JRC TECHNICAL REPORTS

Food security resilience to shocks in Niger: preliminary findings on potential measurement, drivers and challenges from LSMS-ISA data

RESIFOOD project

Rodriguez-Llanes, Jose M

Kayitakire, Francois

2018

EUR 29143 EN

Contact information
Name: Francois KAYITAKIRE
Address: Joint Research Centre, 27B 01/142, Ispra
Email: francois.kayitakire@ec.europa.eu
Tel.: +390332786580

JRC Science Hub
https://ec.europa.eu/jrc

JRC110837

EUR 29143 EN

PDF ISBN 978-92-79-80958-3 ISSN 1831-9424 doi:10.2760/907939

Luxembourg: Publications Office of the European Union, 2018

How to cite this report: Rodriguez Llanes, J. and Kayitakire, F., Food security resilience to shocks in Niger: preliminary findings on potential measurement, drivers and challenges from LSMS-ISA data , EUR 29143 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-80958-3, doi:10.2760/907939, JRC110837.

Contents

Authors

Rodriguez-Llanes, Jose Manuel

Kayitakire, Francois

Abstract

The measurement of food security resilience (FSR) to shocks is yet hampered by inherent aspects of its complexity along with that of food security assessment itself. Yet, there is an urgent need for scientific evidence on which to base decision-making and policies to build resilience. Niger is one of the most underdeserved and underdevelopped coutries worldwide. We took advantage of the LSMS-ISA data to attempt defining as flexibly as possible the concept of FSR and move forward with its measurement and the investigation of policy-actionable drivers taking a multisectorial perspective.

Food security was measured as reportedly self-assessed by household heads through Food Insecurity Experience Scale (FIES) collected by panel design in two waves from September to November 2014 (post-planting) and January to March 2015 (post-harvest) and representative of Niger and 26 additional strata representing settings and agroecological zones. According to changes in food security status (food secure vs food insecure) from one wave to the next, we identify four potential trajectories, two of which are compatible with resilient trajectories of recovery and resistance to shock impacts. Two exposures were considered, rain deficits at onset of rainy season (May-June) or being affected by drought in previous year to the time of interview. Weighted estimates of each trajectory were provided for the country and rural vs urban areas. Associations with socio-economic factors were explored using multinomial logistic regression models.

Our preliminary findings point to a severe lack of food security in general and in particular lack of FSR to shocks in the country, and extremely low FSR in rural areas. A better road network, access to markets, improved rural-urban connectivity and increasing education level might be helpful in building up resilience. Farmers and female-headed households are particular vulnerable groups and need special and effective protection policies to improve their FSR.

1 Introduction

Following a rising interest in the concept of resilience among policy circles, scientists have engaged into the task of its conceptualization and measurement. In the field of food security, this undertaking is hampered by the inherent complexity of measuring food security, which include its four pillars, multiple indicators, and their hierarchical interdependence and scale issues (Barrett and Constas, 2014; Upton, Cissé and Barrett, 2016). Many of these remain a challenge for scientists working in the field. Resilience comes then with its own challenges adding a second layer of complexity. It attempts to goes beyond vulnerability by expanding from the capacity of standing (absorbing) a shock to the dynamic capacity of keeping or quickly recovering a system' functionality after a shock, and in occasions leading to systems' transformation when this capacity is compromised (Benczur et al., 2017). While the concept of resilience can be particularly suitable and useful under increasing shocks due to climate change extreme weather, increasing urbanization and urbanization in at risk areas (Pesaresi et al., 2017), land use changes and transformation derived from current agricultural practices, there is need for clear and flexible definition of food security resilience (FSR) to allow its measurement. Measuring it properly and frequently enough might be the basis for a monitoring tool, supplementing other initiatives currently monitoring food security such as The Integrated Food Security Phase Classification (IPC, 2017), and one helping the international donors' community to assess the influence of policy interventions to resilient outcomes as well as developing a necessary analytical framework to investigate the influence of policy-actionable drivers on FSR.

