Leibniz Institute of Agricultural Development in Transition Economies

Household resilience and coping strategies to food security: an empirical analysis from Tajikistan

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Introduction

A condition or system is resilient if there is no shifting into an alternative circumstance (Walker et al., 2006).

Resilience represents the idea of bouncing back as a response to changes in a dynamic or adaptive environment (Capdevila et al., 2021).

- Resilience in Food Security

"…the capacity of a household to bounce back to a previous level of well-being (e.g. food security) after a shock" (FAO, 2016).

"…the ability of a household to manage or recover from shocks and stresses" (Smith, 2015).

"…the ability of a household to mitigate the adverse effect of shocks" (Sunday et al., 2022).

"…the ability of households to mitigate, adapt to, and recover from shocks by reducing chronic vulnerability and facilitating inclusive growth" (FAO, 2016).

"…the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences" (Barrett and Constas 2014).

Introduction

Resilience Index Measurement Analysis (RIMA) approach estimates household resilience capacity to food insecurity based on a quantitative approach (FAO, 2016).

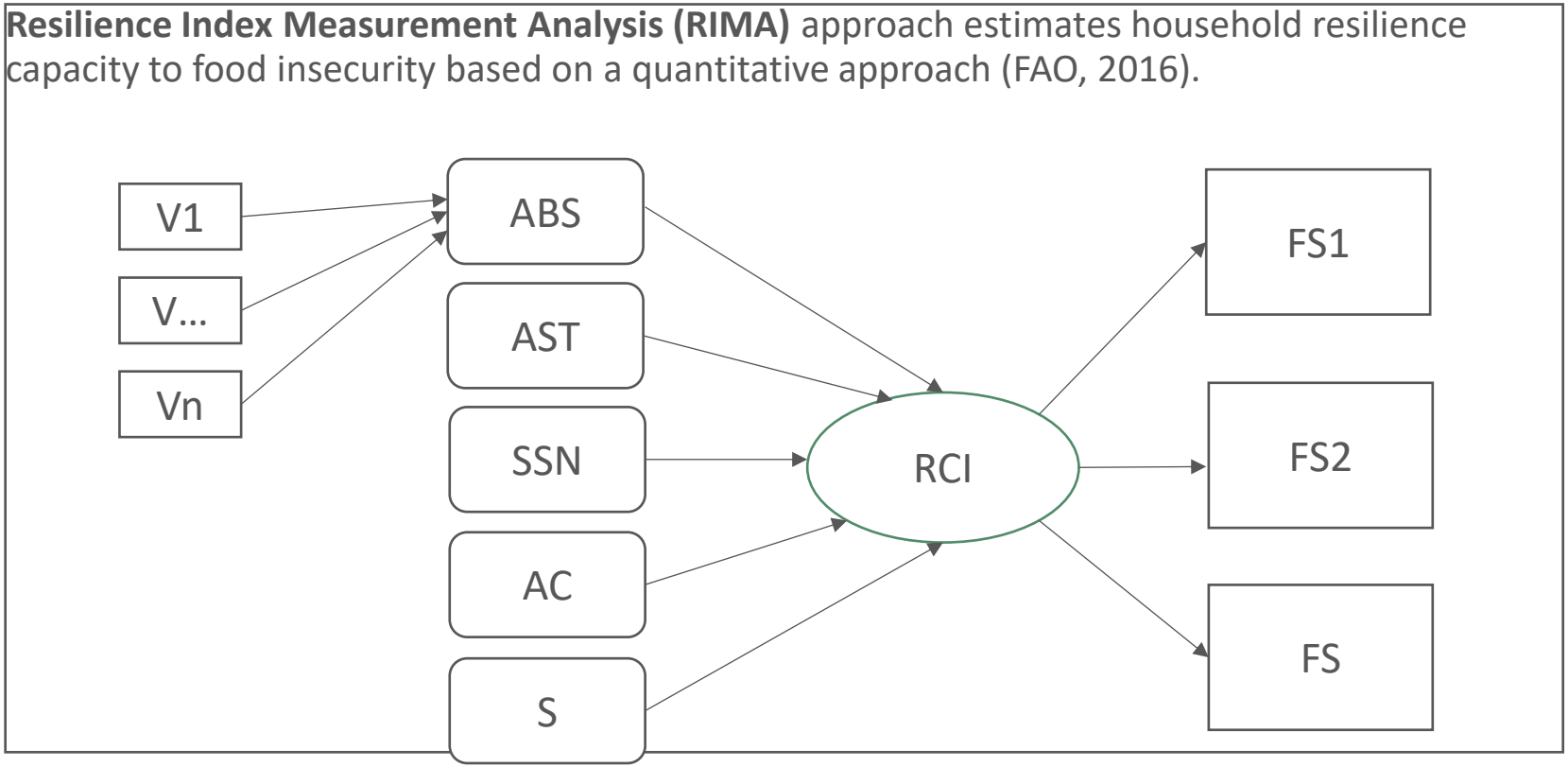


Fig.1. RIMA Approach -
Source: (D'Errico and Smith 2019)

Note: ABS-Access to Basic Services; AST-Assets; SSN-Social Safety Nets; AC-Adaptive Capacity; S-Sensitivity; RCI-Resilience Capacity Index; FS-Food Security Indicators

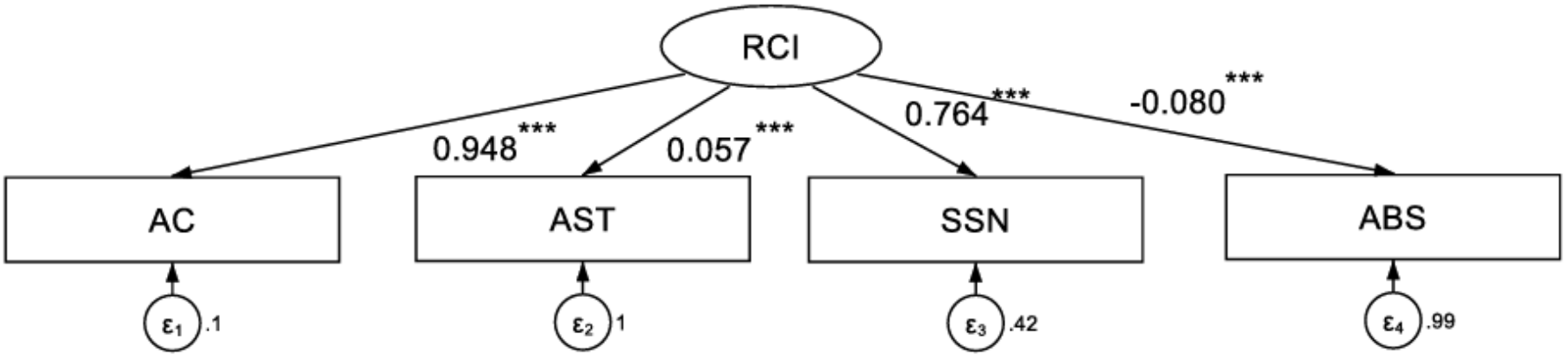
Social capital and resilience in Kyrgyzstan

