Tropentag 2009
University of Hamburg, October 6-8, 2009
Conference on International Research on Food Security, Natural Resource Management and Rural Development

Towards Comparative and Aggregate Vulnerability: An Analysis of Welfare Distributions in Rural Provinces in Thailand and Vietnam

Hardeweg[a], Bernd, Andreas Wagener[b] and Hermann Waibel[a]

[a] Leibniz Universität Hannover, Institut für Entwicklungs- und Agrarökonomik, Königsworther Platz 1, 30419 Hannover, Germany. Email: hardeweg@ifgb.uni-hannover.de
[b] Leibniz Universität Hannover, Institut für Sozialpolitik, Königsworther Platz 1, 30419 Hannover, Germany.

Introduction

The World Development Report 2000/2001 has raised awareness of the dynamic aspects of poverty in developing countries. Since then, the concept of vulnerability to poverty as an ex-ante, forward-looking approach has received much attention. In recent years, various concepts of vulnerability and associated indicators have been developed without, however, reaching a consensus on the relative merits of these concepts. The most prominent among these concepts are: (1) vulnerability as expected poverty (EP) and measured by the probability that a household will be below the poverty line in some future period (e.g. PRITCHETT et al., 2000). This approach is underlying most empirical applications to date and can be generalized by giving higher weight to more severe degrees of poverty as in vulnerability indices based on FGT measures of poverty (FOSTER *et al*., 1984). (2) Vulnerability may be regarded as a low level of expected utility (LS): a shortfall of a household's expected utility below a threshold reflecting a socially acceptable minimum level of well-being (LIGON and SCHECHTER, 2003). (3) Individual vulnerability to poverty as developed by CALVO and DERCON (2005) (CD) is measured by an index of expected deprivation, accounting for both the probabilities of negative future events and their severity. For practical applications, each concept can be represented by a class of expected values of functions of income or consumption. The CD and EP concepts rely on censored welfare indicators, i.e. treat welfare levels above a certain threshold (the poverty line) as irrelevant; this reflects the focus axiom of poverty measurement. Given the multitude of approaches, it may appear to the superficial observer that "vulnerability" is a woolly idea, pliable at the discretion of the analyst. Applied studies, thus, appear to invite criticism for the specific concepts of vulnerability or poverty lines they use. Such verdicts may be too quick, however. Given that many applied measures share the common mathematical structure of expected values, they are in fact quite closely related. These relations can be traced back to the idea of stochastic orderings (e.g. SHAKED and SHANTHIKUMAR, 2006). The idea of this paper is to utilize the concept of stochastic orderings to compare various consumption distributions with respect to their vulnerability to poverty. In an application to consumption distributions in six rural provinces of Thailand and Vietnam, we show that this idea can indeed be set to work also in practise.

Data

In the context of the DFG research unit "Impact of Shocks on the Vulnerability to Poverty: Consequences for Development of Emerging Southeast Asian Economies" in 2007 and 2008 a panel survey of some 4400 rural households was carried out in six provinces of Thailand and Vietnam (HARDEWEG *et al.*, 2007). These provinces are Buriram, Nakhon Phanom, and Ubon Ratchathani in Thailand, and Dak Lak, Ha Tinh, and Thua Thien Hue in Vietnam. Provinces were purposively selected to include peripheral areas in the poorest region of Thailand and provinces representing

different levels of economic development of the Central Coast and Central Highland regions of Vietnam. Households were selected in a three-stage random sampling procedure with two cluster stages at the sub-district and village levels. A fixed size sample of ten households was selected from each village cluster in the ultimate stage. As a result a sample representative for the rural population of the selected provinces is obtained. An extensive questionnaire generated data that allows us to establish, for two consecutive waves, cumulative distribution functions of income and consumption at the level of provinces. In this paper we search for stochastic dominance relations between distributions of consumption for the 2007 wave. Such comparisons allow for initial, but quite robust conclusions on welfare; they provide benchmarks for assessing the vulnerability to poverty of the target population.

Method

In this paper we use raw data for sampled consumption distributions over individuals of six rural areas in Thailand and Vietnam, considering sampling weights to account for unequal sampling probabilities. We take these empirical distributions and subject them to dominance comparisons. We then interpret our observations in terms of comparative vulnerability. The main purposes of this paper are (i) to present summaries for the income distributions in the sample regions and (ii) to show how such summary information can, *in principle*, be used for vulnerability comparisons. Given this limited scope of our paper, we should be frank about the limitations of our method and analysis. Two major concerns are: (a) Vulnerability indices are thought to measure *individual* vulnerability to poverty. Moreover, vulnerability is very much an *ex ante* concept. As our data, we use sampled empirical (*ex post*) distributions of consumption over quite large groups of households as the basis for vulnerability comparisons. At best, we might interpret such an analysis as the construction of a hypothetical, representative inhabitant for each province who uses an observed income distribution for the population in his province as a predictor for her or his own future, personal income distribution. Such a veil-of-ignorance approach is, of course, questionable but, on practical grounds, unavoidable. (b) Econometric issues: We base comparisons among distributions on (more or less) unpolished sample data and do not include an econometric analysis. While the empirical distribution function is a good estimator for the (unknown) population cumulative distribution function (ANDERSON, 1996; DAVIDSON and DUCLOS, 2000), future versions of this paper should be based on statistical testing of dominance relations between the sampled distributions as e.g. in DAVIDSON and DUCLOS (2000). Having noted these caveats, we proceed under the proviso that the sampled distributions and their dominance relations correctly reflect population distributions and the dominance relations among them and that these population distributions are sufficient statistics for the ex-ante stochastic distributions for personal incomes which representative inhabitants in the corresponding province face.

