UNIVERSITÀ DEGLI STUDI FIRENZE
DISEI
Dipartimento di scienze per l'economia e l'impresa

DIPARTIMENTO DI SCIENZE SOCIALI ED ECONOMICHE
SAPIENZA UNIVERSITÀ DI ROMA

Vulnerability and Resilience to Food and Nutrition Insecurity:
A review of the literature towards a unified framework

Pierluigi Montalbano
Sapienza University of Rome

Donato Romano
University of Florence

AIEAA Webinar: 27th April 2023

Background

Why vulnerability and resilience?

- Increased shocks and risks, uncertainty
- Practical reasons: hum & dev't agencies
  - Hyogo framework for action (2007)
  - World Humanitarian Summit (2016): NWoW, HDP nexus
- Conceptual reasons:
  - similar, largely overlapping concepts
  - hot topics, but
    - no comprehensive comparative analysis of V and R
    - many definitions for both V and R: different models and measures

Background

Why vulnerability and resilience?

Vulnerability *is determined by the* ***options available*** *to households and individuals to* ***make a living****, the* ***risks*** *they face and their* ***ability to handle*** *this risk* (Dercon, 2001)

Resilience *is the* ***capacity*** *of a household that ensures adverse* ***stressors*** *and* ***shocks*** *do not have* ***long-lasting adverse development consequences*** (RMTWG, 2014: 4)

- risks ↔ stressors and shocks
- options available and ability to handle risks ↔ capacity
- make a living ↔ prevent long-lasting adverse development consequences

Background

Why vulnerability and resilience?

Working in development

Resilience: meaningless jargon or development solution?

Donors, recipient governments and implementing agencies are selling 'resilience' to the public without a clear definition or a money-back guarantee

Misha Hussain

Tue 5 Mar 2013 16.02 GMT

Background

Why vulnerability and resilience?

- Key question: is resilience just the flip side of vulnerability?
- Specific questions on V and R:
  - how are they conceptualized?
  - how are they measured?
  - how good are they for practical use?
    - targeting
    - impact evaluation

* Specific reference to **food insecurity**

Outline

- Food security measurement axioms
- Vulnerability
  - definitions
  - measurement approaches
- Resilience
  - definitions
  - measurement approaches
- Vulnerability vs. Resilience
  - towards a unifying framework
- Research and policy implications

Food security

World Food Summit (FAO, 1996)

"a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"

FS measurement axioms (Upton et al., 2016)

- **scale**: aggregation and decomposability
- **time**: dynamics, forward-looking
- **access**: conditioning factors
- **outcome**: wellbeing dimension

Vulnerability

- Different approaches
  - **Vulnerability to expected poverty (VEP)** (Christiaensen & Subbarao, 2001; Chauduri et al., 2002)
  - **Vulnerability as low expected utility (VEU)** (Ligon & Schechter, 2003, 2004)
  - **Vulnerability as the threat of future poverty (VTP)** (Calvo & Dercon, 2007, 2013)

* Generally, no reference to food security

Vulnerability #1: VEP

Probability that the HH's level of consumption at time t+1 will be below the consumption poverty line, z

$$VEP_{h,t} = Pr(log\ c_{h,t} < log\ z\ |X_{h,t}) = \Phi\left(\frac{log\ z - log\ \widehat{c_{h,t}}}{\sqrt{\widehat{\sigma^2_{h,t}}}}\right)$$

Axioms	Check
Scale	Y
Time	N
Access	Y
Outcome	N

Assumption:
the cross-sectional variation of the sampled HHs' consumption as the time series variation of HH-specific consumption

Vulnerability #2: VEU

Difference btw the *U* derived from some level of certainty-equivalent consumption at and above which the HH would not be considered vulnerable and the expected *U* of cons.

