



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative

Technical Report Series No 2 Strengthening the Evidence Base for Resilience in the Horn of Africa

REPORT 6

Shocks, Resilience Capacities and Response Trajectories Over Time

Tom Bower, Carrie Presnall, Tim Frankenberger,
Lisa Smith, Vicky Brown and Mark Langworthy



Authors: Tom Bower^a, Carrie Presnall^a, Tim Frankenberger^a, Lisa Smith^a, Vicky Brown^a and Mark Langworthy

^a *TANGO International*

© 2016 ILRI on behalf of the Technical Consortium for Building Resilience in the Horn of Africa, a project of the CGIAR.



This publication is copyrighted by the International Livestock Research Institute (ILRI). It is licensed for use under the Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported Licence. To view this licence, visit <http://creativecommons.org/licenses/by-nc-sa/3.0/> Unless otherwise noted, you are free to copy, duplicate or reproduce, and distribute, display, or transmit any part of this publication or portions thereof without permission, and to make translations, adaptations, or other derivative works under the following conditions:

ATTRIBUTION. The work must be attributed, but not in any way that suggests endorsement by ILRI or the author(s).

NON-COMMERCIAL. This work may not be used for commercial purposes.

SHARE ALIKE. If this work is altered, transformed, or built upon, the resulting work must be distributed only under the same or similar licence to this one.

NOTICE:

- For any reuse or distribution, the licence terms of this work must be made clear to others.
- Any of the above conditions can be waived if permission is obtained from the copyright holder.
- Nothing in this licence impairs or restricts the author's moral rights.
- Fair dealing and other rights are in no way affected by the above.
- The parts used must not misrepresent the meaning of the publication.
- ILRI would appreciate being sent a copy of any materials in which text, photos etc. have been used.

This report is prepared by experts for the Technical Consortium for Building Resilience in the Horn of Africa. For more information on the Technical Consortium contact Dr. Katie Downie – k.downie@cgiar.org.

Disclaimer: The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

Design: Jodie Watt Media, **Layout:** Eric Ouma.

Citation: Bower, T., Presnall, C., Frankenberger, T., Smith, L., Brown, V. & Langworthy, M. (2016). Shocks, resilience capacities and response trajectories over time. Report prepared by the Technical Consortium, a project of the CGIAR. Technical Report Series No 2: Strengthening the Evidence Base for Resilience in the Horn of Africa. Nairobi, Kenya: A joint International Livestock Research Institute (ILRI) and TANGO International publication.

Table of contents

	List of acronyms	ii
1	Introduction	1
2	Background: Measurement of shocks & resilience	2
	Measuring resilience	2
	Measuring shocks and stressors	3
	Geographic scale	3
	Temporal scale	4
	Data types	4
3	Methodology	5
	PRIME	5
	BRACED	5
	Shocks measurement	6
	Resilience capacities indices	6
4	Results	8
	Resilience capacities and reported recovery from shocks	8
	Resilience capacities and response to shocks over time	10
	<i>Shocks context at baseline</i>	11
	<i>Shocks context during interim monitoring</i>	13
	<i>Downstream shocks</i>	14
	<i>Coping strategies</i>	15
5	Discussion	17
6	References	19
7	Annex 1. Detailed regression results	21

List of **acronyms**

BRACED	Building Resilience and Adaptation to Climate Extremes and Disasters
DfID	Department for International Development (UK)
OLS	Ordinary Least Squares
PRIME	Pastoralist Areas Resilience Improvement through Market Expansion
PRIME IMS	(PRIME) Interim Monitoring Survey
USAID	United States Agency for International Development

Introduction



1

Interest in household and community resilience capacities effective for managing shocks and stressors has increased in the last several years. Assessing shocks and the capacities needed to respond to and overcome them is important for understanding how to design interventions and programs that will address the needs of vulnerable populations.

Shocks vary in type, prevalence, and impacts on people. Zselezky and Yosef (2014) found that although the frequency of some shocks such as hurricanes, earthquakes, and conflict has not changed, impacts have become more severe due to factors such as stronger hurricanes, protracted conflict, and larger urbanized populations vulnerable to earthquakes. Moreover, poor populations are more vulnerable to such shocks. Low-income and lower-middle income countries experienced just one-third of the disasters but incurred 81% of disaster-related deaths (UNDP, 2014). Efforts to build resilience, and decisions on when to implement social protection or safety net programs should be grounded in a clear understanding of how shocks and stressors threaten development outcomes and resilience capacities. Highly detailed, technically sound information about households' and communities' exposure and responses to shocks is therefore central to resilience programming.

The Food Security Information Network (FSIN) Resilience Measurement Technical Working Group (RMTWG) has proposed measurement principles for resilience capacities and shocks ((Constas, Frankenberger & Hoddinott, 2014; Constas et al., 2014). A Resilience Analytical Framework proposed by Constas and colleagues (Constas et al., 2014a; Constas et al., 2014b) states that wellbeing outcomes should be measured (e.g., food security, health, or poverty) as a function of vulnerability, resilience capacities, and shocks (Smith et al., 2015; Frankenberger & Smith, 2015). There is a growing body of evidence from studies carried out in the Horn of Africa that capture shock measures and their perceived impacts and how households and communities cope and recover from these different types of shocks. This paper presents results from the USAID-funded Pastoralist Areas Resilience Improvement through Market Expansion (PRIME) program baseline, the PRIME interim monitoring study (IMS) and the DfID-funded Building the Resilience and Adaptation to Climate Extremes and Disasters (BRACED) program ((Smith et al., 2015; Frankenberger & Smith, 2015). Not only are shock exposure, resilience capacities and recovery analyzed from one time period but through the interim monitoring study of the PRIME program, they are also measured over time in response to changing conditions.

This paper contributes to the resilience measurement body of knowledge by looking at the relationship between shocks and resilience capacities. This paper discusses important principles in resilience measurement and then examines two studies to (1) determine the separate contribution of different resilience capacities to households' ability to cope with two distinct types of shock – drought and food price shocks, and (2) examine how households respond over time to exposure to shocks, and how resilience capacities influence the way that households recover from shocks. The paper will also discuss important lessons learned about resilience measurement regarding the frequency of data collection and timing of social protection responses.

2

Background

Measurement of shocks & resilience

Resilience is defined as a capacity that ensures stressors and shocks do not have long-lasting adverse development consequences (Constas et al., 2014a). Shocks can be sudden or slow onset events that can have a substantial negative effect on a household or community's wellbeing, livelihoods, assets, or ability to cope with future shocks (Bujones et al., 2013; Zseleczy & Yosef, 2014). Stressors are long-term pressures such as natural resource degradation, urbanization, or diminishing social capital that undermine stability and increase vulnerability (Bujones et al., 2013). Implementing resilience-building interventions at the right time and place with an effective level of support requires a clear understanding of how different types and combinations of shocks affect people, as well as how the duration of a shock can also influence the effect. Households may be well adapted to drought but unable to cope with other types of extreme weather or the combination of drought and other shocks (e.g., food price spikes, conflict). In Niger, a Catholic Relief Services (2013) study reported that despite highly variable climatic conditions which included regular drought, few respondents reported exposure to drought, suggesting that people had become accustomed to drier conditions as the new "normal." Households were discounting climatic shocks that had occurred and reporting only the more extreme events (Catholic Relief Services, 2013).