Results

We obtained our results using the DASD software package for STATA developed by ARAAR and DUCLOS (2009) accounting for the complex sample design and report comparative results with respect to first, second and third degree of stochastic dominance between the 2007 distributions of per capita daily consumption. Our results are summarized in Table 1. That we do not find full first degree stochastic dominance (FSD) relations between the provincial distributions within countries is an expected result, given the strength of FSD. Still, for focused vulnerability measures relying on censored values of consumption we can be much more specific in partial vulnerability comparisons by identifying the first point of intersection of pairs of cumulative distribution functions. These earliest crossing points, together with the direction of the crossing, are reported in the FSD-rows of Table 1 for consumption. E.g., the pair (<, 9.18) reported in the FSD comparison between the Vietnamese provinces of Ha Tinh and Thua Thien Hue indicates that the distribution for Thua Thien Hue first-order dominates that of Ha Tinh up to the income level of $9.18. Hence, for all poverty lines below $9.18 all (monotonic) poverty and all focused vulnerability indices would indicate that (a representative individual in) Ha Tinh is poorer and more likely to be vulnerable than (in) Thua Thien Hue. Given that $9.18 is well above commonly used poverty lines, it appears justified to interpret people in Ha Tinh to be comparatively more vulnerable to poverty at standard poverty lines than in

Thua Thien Hue, independently of how vulnerability is specifically measured (as long as the measure is focused).

Table 1: Dominance relations for provincial distributions of per capita consumption

	Thailand			Vietnam			Cross-country	
	Buriram - Ubon'	Buriram - Nakhon Phanom	Ubon' - Nakhon Phanom	Ha Tinh - Thua Thien Hue	Ha Tinh - Dak Lak	Thua Thien Hue - Dak Lak	Ubon' - Dak Lak	Nakhon Phanom - Ha Tinh
FSD	> 0.83	< 0.73	< 0.74	< 9.18	> 1.53	> 2.51	≫	> 0.74
SSD	> 1.72	< 0.75	< 1.90	≪	> 1.97	> 5.11	≫	≫
TSD	> 2.34	< 0.78	< 2.29	≪	> 2.51	> 8.32	≫	≫

Notes: Consumption per day in $ PPP(2005). A>B [A<B] denotes dominance of distribution A over B [B over A] in the respective stochastic order up to the critical value reported in the row below. A>>B and A<<B denote stochastic dominance over the whole range of the distribution**.**

For vulnerability comparisons based on the commonly used EP and CD measures, the property of FSD is only partly relevant since they impose more restrictions: Interestingly, we see that the consumption distribution of Thua Thien Hue second-order stochastically dominates that of Ha Tinh. Hence, all vulnerability measures considered above (for FGT_α where $\alpha>1$) would, at any poverty line, agree that an individual is less vulnerable with respect to consumption in Thua Thien Hua than in Ha Tinh. Within the class of LS measures (with concave utility), CD measures (with convex valuation function), and FGT measures (for $\alpha>1$) this comparison is robust for every poverty line. In addition, the comparison remains, for any poverty line, robust for whatever measure of vulnerability one can conceive of that attaches more severity to low incomes or consumption levels that are farther away from the poverty line. For all pairwise comparisons without full stochastic dominance in the second order (SSD), Table 1 again reports the supremal levels of income and consumption up to which poverty dominance in the second order holds. Clearly, these threshold levels are higher than those for FSD, reflecting that second-order comparisons are more robust (though less general) than FSD ones. The interpretation of the threshold levels in the SSD case is analogous to the FSD case: E.g., the pair (>, 5.11) reported in Table 1 for SSD comparison between Thua Thien Hue and Dak Lak in indicates that the distribution for Thua Thien Hue second-order dominates that of Dac Lak for all poverty lines not higher than $5.11. Below that threshold, all monotonic and convex poverty and focused vulnerability indices would indicate that Thua Thien Hue is more vulnerable than Dac Lak. Going beyond second-degree stochastic dominance basically leads to higher first crossing points as listed in TSD-rows of Table 1, which indicate that most vulnerability and poverty comparisons for all the measures just mentioned would be robust at common poverty lines.