Pillars	Variables
Access to Basic Services (ABS)	Improved drinking water; Improved heating; Improved cooking sources; Next main road; Next livestock market; Next school; and next hospital
Income and Food Access (IFA)	Dietary diversity; Food Expenditure; Adequacy of Fruits and Vegetables; Income from agriculture; The number of pension types; The number of allowance types; The number of other benefits; and Remittance
Agricultural Production and Technology (APT)	Livestock production; Crop production; Plot numbers; Harvest; Own seed; Hiring labour in agriculture; and Plantation area
Adaptive Capacity (AC)	Wealth Index; Tropical Livestock Unit (TLU); Weather information; Extension service; Informal Networking Index; Education; Household Stability Index

Social capital and resilience

- A causal relationship indicates that both **Trust** and **Membership** have **positive effects** on **ABS, IFA, APT, AC** and **RCI**.
- For the intervention programs, the presence of **trust** and **group membership** may provide an **additional margin** to **enhance** household **food insecurity resilience.**

Resilience Capacity and Food Security



N: 2530
R-squared: 0.910
Chi2: 96.239
p-value: 0.000
RMSEA: 0.136
CFI: 0.953
TLI: 0.858
***p<0.01, **p<0.05, *p<0.1

Fig.2. Resilience Capacity Index (SEM Approach)
Source: Egamberdiev et al. 2023

Resilience Capacity and Food Security

Our results suggest that the **household resilience capacity** serves to **increase household dietary diversity, food expenditure and the adequacy of fruit and vegetable consumption** or to **decrease losses in dietary diversity and food expenditure**.