¹ The six principles discussed by FISN (2015a) are: analyze the larger risk context; measure shocks and stressors at multiple scales and over different time periods; measure the connections and interrelationships between shocks and stressors; include objective and the subjective aspects of shocks; measure the occurrence of large-scale and small-scale shocks; and include indicators of political instability and conflict in shock measurements.

Drawing on the FSIN papers that offer greater details on measuring shocks and resilience (Charloutan et al., 2015; Constas et al., 2014a; 2014b; Constas, Frankenberger, Klaus & Mock, 2015),¹ this section discusses issues pertinent to the datasets under analysis: (1) measuring resilience, and (2) measuring shocks and stressors at multiple geographic and temporal scales and using objective and subjective data.

Measuring resilience

Resilience is comprised of three capacities, absorptive, adaptive, and transformative (Constas et al., 2014). **Absorptive** capacity is the ability to minimize exposure to shocks and stresses and recover quickly when exposed (Smith et al., 2015). Disaster risk management, for example, aims to strengthen community and household level absorptive capacity to both reduce disaster risk and absorb the impacts of shocks without suffering permanent, negative impacts on longer-term livelihood security. **Adaptive** capacity involves making proactive, informed choices about livelihood strategies based on changing conditions. Interventions to improve adaptive capacity seek to improve households' and communities' abilities to respond to longer-term changes through interventions such as

livelihood diversification and asset accumulation. **Transformative** capacity relates to system-level changes in factors such as good governance, infrastructure (e.g., roads, communication systems), and formal safety nets that enable long-term resilience. These capacities are described separately here but are not mutually exclusive. Social capital, for example, appears as an indicator for all three dimensions of resilience capacity.

Resilience is an intermediate outcome, which leads to the achievement of longer-term wellbeing outcomes such as household food security (Béné, Frankenberger & Nelson, 2015). Changes in wellbeing outcomes are a result of the combined effects of a shock or stressor along with the capacities upon which people rely and their responses to the shock.

In the case of the datasets reviewed in this paper, pastoralists may have been affected by a combination of drought, conflict, and/or economic shocks. Some households may have experienced the same shock at equal severity but differed in their absorptive, adaptive, and transformative capacities and thus chose different responses or coping strategies. Some responses are appropriate and constructive (e.g., selling livestock at market price, drawing on savings) while others have high potential for negative long-term effects such as distress sales of livestock, skipping meals, or removing children from school to earn income (Béné et al., 2015; Skoufias, 2003). Such strategies reduce income earning potential and opportunities to escape poverty; worse, they may perpetuate poverty in the next generation. Studies have found correlations between child malnutrition and lower school achievement and lower wages, as well as a relationship between this same malnutrition and productivity in adulthood (Glewwe et al., 2000).

Measuring shocks and stressors

Geographic scale

In order to effectively measure shocks and stressors, it is necessary to adopt an approach which incorporates measurements at multiple scales. This is because shocks and stressors may affect entire regions or communities (covariate shocks) or have much smaller scale impacts, which are limited to individual or household levels (idiosyncratic shocks) (Frankenberger et al., 2014). Macro-level measurements of large-scale shocks and subsequent impacts of food security can be found using methodologies such as those described in the Integrated In order to effectively measure shocks and stressors, it is necessary to adopt an approach which incorporates measurements at multiple scales. This is because shocks and stressors may affect entire regions or communities (covariate shocks) or have much smaller scale impacts, which are limited to individual or household levels

(idiosyncratic shocks) (Frankenberger et al., 2014). Macro-level measurements of large-scale shocks and subsequent impacts of food security can be found using methodologies such as those described in the Integrated Food Security Phase Classification, Famine Early Warning Systems Network, FAO's Global Information and Early Warning System, and WFP's Global Food Security Update (Charloutan et al., 2015). A measurement tool such as Mali's *Système d'Alerte Précoce*, which is comprised of county reports on rainfall, animal health and water availability, is an example of a national or local level source (Charloutan et al., 2015). National and household information has been gathered by the World Bank in eight African countries through Living Standards Measurement Study Integrated Surveys on Agriculture (LSMS-ISA) and includes geospatial household-level information such as climate information and soil quality (Banerjee et al., 2015; World Bank, 2015). While global and national measures are important for generally describing conditions, local level data are also important to reflect microclimates and community and household exposure to shocks and stressors (Charloutan et al., 2015). Tools such as the Emergency Market Mapping and Analysis toolkit can be used to gather information about local market systems (Charloutan et al., 2015; EMMA, 2011).

Temporal scale

Constas et al. (2014b) suggest measuring indicators before and after an intervention and at more than one point in time to increase the accuracy of measurements – especially after a shock – and to measure indicators such as food security, frequently. The frequency of data collection should be based on the expected rate of change and should assist in the establishment of trends in wellbeing. The importance of factors such as frequency in measurement was highlighted by the results of a study in Niger, by Bauer, Pompili and Ballo (2012), in which recovery rates among households, varied across districts and agricultural zones.

Data types

Studies should draw on various types of data and include quantitative, qualitative, objective and subjective data (Charloutan et al., 2015). Quantitative data describes what happened on what scale. National, community, and household level surveys gather quantitative data such as type, duration, and severity of shocks and coping strategies used. Qualitative data, gathered through focus group discussions and interviews, can explain context and people's perceptions such as the significance of changes and why events occurred. Objective data do not rely on individuals' judgements but stem rather from environmental or observable measurements such as satellite data or amount of rainfall. Subjective data is based on respondents' ratings or assessments.

Methodology

This paper examines baseline and interim monitoring data from the Pastoralist Resilience Improvement and Market Expansion (PRIME) and Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) projects. The next section describes the projects and data collection methods and how shocks and resilience were measured.

PRIME

PRIME is a USAID Ethiopia Feed the Future Project which aims to: (1) increase household incomes, (2) enhance resilience, and (3) bolster adaptive capacity to climate change. Program beneficiaries include pastoralists, non-pastoralists, and people transitioning between these two livelihoods in 23 woredas within three pastoralist clusters (PC): Southern PC (Borena, Guji, and Liban zones), Somali PC, and Afar PC. PRIME activities foster the competitiveness of livestock value chains, addressing the needs of the very poor and chronically food insecure through value chain interventions, improving policy environment, improving delivery of health services, and behavior change. This paper presents baseline data, collected from November 19 to December 24, 2013 in two of the three PRIME project sub-regions, Borena and Jijiga, and interim monitoring survey (IMS) data, collected monthly from October 2014 through March 2015. Both baseline and interim surveys used quantitative questionnaires and collected qualitative data through focus group discussions and key informant interviews.

