, Calvo (2008) find that rural households are more vulnerable to consumption poverty and less vulnerable to leisure-poverty in comparison to urban in Peru[1]. Overall, vulnerability to consumption poverty (0.10) is greater than vulnerability to leisure poverty (0.02) in Peru. Gunther and Harttgen (2009) estimate that rural people are more vulnerable to consumption poverty (86%) than urban (24%) in Madagscar. They assert that idiosyncratic shocks with low expected mean consumption are higher in urban areas while covariate shocks with higher fluctuations in consumption are higher in rural areas. In the same line, Tesulic and Lindert (2002) using 2000 Living Standards Measurement Survey (ENCOVI) data for Guatemala, also shows that rural households are more vulnerable than urban. They estimates that 20 percent households are vulnerable due to high volatility in consumption while 80 percent are due to low expected consumption. They find that the high consumption volatility leads even highly educated households to be vulnerable. In contrast, Jadotte (2010) find that rural vulnerability (93%) is lesser than urban vulnerability (96%) in Haiti. The rural vulnerability is mainly due to low consumption while urban vulnerability is due to volatility in consumption. Kasirye (2008) point out that vulnerability in

[1] Deducting working time from "total time", Calvo (2008) calculate leisure time as 119 hours per week (17 X 7, allowing 7 hours as daily sleep). Assuming work beyond 8 hours per day as severe deprivation of leisure time, he set the leisure-poverty threshold as 71(119-48, 8 hours as working hours for 6 days in a week) weekly hours.

Uganda is mainly caused by low mean consumption. Out of 14% vulnerable households, two thirds are due to low mean consumption. Dercon and Krishnan (2006) finds that vulnerability to low mean consumption is much higher than poverty estimates in rural Ethiopia.

In terms of relative share of idiosyncratic and covariate shocks, most researchers state that these shares vary across regions/countries. Using 1994 and 1997 welfare monitoring survey data for rural Kenya, Christiaensen and Subbarao (2004) find that covariate shocks like rainfall volatility are more in arid and semi-arid areas while idiosyncratic shocks like malaria are more in non-arid areas. Possession of sheep/goat helps to reduce idiosyncratic shocks especially in arid zones while they are ineffective in reducing covariate shocks. Jadotte (2010) makes a distinction between three types of shocks: idiosyncratic, meso-level (community wise) and covariate. Applying the three-level hierarchy model to the Haiti Living Conditions Survey of 2001 (ECVH-2001), Jadotte (2010) finds that idiosyncratic shocks are far more than meso-level shocks which in turn are more prevalent than covariate shocks in Haiti. In contrast, Calvo (2008) discovers that the importance of idiosyncratic shocks is similar for both rural and urban areas in Peru. Jha et al. (2010) find that idiosyncratic shocks are dominant in Tajikistan while Ligon and Schechter (2003) observe that covariate shocks are more dominant in determining vulnerability in Bulgaria. Sarris and Karfakis (2006) also note that covariate shocks, particularly weather-induced fluctuations in production and terms of trade shocks, are the foremost determinants vulnerability in Tanzania. Dercon and Krishnan (2006) conclude that households are vulnerable to common climatic and crop shocks as well as idiosyncratic shocks to livestock in rural Ethiopia.

Social vulnerability rather than individual vulnerability is the subject matter of most studies in developed countries like the U. S. in recent times. Using social and physical factors in the Factor and Data Envelope Analysis, Geroge et al. (1998) develop vulnerability maps for Revere City, Massachusetts, USA, and argue that vulnerability maps can be used as an important tool for mitigating risk due to coastal flood. Myers et al. (2008) find that outmigration, following Hurricane Katrina and Rita in the U. S., is linked with social vulnerability. They state that outmigration pattern of a county is related not only to various dimensions of social vulnerability of that county but also to the migration patterns and social vulnerability of the surrounding counties. Wang and Yarnal (2012) show that social vulnerability due to hurricane hazards among elderly people of Sarasota, Florida, vary across locations. Applying Principal Component Analysis (PCA), they find that elderly people living in barrier islands

face a considerable physical vulnerability but less social vulnerability because of their wealth. In contrast, inhabitants of inland are far less physically vulnerable but they have limited adaptive capacity.

