SISMOD FOR CHAD

LINGERING ECONOMIC CRISIS AND THE RISK OF DROUGHT: IMPACT SIMULATION IN CHAD

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World Food Programme

OCTOBER 2017
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ACKNOLEDGEMENTS

ACRONYMS

CPI	Consumer Price Index
ENSA	Enquête Nationale sur la Sécurité Alimentaire
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
FoodSECuRE	Food Security Climate and Resilience
IMF	International Monetary Fund
INSEED	Institut National de la Statistique, des Études Économiques et Démographiques
LAIDS	Linearized Almost Ideal Demand System
LES	Linear Expenditure System
NGO	Non-governmental organization
SISAAP	Système d'Information durable sur la Sécurité Alimentaire et d'Alerte Précoce
SISMod	Shock Impact Simulation Model
VAM	Vulnerability Analysis and Mapping Unit of WFP
WFP	World Food Programme

EXECUTIVE SUMMARY

The lingering economic downturn in Chad is stifling market growth for the main livelihoods, which are still agriculture and pastoralism for more than 83 percent of the population.

We developed a shock impact simulation model (SISMod) to estimate the effects on the household economy and food security of three different scenarios: a continuation of the economic crisis, a drought, and the combination of the two. Results were explored according to population profiles and livelihoods as well as by geographical disaggregation. The model yielded the results summarized below.

Low domestic consumption, a lack of foreign currency and insecurity have a negative impact on trade in Chad, particularly across borders, affecting both traders and pastoralists.
The reduction of the terms-of-trade for pastoralists and the depletion of assets to cope with food insecurity leads to further decreases of well-being, in particular for those whose food consumption is not sustained by own production.

Even without the shock of price increases, a comparison of prices and wages shows that household spending capacity is falling. Deteriorating market access renders all households highly vulnerable to additional shocks.
If a drought were to hit before household resilience recovered from the ongoing economic crisis, the number of people in need would increase to 7.9 million and, if markets were not able to provide enough food, the country would need almost ten times the current level of in-kind aid.
Furthermore, the effects of a drought would hit a part of the population that is far from the areas in which WFP is operating. This indicates the need for additional preparation, as WFP and its cooperating partners must be ready to expand their operations quickly if needed.

1. INTRODUCTION

In June 2017, the productive areas of Chad were at considerable risk of drought. What would be the potential impact of such a shock on household food security? The need to gauge the implications of a drought was made even more pressing as food requirements were projected to rise in the face of the ongoing economic crisis.

In October 2015, under the aegis of SISAAP,[1] WFP conducted an Enquête Nationale sur la Sécurité Alimentaire (ENSA) questionnaire designed to draw a baseline of 8157 households in 21 of the 23 regions[2] of Chad and to inform the cycle of analysis of the Cadre Harmonisé.

Using this baseline analysis,[3] we modelled the impact of price and production shocks on households to estimate how food security would be affected in different regions of Chad via income and consumption transmission mechanisms, using a Light Shock Impact Simulation Model (SISMod-Light[4]) developed jointly by WFP and FAO.[5] The simulated data was then compared against the baseline.

This report comprises four sections. Section 2 presents the methodology used to produce the estimates and details the assumptions made to replicate the current situation. Section 3 discusses the results in terms of agricultural income, expenditures, sex of household head and dependency ratio by ward. The final section contains our concluding remarks.

A dataviz dashboard was produced and published to share the information produced with the SISMod estimates and render it accessible for further analysis. This could be considered an Annex to the present report.[6]

2. METHODOLOGY

SISMod aims to replicate the economic behaviour of households in order to simulate the impact of a shock on household food security. A production shock similar to the drought of the agricultural season 2011/12 can be modelled in economic terms using a specific shock impact factor, which we define as the cereal and cash crop production outcomes ratio between the baseline and the simulated period, and similar ratios for food prices and consumer price index (CPI) levels as well. Modelling specific shocks requires some assumptions, which we explain in more detail below. The economic behaviour of each household is modelled through a Linear Expenditure System (LES) and a Linearized Almost Ideal Demand System (LAIDS). We input the following data:

⇒   Household demographics
⇒   Household income
⇒   Expenditures on food and non-food items
⇒   Number of days in which any food item from different groups has been consumed by household members over a seven-day recall period
⇒   Agricultural inputs
⇒   Crop production

Using a LES[7] with these data, we built a matrix of coefficients – i.e. income elasticities for expenditures – that expresses how the allocation of disposable income to food and non-food items changes.
The changes affect household food expenditures through a LAIDS[8] – i.e. demand elasticities – which then influence household food consumption.

The shocks are modelled as follows: we assume that a drop in income from lower agricultural production and other sources has a linear effect on expenditures and consequently on food consumption. Since household food expenditures (but not quantities) are commonly available in surveys, we derive the quantities by linking these expenditure shares to human food consumption as available in FAO's Food Balance Sheet and expressed in terms of daily caloric consumption per person for each item (group).[9] The final step is to transform these estimated food quantities into food security outcomes by transforming consumption shares into grams using NutVal data.[10] We assume that the sampled households with acceptable food consumption[11] have a consumption pattern in line with what is described in the Food Balance Sheet. Thanks to these assumptions we are able to obtain a proxy for quantities consumed in each food group and compare it with the food security situation for a representative population's sub-group.

The potential combination of production, price and income variations was captured in three
scenarios:

1) the impact of a stand-alone economic crisis;

2) the impact of a stand-alone drought; and

3) the impact of a combination of drought and economic crisis.

The components of each scenario will be discussed in this section.

i. Production

A production shock in the different regions of Chad has been estimated using historical production
data by region. In an average year, national food production amounts to 2,750,000 mt and national
cash crop production stands at 1,660,000 mt (see scenario 1 in Figure 1). Scenario 2 estimates the im-
pact of a drought with the same magnitude as in 2011/12; it predicts a drop in household food pro-
duction of 37 percent compared with the 2015/16 baseline, down to 1,657,000 mt. The production of
cash crops, which is less variable over time, is estimated to fall by 13 percent to 1,305,000 mt a year.