Findings for the mediating effects imply that the **resilience capacity** is able to **mediate** the **impact of shocks on food security outcomes**.

The results call for interventions and policies to **encourage especially SSN** and **AC** to **enhance household resilience.**

Data and Methods

Food security remains in a critical condition in Tajikistan (FAO, 2022), while households are characterized by a weak adaptive capacity to food insecurity (WFP, 2017).

The COVID-19 pandemic and climate change have increased hunger, poverty, inequality and vulnerability in food security (Dixon et al., 2021; Egamberdiev, 2021).

As a policy response mechanism, household resilience capacity is one of alternative strategies to increase adaptability (Rajiv and Aliev 2024).

Data

- **Tajikistan Living Standards Survey** (the TLSS) in 2007 and 2009 by the World Bank
- **Tajikistan Household Panel Survey** (THPS) in 2011 by the Leibniz Institute for East and Southeast European Studies (*Leibniz-Institut für Ost- und Südosteuropaforschung* – IOS)

Objectives

- Step-1: To measure resilience pillars (Access to Basic Services, Assets, Social Safety Nets, Adaptive Capacity and Sensitivity) and Resilience Capacity Index (RCI) through Factor Analysis.
- Step-2: To estimate coping strategy classes through Latent Class Analysis.
- Step-3: To estimate a causal relation between RCI and food security outcomes.