Niger is, by nearly any human development indicator, one of the most underdeserved and underdeveloped countries worldwide. With a staggering national poverty rate at 44% (2014), stagnated adult literacy rate at about 15% (2001-2012) and a rapidly rising population at 21 million inhabitants, it is highly affected by the current instability of the region with refugee influxes from conflicts in neighboring Mali and Nigeria, high dependency on imports from Nigeria and Burkina Faso for staple food cereals such as millet, sorghum or maize, which contribute to price instability and food insecurity (World Bank, 2017). In addition, the Sahel region is being increasingly affected by erratic rain, droughts and other weather shocks, important contributors for further deterioration of the situation within the entire region. In consequence, Niger is an obvious candidate for studies aiming to guide future directions for most priority development investments in the country with tangible impact on resilience building.

Taking advantage of the rich and recent datasets collected in Niger, including variables on agriculture, food security and multiple societal sectors, we proposed here a flexible and operational definition to provide a first estimate of FSR in Niger as a measurable outcome under two shocks, drought and delayed onset of rain, and explore associations with socio-economic and demographic variables.

2 Methods

The World Bank Living Standard Measurement Studies (LSMS) is an international programme initiated in the Eighties to gather survey panel data on developing countries for development analysis and decision making. More recently similarly inspired surveys but with a dedicated agriculture module, the so called Integrated Surveys of Agriculture (ISA) were conducted in eight African countries (Niger, Mali, Burkina Faso, Nigeria, Tanzania, Ethiopia, Malawi and Uganda). The LSMS-ISA project (funded by the Melinda and Bill Gates Foundation) have been supporting the design and implementation of these surveys, including the Niger Enquête Nationale sur les Conditions de Vie des Ménages et l'Agriculture (ECVM/A), also known as the National Household Living Conditions and Agriculture (The World Bank, 2017). The ECVM/A was implemented by the Niger Institut National de la Statistique (INS).

The ECVM/A was designed to be nationally representative, and provide representative estimates from both urban and rural areas in all 8 Niger administrative regions including agro-ecological zones of the country divided as agricultural, agro-pastoral and pastoral. The target population was drawn from households in all regions of the country with the exception of areas in Arlit (Agadez Region) because of difficulties to travel there, very low population density, and collective housing. A total of 36,000 people were not included in the sample design, of whom 29,000 lived in Arlit and 7,000 in collective housing elsewhere. The sample was obtained in a two stage selection process. In the first stage, 270 Enumeration Areas or clusters (known in French as Zones de Dénombrement or ZDs) were selected through Probability Proportional to Size (PPS) sampling using the 2001 General Census of Population and Housing as the base for the sampling frame, and the number of households as a measure of size. At the second stage of selection, 12 or 18 households were selected with equal probability in each urban or rural ZD respectively. The sampling frame at this stage was an exhaustive listing of households for each selected cluster compiled before the start of the survey. The total estimated size of the sample was 4,074 households. The fact that this is the first survey with panel households to be revisited in the future was taken into account in the design and therefore it was possible to lose households between the two surveys with minimal adverse effects on the analyses (The World Bank, 2017).

The first survey in Niger during 2011/12 and a second in 2014/15 were used for our study. However, the focus was on shocks and outcomes collected during 2014/15. Each survey was composed by two waves of data collection, one so called post-planting from September to November 2014 and the so called post-harvest, from January to March 2015. A total 4,000 households were successfully surveyed in the first wave of the initial 2011 survey. The sample suffered from substantial attrition due to household migration and missingness on key variables in the following three waves. As such the final analyzed sample size was about 3,100 households, depending slightly on the shock analyzed.