Figure *1: Food and cash crop production (in metric tons)*
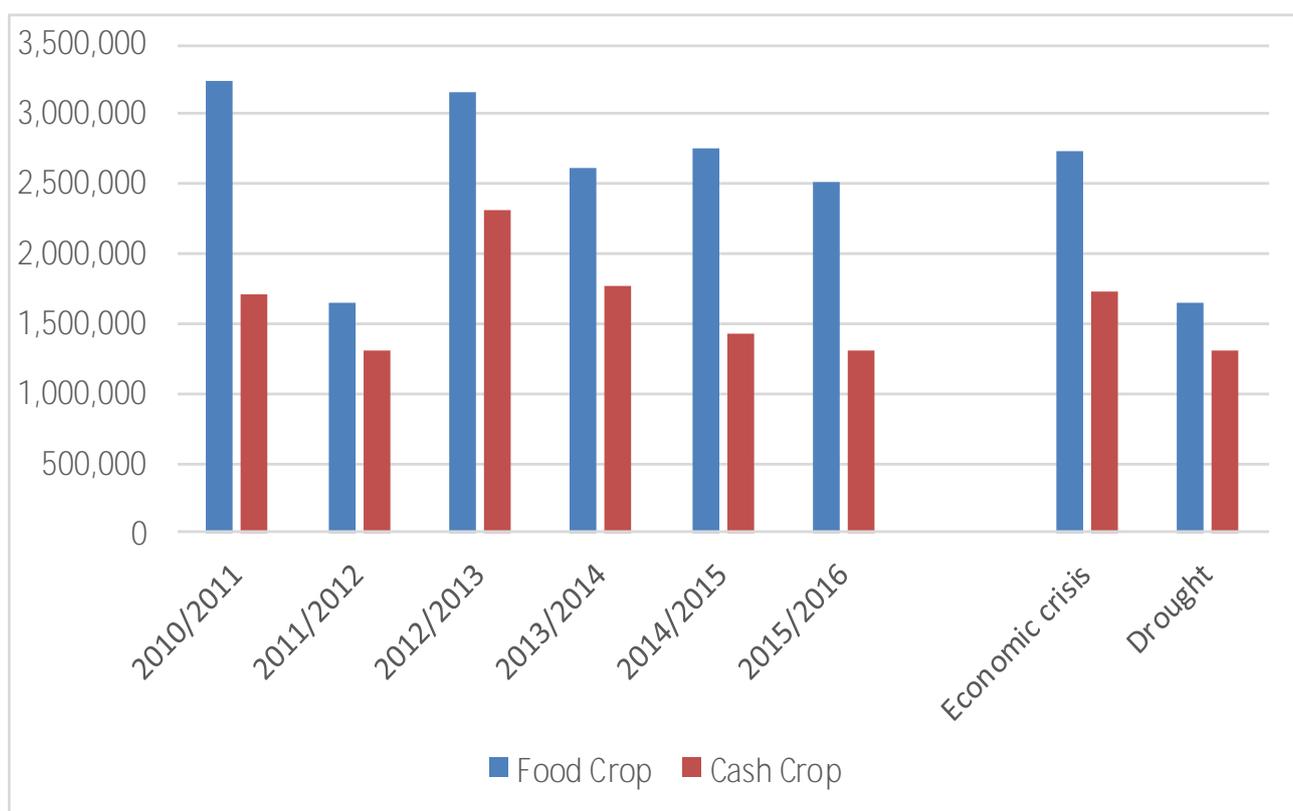
Source: VAM Chad, author's calculation

Major regional differences in the average and expected level of output in metric tons are presented in Figure 2, where the regions are ordered by the relative reduction in food crop production. In the past, Mayo-Kebbi Est had above-average levels of production despite the drought; therefore, the shock factor assigned to this region is 118 percent of baseline food production and 133 percent of baseline cash crop production. There are no production figures available for certain regions.[12] The shock factor used in this case is the ratio between the national output in the two reference periods, which is 59 percent of baseline national production. Some of the most agriculturally productive areas see their output drop considerably: in Chari Baguirmi, production falls by 24 percent; in Sila, it falls by 49 percent; and in Salamat, it drops by 51 percent. On a 2010 to 2016 average, these three regions account for over 35 percent of all food produced in Chad.