BRACED

Funded by the United Kingdom's Department for International Development (DFID), the Mercy Corps-led BRACED program enhances resilience to climate extremes in northern Kenya and Uganda through a community-led and systems-driven approach. The program focuses on vulnerable groups, particularly women and girls, and promotes improving public sector engagement and service delivery, broadening economic opportunity, and increasing community capacity to manage resources and prepare for disaster. The program operates throughout Wajir County and the urban center of Garissa on the Wajir/Garissa County border in Kenya, and throughout the Karamoja sub-region and its districts within Uganda. Both regions comprise arid/semi-arid landscapes that have traditionally been pastoral in Wajir and agro-pastoral in Karamoja. Baseline data were collected from randomly selected samples of 552 households within the project implementation area of Karamoja and 561 households in the implementation area of Wajir.

Shocks measurement

The PRIME baseline, PRIME IMS and BRACED baseline surveys asked households about their perceptions of the severity of their exposure to different types of shocks that had occurred in the program areas in the year prior to the surveys (i.e., climatic, conflict, and economic shocks). Climate shocks included drought and flood which may have resulted in landslides, erosion, or poor harvests. Conflict shocks include theft, violence against family members, and loss of land due to conflict. Market shocks include increased price of food or agricultural and livestock inputs. Interim monitoring data includes climate indicators and market prices. This paper will compare climate data with perceptions of impact severity.

² Recurrent monitoring was carried out as part of the PRIME impact evaluation conducted through the USAID FEEDBACK project for Feed the Future.

³ Three indices used are the Standardized Precipitation Index (SPI); Soil moisture index (percent of norm); and Normalized Difference Vegetation Index (NDVI) percentile)

⁴ A kebele is the smallest administrative level, like a neighborhood

During interim monitoring of the PRIME project the IMS study collected data on a subset of 430 households derived from the baseline sample that was conducted in Borena and Jijiga.² To determine how households and communities responded to a shock (i.e., drought) and how wellbeing (i.e., food security) was affected, quantitative and qualitative data were collected monthly over a six-month period after a shock occurred (Frankenberger & Smith, 2015). Monthly interviews shed light on changing conditions and coping strategies over time.

As part of the interim monitoring, climate data were collected monthly from four objective sources, (1) FEWS NET *Food Security Outlook and Food Security Outlook Updates*, (2) PRIME trigger indicators, (3) African Flood and Drought Monitor (AFDM) satellite remote sensing data,³ and (4) National Meteorological Agency of Ethiopia (NMA) Seasonal Agrometeorological Bulletins. NMA provides classifications of rainfall conditions by season in terms of the percent of rainfall compared to normal (i.e., above normal (>125% of normal); normal (75-125% of normal); below normal (50-75% of normal) and much below normal (<50% of normal). FEWS NET data collected monthly at the regional level, along with early warning information collected every two weeks at the kebele level,⁴ can be matched to quantitative and qualitative household data, which was collected monthly.

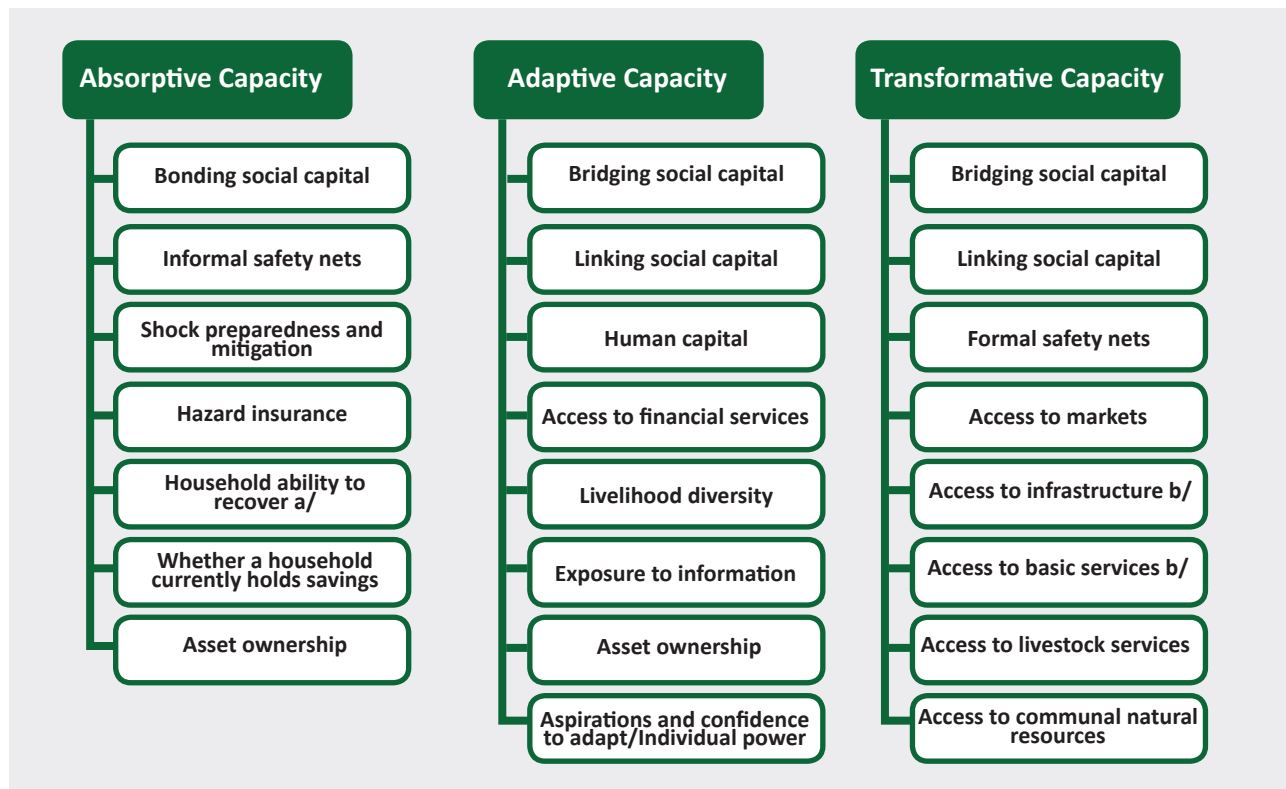
The IMS study also created three summary measures of shock exposure, (1) the total number of drought-related shocks experienced by households, (2) perceived severity of shocks, and (3) a kebele-level index based on the percent of reporting drought conditions, downstream drought impacts, and use of coping strategies.

Resilience capacities indices

Smith et al. (2015) created indices to measure respondents' absorptive, adaptive, and transformative capacities (Figure 1). The absorptive capacity index is composed of the perceived ability of households to recover from shocks and factors that help households minimize and recover from exposure to shocks (e.g., bonding social capital, informal safety nets, assets, insurance, and the presence of a disaster preparedness program). To measure adaptive capacity, Smith et al. (2015) used an indicator describing the following characteristics of households (aspirations and confidence to adapt to changing conditions, exposure to information, human and social capital and economic capital.

