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A risk sensitive measure of individual vulnerability to poverty

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Motivation

- **Growing interest in evaluating individual's vulnerability to poverty**

- **1 general definition:**
  VP= the risk of falling into/further into poverty in **future**
  ≠ state of poverty due to uncertainties about living standard

- **Many measures and estimations methods**

- **BUT lack of clear theoretical foundations**

Contributions

- Focus on the measurement of VP defined as expected poverty from a theoretical & empirical point of view
- Show that assumptions made for measurement can jeopardize the ex-ante evaluation of VP
- Use a conceptual framework to propose a risk-sensitive measure of individual VP consistent with standard functional forms of welfare and estimation methods

Literature review

- **Ravallion, 1988**: Theoretical foundations for the measurement of aggregated poverty under risk-induce welfare variability

- **Chaudhuri et al, 2001, 2002**: **Defines individual VP as expected poverty**
  - **Empirically VP=mathematical expectation of a poverty indicator**
  - **Key choices: Poverty indicator, consumption generating process, time horizon**

- **Ligon & Schechter, 2004**: Evaluate approaches to estimate vulnerability. **Key dimension: the time series properties of consumption.**

- **Calvo & Dercon, 2005:** Axiomatic foundations. F**ocus on downside-risk and risk aversion.**

Operational choices & assumptions

Authors	Poverty index	Probability distribution	Time series properties of consmpt.	Data
Chaudhuri et al, 2001	Headcount (HC)	Unconditional Log-normal	Stationarity & ergodicity	Cross-section
Zhang & Wan, 2008	"	"	Stationarity	Panel
McCulloh&Calandrino, 2003	"	Unconditional Normal	"	"
Christiansen& Subbaro, 2005	Foster et al, 1984 class	Conditional Log-Normal	"	Pseudo-panel
Calvo & Dercon, 2005	Chakravarty, 1983	Not expl. specified	Stationarity, AR1	"
Pritchett et al, 2000	"	"	Non-stationarity	"
Mansuri & Haly, 2001	Headcount	Conditional Normal	Non-stationarity	Panel

Empirically each choice and assumption has been independently considered from each other. Result in dif. Vulnerability index

Implications of operational choices & assumptions

- **Functional form of poverty indices reflects risk aversion**
- **(Log-)Normality + Headcount =** ONLY Parametric index of VP BUT increase in risk can reduce VP!
- **Expectation of other proposed index: no close form solution → "ad-doc" estimation methods:**
  - Measurement of Pov(E[y]) ≠ E[Pov(y)]
  - Econometric model: predict lny ≠ y → Pov(lny) ≠Pov(y)
- **Ergodicity:** cross-sectional variation can be used to proxy individual's intertemporal variation

Implications of stationarity & conditional moments

Ex : AR(1) process, covariance stationarity

$$\ln y_t^i = \alpha \ln y_{t-1}^i + \eta^i + v_t^i$$

Conditional moments depends on information set availabe at time T

(1) $E[\ln y_{T+1}^i \mid \Omega_T^i] = \eta^i + \alpha \ln y_T^i$ **(2)** $Var[\ln y_{T+1}^i \mid \Omega_T^i] = Var(v_T^i) + c$

>> Ensure identification of VP in period T + 1 : truly forward - looking approach

Unconditional expectation caracterize over life - span :

(3) $E[\ln y_{T+1}^i] = E[\ln y_T^i] = \dfrac{\eta^i}{1-\alpha}$ **(4)** $V[\ln y_T^i] = \dfrac{Var[v_T^i] + c}{1-\alpha^2}$

>> Identify individuals' underlying permanent risk of poverty

>> measuring VP ≠ measuring Chronic poverty

>> "only" because probabilistic approach takes into account welfare variability

PANEL DATA NEED!

CROSS - SECTIONS : Stationary & Ergodic & IID process!!!