Figure 2: Food and cash crop production shocks (percentage) and 2010/2016 average production (metric tons) by administrative level 1
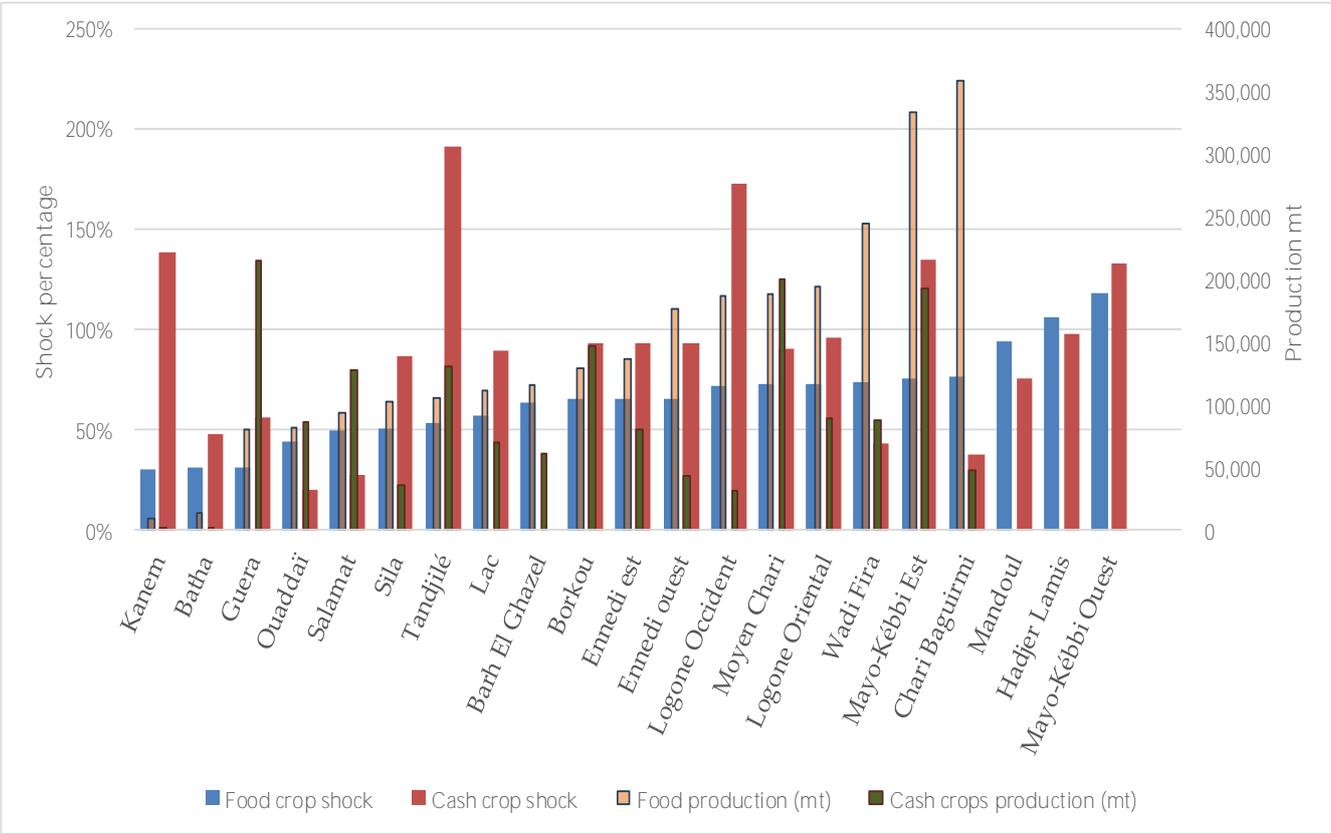
Source: VAM Chad, author's calculation

ii. Prices

Traders and pastoralists of western Chad suffer greatly from the disruption of cross-border trade with Nigeria, which also has an impact on the regional network (involving northern Cameroon). This has been the situation since early 2015, when the conflict with the armed jihadist group Boko Haram began. Large population displacements are putting pressure on the demand for basic foods and increasing the offer of small ruminants in the markets in the area. As seen in Figure 3, the prices for food and non-food commodities are not expected to rise significantly under the three scenarios – in fact, they are projected to be below the baseline. This can be explained by the negative trend in overall inflation. The food CPI falls by 6.5 percent between 2015 and scenario 1 (economic crisis). It drops by 3.5 percent in scenario 2 (drought).

The CPI for non-food items is more stable and is not expected to increase from baseline levels in any of the three scenarios. The IMF has forecast that in 2017, the CPI will not grow beyond 1 percent from 2016 levels.[13] For both indices, the assumptions in scenario 3 are close to scenario 1, with national food prices falling by 3.2 percent and non-food prices remaining stable.

Figure 3: Food and non-food CPIs, 2008/01=100
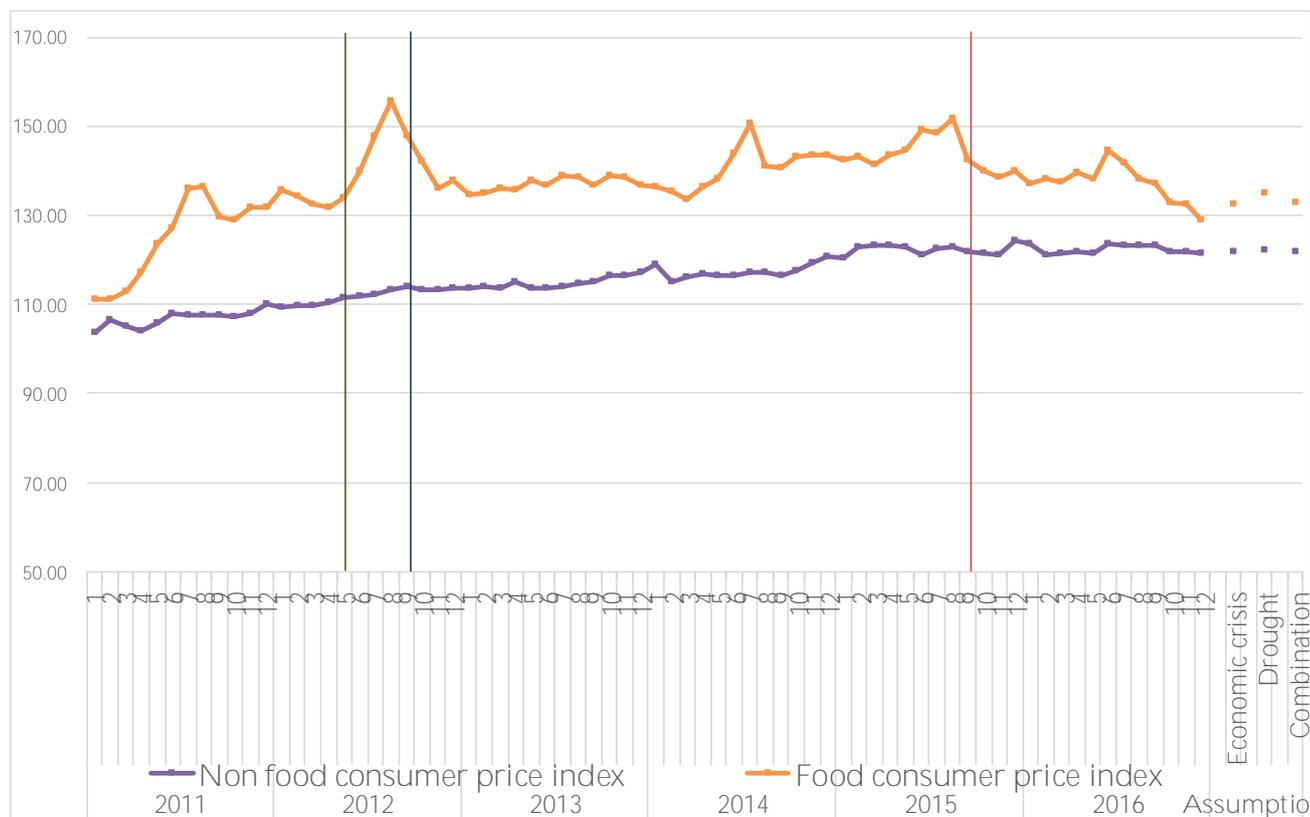
Source: INSEED author's calculation