$$VEU_h = \left[U_h(z_{ce}) - U_h(Ec_{h,t})\right] + \left[U_h(Ec_{h,t}) - EU_h(c_{h,t}|\mu_k)\right] + \left[EU_h(c_{h,t}|\mu_k) - EU_h(c_{h,t}|\mu_k,\mu_t)\right] + \left[EU_h(c_{h,t}|\mu_k,\mu_t) - EU_h(c_{h,t}|\mu_k,\mu_t,x_{h,t})\right] + \left[EU_h(c_{h,t}|\mu_k,\mu_t,x_{h,t}) - EU_h(c_{h,t})\right]$$

$$[poverty] \quad [meso\ risk\} \quad [aggregate\ risk] \quad [idiosyncratic\ risk] \quad \left[\begin{matrix} unexplained\ risk/ \\ measurement\ error \end{matrix}\right]$$

Axioms	Check
Scale	Y
Time	Y
Access	Y
Outcome	N

Main limitations:

- No focus axiom
- Mean consumption as independent from risk, underestimating the overall effect of risk

Vulnerability #3: VTP

The burden caused by the threat of poverty, i.e. exposure to states of the world where hardship may strike causes distress ex-ante, even if ex-post the dice are benign and poverty (consumption below a critical norm) does not materialize

$$V_\alpha = \left[1 - \mathrm{E}\left(\prod_{i=1}^{n} x_i^{\frac{1}{n}}\right)^{\alpha}\right]$$

Axioms	Check
Scale	N
Time	Y
Access	Y
Outcome	Y

Main limitations:

- Outcomes assumed to be non-transferable across states of nature
- Highly data demanding (knowledge of all possible states of nature)

Resilience

- Different approaches
  - **Resilience as capacity (RCI)** (Alinovi et al., 2008; FAO, 2016)
  - **Resilience as as return to equilibrium** (Perrings, 2006; Knippenberg et al., 2019)
  - **Resilience as a normative condition (ρ)** (Barrett & Constas, 2014; Cissé & Barrett, 2018)
  - **Resilience as transformability** (Walker et al., 2004; Reyers et al., 2018)

* Referred to poverty as well as food security

Resilience #1: Capacity

An ex-ante capacity that limits the adverse well-being effects of risk exposure (i.e., stressors) and/or the near- or longer-term consequences of shocks

$$RCI = [\beta_1, \beta_2, \dots, \beta_n] \cdot [ABS, AST, SSN, AC] + \varepsilon_1$$

$$[W_1, W_2, \dots, W_n] = [\alpha_1, \alpha_2, \dots, \alpha_n] \cdot RCI \cdot [\varepsilon_2, \varepsilon_3, \dots, \varepsilon_n]$$

Axioms	Check
Scale	N
Time	N
Access	Y
Outcome	Y

Main limitations:

- Explanatory variable, rather than an outcome
- Not forward-looking
- Not anchored to a norm

Resilience #2: Return to equilibrium

HH's capacity to recover – sometimes how fast is the speed of recovery – from a shock, i.e. ex-post recovery of a well-being variable rather than explicitly modeling the various capacities that result in rapid recovery

$$Z_{i,t}^{s} = \gamma_0 + \gamma_1^s Z_{i,t-1}^{s} + \gamma_t^s \left(Z_{i,t-1}^{s} \delta_t \right) + \delta_t + \mu_i^s + \delta \varepsilon_{i,t}$$

Axioms	Check
Scale	N
Time	Y
Access	Y
Outcome	N

Main limitations:

- Not decomposable/aggregable across sub-populations
- Focus only on the capacity of the household/individual to return to the pre-shock status