Two-step approach for Resilience Capacity Index (RCI) in RIMA-II

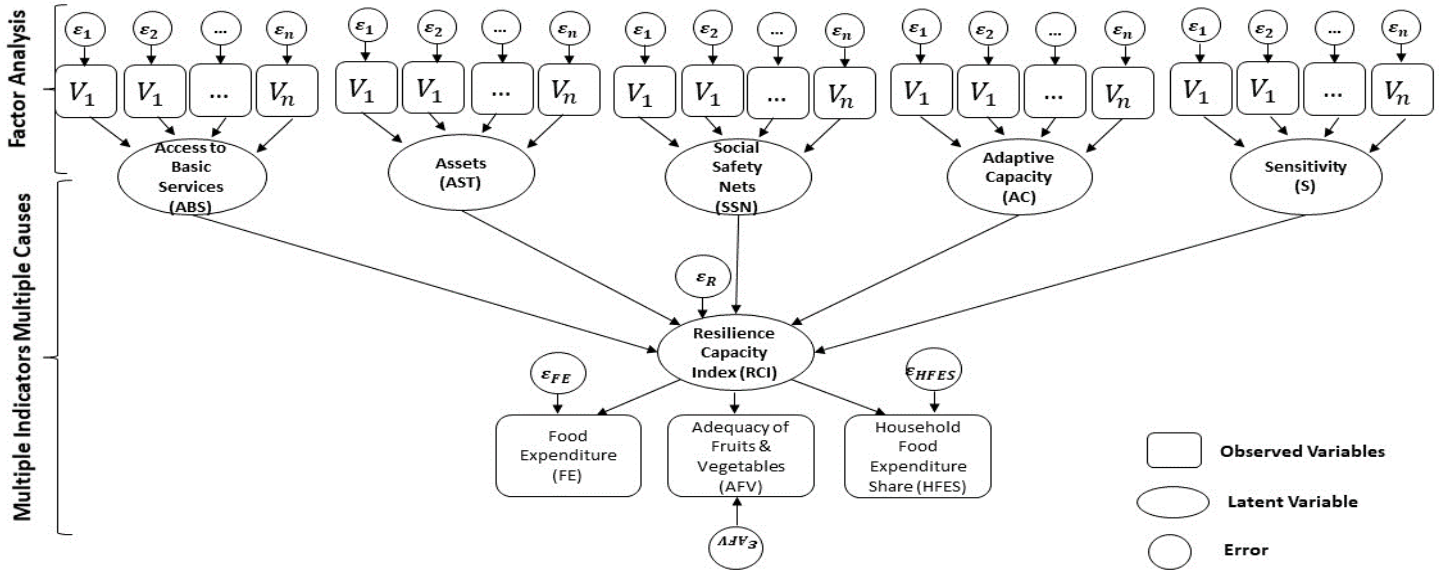


Fig.3. Resilience Index Measurement Analysis II (RIMA) approach
Source: (Egamberdiev et al. 2024)

Factor Analysis

Tab.1. ABS pillar

Pillar	Variable	Mean	St.Dev	Min	Max
Access to Basic Services (ABS)	Central heating	0.122	0.327	0	1
	Electricity heating	0.314	0.464	0	1
	Gas	0.324	0.468	0	1
	Improved water source	0.538	0.498	0	1

Factor Analysis

Tab.2. AST pillar

Pillar	Variable	Mean	St.Dev	Min	Max
Assets (AST)	Wealth Index (based on factor analysis)	0.233	0.161	0	1
	Monthly per capita non-food consumption in nominal value	59.919	119.129	0	1958.5
	Monthly per capita expenditures on utilities in nominal value	20.948	22.125	0	265

Factor Analysis

Tab.3. AC pillar

Pillar	Variable	Mean	St.Dev	Min	Max
Adaptive Capacity (AC)	Income diversification (based on factor analysis)	0.019	0.043	0	1
	Income earner share	0.616	0.230	0	1
	Secondary education	0.964	0.184	0	1
	Migration	0.330	0.470	0	1
	Number of elderly people (65+)	0.290	0.564	0	2

Factor Analysis

Tab.4. SSN pillar

Pillar	Variable	Mean	St.Dev	Min	Max
Social Safety Nets (SSN)	Old age pension	0.326	0.469	0	1
	Disability pension	0.103	0.305	0	1
	Survivor pension	0.031	0.174	0	1
	Special merit pension	0.003	0.057	0	1
	Social pension	0.001	0.044	0	1
	Compensation	0.020	0.142	0	1
	Compensation cash	0.029	0.168	0	1
	Compensation bulbs	0.133	0.340	0	1

Factor Analysis

Tab.5. S pillar

Pillar	Variable	Mean	St.Dev	Min	Max
Sensitivity (S)	Life un-satisfaction	0.384	0.486	0	1
	Financial un-satisfaction	0.563	0.491	0	1
	Hospitalization (reversed)	0.712	9,451	0	1
	Hospitalization times (reversed)	17.292	1.750	0	18

Multiple Indicators Multiple Causes (MIMIC)

$$[RCI] = [\beta_1, \beta_2, \beta_3] \times \begin{bmatrix} ABS \\ AST \\ SSN \\ AC \\ S \end{bmatrix} + [\varepsilon_R]$$

Resilience is influenced by five pillars (ABS, AST, SSN, AC and S).

$$\begin{bmatrix} FE \\ AFV \\ HFES \end{bmatrix} = [\Lambda_1, \Lambda_2, \Lambda_3] \times [RCI] + [\varepsilon_{FE}, \varepsilon_{AFC}, \varepsilon_{HFES}]$$

The measurement or reflective model is specified by the weekly food expenditure (FE), the adequacy of fruit and vegetable consumption (AFV), and household food expenditure share (HFES).

$$RCI^* = (\text{RCI} - RCI_{min}) / (RCI_{max} - RCI_{min}) \times 100$$

RIMA adopts a min-max scaling method (FAO, 2016).

For post-estimation analysis, *Likelihood Ratio (LR)* test, *Root Mean Square Error of Approximation (RMSEA)* and *Comparative Fit Index (CFI)* are applied (Acock, 2013). The validity analysis includes *convergent*, *discriminant*, and *external* validity.