The outcome was the Food Insecurity Experience Scale (FIES), a self-reported measure of food security validated across countries and cross-cultural settings (FAO, 2017). We used the developed dichotomic version of this scale to characterize households as food secure (if they answered negatively to all eight questions) or food insecure (if at least one answer was affirmative). Using the change in food security status within a household across the two waves, we defined four trajectories: resistant if they reported being food secure in both waves (post-planting and post-harvest), recovered if they were food insecure in first and food secure in the second, worsened if they moved from food secure to food insecure and chronically food insecure if they remain in this situation in both waves. According to current definitions of FSR (Box 1), those resistant and recovered might be two forms of resilient households.

Box 1. Selected definitions of Food Security Resilience

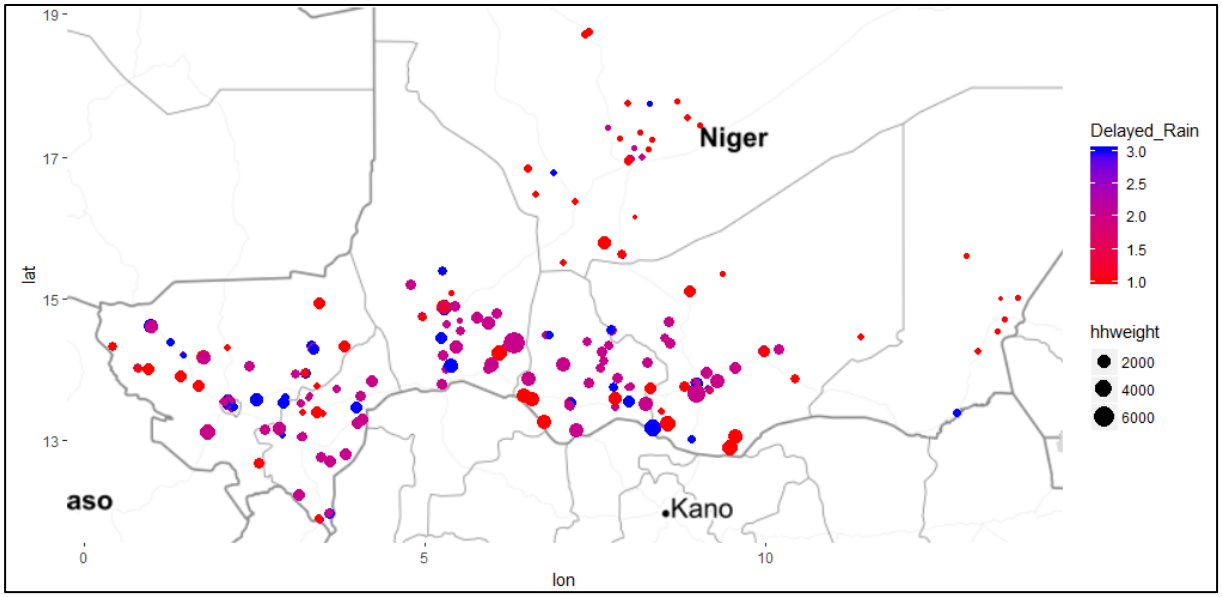
— "Food security resilience is the capacity over time of a person, household or other aggregate unit to maintain food security in the face of various stressors and in the wake of myriad shocks. If and only if that capacity is and remains high over time, then the unit is resilient" (inspired from Barrett & Constas 2014; Upton, Cissé & Barrett 2016)

— "The capacity of a household to bounce back to a previous level of well-being (for instance food security) after a shock" (FAO, 2016)

We considered here two distinct shocks, rainfall deficits at the onset of the rainy season (May-June) needed for most rain-fed agriculture production (sorghum and millet mostly) and livestock production within the year of study. This variable was reported by each head of household interviewed. Shocks experienced by each household were also reported. Here we investigated only drought, reported as one having an impact to a household within a year from interview in September-November 2014. Both shocks were confirmed to the best possible extent by climatic data on precipitation and drought condition (SPEI, Vicente-Serrano, Begueria and Lopez-Moreno, 2010).