Resilience #3: Normative condition

A condition that reflects one's capacity to avoid adverse well-being states, rather than a capacity itself

$$W_{i,t} = \sum_k \alpha_k W_{i,t-1}^k + \boldsymbol{\gamma}\mathbf{X_{i,t}} + \boldsymbol{\theta}\mathbf{S_{i,t}} + \varepsilon_{i,t}$$ (HH-specific conditional mean)

$$\varepsilon_{i,t}^2 = \sum_k \beta_k W_{i,t-1}^k + \boldsymbol{\delta}\mathbf{X_{i,t}} + \boldsymbol{\vartheta}\mathbf{S_{i,t}} + u_{i,t}$$ (HH-specific conditional variance)

$$\rho_{i,n} \equiv \Pr\left(W_{i,n} \geq \underline{W} \middle| W_{i,n-1}, \mathbf{X_{i,n}}, \mathbf{S_{i,n}}\right) = F\left(\underline{W}, \widehat{W}_{i,n}\left(W_{i,n-1}, \mathbf{X_{i,n}}, \mathbf{S_{i,n}}\right), \hat{\varepsilon}_{i,n}^2\left(W_{i,n-1}, \mathbf{X_{i,n}}, \mathbf{S_{i,n}}\right)\right)$$

Axioms	Check
Scale	Y
Time	Y
Access	Y
Outcome	Y

(HH-specific conditional probability of satisfying a normative wellbeing standard)

Vulnerability vs. Resilience

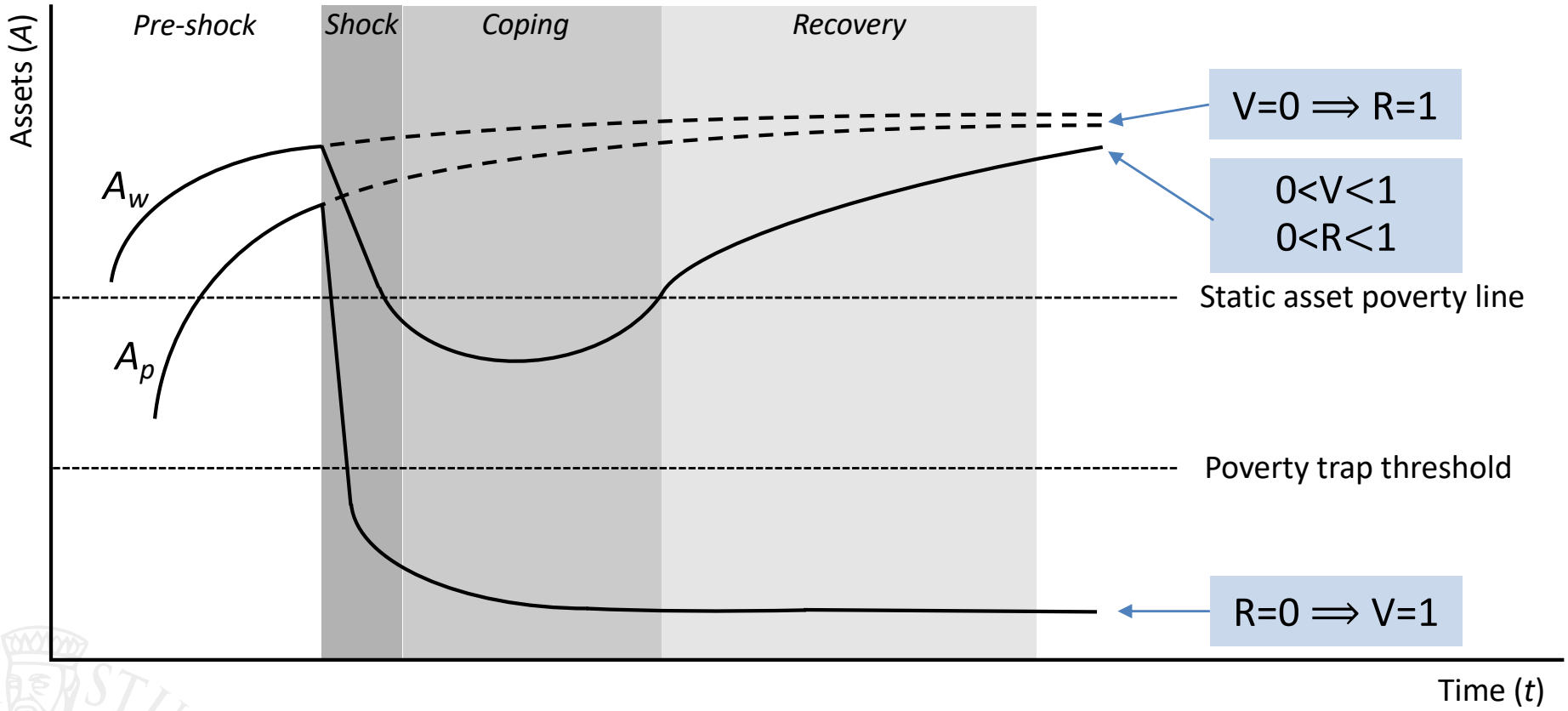
Vulnerability *is determined by the options available to households and individuals to make a living, the risks they face and their ability to handle this risk* (Dercon, 2001)