National average food prices are illustrated in Figure 4, with vertical lines for different reference periods. On the left we have the reference period for farming households to set farm-gate prices, five months before the baseline month of October. The vertical blue line stands for the reference period for prices during the 2012 drought, with the same month as baseline. The final vertical red line corresponds to October 2015, the baseline period in which the ENSA data collection was performed. These three reference periods are used to produce ratios that are then applied to 2016 prices. The values obtained are also weighted according to the average percentage difference between markets in the different regions, in order to differentiate levels that otherwise would simply reflect a national average.

Table 1: Average food price shock factors in the three scenarios compared with 2015 baseline

	Cereals	Meat	Fish	Dairy	Oil and Fats	Vegetables and tubers
Economic crisis	-12%	-6%	1%	-2%	8%	-12%
Drought	-8%	14%	-21%	-13%	5%	-8%
Combination	-8%	1%	-22%	-16%	6%	4%

Source: INSEED author's calculation

In the three scenarios, downward pressure from the economic crisis is countered by the scarcity of food products, which increases prices in half the markets. As per Figure 4, the effects of an early lean season[14] can be assumed, particularly if we look at the historical series of each commodity index.

Figure 4: Food price indices by food groups
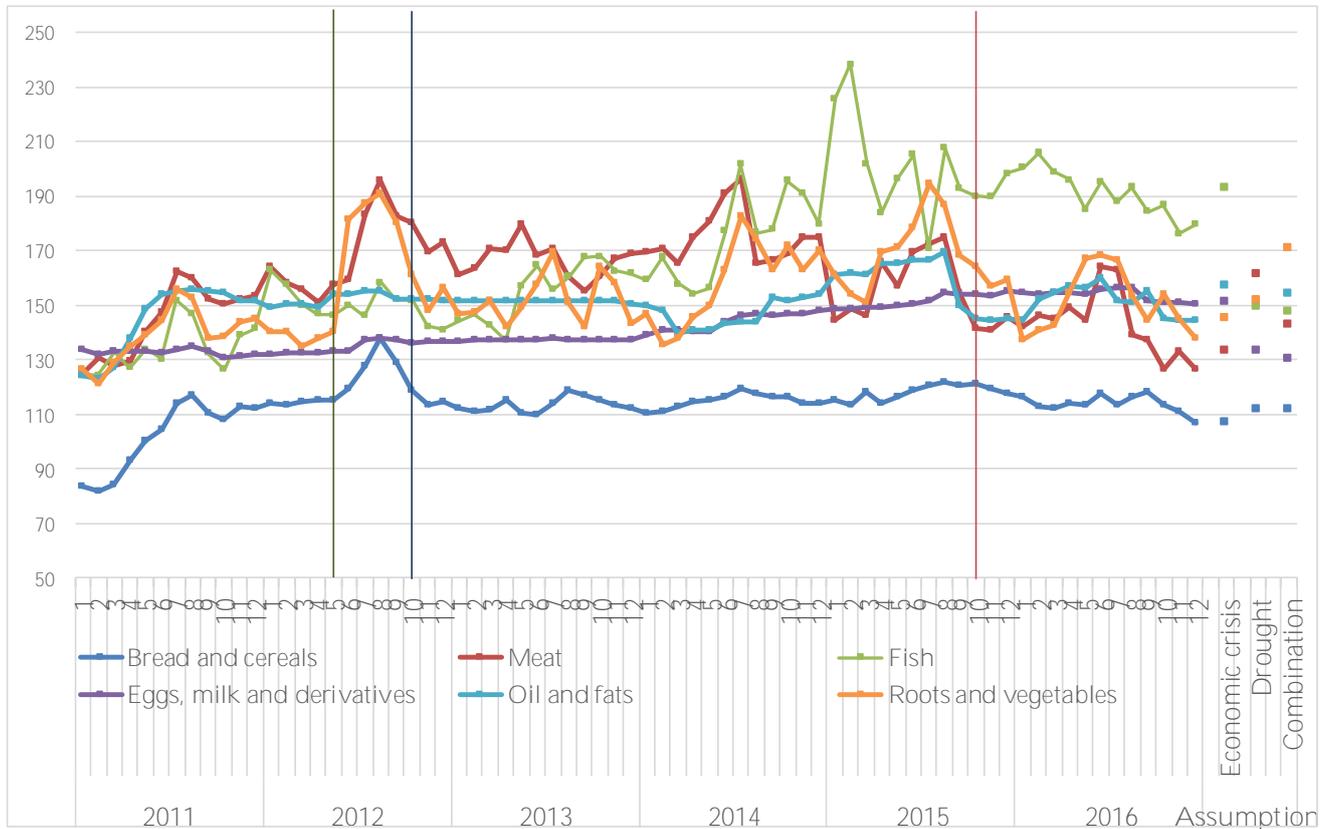
Source: INSEED, author's calculation

ii. Income

The foreign currency shortage at the central bank of Chad and the contraction of real GDP by 6.4 percent in 2016 is driving an economic downturn that has led the government to apply large fiscal austerity measures. Beyond the political implications of these policies, our analysis will focus on how economic factors have affected household incomes. Public expenditures have halved since the baseline year, and the value of exports is decreasing[15] despite rising exchange rates (as seen in Figure 5, the fall in CPI, and various commodities and particularly oil – the largest source of export revenue.