5. Concluding remarks

Estimation of VP makes more sense than does poverty estimation as VP captures dynamic aspects that are ignored in conventional poverty estimates. Besides, by focusing on poverty dynamics over time, VP sheds light on the sources of poverty: whether poverty is because of low consumption or because of consumption volatility due to risks of shocks. There are many ways to define VP but most researchers agree that it is the risk of falling below poverty line in near future. Although panel data or pseudo-panel data seem to be better suited for the estimation of VP as captured by fluctuations in well-being over a period of time, researchers have shown that single cross-section data could be used to estimate VP and its source as well. Based on the results of VP estimation and its sources, researchers conclude that decentralized planning could be useful to curb poverty in near future. Greater community level shocks on household's income and consumption than covariate shocks highlight the importance of an effective role that the local government can play in designing policies to fight poverty. To minimize the effects of idiosyncratic shocks, it has been proposed that importance should be given to risk management strategies that enhance coping ability of the poor people. As almost all researchers find that education is highly related to VP, increased access to education is a necessary step and, therefore, it is imperative to invest more in the education sector. To fight with covariate shocks, it is suggested that appropriate safety nets should be used to target specific aggregate shocks.

Various methods have been suggested for the estimation of individual vulnerability. Although aggregate vulnerability could be estimated by adding up individual vulnerability, individual outcome may not be favorable to society. Moreover, the adding up solution may ignore the threat of simultaneous widespread poverty while calculating aggregate vulnerability. While most researchers use consumption deficits as a threat to well-being, of late, it has been recognized that the feeling of insecurity may be a cause of reduced well-being. This shows that vulnerability is the result of multidimensional deprivations. Calvo (2008) uses a bi-dimensional criterion of well-being (consumption and leisure) to measure VP though there is scope for extending this concept to multiple dimensions, both conceptually and empirically. As stated by Calvo (2008), the substitutability and complementarity among dimensions need to be assessed and it is important to know how individual

vulnerability to multidimensional poverty index could be aggregated to have a single aggregate index. This is an open question for future research.

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Appendix Table A.1: Characteristics of some key studies

Researcher	Method	Where	Data used
Vulnerability to expected poverty (VEP)			
Chaudhuri et al., 2002	VEP through 3SFGLS	Philippines	1997 Family Income and Expenditure Survey and 1998 Annual Poverty Indicator Survey
Tesliuc and Lindert, 2002	Chaudhuri et al. (2002) VEP approach	Guatemala	Living Standards Measurement Survey (ENCOVI, 2000)
Christiaensen and Subbarao, 2004	VEP through pseudo panel data with repeated cross-section	Rural Kenya	1994 and 1997 Welfare Monitoring Surveys
Albert et al., 2007	VEP through panel data	Philippines	1997 FIES as well as 1998 and 1999 (APIS)
Zhang and Wan, 2008	VEP based on weighted average of past savings	Rural China	Household survey data collected in 1989, 1991, and 1993
Kasirye, 2008	VEP using Christiansen and Subbarao (2004) and Chaudhuri (2003)	Uganda	Uganda Integrated Household survey (UIHS) 1992/93 and Uganda National Household Survey (UNHS) 1999/2000
Gunther and Harttgen, 2009	Multilevel analysis	Madagascar, Sub-Saharan Africa	Household survey data of 2001 covering 5,080 households
Jamal, 2009	Chaudhuri et al. (2002) VEP approach	Pakistan	Pakistan cross-sectional data of HIES, 2000-01 and 2004-05
Jha and Dang, 2010	Chaudhuri et al. (2002) VEP approach through clustering, stratification etc.	Papua New Guinea	1996 Papua New Guinea household survey
Jadotte, 2010	Multilevel analysis	Haiti	Haiti Living Conditions Survey 2001 (ECVH-2001)
Vulnerability as expected low utility (VEU)			
Christiansen and Boisvert, 2000	VEU through 3SFGLS	Northen Mali	Panel data of 1997-98
Kamanou and Morduch, 2002	Monte Carlo bootstrap method	Côte d'Ivoire	1985–88 rounds of the Côte d'Ivoire Living Standards Survey.
Ligon and Schechter, 2003	VEU	Bulgaria	Household Budget Survey (HBS) 1994
Dercon and Krishnan, 2006	Regression model with household and village level fixed effects	Rural Ethiopia	Panel data of 1994-95
Vulnerability as uninsured exposure to risk (VER)			

Glewwe and Hall, 1998	One form of VER	Peru	Peru Living Standard Surveys 1985–1986 and 1990.
Amin et al., 1999	One form of VER	Bangladesh	Household survey data of 1991-92
Tesliuc and Lindert, 2002	One form of VER	Guatemala	Living Standards Measurement Survey (ENCOVI, 2000)
Dercon and Krishnan, 2000	One form of VER	Rural Ethiopia	Household survey data during 1994-95
Others			
Jha, Dang and Tashrifov, 2010	Using both VEP and VEU	Tajikistan	two period household panel for 2004 and 2005
Calvo, 2008	Vulnerability to multidimensional poverty through panel data	Peru	National Household Surveys 1998-2002
Calvo and Dercon, 2013	VP through random effects model	Ethiopia	1994, 1999 and 2004 of rural household panel data survey

Source: Authors' compilation