Resilience *is the capacity of a household that ensures adverse stressors and shocks do not have* ***long-lasting*** *adverse development consequences* (RMTWG, 2014: 4)

* **R: long-term consequences** → not being trapped in a low-level equilibrium, ability to bounce back

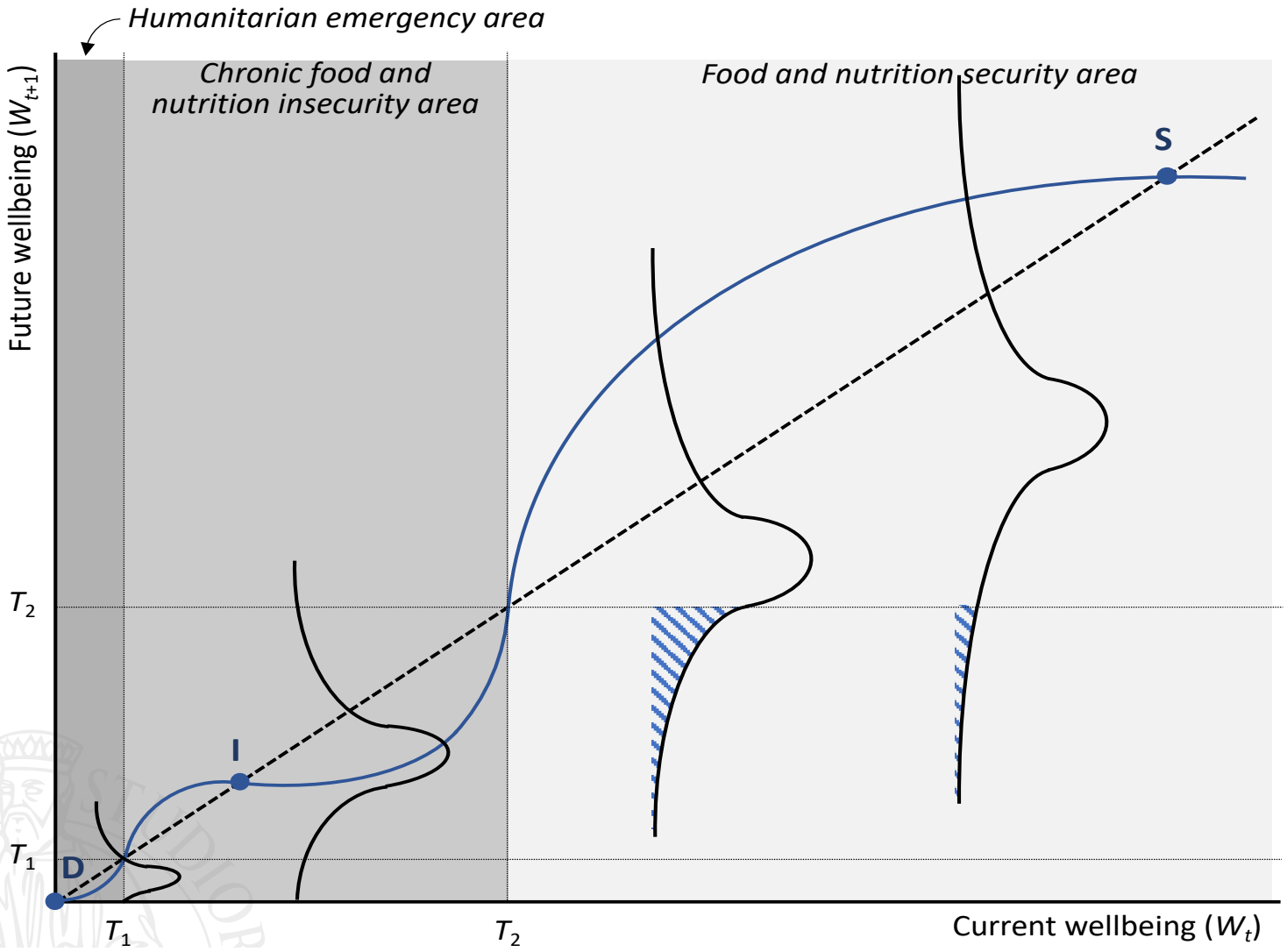
Vulnerability vs. Resilience

Is resilience just the the flip side of vulnerability?



Vulnerability vs. Resilience

Is resilience just the the flip side of vulnerability?



A non-poor HH with high m^2 may be both vulnerable and resilient

Towards a unifying framework (Cissé & Barrett, 2018)

The case for a conditional moments-based approach

Poverty traps literature

- Estimating only the first moment (expected path dynamics)
- Allowing for potentially non-linear dynamics

Vulnerability literature

- Estimating both the conditional mean and conditional variance
- Ignoring non-linearity in prospective dynamics

Resilience

- Considering higher order conditional moments
- Considering non-linearity in prospective dynamics

Towards a unifying framework

The case for a conditional moments-based approach

Normatively anchored, intrinsically dynamic, forward-looking

- **Scale**: possibility aggregation across / decomposition between subpopulations
- **Time**: ability to estimate the time series of resilience score per each period, *s*, beyond *t*
- **Access**: condition the moments of the food security distribution on any of a host of economic, physical, and social factors
- **Outcome**: conditional probability of satisfying a normative wellbeing (e.g. FCS, HDDS, MUAC, etc.)