Figure 5: US$/XAF exchange rate and year-on-year changes
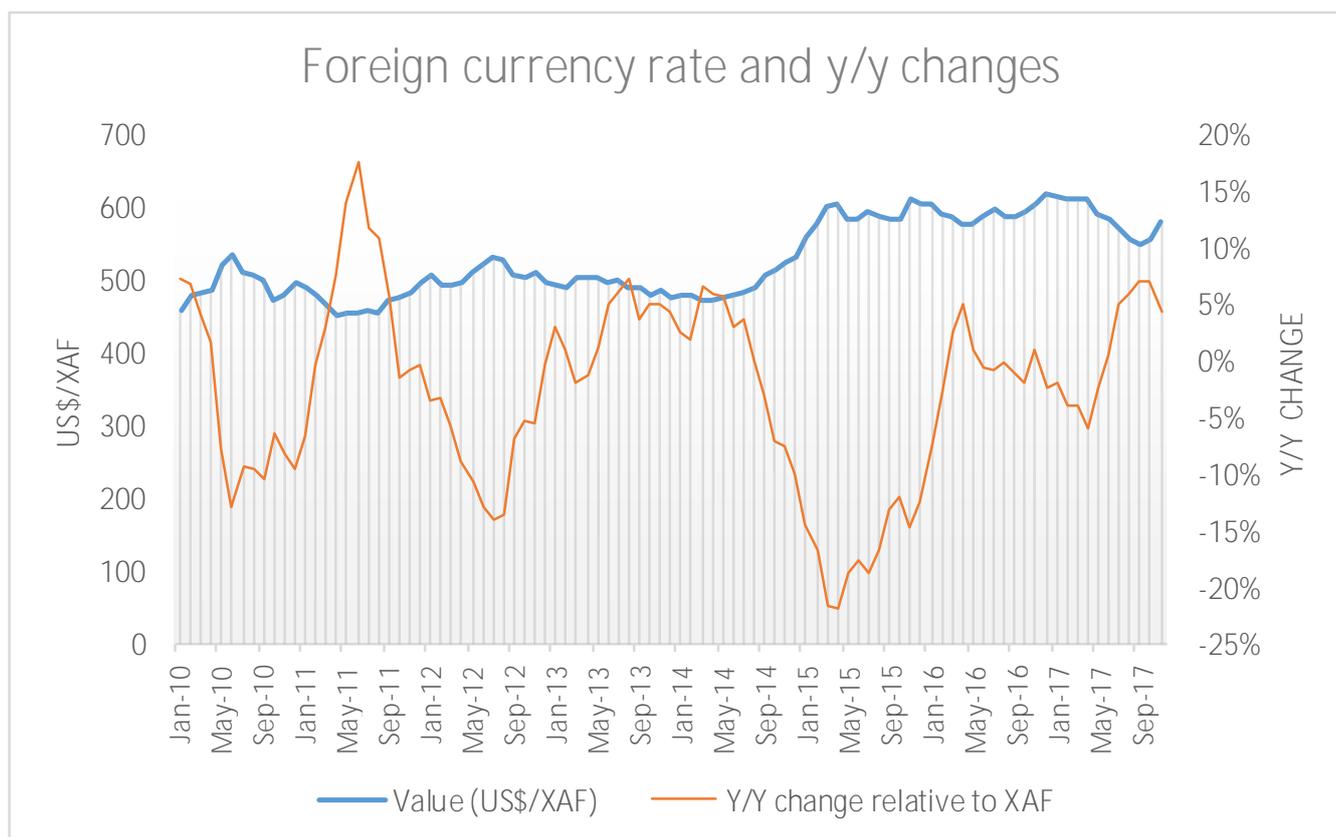
Source: Trading Economics

Chad's economic growth slowed in 2015 with a currency depreciation and a drop in GDP, driven by lower internal consumption and persistently low oil prices. Since exports are centred on crude oil,[16] the economy is not benefiting from the competitiveness afforded by the currency devaluation.

Table 2: Summary of annual economic indicators[17]

	2012[a]	2013[a]	2014[a]	2015[a]	2016[b]
GDP at market prices (XAF bn)	6,314.2	6,397.7	6,883.4	6,440.2	5,902.8
GDP (US$ bn)	12.4	12.9	13.9	10.9	10
Real GDP growth (%)	8.9	5.7	6.9	1.8	-3.1
Consumer price inflation (av; %)	14	0.1	1.7	3.7	-4
Population (m)	12.7	13.1	13.6	14	14.5[a]
Exports of goods FOB (US$ m)	4,327	3,892	3,932	2,629	2,187
Imports of goods FOB (US$ m)	-3,375	-3,034	-3,533	-2,572	-1,988
Current-account balance (US$ m)	-1,077	-1,188	-1,248	-1,346	-752
Foreign-exchange reserves excl gold (US$m)	1,156	1,183	1,076	369	8[a]
Exchange rate (av)XAF:US$	510.5	494	494.4	591.5	593.0[a]

Source: The Economist Intelligence Unit 2017; [a] actual figures, [b] estimates.

Photo Credit: Giulio d'Adamo

These factors already affect the household economy, even though the most common sources of income are agriculture and pastoralism. The baseline assessment found that over 83 percent of the population relied on these two livelihoods, with variations by region and season.

The regions of Batha, Mayo-Kebbi Est, Salamat and Sila have the largest component of waged labour. Salaried work and pensions – mainly from the government – are common in Barh el Gazel, Kanem and Lac. Pastoralist activities are a prominent part of the local economy in Borkou, Ennedi and Barh el Gazel, and they are also significant in Mayo-Kebbi Est, Wadi Fira and Tandjilé.