Psychosocial capabilities, included in adaptive capacity and hypothesized to contribute to greater resilience, are discussed further in another paper in this series, “**The Influence on Subjective and Psychosocial Factors on People’s Resilience: Conceptual Framework and Empirical Evidence**” (Béné et al., 2016). The index for transformative capacity uses indicators of the availability of formal safety nets and two aspects of social capital that draw on relationships with entities in other communities (bridging and linking). The index also incorporates access to key infrastructure and services (e.g., markets, infrastructure, livestock services, and communal natural resources).

Figure 1. Aspects of resilience capacity



a/ intermediate variable

b/ included in linking social capital index



4

Results

Resilience capacities and reported recovery from shocks

The first analysis, based on the PRIME and BRACED baseline surveys, examines the degree to which the three types of resilience capacity each help to mitigate the adverse effects of shocks. In the analysis of the PRIME and BRACED baseline data, regressions are run with reported recovery from shocks as the dependent variable against the three types of resilience capacity, along with other explanatory variables, including household demographic characteristics and exposure to shocks. The dependent variable is a ranked categorical variable with responses from ‘have not recovered at all’ to ‘fully recovered and better than before the shocks’. Ordered logit is the appropriate regression specification to apply with this categorical dependent variable. Separate models were run for households exposed to two different types of shocks: drought, a climate shock, and food price shocks, a type of market shock. These are the two most common types of shock reported across the four locations in the two project areas. Separate regressions were also run with each type of resilience capacity included separately in order to measure the impact of each type of resilience capacity independently.⁵ Complete regression results are provided in Annex1.

⁵ Because the three types of resilience capacity are highly correlated with each other, inclusion of all three capacities in a single model would introduce problems of multicollinearity, and the regression model would not be able to detect the independent impacts of each individual capacity.

Tables 1 through 4 report the regression coefficients for the three resilience capacities. Table 1 and Table 3 report on the impact of resilience capacities on household recovery from drought in PRIME and BRACED, respectively, while Table 2 and Table 4 report on the relationship between resilience capacities and recovery from food price shocks. With the exceptions of adaptive capacity and transformative capacity for food shocks in Borena, and transformative capacity for food price shocks in Karamoja, all three resilience capacities show positive impacts on reported recovery from both drought and food price shocks. These results verify that households with greater resilience capacities, as measured by the indices, do recover more quickly from drought and food price shocks than households with less of each of these capacities.

Table 1. Relationship between resilience capacities and recovery from drought shocks, PRIME

Indicators	Borena			Jijiga		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities						
Absorptive	0.010 **			0.024 ***		
Adaptive		0.029 ***			0.032 ***	
Transformative			0.030 ***			0.015 **
Number of obs	625	633	588	686	684	676

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**) and 0.1 (*) levels.

Table 2. Relationship between resilience capacities and recovery from food price shocks, PRIME

Indicators	Borena			Jijiga		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities						
Absorptive	0.012 **			0.020 ***		
Adaptive		-0.009 !			0.029 ***	
Transformative			-0.004			0.012
Number of obs	941	1053	995	718	719	703

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**) and 0.1 (*) levels.

Table 3. Relationship between resilience capacities and recovery from drought shocks, BRACED

Indicators	Borena			Jijiga		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities						
Absorptive	0.012 **			0.020 ***		
Adaptive		-0.009 !			0.029 ***	
Transformative			-0.004			0.012
Number of obs	941	1053	995	718	719	703

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**) and 0.1 (*) levels.

Table 4. Relationship between resilience capacities and recovery from food price shocks, BRACED

Indicators	Karamoja			Wajir		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities	!	!	!	!	!	!
Absorptive	0.104 ***	!	!	0.071 ***	!	!
Adaptive	!	0.045 ***	!	!	0.036 ***	!
Transformative	!	!	0.005 !	!	!	0.032 ***
Log likelihood	-183.6 !	-190.3 !	-242.1 !	-338.4 !	-334.1 !	-318.2 !
Number of obs	250 !	251 !	288 !	463 !	426 !	425 !

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**) and 0.1 (*) levels.

Resilience capacities and response to shocks over time

⁶ See Frankenberger and Smith (2015), chapter 2 for a detailed explanation of the empirical methodology.

⁷ See <http://stream.princeton.edu/AWCM/WEBPAGE/index.php> for more details on this platform.

The PRIME IMS dataset affords a unique opportunity to assess how the resilience capacities of households affected the responses to shock exposure over time. To determine the degree to which specific components of resilience capacities affected coping strategies used and resilience levels between baseline and the first round (R1) of interim monitoring, multivariate regression analysis was used. The regressions used data from two data collection areas, Borena (in Oromiya) and Jijiga (in Somali).⁶ The dependent variable is the change in food security over the drought period, which represents resilience because the greater the increase in household food security over time, the more resilient the household was to the drought. Drought exposure is controlled for using six alternative measures:

1. Change in rainfall deficit from baseline to R1
2. 12-month rainfall deviation from norm at R1
3. Cumulative (net) rainfall deficit from baseline to R1
4. Change in soil moisture deficit from baseline to R1
5. Cumulative soil moisture deficit from baseline to R1
6. Perceptions-based drought exposure index (*kebele* fixed-effects), R1

Most of these measures are calculated from satellite remote sensing data retrieved from the African Flood and Drought Monitor⁷ specifically for the *kebeles* in the study. The last measure is a perceptions-based measure calculated using data on the number of downstream drought-related shocks households experienced in addition to the perceived severity of the shocks as measured on a five-point scale.

Shocks context at baseline

Most PRIME households (over 85% reported at baseline that they had experienced at least one shock in the previous year, and most felt they had not yet recovered from those shocks. Quantitative data indicate that the most commonly experienced shocks were increased food prices, followed by livestock and crop disease, drought, poor harvests, and increased prices of agricultural or livestock inputs. Qualitative data, however, indicate that the biggest perceived problem is more frequent droughts and subsequent intense rains and flooding, which had occurred in the few years prior to the study. At baseline, households in Borena reported a greater ability to recover than did households in Jijiga, particularly when economics shocks were considered. Less than one year after the baseline survey, PRIME trigger indicators (e.g., livestock body conditions) showed that a protracted drought had begun in March 2014.

Baseline to IMS (R1) analysis

The first column of Table 5 lists the indices of resilience capacity in addition to the factors contributing to each.⁸ For example, bonding social capital is thought to contribute to households' absorptive capacity. Other independent variables controlled for are household demographic variables, education, pastoralist status (whether the households is a pastoral, agro-pastoral or non-pastoral household), the project area (Borena or Jijiga), and an asset index based on ownership of consumer durables, agricultural productive assets and livestock. Note that when the perceptions-based measure is employed, because this variable is measured at the household level, it is possible to control for factors affecting households' resilience at the *kebele* level using *kebele* fixed-effects regression. The (+) boxes signify that, for a particular shock exposure measure, the regression coefficient of the resilience-capacity factor of interest is statistically significant at least at the 10% level. The (-) boxes signify that the regression coefficient is negative and statistically significant at least at the 10% level.