In summary, our application to Thailand and Vietnam gives rise to the following observations: (1) As expected, (meaningful) FSD relations do not emerge from the data. Hence, all comparisons of vulnerability are, at least to some degree, dependent on the measure used and/or on the poverty line employed. (2) For the distribution of consumption, poverty dominance relations in the second order are not uncommon at (and also above) standard poverty lines. Hence, the focused vulnerability measures proposed by CALVO and DERCON (2005) and all expected poverty measures based on FGT indices would agree on comparative vulnerability assessments for the provinces in our samples at standard poverty lines (but not elsewhere). (3) Subject to the restrictions mentioned in the previous item, for the three Thai provinces in the sample the consumption vulnerability ranking would be, in order of increasing vulnerability: Nakhon Phanom, Buriram, Ubon Ratchathani. For Vietnam, we obtain: Ha Tinh, Thua Thien Hue, Dak Lak. (4) For incomes (not shown above), comparable (weak) dominance relations are not found. As a consequence, conflicting assessments of comparative vulnerability are more likely to occur for income than for consumption.

Conclusions

Our paper is a first (and necessarily imperfect and incomplete) attempt to use ideas from the theory of stochastic orderings to rank income distributions with respect to their degree of vulnerability to poverty. The application to questionnaire-based income and consumption data from Thailand and Vietnam demonstrates that our idea could in fact be fruitful. The results reported here can serve as benchmarks for future studies on comparative vulnerability. Moreover, the techniques illustrated here could be also applied for different aggregates than provinces (e.g., farm households vs. non-farm households; rice farmers vs. producers of other crops etc.). Knowledge whether and how income distributions compare to one another with respect to stochastic dominance is tantamount to knowing which (if any) classes of vulnerability measures and concepts would come up with equivocal assessments of the relative vulnerabilities in these distributions. Put a bit more bluntly, it tells us to what extent vulnerability comparisons are driven by the analyst's choice of measure or really "come from the data". Knowledge about stochastic dominance properties between income distributions is relevant also from a policy perspective. It not only shows where the poor and rich provinces lie but also indicates how politics could intervene should it wish to alter the relative standings of provinces. E.g. since one distribution first-order stochastically dominating another means that in the latter incomes are lower at all percentiles of the distribution, FSD is indicative of a generally worse economic structure. Then, promoting growth (only) in the province with the dominated distribution would tend to equalize welfare levels (if that were desired). With second-order dominance at common means, the dominating distribution is more unequal (in the Lorenz sense) than the dominated one. Hence, an equalization of welfare levels across provinces requires intra-provincial redistribution from rich to poor in the more unequal province. Likewise, if – at equal first and second moments – a distribution is dominated by another in the third degree, then it entails a higher degree of skewness or downside risk. The corresponding policy tool would have to be transfer-sensitive, i.e., must obey the principle of diminishing transfers (KOLM, 1976; DAVIES and HOY, 1995), stating that a transfer of income or consumption from a richer to a poorer person is considered to be more equalizing the lower it occurs in the income or consumption distribution. Much research on the policy implications of observations of different degrees of vulnerability has to be done.

References

ANDERSON, G. J. (1996): Nonparametric Tests of Stochastic Dominance in Income Distributions, *Econometrica* 64, 1183-1193

ARAAR, A. and J.Y. DUCLOS (2009): DASP: Distributive Analysis Stata Package, Université Laval

CALVO, C. and S. DERCON (2005): Measuring Individual Vulnerability. Discussion Paper No. 229, Dept. of Economics, University of Oxford

DAVIDSON, R. and J.-Y. DUCLOS (2000): Statistical Inference for Stochatic Dominance and for the Measurement of Poverty and Inequality. *Econometrica* 68, 1435-1464

DAVIES, J. B., and M. HOY (1995): Making Inequality Comparisons when Lorenz Curves Intersect. *American Economic Review* 85, 980-986

FOSTER, J. E., J. GREER, and E. THORBECKE (1984): A Class of Decomposable Poverty Measures, *Econometrica* 52, 761-766.

HARDEWEG, B., H. WAIBEL, S. PRANEETVATAKUL and PHUNG DUC TUNG (2007): Sampling for Vulnerability to Poverty: Cost Effectiveness Versus Precision. Tropentag 2007 Witzenhausen

KOLM, S.CH. (1976): "Unequal inequalities I", Journal of Economic Theory 12, 416-442

LIGON, E. and L. SCHECHTER (2003): Measuring Vulnerability, *Economic Journal* 113, C95-C102

PRITCHETT, L., A. SURYAHADI, and S. SUMARTO (2000): Quantifying Vulnerability to Poverty: A Proposed Measure, with Application to Indonesia. SMERU Working Paper.

SHAKED, M., and J. G. SHANTHIKUMAR, 2006, Stochastic Orderings. Springer, New York