Figure 6: Main source of income per household by region
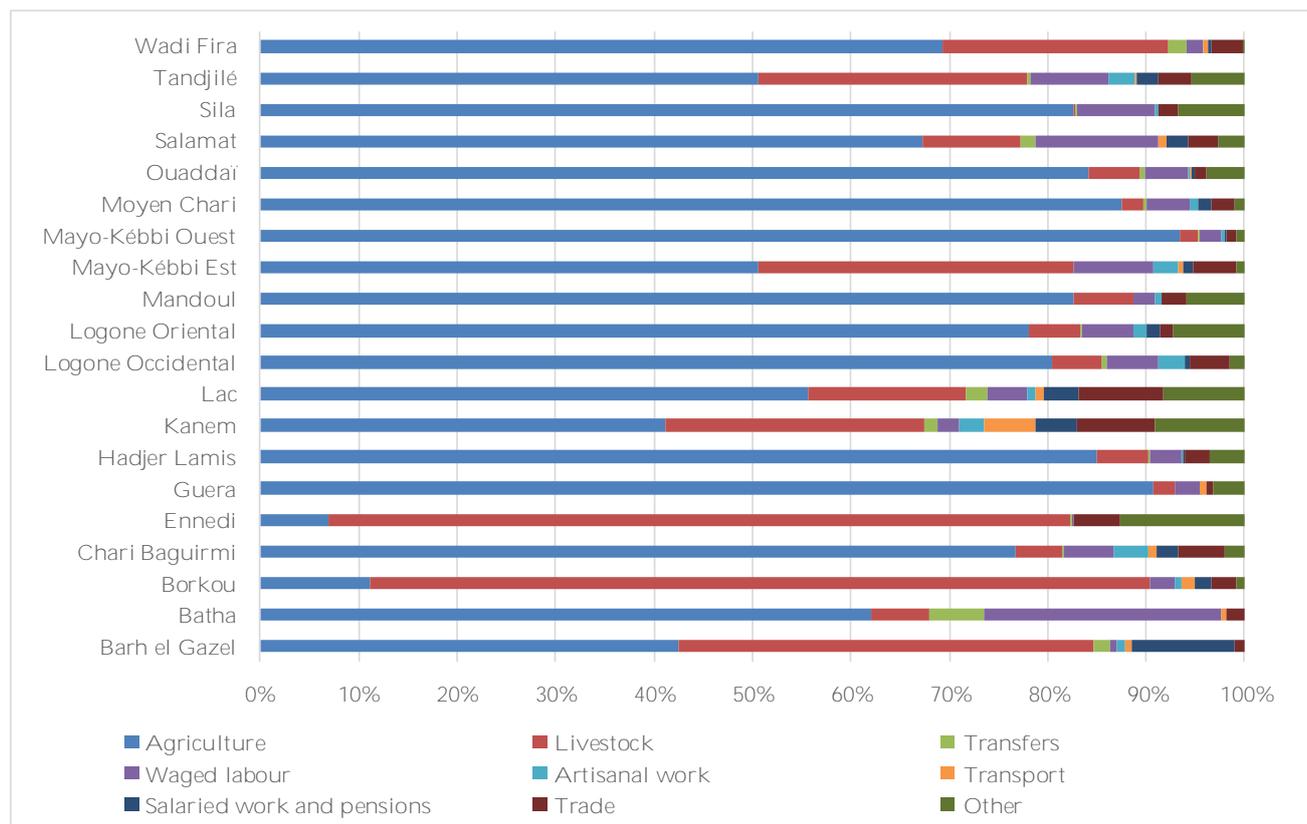
Source: ENSA 2015. author's calculation

Despite the effects of falling production and stagnating prices, the balance between income sources barely changes under each shock scenario. The income information collected in the assessment is restricted to each household's main source of income, and it includes a self-estimated value for the auto-consumption of the household. In the region of Kanem, the share of total income provided by agriculture is expected to fall by 29 percentage points in favour of pastoral activities; in Tandjilé, it is expected to drop 19 percentage points, again in favour of pastoral activities. Meanwhile, in Batha agricultural income is set to fall by 9 percentage points in favour of transport. In the latter region, the relative weight of trade in the economy is expected to shrink by 23 percent, partially offset by transfers.

Figure 7: Scenario 3: Main source of income per household by region, after shock
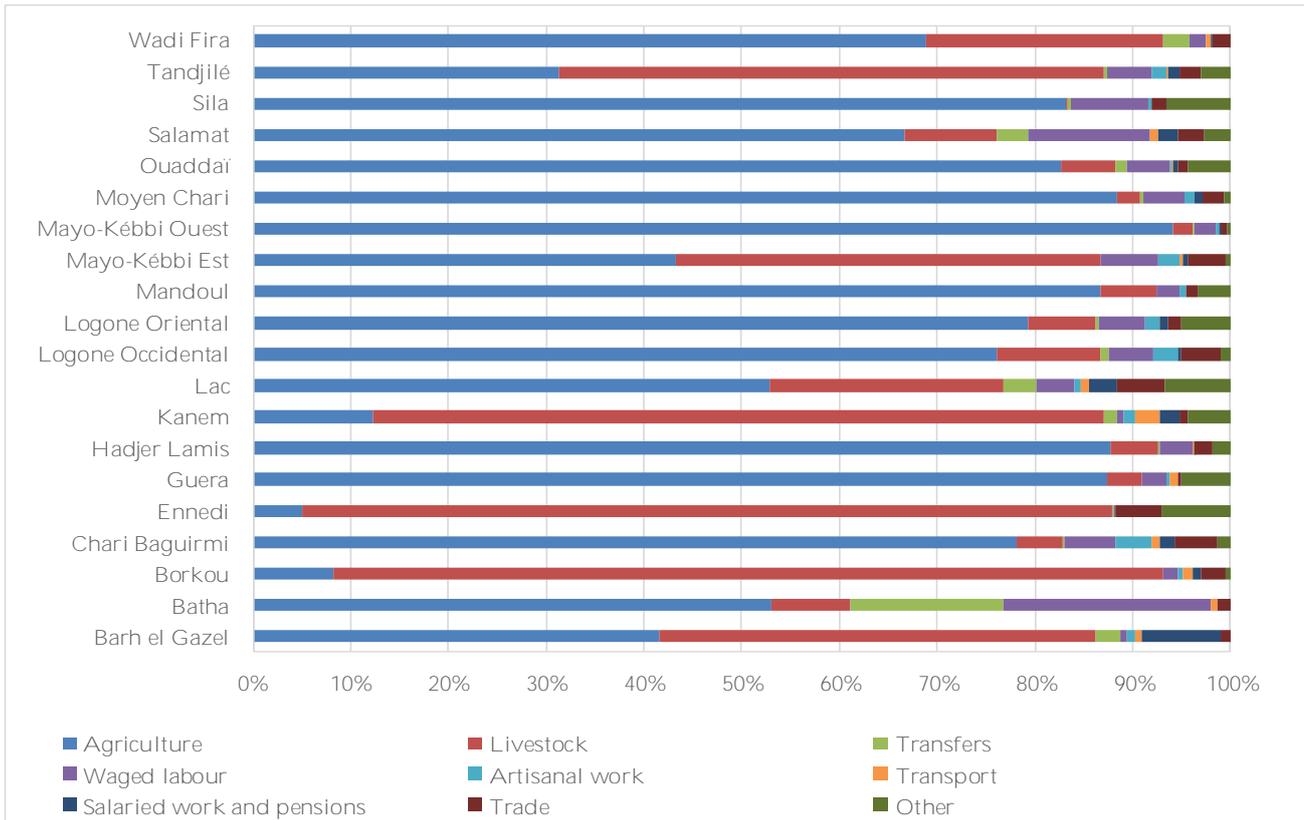
The 2015 household assessment shows large discrepancies between regions. Income information in 2015[18] is summarized in Figure 8. Income is particularly high in Borkou, Ennedi and Chari Baguirmi; the first two report widespread pastoralist activities. By contrast, households in Batha, Barh el Gazel and Mayo-Kebbi West reported the lowest income. Other regions where average income is below the international poverty line are Guera, Kanem, Lac, Logone Oriental and Sila. The equilibrium of such an economy is fragile and subject to the volatile, seasonal behaviour of traditional agricultural methods, with consumption hovering around subsistence levels for most households.