⁸ *The meanings and measurement of these factors is given in Smith et al., 2015.*

Importantly, the sample size for this regression analysis, 414 households, is quite small. Thus some results that are nearly statistically significant might have been statistically significant if the sample size were larger. For this reason, factors should not be *ruled out* as important for households' resilience in the face of a shock based on the significance tests employed here. Another key point is that although resilience was higher in Borena than in Jijiga during the baseline, resilience capacities were far lower in Jijiga at the onset of the drought, and Jijiga households experienced lower drought exposure. This may explain why the results are stronger for Borena.

Table 5. Effect of resilience capacity and index sub-components on changes in food security over the drought period (PRIME baseline to IMS [R1]) a/

Shock measure	Change in rainfall deficit from baseline to RI			12-month rainfall deviation from norm at RI			Cumulative (net) rainfall deficit from baseline to RI			Change in soil moisture deficit from baseline to RI			Cumulative soil moisture deficit from baseline to RI			Perceptions-based drought exposure index (Kebele fixed-effects), RI		
	A	B	J	A	B	J	A	B	J	A	B	J	A	B	J	A	B	J
Absorptive capacity		(+)			(+)			(+)			(+)			(+)			(+)	
Bonding social capital		(+)			(+)			(+)			(+)			(+)			(+)	
Access to informal safety nets		(+)	(-)		(+)			(+)	(-)		(+)	(-)		(+)	(-)			
Holdings of savings																		(+)
Adaptive capacity																		(+)
Bonding social capital		(+)			(+)			(+)			(+)			(+)			(+)	
Linking social capital																		
Human capital		(+)			(+)			(+)			(+)			(+)			(+)	(-)
Access to financial resources					(+)						(+)							
Transformative capacity																		
Bridging social capital		(+)			(+)			(+)			(+)			(+)			(+)	
Access to formal safety nets																	(-)	
markets		(+)						(+)						(+)			(+)	(-)
infrastructure																	(-)	
basic services	(-)			(-)			(-)			(-)			(-)				(-)	
communal natural resources					(+)			(+)	(-)	(-)				(+)	(-)			

Note: Figures in boxes above represent positive or negative associations, statistically significant at least at the 0.1 level. A= "All"; B="Borena"; J="Jijiga"

a/ Findings in this table represent only those aspects of resilience capacity that are significant. Refer to Appendix 1 for a complete table of significant regression coefficients in all regressions.

As can be seen from Table 5, all three dimensions of resilience capacity—absorptive capacity, adaptive capacity and transformative capacity—contributed in some way to making households resilient to the drought that took place from March through October 2014 (after the baseline study and before the first round of interim monitoring) in the PRIME project’s operational area.

Absorptive capacity

The evidence is strong that the absorptive capacity of households in Borena likely contributed to their resilience in the face of the drought. This result is robust to shock exposure.

- The two contributors to absorptive capacity that made a difference are bonding social capital and access to informal safety nets.

- The regression results only point to one factor that may have contributed to the resilience of households in Jijiga, their holdings of savings prior to the onset of the drought.
- Although regressions with four of the drought-exposure measures signal a *negative* impact of access to informal safety nets on the drought resilience of Jijiga households, this result is not supported by the results using the perceptions-based measure of shock exposure, controlling for *kebele*-level factors.

Adaptive capacity

- The overall index of adaptive capacity has a statistically significant coefficient for Borena when the perceptions-based measure of shock exposure is employed (and controlling for *kebele*-level factors).
- Two contributors to adaptive capacity stand out as having supported Borena households' resilience during the drought: their bonding social capital (again) and their human capital. Access to financial resources might have also helped.
- The regression results do not point to adaptive capacity as a source of resilience for Jijiga households.

Transformative capacity

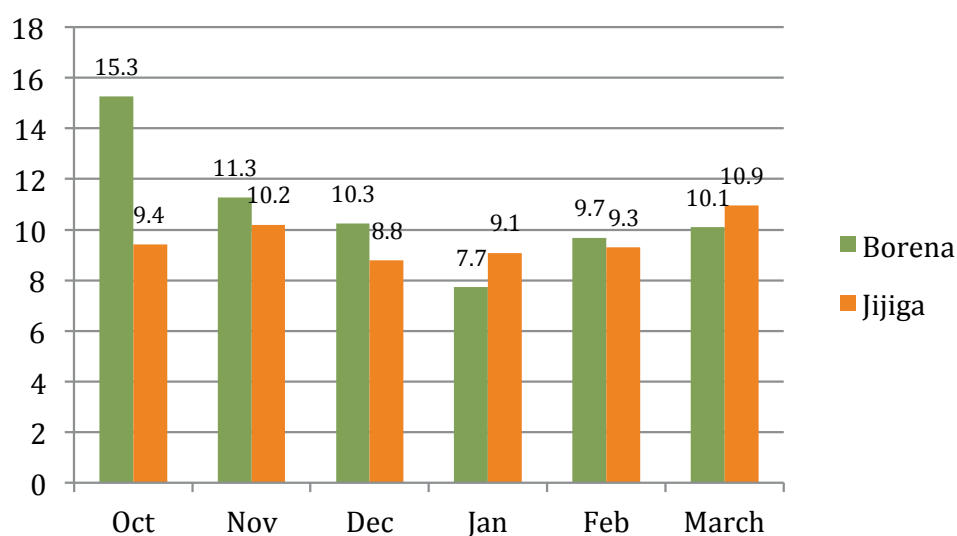
- Although the overall index of transformative capacity is not statistically significant, three index components are found to have made a difference to resilience to the drought: bridging social capital, access to markets, and access to communal natural resources.
- While the evidence of the role of bridging social capital is strongest for Borena, the results suggest that it played a role in Jijiga as well.
- Access to markets and communal natural resources supported households' resilience in Borena, but there is no evidence from these data that it did in Jijiga.
- Contrary to expectations, access to basic services⁹ is shown by the regression analysis to have had a negative impact on households' resilience to the drought in both regions, perhaps due to its correlation with some other unobserved factor, such as humanitarian assistance received.

⁹ The services for which access is measured are: primary school, health center, facility for veterinary services, agricultural extension service, institutions where people can borrow money, and security services.

Shocks context during interim monitoring

Interim monitoring collected both objective and subjective shock data. Objective sources (i.e., rainfall, soil moisture and vegetation data) showed that Borena experienced more severe drought than Jijiga. Soil moisture deficiency (percentage-points below norm), for example, was more severe in Borena than in Jijiga (about 50% in Borena vs. 8% in Jijiga in October, worsening to 79% and 37%, respectively, in March 2015). However, although objective measures indicated more severe drought conditions in Borena in every round of monitoring, respondents in Borena and Jijiga reported experiencing about equal levels of impact, except for one round where perceived shock was much higher in Borena, and two rounds when perceived shock was higher in Jijiga (January and March 2015), (Figure 2).