Regarding potential predictor variables, wellbeing level (low, middle, high) – based on per capita-adjusted expenditure, agro-ecological zones (urban, agricultural, agropastoral, pastoral), rurality (urban vs rural), household size (median=6), household-head gender, age and education level (only 20% attended primary school or more), household occupation (agriculture vs any other) and distances (in km) from household to 1) main national road, 2) nearest town >20,000 inhabitants, 3) FEWSNET key market centers 4) admin1 capital 5) admin2 capital 6) other national borders.

Figure 1. Rain deficits at onset of rainy season in Niger, 2014 ([1])



([1]) Lighter red (1) indicates high congruence at cluster level on household responses pointing to perceived rain deficits at onset of rainy season. Darker color (2) show those clusters with nearly all households reporting average timing for rainy season onset or masking a balance of contrasting responses with average near 2. The lighter blue represents clusters reporting mostly onset of rains earlier than usual within the rainy season. Weights (hhweight) show the relative importance of each cluster sample to the country total.

Source: The authors, 2018.

Statistical analysis were conducted using R software (v 3.4.0). The survey package was used to provide representative estimates on different quantities using available sampling weights (hhweights). Associations were explored through multinomial logistic regression models using the package nnet. First, univariate multinomial logistic regression models were run on each predictor variable among exposed cases to both shocks (rain deficits and drought in the previous year). If any significance association was found with the outcome ($p<0.05$), it was selected for inclusion into the multivariate model. Model reduction was based on variance inflation factor (VIF) using the vif function. This to avoid collinearity issues with a conservative cutoff of 3. The variable having the largest VIF value was removed first and the model rerun in an iterative process until all variables had values below 3. The model was further reduced using backward selection based on p-value ($p<0.05$), eliminating larger p-values first. Multinomial Logistic Regression model coefficients were exponentiated to be shown as odds ratios (ORs) with associated standard errors (se).

3 Results

Looking at the shocks considered, rain deficits at the onset of the rainy season occurred in 32.1% (95% CI 29.6-34.6) of the households during 2014. Droughts were also common affecting a 24.9% (95% CI 22.5-27.4) of all households in the country in the last year.

Overall, an important finding was the shocking prevalence of chronic food insecurity in rural areas, compared to urban (table 1). Urban households were also more likely to maintain food security (resistant) relative to rural areas.

Table 1. National-representative estimates of food security trajectories in Niger 2014-15

	Urban		**Rural**		**Multinomial**
	n	% (95% CI)	n	% (95% CI)	P-value
Chronically food insecure	421	37.1 (33.1-41.0)	1215	65.8 (63.8-68.7)	p<0.01
Recovered	181	13.8 (11.2-16.4)	179	10.3 (8.4-12.1)	NS
Resistant	432	36.3 (32.4-40.3)	227	10.6 (8.9-12.3)	p<0.01
Worsened	164	12.8 (10.2-15.3)	281	13.3 (11.4-15.2)	Ref.

Regarding droughts, they showed to increase the likelihood of a household reporting chronic food insecurity and on the other hand decreased the likelihood of maintaining food security across waves (table 2).

Table 2. National-representative estimates of food security trajectories by drought affectedness in Niger 2014

	Drought-affected		**Unaffected**		**Multinomial**
	n	% (95% CI)	n	% (95% CI)	P-value
Chronically food insecure	445	74.9 (70.4-79.5)	1193	56.3 (53.3-59.2)	p<0.01
Recovered	51	8.4 (5.6-11.2)	310	11.7 (9.8-13.6)	Ref.
Resistant	47	5.8 (3.7-8.0)	614	18.0 (16.0-20.0)	p<0.01
Worsened	83	10.8 (7.6-14.0)	365	14.0 (12.1-16.0)	*NS*

For rain deficits at onset of rainy season, we found a more pronounced difference for those able to recovering favoring those not affected and an increased proportion of households in a worsening trajectory if rain deficits were noted, which seems reasonable given the

difference from these shocks in terms of intensity, timing, complexity and potential to erode livelihoods (table 3).