"SISMOD AIMS TO REPLICATE THE ECONOMIC BEHAVIOUR OF HOUSEHOLDS IN ORDER TO SIMULATE THE IMPACT OF A SHOCK ON HOUSEHOLD FOOD SECURITY."

Figure 8: Daily income per adult by region
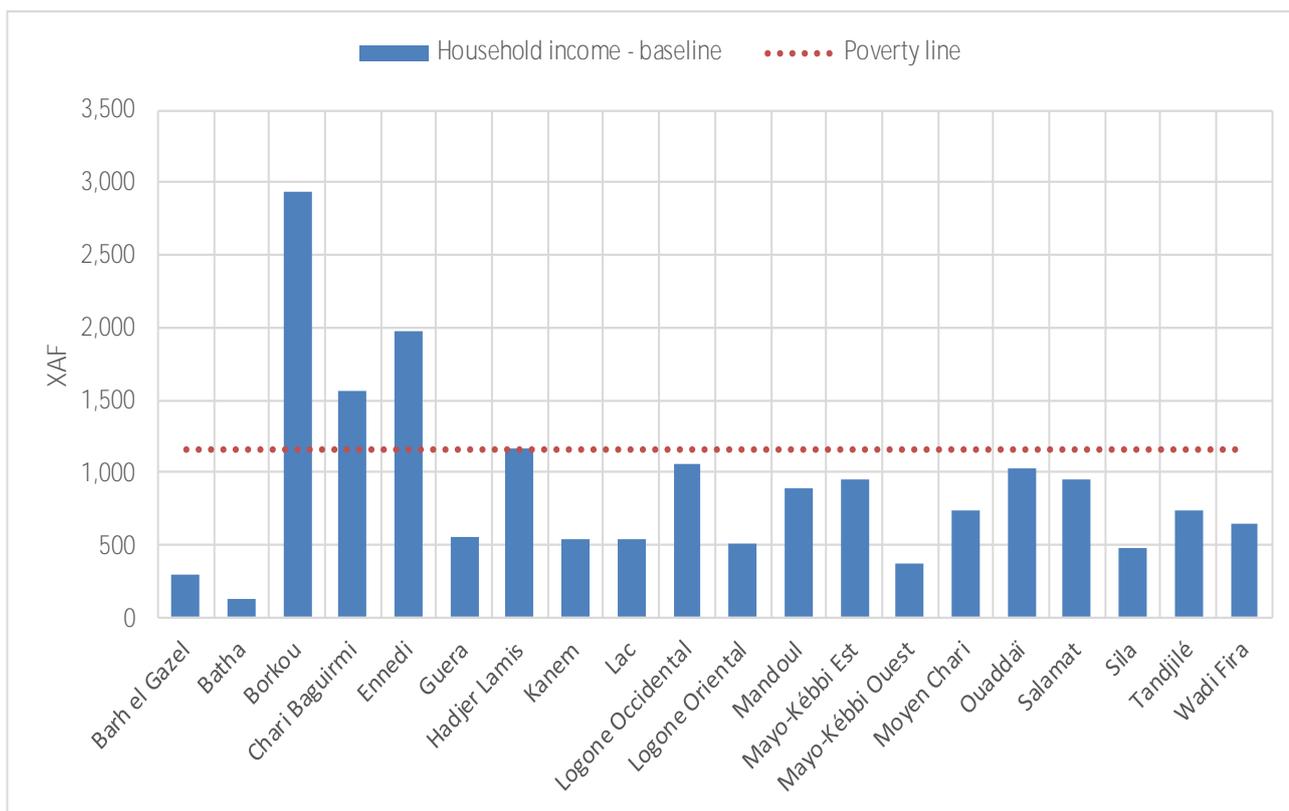
Source: ENSA 2015 – author's calculation

The daily average income per adult in the different regions (in XAF) confirms the large discrepancies already identified in the previous section. It shows how less productive agricultural sectors correspond to high levels of severe food insecurity during the baseline period. The sum of the shocks in scenario 2 can be seen in the effects on agricultural income (see Figure 9). While households in some regions succeed in keeping their relatively high income from agriculture, in other regions such as Barh el Gazel, Batha, Guera, Kanem, Lac and Tandjilé, households lose over half their agricultural income and often already face high levels of food insecurity. The share of the population who were severely food insecure in October 2015 ranges from 38 percent in Barh el Gazel and 23 percent in Batha, to 9 percent in Lac and around 13 percent in Guera, Kanem and Tandjilé.