Figure 2: Perceptions-based shock exposure index from PRIME Interim Monitoring, October 2014 – March 2015



Downstream shocks

The IMS showed that the March 2014 drought was followed by numerous downstream shocks and stressors. Reduced rainfall led to shortages of potable water for people and of fodder and water for livestock, increased livestock and crop disease, very poor harvests, cross-border migration to find pasture, and conflict over grazing land and water. As a result of poor harvests, demand for grain increased, and the government began importing food from other areas. Food price inflation was the most frequently experienced shock in both Borena and Jijiga, and prices reached record levels. At the same time, prices paid to pastoralists for their livestock declined as distress sales increased, and demand for livestock and livestock products (e.g., meat, milk) declined as a result of reduced incomes. Conflict shocks (i.e., theft, violence) or death of a family member were experienced by a relatively small though increasing number of households over the course of the IMS.

Coping strategies

As the drought progressed, households utilized positive and negative coping strategies with household- and community-level impacts. Almost all households (nearly 90%) relied on assistance from friends and relatives, including receiving money for food and borrowing money. Other frequently reported strategies included sending livestock in search of pasture, taking up new wage labor, migration of family members, and borrowing money from a formal institution (e.g., savings and credit association). Negative coping strategies that undermine recovery included taking children out of school, selling productive assets, limiting portions or meals in a day, and skipping eating for entire days. Most of the food insecurity and drought coping strategies were employed more often in Borena than in Jijiga.

Although borrowing money was a commonly relied upon strategy, it was only a reliable strategy in the first few months of the monitoring period. As the drought wore on and social capital and resources were depleted, better-off households and community leaders were no longer able to support those in need. Governance systems were also weakened because community leaders were migrating to find food and water for their livestock, which meant that clan meetings, where support is mobilized for the poor and elderly, did not occur, leading to the erosion of informal social protection systems. Traditional rituals and supportive practices (e.g., visiting relatives, arranging weddings, and giving gifts following births) were postponed or skipped, representing further reduction of opportunities for developing or drawing on social capital.



5

Discussion

Results from the PRIME and BRACED baseline surveys show that all three types of resilience capacity – absorptive, adaptive, and transformative – are positively related to household recovery from different types of shocks, particularly drought and food price shocks. The results provide empirical evidence to support the fact that the resilience capacities, as measured by the indices used for these studies, do in fact capture the ability of a household to recover from different types of shocks.

Results from the regression analysis and interim monitoring data illustrate the importance of resilience measurement principles. First, all three components of resilience helped households respond to shocks. Second, ongoing monitoring was critical to track emerging issues and changing conditions. Without interim monitoring, practitioners might have concluded that Borena households had high levels of resilience and did not need further assistance. Interim monitoring however, tracked changing conditions and coping strategies, indicating that further assistance was needed.

This study highlights in particular a few key points:

- 1. Ongoing monitoring is needed.** Following an initial shock event, downstream shocks/stressors may manifest over time and may be undetected in a single round of monitoring. Downstream impacts following a drought could include decreased terms of trade, increased livestock disease and increased conflict as people migrate to find suitable pasture. Moreover, people's ability to respond to shocks changes over time and in different seasons as downstream effects emerge. For example, pastoralists in Borena rotate seasonally between wetland and dryland grazing resources, allowing vegetative regrowth in the off- season. During a drought, however, increased utilization of grazing land could lead to cascading shocks such as land use conflict, degraded pastureland, and livestock disease. Ongoing monitoring would capture such changes and indicate if a threshold level is reached.

The IMS provided two examples of conditions to that indicate a threshold had been reached. First, when clan leaders left the villages to find grazing land for their livestock, the social safety net broke down. Without community meetings, identification of households in need and distribution of informal aid to those households stopped. Second, villages were able to take care of community members in the first months, but over time, people used up marginal resources and social capital. People began to resort to negative coping strategies such as incurring debt, reducing food consumption and

pulling children out of school which have long term negative effects on resilience and wellbeing. These critical events should be monitored to know when to start a social protection program and to what extent the program should be implemented (i.e., how many people to target) and what type of aid should be delivered (e.g., cash transfer, fodder, food for work) and for how long

- 2. The measurement of shocks needs to include both objective and subjective measures.** Objective data can reveal whether or not a shock has occurred. Subjective data reflects perceptions, and more importantly, identifies in real time what people perceive as the biggest shock/stressor and the coping strategies they are using. However, individual perceptions may not accurately reflect environmental conditions. Data distortion can stem from varied sources such as individuals habituated to drought conditions who may under-report the severity of a drought, whereas individuals completely unprepared for a new or unusual type of shock may overstate its impact. Individuals may also over-report the severity of shocks to secure more aid.

Using objective data can avoid such distortion. Vicente-Serrano et al. (2012) report that drought indices vary in performance and should therefore be chosen based on context such as location, data availability, and impacts to be measured (i.e. agriculture, food security). Based on the datasets assessed in the IMS, soil moisture deficit and cumulative soil moisture deficit were the preferred measures for drought. Other types of satellite imagery (NDVI) show vegetation conditions which can include irrigated crops and are thus misleading. NDVI also does not accurately show the amount of available water, which is indicated by soil moisture measures. Precipitation indices are also of limited utility because rainfall may flow off site or evaporate and thus not be available for use in a given area.

Objective data should be used in conjunction with subjective and qualitative data. Objective data does not capture why people respond to conditions the way they do, such as diminishing social capital, strained social relationships, and reduced access to informal loans due to prolonged shocks. The PRIME baseline survey collected only subjective data about the severity of shocks, whereas the IMS collected both subjective and objective data. On-the-ground subjective/qualitative assessment was especially helpful in this case to assess and validate perceived impacts, which differed from objective measures. Qualitative data captured details about how households were experiencing the drought and its downstream effects.



6

References

- Banerjee, R., Carletto, G., & Zezza, A. (2015). Household Data Sources for Measuring and Understanding Resilience. Technical Series paper of the Food Security Information Network's (FSIN) Resilience Measurement Technical Working Group (RM TWG).
- Bauer, J., Pompili, F., & Ballo, M. (2012). Recovering from drought in Niger: Trend analysis of household coping, 2007-2011. Paper presented at the Expert Consultation on Resilience Measurement Related to Food Security. Food and Agricultural Organization and World Food Programme, Rome, Italy.
- Béné, C., Newsham, A., Davies, M., Ulrichs, M., & Godfrey-Wood, R. (2014). Resilience, Poverty and Development. *Journal of International Development* 26:598–623.
- Béné, C., Frankenberger, T., & Nelson, S. (2015). Design, Monitoring and Evaluation of Resilience Interventions: Conceptual and Empirical Considerations. IDS Working Paper 459. Brighton, UK. Institute of Development Studies.
- Bujones, A., Jaskiewicz, K., Linakis, L., & McGirr, M. (2013). A Framework for Analyzing Resilience In Fragile and Conflict-Affected Situations. USAID Final Report. Columbia University SIPA 2013.
- Catholic Relief Services. (2013). Niger Resilience Study conducted by TANGO International. Baltimore. <http://www.crs.org/sites/default/files/tools-research/niger-resilience-study.pdf>
- Choularton, R., Frankenberger, T., Kurtz J. & Nelson, S. (2015). Measuring Shocks and Stressors as Part of Resilience Measurement. Resilience Measurement Technical Working Group. Technical Series No. 5. Rome: Food Security Information Network. Available at: http://www.fsincop.net/fileadmin/user_upload/fsin/docs/resources/
- Constas, M., Frankenberger, T., & Hoddinott, J. (2014a). Resilience measurement principles: Toward an agenda for measurement design. Food Security Information Network (FSIN) Resilience Measurement Technical Working Group. Technical Series No. 1. Rome: World Food Programme.
- Constas, M., Frankenberger, T., Hoddinott, J., Mock, N., Romano, D., Béné, C., & Maxwell, D. (2014b). A Common Analytical Model for Resilience Measurement: Causal Framework and Methodological Option. Food Security Information Network (FSIN) Technical Series No. 2. Rome: World Food Programme
- Emergency Market Mapping and Analysis (EMMA). (2011). EMMA Toolkit. <http://emma-toolkit.org/> Accessed September 17, 2015.
- Frankenberger, T. & Smith, L. (2016). Ethiopia Pastoralist Areas Resilience Improvement and Market Expansion (PRIME) Project Impact Evaluation: Report of the Interim Monitoring Survey 2014-2015, DRAFT. February 2016. Washington, DC: USAID Feed the Future.