Structural Equation Modelling (SEM) for RCI

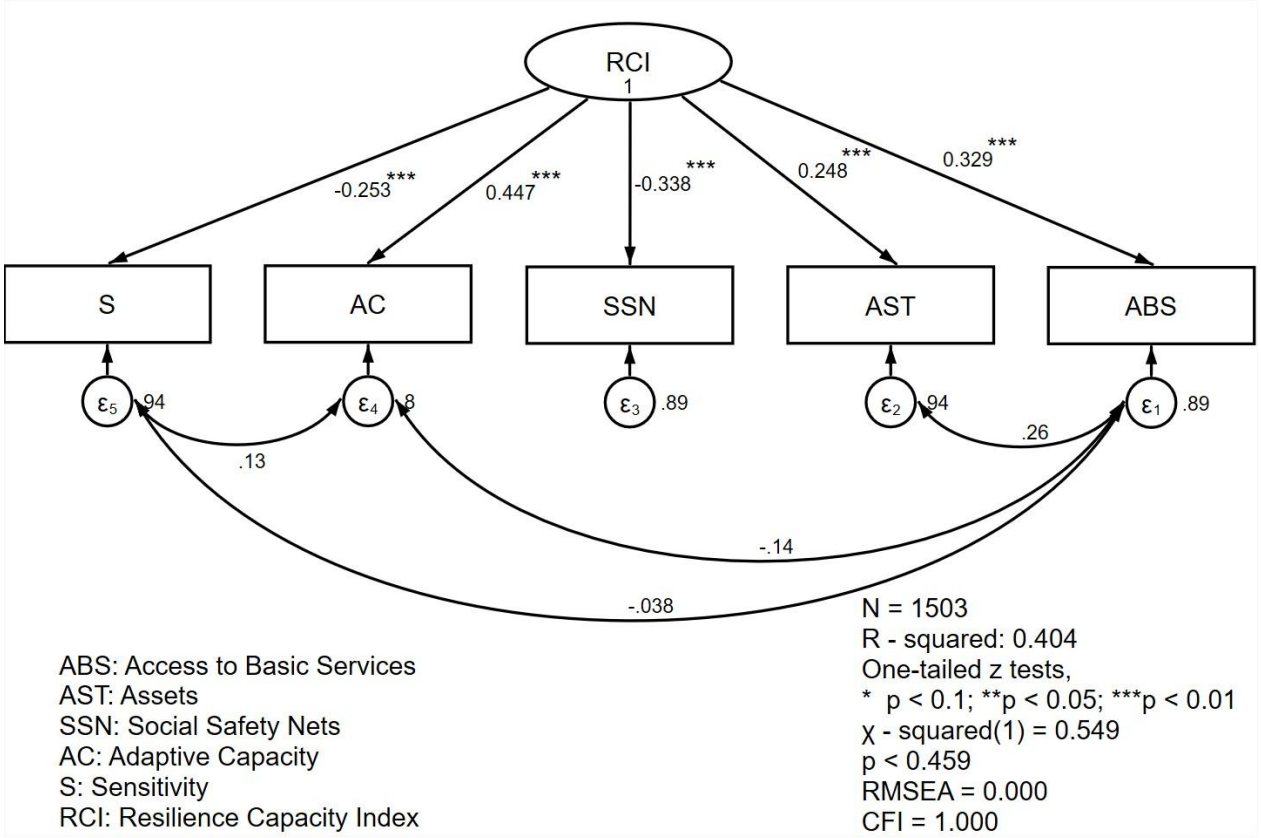


Fig.4. SEM for RCI
(Egamberdiev et al. 2024)

Multiple Indicators Multiple Causes (MIMIC)

