

Measuring Resilience An Approach using Data from Nepal, Bangladesh, and Uganda

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USAID's resilience definition

USAID defines resilience as "the ability of people, households, communities, countries and systems to mitigate, adapt to and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth."

In other words, it is the ability to manage adversity and change without compromising future well-being.

USAID's resources regarding resilience: resiliencelinks.org



Outline:

- I. Setting the stage
- 2. One method to measure resilience
- 3. Applications to maternal and child nutrition
- 4. What does it mean for programming approaches?



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The word "resilience" has come into widespread use

Resilience (noun):

- 1. the capacity to recover quickly from difficulties; toughness.
 - Example: "the often remarkable resilience of so many British institutions"
- 2. the ability of a substance or object to spring back into shape; elasticity.
 - Example: "nylon is excellent in wearability and resilience"

Opposite: rigidity, fragility, vulnerability, weakness



Source: Definition is from Oxford Languages (<u>https://languages.oup.com/google-dictionary-en</u>) word frequency is from Google Books ngram viewer (<u>https://books.google.com/ngrams</u>), 15 Nov. 2020.

Frequency in English-language books, 1900-2019



USAID used resilience early, for crisis recovery in the 2010s



Defining Resilience

USAID defines resilience as "the ability of people, households, communities, countries and systems to mitigate, adapt to and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth"

- USAID's Building Resilience to Recurrent Crisis (2012)



Source: Andre Mershon (2012), Resilience in USAID. https://slideplayer.com/slide/12046914



Resilience is more cost-effective than delayed responses

THE ECONOMICS OF RESILIENCE TO DROUGHT IN KENYA, ETHIOPIA, AND SOMALIA

AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE

Humanitarian Assistance Savings* and Avoided Losses Over 15 Year Period for Population of 15 Million as Compared to Standard Humanitarian Response



Source: https://www.usaid.gov/sites/default/files/documents/1867/V4_Infographic.pdf



Resilience is now a central theme for many USAID activities



Source: https://www.usaid.gov/resilience/resources



USAID leadership on resilience is important for others as well



Source: https://www.slideshare.net/2020resilience/vaughn-institutionalizing-resilience-in-usaid-5-14





Source: http://www.fao.org/inaction/kore/news-and-events/eventsdetails/en/c/1158471/



Resilience is complex, calling for a range of measurement tools





Resilience is complex, calling for a range of training materials



Source: https://resources.kdad.org/sites/default/files/165_1/Resilience%20101%20HTML/story.html



Resilience is complex, calling for a range of expertise

AGRILINKS

TOOLS & TRAINING MEMBERS TOPICS EVENTS ACTIVITIES

Resilience

Tools to anticipate and prepare for market shocks, health crises, political instability and weather extremes gives vulnerable people ways to manage risks and rebound more quickly.

POSTS AGRILINKS EVENTS

AGRILINKS EVENT

Current and Emerging Threats to Crops: Building the Knowledge Base

Oct 21, 2020 D online

Please join USAID Bureau for Resilience and Food Security as we consider current efforts to combat threats and share a new research opportunity to further the practice.

C	AGRICULTURAL PRODUCTIVITY		
C	CLIMATE AND NATURAL RESOURCES		
C	MONITORING, EVALUATION, AND LEARNING	$\mathcal{D}($	RESILIENCE



UPCOMING EVENTS

Search Agrilinks...

Women and Gender in Development at Virginia Tech Virtual Conference 2021

LOG IN

iiiii Feb 23, 2021 to Feb 26, 2021 United States D online

Lessons in Working Towards Global **Eradication of Peste des Petits Ruminants** (PPR) ₩ Dec 02, 2020 United States D online

Source: https://www.agrilinks.org/topics/resilience



Today's focus is measurement, building on economic methods



Source: Hallegatte S. (2014) "Economic resilience. Definition and Measurement", Policy Research Working Paper 6852, The World Bank <u>http://documents.worldbank.org/curated/en/350411468149663792/pdf/WPS6852.pdf</u>



Our approach starts when outcomes are measured 3 times

Resilience is concerned with those who experience a decline and then recover at least some of what they lost.

Are they truly resilient, or did they just experience random noise?





To measure resilience, we compare two successive changes

Our focus is on recovery after decline, which we compare to decline after improvement





Our longitudinal (panel) surveys reveal dynamics of change

For example, over the four years of the PoSHAN survey (2013-16) in Nepal women whose dietary diversity declined recovered some of their losses while those whose diets initially improved kept most of their gains.



Source: NiL PoSHAN survey data, from Zaharia et al 2020. n=1,808 women (Terai subsample only).