- Maxwell, D., Constas, M., Frankenberger, T., Klaus, D. & Mock, N. (2015). Qualitative Data and Subjective Indicators for Resilience Measurement. Resilience Measurement Technical Working Group. Technical Series No. 4. Rome: Food Security Information Network. Available at: http://www.fsincop.net/fileadmin/user_upload/fsin/docs/resources/FSIN_TechnicalSeries_4.pdf
- Smith, L., Frankenberger, T., Langworthy, B., Martin, S., Spangler, T., Nelson, S. & Downen, J. (2015). Ethiopia Pastoralist Areas Resilience Improvement and Market Expansion (PRIME) Project Impact Evaluation: Baseline Survey Report. Feed the Future FEEDBACK project report for USAID.
- TANGO International. (Forthcoming). Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED). Mercy Corps.
- UNDP. (2014). Disaster risk reduction makes development sustainable. http://www.undp.org/content/dam/undp/library/crisis%20prevention/UNDP_CPR_CTA_20140901.pdf
- USAID. (2015). Measuring Climate Resilience and Vulnerability: A Case Study from Ethiopia, Intermediary Report. Draft report by Kimetrica. Contract No. AID-OAA-C-11-00171.
- Vicente-Serrano, S., Beguería, S., Lorenzo-Lacruz, J., Camarero, J., López-Moreno, J., Azorin-Molina, C.,... Sanchez-Lorenzo, A. (2012). Performance of drought indices for ecological, agricultural, and hydrological applications. *Earth Interact.*, 16, 1 – 27. doi: <http://dx.doi.org/10.1175/2012EI000434.1>
- Vollenweider, X. (2014). A Simple Framework for the Estimation of Climate Exposure. Centre for Climate Change Economics and Policy Working Paper No. 177. Grantham Research Institute on Climate Change and the Environment Working Paper No. 158.
- World Bank. (2015). Living Standards Measurement Study: LSMS-ISA. <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/O,,contentMDK:23512006~pagePK:64168445~piPK:64168309~theSitePK:3358997,00.html> Accessed September 17, 2015.
- Zselezky, L., & Yosef, S. (2014). Are shocks really increasing? A selective review of the global frequency, severity, scope and impact of five types of shocks. 2020 Conference Paper 5. May 2014. Washington, D.C.: International Food Policy Research Institute.

7

Annex 1

Detailed regression results

Tables in this annex present results from ordered logit equations estimating a household's reported recovery from shocks in the past 12 months. Response categories are 1=did not recover, 2=recovered but are worse off than before the shock, 3=recovered to the same level as before the shock, and 4=recovered and are better off.

Coefficients are reported in log-odds units. Cut points are intercept terms. The interpretation is different than for Ordinary Least Squares (OLS) and uses predicted probabilities. For logit equations, the probability is $1/(1+e^{xb})$. So for each household:

$$\begin{aligned} \text{prob}(y=1=\text{'did not recover'}) &= 1/(1+e^{(xb-\text{cut}1)}) \\ \text{prob}(y=2=\text{'recovered but worse off'}) &= 1/(1+e^{(xb-\text{cut}2)}) - 1/(1+e^{(xb-\text{cut}1)}) \\ \text{prob}(y=3=\text{'recovered to same level as before shock'}) &= 1/(1+e^{(xb-\text{cut}3)}) - 1/(1+e^{(xb-\text{cut}2)}) \\ \text{prob}(y=4=\text{'recovered and better off'}) &= 1 - 1/(1+e^{(xb-\text{cut}3)}) \end{aligned}$$

Table A1 . Relationship between resilience capacities and recovery from drought shocks, PRIME

Indicators	Borena			Jijiga		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities						
Absorptive	0.010 **			0.024 ***		
Adaptive		0.029 ***			0.032 ***	
Transformative			0.030 ***			0.015 **
Household characteristics						
Household size	-0.029 !	-0.037 !	-0.019 !	-0.051 !	-0.038 !	-0.022 !
Age HH head	-0.013 ***	-0.011 ***	-0.014 ***	-0.002 !	-0.003 !	-0.003 !
Female-headed HH	-0.031 !	-0.031 !	-0.031 !	0.114 !	0.130 !	0.069 !
Severity of shocks	0.013 !	-0.004 !	-0.004 !	0.007 !	0.007 !	0.006 !
Recovery thresholds (Dependent variable response categories)						
Worse off (cut 1)	-1.154 ***	-0.558 !	-0.498 !	0.965 **	1.072 **	0.618 !
Same (cut 2)	-0.017 !	0.647 !	0.700 !	2.041 ***	2.136 ***	1.665 ***
Better off (cut 3)	2.181 ***	2.919 ***	2.920 ***	3.416 ***	3.502 ***	3.002 ***
Number of obs	625 !	633 !	588 !	686 !	684 !	676 !

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**) and 0.1 (*) levels.

Table A2. Relationship between resilience capacities and recovery from food price shocks, PRIME

Indicators	Borena			Jijiga		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities						
Absorptive	0.012 **			0.020 ***		
Adaptive		-0.009 !			0.029 ***	
Transformative			-0.004 !			0.012 !
Household characteristics						
Household size	-0.019 !	0.000 !	0.009 !	-0.006 !	-0.012 !	-0.002 !
Age HH head	-0.002 ***	-0.003 !	-0.003 !	0.001 !	0.002 !	0.002 !
Female-headed HH	-0.107 !	-0.247 !	-0.111 !	-0.310 !	-0.230 !	-0.291 !
Severity of shocks	-0.022 !	-0.016 *	-0.021 **	-0.009 !	-0.012 *	-0.016 **
Recovery thresholds (Dependent variable response categories)						
Worse off (cut 1)	-1.076 ***	-2.233 ***	-1.951 ***	0.930 ***	0.930 ***	0.456 !
Same (cut 2)	0.078 !	-1.085 ***	-0.793 *	2.173 ***	2.173 ***	1.666 ***
Better off (cut 3)	1.802 ***	0.624 !	0.883 *	3.805 ***	3.805 ***	3.280 ***
Number of obs	941 !	1053	995 !	718 !	719 !	703 !