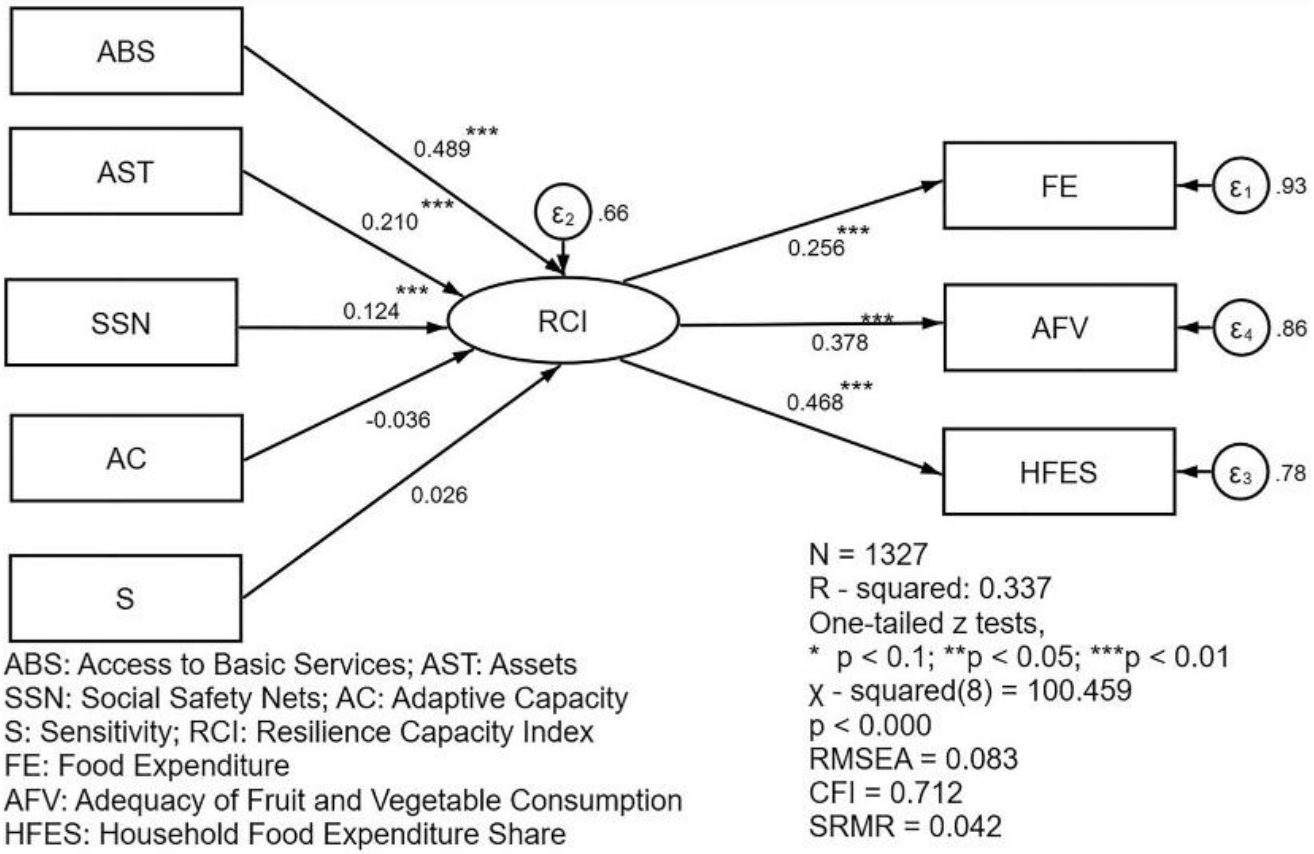


Fig.5. MIMIC result
(Egamberdiev et al. 2024)

Latent Class Coping Strategy

$$P(Y = y) = \sum_{c=1}^{C} \gamma_c \prod_{j=1}^{J} \prod_{r_j=1}^{R_j} \rho_{j,r_j|c}^{I(y_j=r_j)}$$

y_j: element *j* of *y* response pattern.

When the response to variable $j = r_j$, the indicator function $I\ (y_j=r_j)$ is equal to 1 and 0 otherwise.

$\gamma's$: the latent class prevalence

$\rho's$: item response probabilities

The optimal number of classes is determined by *Akaike's Information Criterion* (AIC), *Bayesian Information Criterion* (BIC) and *Entropy Criterion* (Acock, 2013).

