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Measuring Exposure to Downside Risk with an Application to Thailand and Vietnam

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Summary. — In this paper we propose a new measure of exposure to downside risk. Its reference point is the current standard of living of a household as opposed to other benchmarks such as the poverty line in the case of measures of vulnerability. Using panel data from Thailand and Vietnam we develop an empirical approach to quantify our measure. More precisely, we predict truly forward looking probabilities and deprivation indices of different states of the world and aggregate them to country specific measures of exposure to downside risk. We scrutinize the correlates of these measures in the periods 2007–08 and 2008–09 using regressions with household fixed effects. We examine vulnerability to poverty and "hybrid" vulnerability to poverty in an identical empirical framework. This allows us to draw conclusions with respect to the value added of our new measure. We find that the measure of exposure to downside risk indeed offers complimentary information that may be relevant from a policy perspective and recommend to incorporate its appraisal in holistic assessments of vulnerability and risk exposure.
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1. INTRODUCTION

Literature on the vulnerability of households has proliferated in recent years. The reasons for increased interest of economists in vulnerability are the following: First, risk combined with the inability to smooth consumption and income determines future levels of poverty. Second, vulnerability impacts negatively on the current standard of living of risk averse households because it increases the variance of future outcomes. Third, besides being a dimension of deprivation vulnerability is also a cause of it. For instance, poor and vulnerable households are likely to opt for stable, low-return sources of income and thus perpetuate their low level of well-being (Dercon & Christiaensen, 2011). Therefore, attacking vulnerability has the potential to reduce poverty.

Most measures of vulnerability at the household level refer more or less explicitly to the poverty line (Calvo & Dercon, 2005, 2007; Dutta, Foster, & Mishra, 2011; Kamanou & Morduch, 2004). Instead, in its most basic definition of vulnerability the World Development Report 2000–01 did not rely on the poverty line but rather chose the current standard of living as reference point: "...vulnerability measures the resilience against a shock—the likelihood that a shock will result in a decline in well-being..." (World Bank, 2000).

The purpose of this paper is threefold: First, following the World Bank (2000), as well as the idea of reference point utility (Dutta et al., 2011; Jäntti, Kanbur, Nyyssölä, & Jukka Pirttilä, 2012) we propose a measure of exposure to downside risk that uses the current standard of living as reference point. This choice of the relevant benchmark distinguishes the measure of exposure to downside risk from most measures of vulnerability. [1] It is influenced by all states of the world in which a household is worse off than currently and not only by future states below the (hybrid) poverty line. We propose the measure of exposure to downside risk because we expect it to offer insights that are complementary to the ones provided by measures of vulnerability. While being different from measures of vulnerability in the choice of the reference point, the measure of exposure to downside risk still belongs to the class of measures which are based on "a probability weighted average of state-specific 'deprivation indices' ..." (Calvo & Dercon, 2005). We only propose a measure of household exposure to downside risk in this paper and do not discuss measures of aggregate risk exposure for society.

Second, rather than to place emphasis on a theoretical discussion of the properties of the new measure we focus on developing an empirical approach to quantify it. This procedure is motivated by the observation that theoretical aspects of forward looking probability weighted averages of state-specific deprivation indices are extensively discussed in the literature (Calvo & Dercon, 2005; Dutta et al., 2011; Günther & Maier, 2008). However, only few attempts of bringing such measures to the data exist. Using a three-wave panel comprising over 4,000 households from rural Thailand and Vietnam with specific information about shock occurrence and associated income loss allows us to predict state of the world specific probabilities and deprivation indices that are truly forward looking. Building on these we quantify ex-ante exposure to downside risk (and vulnerability) of households. [2] In both countries growth and poverty reduction have been noninclusive leaving especially rural areas behind. [3] In addition, farmers in Thailand and Vietnam are frequently hit by large scale agricultural and weather related shocks such as floods and pest infestations (ADB, 2010). In such a setting an assessment of exposure to downside risk (and vulnerability) can be very useful to inform policy targeting and design.

Third, we scrutinize the correlates of exposure to downside risk in the periods 2007–08 and 2008–09 using fixed effects regressions. Moreover, we analyze vulnerability to poverty and "hybrid" vulnerability to poverty in an identical empirical framework. This allows us to draw conclusions with respect to the value added of our new measure. We find that the measure of exposure to downside risk indeed offers complimentary information that may be relevant from a policy perspective.

For instance, we show that cushioning the negative effects of the global economic crisis in Thailand primarily requires focusing efforts on vulnerable households rather than on households that are exposed to downside risk.

The remainder of this paper is structured as follows: Section 2 provides background information on existing approaches to vulnerability. In Section 3 the new measure of exposure to downside risk is presented and compared to existing vulnerability measures. Section 4 introduces the data used in the empirical part of this paper while Section 5 presents the econometric methodology. Results are presented and discussed in Section 6. Finally, in Section 7 the findings of the paper are summarized and conclusions drawn.