The method we use draws on techniques developed for financial markets, and could be applied to any outcome



Source: Zaharia, Masters, Shively & Webb (2020) Measuring Resilience as Asymmetric Mean Reversion. Working Paper, Tufts University.



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Observations in the shaded quadrant are improvements after decline. *Is that resilience?*



Source: Zaharia, Masters, Shively & Webb (2020) Measuring Resilience as Asymmetric Mean Reversion. Working Paper, Tufts University.



Estimation

- Where:
 - $y_{i,t}$ is the outcome of interest for individual *i* at time *t*
 - *t*=3,...*T* and *i*=1,...,*N*.
 - $\Delta y_{i,t} = y_{i,t} y_{i,t-1}$
- Bias correction



$$\Delta y_{i,t} = \alpha^{-} + \rho^{-} \Delta y_{i,t-1} + \Delta \varepsilon_{i,t}, \text{ if } \Delta y_{i,t-1} < 0$$

$$\Delta y_{i,t} = \alpha^{+} + \rho^{+} \Delta y_{i,t-1} + \Delta \varepsilon_{i,t}, \text{ if } \Delta y_{i,t-1} \ge 0$$





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Data

Outcome:

Dietary diversity scores (DDS) from 7-day and 24-hour diet recalls Women's Body Mass Index (BMI) Children's weight-for-height z-score (WHZ)

Population:

Women (13 to 47 years old) and children (2 to 5 years old)

Geography & time:

Nepal: Terai region, 2013-2016 (yearly) Bangladesh: Feed the Future Zone of Influence, 2016-2017 (bi-annual) Uganda: six districts from N and SW Uganda, 2012-2016 (biennial)

Data sources:

Nepal: PoSHAN survey (Klemm et al. 2018) Bangladesh: BAHNR survey Uganda: Uganda panel survey



Evidence of resilience in Nepal

Outcome	Reverting tendency of declines $({oldsymbol ho}^-)$		
Women's weekly DDS	-0.36***	Reversal	
Children's weekly DDS	-0.54***	Reversal	
Women's daily DDS	-0.03	Random walk	
Children's daily DDS	-0.03	Random walk	
Women's BMI	0.40***	Momentum	
Children's WHZ	0.19***	Momentum	

OLS regressions, corrected for bias. *p<0.1, ** p<0.05, ***p<0.01. Nepal: n=3,752 (women) & 2,203 (children)

Source: Zaharia et al. (2020) Recovery without resilience? Evidence on diet quality and anthropometric outcomes of rural women and children from Nepal, Bangladesh and Uganda. Working Paper, Tufts University.



No evidence of resilience in Bangladesh and Uganda

Outcome	Reverting tendency of declines (ρ^-)		
Bangladesh			
Women's daily DDS	0.38***	Momentum	
Children's daily DDS	0.13**	Momentum	
Women's BMI	0.86***	Momentum	
Children's WHZ	0.23***	Momentum	
Uganda			
Women's daily DDS	0.48***	Momentum	
Women's BMI	0.22**	Momentum	

OLS regressions, corrected for bias. *p<0.1, ** p<0.05, ***p<0.01. Bangladesh: n=2,753 (women) & 1,547 (children); Uganda n=1,617 (women).



How does resilience vary in the population?

- In Nepal, dietary diversity resilience of women and children varies across **households** and **districts**.
- Who is most resilient?



Women and children from **more market-oriented** households and those with **better access to credit** are more resilient



Source: Zaharia et al. (2020).



Women and children from **districts with more developed infrastructure** are more resilient



Source: Zaharia et al. (2020).



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Household food insecurity across the year (Nepal 2014)



FIGURE 3 Monthly reporting of food insecurity, among farming compared with nonfarming households (n = 340 households). Vertical error lines represent 95% CIs.



Livelihood 'resilience' post-earthquake (Nepal 2015)





Implications?

- Program goals could include 'net' resilience at household or ZOI levels (to allowing for 'churning')?
- Co-variate shocks can weaken systems over time. Setting expectations: will your resilience programming reverse this? Over what period?
- Programs need longitudinal data to assess multiple time points (coordinate with national statistics offices)?
- We need to find ways to treat 'past gains protected' during shocks in ways that value this alongside 'future gains achieved' without shocks.



Programming implications?

- Delivery systems made resilient:
 - Strengthen services, inputs, assets, credit, income flows so that the systems themselves are more resilient.
 - Resilient systems support outcomes across the food system (wealth, jobs, purchasing power).
 - Preparedness can be embedded in all parts of food systems.
- Attribution is challenging. What might not have happened is hard to measure and value.
- We need to focus much more on supporting resilience policy and programming, via clarity on metrics and evidence.



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