Tab.6. Coping strategies

N.O	Variable	N	Mean	St.Dev	Min	Max
1.	Aid from friends or family for money	1503	0.355	0.478	0	1
2.	Borrowed money	1503	0.051	0.220	0	1
3.	Sent a member of the household to work elsewhere as a seasonal worker	1503	0.396	0.489	0	1
4.	Increased the production of food products	1503	0.390	0.488	0	1
5.	Cancelled health insurance	1503	0.153	0.360	0	1
6.	Cancelled house or car insurance	1503	0.142	0.349	0	1
7.	Spent savings or investments	1503	0.193	0.395	0	1
8.	Worked more than normally	1503	0.399	0.490	0	1
9.	Sold the harvest in advance	1503	0.181	0.385	0	1
10.	Household members sent to work who normally do not work	1503	0.330	0.470	0	1

Latent Class Coping Strategy

The fist class accounting for 47% of the sample is labelled as “Low Coping Strategy” class.

The second class showing the remaining 53% of the sample is labelled as “High Coping Strategy” class.

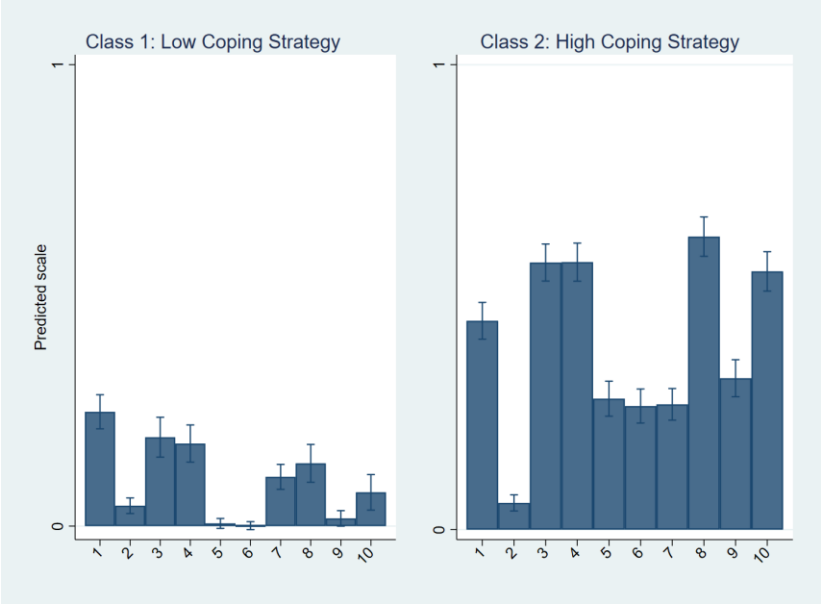


Fig.4. Latent Classes

1: Aid from friends or family for money; 2: Borrowed money from a moneylender; 3: Sent a member of the household to work elsewhere as a seasonal worker; 4: Increased the production of food products for own consumption; 5: Cancelled health insurance; 6: Cancelled house or car insurance; 7: Spent savings or investments; 8: Worked more than normally; 9: Sold the harvest in advance; 10: Household members sent to work who normally do not work

Identification Strategy

$$FS_{h,t} = \beta RCI_{h,t-1} + \gamma C_{h,t} + \theta S_{ht} + \tau X_{h,t} + \epsilon_{h,t}$$

FS= **Food expenditure** (per week), **household adequacy of fruit and vegetable consumption**, and **Household Food Expenditure Share (HFES)**

h=1,2...,n households; t=1,2,..., times; RCI=Resilience Capacity Index; C=subjective latent coping strategy; S=shock explained by the number of modeate and/or severe drought events (the Standardized Percepitation Index) for the last 12 months; X=vector of household characteristics.

Furthermore, the interaction term between **RCI and shock ($RCI_{h,t-1} \times S_{h,t}$)** is included in the model, aiming to capture a mediating role of resilience.

$$RCI_{h,t-1} = \alpha z_{h,t-2} + \gamma C_{h,t} + \theta S_{ht-1} + \tau X_{h,t} + \epsilon_{h,t}$$

To deal with the problem of endogeneity, *distance from population point in the community to the capital (Dushanbe)* as *an* instrumental variable is used.