Our choices & Assumptions

I. Utility poverty gap indices (Chakravarty & Muliere, 2004)

Watts, 1968 : $\pi_W\left(\mathbf{u}, y^i_{t+1}, z\right) = (\ln z - \ln y^i_{t+1})$,

Haggenaars, 1987 : $\pi_{HAG}\left(\mathbf{u}, y^i_{t+1}, z\right) = \dfrac{\pi_W}{\ln z}$

Log function → CRRA (poor more risk averse)

II. Log-normality + Watts (I) parametric expression. Properties defined at aggregated level **(**Muller, 2001).

I & II → Concavity in stochastic variable + strict convexity of poverty index ensures risk-sensitivity (Ravallion, 1988)

→ Sensitive to the potential depth of future poverty

III. Conditional distribution, Stationarity, Panel data

A new index of Individual VP

$$V_{i,T}^{W} = \Phi\left(\frac{\ln z - \mathbf{E}_T^i\left(u, y_{i,T+1}\right)}{\sqrt{\mathbf{Var}_T^i\left(u, y_{i,T+1}\right)}}\right) * \left\{ \ln z - \left[\mathbf{E}_T^i\left(u, y_{i,T+1}\right) - \sqrt{\mathbf{Var}_T^i}\,\lambda_T\right] \right\}$$

<u>An Expected Poverty Gap Measure</u> $\epsilon\ [0, +\infty[$
The threat of the severity of poverty

- Depends on **conditional** expectation and **variance** of future welfare (1 period ahead)
- Decomposable into vulnerability due to high welfare volatility and/or low expected welfare

Illustration

Bulgaria, 1994: Monthly data from January to December. Use 11 months to forecast the expected severity of poverty of the last month.

Estimation methods:

- AR process to forecast cond. Expectation. Variance of residuals = measure of risk

  (system GMM estimation, Blundell and Bond, 1998)

- Sample mean and variance over first 11 months

Dependent variable is the logarithm of consumption per capita, $lny_{i,t}$, system GMM estimation results

Education level	Rural	Urban
of the Head:	some educ.	some educ.
	coef(se)	coef(se)
	II	IV
Lagged welfare, $lny_{i,t-1}$	0.07**	0.11***
	(0.026)	(0.025)
2nd order lag, $lny_{i,t-2}$		0.09***
		(0.020)
3rd order lag, , $lny_{i,t-3}$		0.03*
		(0.016)
Lagged income	0.24***	0.13*
	(0.068)	(0.092)
Lagged age of head		0.00
		(0.012)
Lagged family size		
Lagged log. age of head	1.32***	
	(0.127)	
Lagged log. Fam. size	0.36**	0.31**
	(0.132)	(0.233)
Number of observations	6370	11008
Number of individuals	654	1379
Av. nb. of obs. per individual	9.74	7.98
m1	-13.71***	-19.675***
m2	.012	-.0756

* , ** , *** denote significance at 5%, 1% and 0.1% significance level.

Notes:

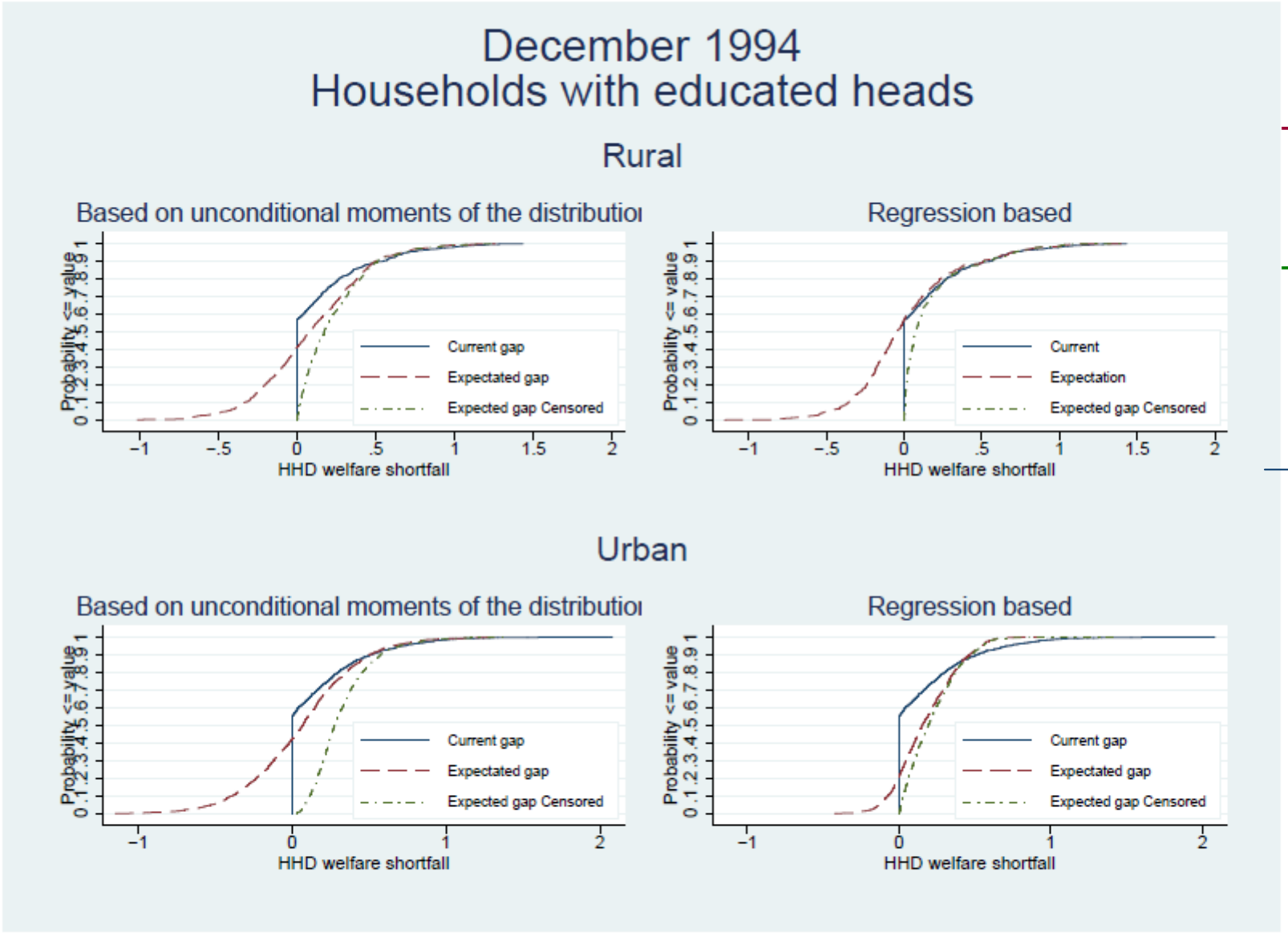

Figure 7: Cumulative distribution of hhds' expected censored welfare shortfall under the assumption of log-normality

Table 5: **Current and Expected Watts Poverty Gap, Bulgaria, December 1994**

by Household characteristics	Watts poverty gap ratio	
	Expected from the perspective of November, based on	
	conditional expectation[1] and variance of residuals	unconditional expectation[2] unconditional variance
Rural	**0.19**	**0.28**
Head has no education	0.34	0.39
Head has some education[3]	0.15	0.26
Urban	**0.17**	**0.25**
Head has no education	0.37	0.37
Head has some education	0.16	0.24
Bulgaria	**0.17**	**0.26**

Source: Household Budget Survey Bulgaria 1994. Author's own calculation.

Notes:[1] The conditional expected welfare is calculated using the predictions from the dynamic linear par model (see Table 3). The variance of the residuals are used to proxy uninsured risk exposure.

[2] The unconditional expectation and variance are calculated using each household's sample mean and variance of per capita welfare over the months January to November. [3] Education leve of the head of the household are primary, secondary or post-secondary.

Conclusion

Possible to derive an index of individual vulnerability that is consistent with:

- behavioral assumptions about risk
- the stochastic underlying process of consumption
- can be estimated from "standard" econometric models that focus on the conditional expectation of log consumption

Unconditional moments preferred only

- in the absence of information about recent observations
- panel with unequally spaced data
- if one is willing to forecast welfare in the far future.

Stationary assumption does not allow individuals to escape poverty permanently!

Relaxing stationarity:

- only changes in poverty are identifiable!
- Use the life-cycle assumption (Hall, 1897). Sceptical! Why? Based on:
- Quadratic preferences → income risk plays no role in optimal intertemporal consumption plan (Blundell & Stocker, 1999)
- Perfect credit markets
- Known constant interest rate