Table 3. National-representative estimates of food security trajectories households affected by delayed rainy season, Niger 2014

	Delayed Rainy Season		**Non-delayed**	
	n	% (95% CI)	n	% (95% CI)
Chronically food insecure	587	60.9 (57.8-64.0)	1049	61.1 (56.7-65.4)
Recovered	131	9.4 (7.6-11.3)	229	13.9 (10.9-16.9)
Resistant	236	15.3 (13.2-17.4)	423	14.3 (11.7-16.9)
Worsened	130	14.4 (12.3-16.5)	315	10.7 (8.0-13.4)

Multivariate models for both shocks considered were rather congruent. Female-headed households were less resilient and in the case of drought, most evidence pointed to these households being chronically food insecure (table 4). In households affected by rainfall deficits, the likelihood was lower for resistant households (table 5). More education seemed to confer some protection in the case of drought (table 4), but the effect was much clearer in the case of rain deficits (table 5). Lack of rain early on the rainy season was particularly negative for farmers, which were at much higher risk of becoming food insecure, compared to households dedicated to other professional activities. While drought is a more long-lasting process and can affect many societal sectors, vulnerable groups, and professional activities rain deficits should typically affect mostly activities relying on timing of rains such as agriculture.

Table 4. Multivariate associations of socio-economic and demographic variables with FS trajectories in drought-affected households

		Recovered		**Resistant**		**Worsened**	
Variables		OR	se	OR	se	OR	se
	Gender (female vs male)	0.283**	0.609	0.093**	1.018	0.213***	0.527
	Education (prim. vs none)	2.122**	0.375	0.900	0.500	0.597	0.453

** p<0.05, *** p<0.01; Reference: Chronically food insecure

Table 5. Multivariate associations of socio-economic and demographic variables with FS trajectories in households experiencing rain deficits at onset of rainy season

		Recovered		Resistant		Worsened	
Variables		OR	se	OR	se	OR	se
	Gender (female vs male)	1.041	0.244	0.504***	0.237	0.628	0.277
	Education (prim. vs none)	1.924***	0.243	2.811***	0.189	0.925	0.282
	Farming (Yes. vs other)	0.687	0.207	0.360***	0.174	0.637**	0.205

** p<0.05, *** p<0.01; Reference: Chronically food insecure

In the case of associations of distance to major markets, national roads, borders and cities of varying size, the likelihood of worsening was closely related to the distance to a market. Vicinity to a national road was protective in the case of drought and rain deficits but being close to a local capital did increase the likelihood of maintaining food security in the case of having experienced rain deficits. Overall this result points to connectivity and basic infrastructure as key elements to increase food security resiliency to shocks in Niger (tables 6, 7).

Table 6. Multivariate associations of distance to markets, roads, borders and cities with FS trajectories in drought-affected households

	Recovered		Resistant		Worsened	
Distance in km	OR	se	OR	se	OR	se
Market	1.006	0.004	1.007	0.004	1.010***	0.003
National Road	0.967***	0.012	0.980**	0.009	0.989	0.006

** p<0.05, *** p<0.01; Reference: Chronically food insecure

Table 7. Multivariate associations of distance to markets, roads, borders and cities with FS trajectories in households experiencing rain deficits at onset of rainy season

	Recovered		**Resistant**		**Worsened**	
Distance in km	OR	se	OR	se	OR	se
Market	1.002	0.002	1.001	0.002	1.006***	0.002
National Road	0.968***	0.007	0.989	0.006	0.997	0.005
Local capital	0.999	0.003	0.988***	0.003	0.997	0.003

** p<0.05, *** p<0.01; Reference: Chronically food insecure

4 Conclusions

The above are first and preliminary observations on the LSMS-ISA data, which are encouraging to move forward with further investigations. Our approach was resilient-focussed and multi-sectorial instead of agriculture-based. We adopted a flexible definition of resilience to allow us moving forward with its understanding, measurement and investigation of its drivers. Our early results point to a general lack of food security resiliency to shocks in the country, and particularly low in rural areas. Basic investments in the country, including roads, markets and better connectivity and education might be helpful in building resilience up. Farmers, which represent around 50% of the country's households might require targeted policies as well as female-headed households as shown by our initial analyses. Investments and strategies into these directions and a more engaged debate should be initiated. Our results warrant further analyses and research. Our work comes with limitations and our commitment for further analysis will include the inclusion of further exposures, isolation of exposure effect, consideration of multiple simultaneous exposures, consideration of interaction analysis and inclusion of further variables to get a more inclusive picture.