Resilience and Food Security Outcomes (Second Stage)

Tab.7. Resilience and Food Security (Second Stage)

	AFV		FE	
RCI	12.940**		45.470***	
	(5.849)		(15.390)	
RCI*Shock		2.901**		10.200***
		(1.171)		(2.879)
High Coping Strategy	7.287	6.775	59.149	57.308*
	(14.162)	(12.681)	(37.439)	(31.313)
Drought Shock Events	-6.036	-146.039**	-54.729**	-546.874***
	(10.100)	(64.032)	(26.691)	(157.489)
Observations	1327	1327	1333	1333
Cragg-Donald F Stat.	14.961	34.377	15.215	34.904

**** p<0.01, **p<0.05, *p<0.1.*
The reference class is "Low Coping Strategy". Standard errors in parentheses.
Household controls: head female, head age, household size, squared household size, rural.

Resilience and Food Security Outcomes (Second Stage)

Tab.8. Resilience and Food Security (Second Stage)

	HFES	
RCI	0.011**	
	(0.004)	
RCI*Shock		0.002***
		(0.001)
High Coping Strategy	-0.033***	-0.034***
	(0.011)	(0.009)
Drought Shock Events	-0.025***	-0.152***
	(0.008)	(0.048)
Observations	1333	1333
Cragg-Donald F Stat.	15.215	34.904

**** p<0.01, **p<0.05, *p<0.1.*
The reference class is "Low Coping Strategy". Standard errors in parentheses.
Household controls: head female, head age, household size, squared household size, rural.

Resilience and Food Security Loss (Second Stage)

Tab.10. Resilience and Food Security Loss (Second Stage)

	AFV		FE	
RCI	0.049***		-0.083***	
	(0.017)		(0.023)	
RCI*Shock		0.011***		-0.018***
		(0.003)		(0.003)
High Coping Strategy	-0.028	-0.030	-0.051	-0.047
	(0.041)	(0.035)	(0.056)	(0.041)
Drought Shock Events	-0.086***	-0.626***	0.147***	1.053***
	(0.029)	(0.178)	(0.040)	(0.210)
Observations	1327	1327	1333	1333
Cragg-Donald F Stat.	14.961	34.377	15.215	34.904
AR Stat. *p-value*	0.000	0.000	0.000	0.000

**** p<0.01, **p<0.05, *p<0.1.*

The reference class is "Low Coping Strategy". Standard errors in parentheses.

Household controls: head female, head age, household size, squared household size, rural.

Resilience and Food Security Loss (Second Stage)

Tab.11. Resilience and Food Security Loss (Second Stage)

	HFES	
RCI	-0.047***	
	(0.016)	
RCI*Shock		-0105***
		(0.003)
High Coping Strategy	0.014	0.016
	(0.039)	(0.033)
Drought Shock Events	0.069**	0.579***
	(0.028)	(0.167)
Observations	1333	1333
Cragg-Donald F Stat.	15.215	34.904
AR Stat. *p-value*	0.000	0.000

**** p<0.01, **p<0.05, *p<0.1.*

The reference class is "Low Coping Strategy". Standard errors in parentheses.

Household controls: head female, head age, household size, squared household size, rural.

Conclusion

- A causal relationship indicates that household resilience has a positive effect on food security while the reverse is true on the probability of loss.
- being more resilient at time *t* has a positive impact on food security and negative impact on food security loss at time *t+1*
- The interaction between RCI and shock (mitigating effect) is still significant at improving food security outcomes when shocks intensify.
- By including coping strategies, we provided additional evidence for the relation between RCI and coping strategies with food security outcomes.
- Further policy implications are drawn:

- For ABS, there should be a focus to invest in affordable heating and gas for everyday life of Tajikistan.
- For AST and SSN pillars, formal transfers are strongly playing into resilience capacity.
- The policy formulation and intervention program should consider how to strengthen or build household resilience capacity to mitigate negative events of shocks.

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Thank you for your attention!

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