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**) and 0.1 (*) levels.

Table A3. Relationship between resilience capacities and recovery from drought shocks, BRACED

Indicators	Karamoja			Wajir		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities						
Absorptive	0.115 ***			0.076 ***		
Adaptive		0.052 ***			0.039 ***	
Transformative			0.009 *			0.035 ***
Household characteristics						
Household size	0.016 !	-0.019 !	-0.013 !	-0.028 !	0.007 !	-0.011 !
Age HH head	-0.022 *	-0.021 *	-0.026 ***	-0.015 *	-0.015 *	-0.015 *
Female-headed HH	0.002 !	0.004 !	-0.001 !	-0.001 !	-0.002 !	-0.002 !
Severity of shocks	-0.022 *	-0.035 **	-0.014 !	-0.034 ***	-0.022 **	-0.036 ***
Recovery thresholds (Dependent variable response categories)						
Worse off (cut 1)	3.147 !	0.635 !	-0.757 !	-2.147 !	-2.080 !	-3.177 !
Same (cut 2)	7.064 !	4.208 !	1.895 !	2.399 !	1.991 !	1.172 !
Better off (cut 3)	9.415 !	5.182 !	3.642 !	5.104 !	4.527 !	3.879 !
Log likelihood	-135 !	-135.6 !	-186.3 !	-315.2 !	-342.3 !	-323.0 !
Number of obs	227 !	201 !	229 !	415 !	432 !	431 !

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**) and 0.1 (*) levels.

Table A4. Relationship between resilience capacities and recovery from food price shocks, BRACED

Indicators	Karamoja			Wajir		
	(1)	(2)	(3)	(1)	(2)	(3)
Resilience capacities						
Absorptive	0.104 ***			0.071 ***		
Adaptive		0.045 ***			0.036 ***	
Transformative			0.005 !			0.032 ***
Household characteristics						
Household size	0.021 !	0.009 !	0.003 !	-0.022 !	0.027 !	0.007 !
Age HH head	-0.012 !	-0.016 !	-0.022 **	-0.014 *	-0.015 *	-0.015 **
Female-headed HH	-0.002 !	-0.001 !	-0.004 *	-0.002 !	0.000 !	-0.002 !
Severity of shocks	-0.031 ***	-0.044 ***	-0.023 **	-0.023 **	-0.016 *	-0.027 **
Recovery thresholds (Dependent variable response categories)						
Worse off (cut 1)	2.369 !	-0.178 !	-1.447 !	-2.147 !	-2.080 !	-3.177 !
Same (cut 2)	6.450 !	3.337 !	1.542 !	2.399 !	1.991 !	1.172 !
Better off (cut 3)	8.916 !	4.915 !	3.538 !	5.104 !	4.527 !	3.879 !
Log likelihood	-183.6 !	-190.3 !	-242.1 !	-338.4 !	-334.1 !	-318.2 !
Number of obs	250 !	251 !	288 !	463 !	426 !	425 !

NOTES: Stars represent statistical significance at the 0.01 (***), 0.05 (**), and 0.1 (*) levels.

Table A5. Effect of resilience capacity and index sub-components on changes in food security over the drought period (PRIME baseline to IMS [R1])

Shock measure	Change in rainfall deficit from baseline to RI			12-month rainfall deviation from norm at RI			Cumulative (net) rainfall deficit from baseline to RI			Change in soil moisture deficit from baseline to RI			Cumulative soil moisture deficit from baseline to RI			Perceptions-based drought exposure index (Kebele fixed-effects), RI		
	A	B	J	A	B	J	A	B	J	A	B	J	A	B	J	A	B	J
Absorptive capacity		5			1			1			5			1			10	
Bonding social capital		10			5			5			5			5			10	
Access to informal safety nets		5	5		10			10	10		5	5		5	5			
Holdings of savings																		10
Adaptive capacity																	10	
Bonding social capital		10			5			5			5			5			10	
Linking social capital																		
Human capital		5			5			5			5			5			1	10
Aspirations/confidence to adapt																		
Exposure to information																		
Livelihood diversity																		
Access to financial resources					5						10							
Transformative capacity																		
Bridging social capital		10			10			10			10			10			10	
Linking social capital																		
Access to ...formal safety nets																10		
...markets		5						10						5			5	1
...infrastructure																	10	
...basic services	5			5			5			10			5				5	
...communal natural resources					10			10	5	10				5	5			
...livestock resources																		

Note: Figures in boxes above represent percentages and are significance levels associated with each measure in the first column. Red-shaded cells indicate a positive, statistically significant coefficient at least at the 10% level. Purple-shaded cells indicate a negative coefficient at least at the 10% level.

A="All"; J="Jijiga"; B="Borena"

Table A6. Summary IMS measures of shock exposure, by project area and pastoralist status

Measure	All	Project area		Pastoralist status		
		Borena	Jijiga	Pastoralist	Agro-pastoralist	Non-pastoralist
IMS 2014-15 data						
Number of drought-related shocks experienced	3.06	3.11	2.93	3.19 ^a	3.12 ^b	2.75 ^{ab}
Perceptions-based shock exposure index	10.4	10.7 ^a	9.6 ^a	11.0 ^a	10.6 ^b	9.2 ^{ab}
<i>Kebele</i> -level drought-exposure measure	32.8	41.1 ^a	17.0 ^a	--	--	--
African Flood and Drought Monitor data						
Rainfall deviation from norm	0.679	0.869 ^a	0.32 ^a	--	--	--
Soil moisture percentage of norm	50.0	65.3 ^a	21.1 ^a	--	--	--
Vegetation percentage of norm	44.9	58.7 ^a	18.8 ^a	--	--	--



The International Livestock Research Institute (ILRI) works to improve food security and reduce poverty in developing countries through research for better and more sustainable use of livestock. ILRI is a member of the CGIAR Consortium, a global research partnership of 15 centres working with many partners for a food-secure future. ILRI has two main campuses in East Africa and other hubs in East, West and Southern Africa and South, Southeast and East Asia. www.ilri.org



CGIAR is a global agricultural research partnership for a food-secure future. Its science is carried out by 15 research centres that are members of the CGIAR Consortium in collaboration with hundreds of partner organizations. www.cgiar.org



The Technical Consortium for Building Resilience in the Horn of Africa provides technical support to IGAD and member states in the Horn of Africa on evidence-based planning and regional and national investment programs, for the long-term resilience of communities living in arid and semi-arid lands. It harnesses CGIAR research and other knowledge on interventions in order to inform sustainable development in the Horn of Africa. www.technicalconsortium.org