2. CONCEPTS AND MEASURES OF VULNERABILITY

Vulnerability is distinct from poverty as currently nonpoor households may face a risky future that possibly will push them below the poverty line. Because standard poverty measures are not able to adequately identify the vulnerable part of the population researchers increasingly propose and discuss different measures of vulnerability. [4] They can broadly be grouped into the following four categories which are briefly presented in the remainder of this section: (i) vulnerability as low expected utility (Ligon & Schechter, 2003); (ii) vulnerability as uninsured exposure to risk (Amin, Rai, & Topa, 2003; Townsend, 1994); (iii) vulnerability as threat of poverty building on expected utility theory (Calvo & Dercon, 2005, 2007; Chaudhuri, Jalan, & Suryahadi, 2002; Kamanou & Morduch, 2004; Pritchett, Suryahadi, & Sumarto, 2000); and (iv) vulnerability as threat of poverty building on prospect theory (Dutta et al., 2011; Günther & Maier, 2008).

(a) *Vulnerability as low expected utility*

The concept of vulnerability as low expected utility proposed by Ligon and Schechter (2003) puts "expected utility" at the core of its analysis. More precisely, it sets the vulnerability of household i (VEU_i) equal to the difference between the household's utility derived from certainty-equivalent welfare (z) and the household's expected utility derived from its actual level of wellbeing (y_i):

$$VEU_i = U_i(z) - EU_i(y_i) \qquad (1)$$

By assuming U_i to be a weakly concave, strictly increasing function vulnerability as low expected utility accounts for risk preferences and is thus suited for quantifying the welfare loss provoked by risk.

Another useful feature of vulnerability as low expected utility is that vulnerability can be decomposed into a poverty, a covariate risk, and an idiosyncratic risk component as shown in Eqn. (2) (cf. Ligon & Schechter, 2003):

$$
\begin{aligned}
VEU_i = & [U_i(z) - U_i(Ey_i)] \text{ (poverty component)} \\
& + \{U_i(Ey_i) - EU_i[E(y_i|X')]\} \text{ (covariate risk-component)} \\
& + \{EU_i[E(y_i|X')] - EU_i(y_i)\} \times \text{ (idiosyncratic risk-component)}
\end{aligned}
\qquad (2)
$$

where $E(y_i|X')$ equals the expected level of wellbeing given a vector of covariant variables X'.

(b) *Vulnerability as uninsured exposure to risk*

Vulnerability as uninsured exposure to risk measures to what degree shocks impact on wellbeing. That is, the concept is congruent with the World Bank's (2000) definition of vulnerability ("vulnerability measures the resilience against a shock"; see above). The seminal contribution to this strand of literature is Townsend (1994) who focuses on the question whether risk-sharing allows households in Indian villages to smooth consumption in the light of idiosyncratic shocks.

When applied econometrically, idiosyncratic and covariate shocks are usually instrumented by the growth rate of household income (Δy_{iv}) and the growth rate of average village income ($\Delta(\overline{ln\,y_{iv}})$), respectively, of household i in village v as shown in Eqn. (3):

$$\Delta \ln c_{iv} = \alpha + \beta \ln \Delta y_{iv} + \gamma \Delta(\overline{ln\,y_v}) + \delta X'_{iv} + \Delta \varepsilon_{iv} \qquad (3)$$

where $\Delta \ln c_{iv}$ denotes the growth rate of consumption per capita and X'_{iv} reflects a vector of household characteristics. β captures the impact of idiosyncratic shocks on consumption while γ reflects the one of covariate events. Consequently, vulnerability as uninsured exposure to risk rises with both an increasing β and an increasing γ. Perfect insurance, i.e., no vulnerability, is implied by $\beta = 0$ and $\gamma = 0$.

(c) *Vulnerability as threat of poverty building on expected utility theory*

As opposed to the aforementioned concepts of vulnerability the approaches that have been developed within the context of vulnerability as threat of poverty refer to a pre-determined poverty line when assessing different states of the world. One class of such approaches builds on expected utility theory. For example, Calvo and Dercon (2005) put forward the concept of vulnerability to poverty. Within its framework vulnerability is a probability weighted average of future states of the world-specific indices of deprivation. The vulnerability to poverty of household i (VTP_i) is calculated as shown in Eqn. (4):

$$VTP_i = 1 - \left(\sum_{j=1}^{N_i} p_{ij} \times x_{ij}^{\alpha} \right) \qquad (4)$$

where α ranges between zero and one. p_{ij} denotes the probability of state of the world j to occur and $\sum_{j=1}^{N_i} p_{ij} = 1$. x_{ij} ranges between zero and one and is a state specific degree of deprivation which equals $\frac{\tilde{y}_{ij}}{z}$. $\tilde{y}_{ij}$ is a censored outcome measure. That is, all outcomes where y_{ij} is above z are censored at z and consequently do not change the vulnerability measure. There is a total of N_i possible states of the world. The closer (further away) α moves to (from) one the less (more) risk aversion is assumed and the less (more) heavily relatively severe states are weighted.

(d) *Vulnerability as threat of poverty building on prospect theory*

Another class of vulnerability as threat of poverty approaches builds on the prospect theory. [5] More precisely, such approaches introduce the notion of downside risk and reference point utility to concepts of vulnerability as threat of poverty. For example, Dutta et al. (2011) develop a hybrid measure which combines the poverty line and the current standard of living as reference points. This "hybrid" vulnerability to poverty of household i ($VTPH_i$) is expressed in Eqn. (5):

$$VTPH_i = \sum_{j=1}^{N_i} p_{ij} \times f(R(z,\,y_i) - \hat{y}_{ji}) \qquad (5)$$

where p_{ij} denotes the probability of state of the world j to occur and $\sum_{j=1}^{N_i} p_{ij} = 1$. $f(\cdot)$ quantifies state of the world specific