References

Headey, D. and Barrett, C. B., 'Opinion: Measuring development resilience in the world's poorest countries', *Proceedings of the National Academy of Sciences*, Vol. 112, No 37, 2015, pp. 11423-11425.

Barrett, C. and Headey, D., 'Measuring resilience in a volatile world: a proposal for a multicountry system of sentinel sites'. 2020 Conference Paper 1. May 17-19, Addis Ababa, Ethiopia. Washington, D.C.: International Food Policy Research Institute (IFPRI), 2014, pp. 36, Available at: http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/128134

Benczur, P., Kayitakire, F., et al. 'Building resilience for sustainable development'. *In* Science for the AU-EU Partnership: building knowledge for sustainable development, Chapter: Part 2, Chapter 4, Publications Office of the European Union, Luxembourg, 2017.

FAO. Resilience Index Measurement and Analysis – II. Food and Agriculture Organization of the United Nations Rome, 2016.

Food and Agriculture Organization of the United Nations (FAO). Voices of the Hunger, The Food Insecurity Experience Scale, 2017 Available at:http://www.fao.org/in-action/voices-of-the-hungry/fies/en/

Pesaresi, M., Ehrlich, D., Kemper, T., Siragusa, A., Florczyk, A.J., Freire, S. and Corbane, C. Atlas of the Human Planet 2017: Global Exposure to Natural Hazards, EUR 28556 EN, Publications Office of the European Union, Luxembourg, 2017 doi: 10.2760/19837

R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria, 2013. http://www.R-project.org/

The Integrated Food Security Phase Classification (IPC), 2017, Available at http://www.ipcinfo.org/

The World Bank. The Living Standards Measurement Study Integrated Agriculture Module (LSMS-ISA), 2017, Available at http://go.worldbank.org/BCLXW38HY0

The World Bank Open Data, 2017, Available at https://data.worldbank.org/

Vicente-Serrano, S.M., Begueria S. and Lopez-Moreno J.I., 'A multiscalar drought index sensitive to global warming: The standardized precipitation evapotranspiration index', *Journal of Climate*, Vol. 23, 2010, pp. 1696–1718. doi: 10.1175/2009JCLI2909.1

List of abbreviations and definitions

ECVM/A	Enquête Nationale sur les Conditions de Vie des Ménages et l'Agriculture, the National Household Living Conditions and Agriculture
FAO	Food and Agriculture Organisation
FIES	Food Insecurity Experience Scale
FSR	Food Security Resilience
INS	Institut National de la Statistique
LSMS-ISA	Living Standard Measurement Studies – Integrated Survey of Agriculture
SPEI	Standardized Precipitation and Evapotranspiration Index
ORs	Odds Ratios
VIF	Variance Inflation Factor

List of boxes

List of figures

List of tables

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: http://europea.eu/contact

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

- at the following standard number: +32 22999696, or

- by electronic mail via: http://europa.eu/contact

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: http://europa.eu

EU publications
You can download or order free and priced EU publications from EU Bookshop at: http://bookshop.europa.eu. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see http://europa.eu/contact).

KJ-NA-29143-EN-N

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.

EU Science Hub
ec.europa.eu/jrc

@EU_ScienceHub

EU Science Hub - Joint Research Centre

Joint Research Centre

EU Science Hub

Publications Office

doi:10.2760/907939

ISBN 978-92-79-80958-3