Towards a unifying framework

The case for a conditional moments-based approach

Practical use

- **Targeting**: possibility to set different thresholds (e.g. low probability to be above a high threshold vs. high probability to be below a very low threshold) → exclusion vs. inclusion error)
- **Policy impact**: possibility to evaluate performance in 'building resilience':
  - specific assets (e.g., a livestock transfer),
  - products (e.g., insurance or credit),
  - infrastructure (e.g., irrigation, roads, or health clinics)

Policy implications

- Objective: minimize the likelihood of people falling into either of the less desirable zones (HE, CFNI)
- Three possible options for disruptive interventions
  - **shift people's current status**, i.e. increase W_t
  - **alter the conditional transition distributions**, i.e. truncate ε_t from below
    - risk transfers
    - risk reduction
  - **change the underlying system structure** to induce behavioral change and thereby change the functions $m^k = \left(W_{t+s} \middle| W_t, \varepsilon_t\right)$

Research implications

- applied research agenda
  - expand geographical coverage
  - expand the range of shocks and stressors
  - cross-scale measurements
  - socio-ecological system jointly dynamic analysis
- build/use of the relevant data base
  - identify the relevant data needs
  - build a multi-country system of sentinel sites collecting high-quality, high-frequency data over long period of time, particularly in the more disaster-prone areas

Thank you for your attention

donato.romano@unifi.it

pierluigi.montalbano@uniroma1.it