Interestingly, in the past Mayo-Kebbi Ouest managed to offset the lack of production during droughts and saw low variability in agricultural outputs (see *Production shock*). The largest loss of income in absolute value caused by the drought alone is expected to occur in the eastern regions of Ouaddaï, in Salamat, and in the relatively better-off Chari Baguirmi. Historical production data allow us to estimate that the drought would not significantly affect Hadjer Lamis.

Figure 9: Agricultural income (in XAF) before and after scenario 2, share of severely food-insecure population in the baseline period
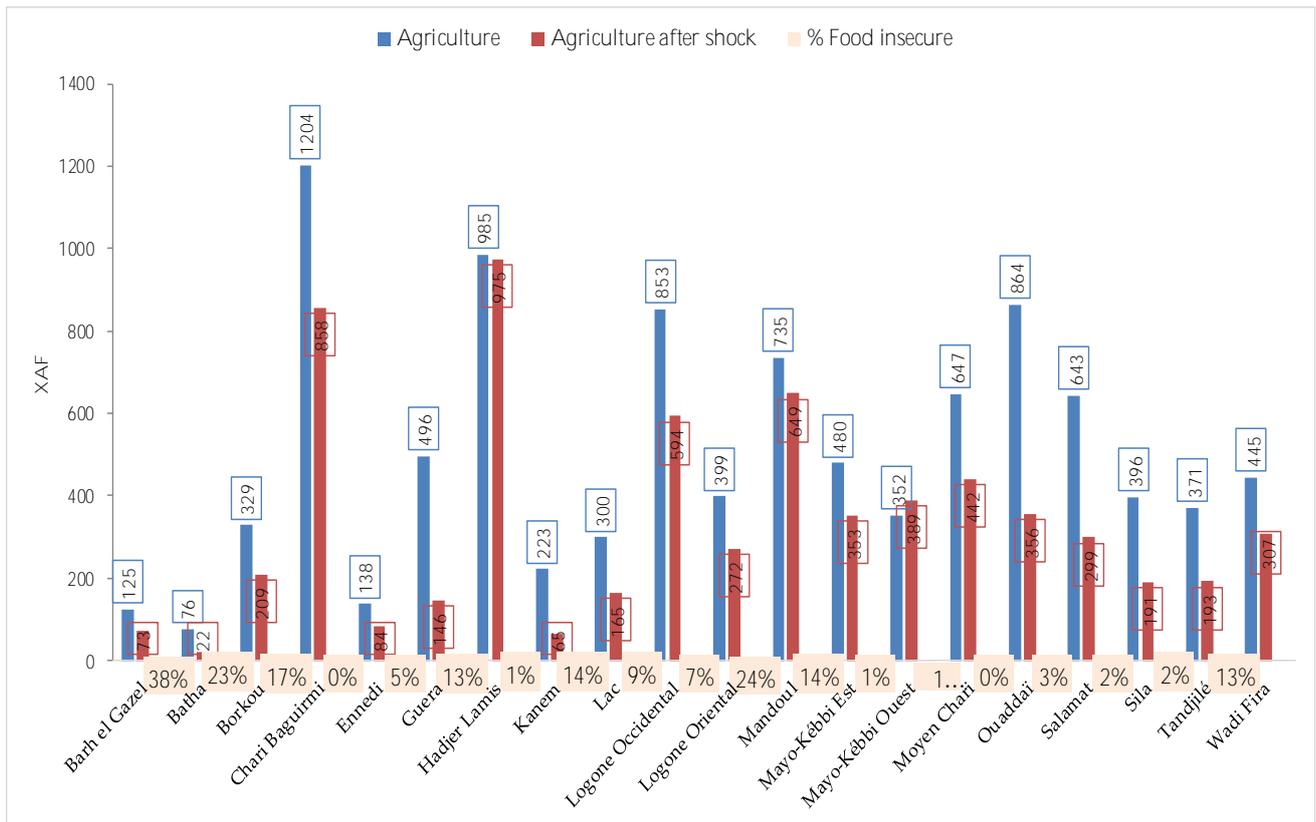
Source: ENSA 2015, author's calculation

3. RUNNING THE SIMULATION

This section discusses the results of the simulation using SISMod, based on the methodology and background information described in section 2. We simulate the impact on household food security using three distinct scenarios:

1. the impact of a stand-alone economic crisis;

2. the impact of a stand-alone drought;

3. the impact of a combination of drought and economic crisis.

Scenario 2 was designed to be a theoretical reference for the impact of the drought alone, as it is not possible to separate the effects of the drought from the impact of the current economic crisis.

The results were broken down by region, sex of household head and education level of household head. The latter was divided in two classes only to ensure a relevant sample size for each of the four groups, as illustrated in Table 3.

We acknowledge that the sample is not representative for this grouping, as the sampling strategy stratified by administrative area. However, the results for this grouping still give a valid indication of the relative differences by sex.

*Table 3: Sample size in baseline assessment by sex and education level of household head*

	Sample size	
	Count	Share
Male - Illiterate	4120	48%
Male - Literate	2854	34%
Female - Illiterate	1427	17%
Female - Literate	116	1%

Source: ENSA 2015

For each of the three scenarios, we estimate total expenditures, food expenditures, caloric consumption and the depth of the caloric gap for the borderline threshold. This last figure is also translated into kilograms of sorghum-equivalent aid that would be needed to fill the gap. This is meant to give a broad indication of the impact, disregarding the nutrient factors that need to be evaluated carefully for programme design.

The estimated result is a reduction of per capita expenditure from baseline levels, given the contraction of the economy (Scenario 1), with a larger impact on households led by women irrespective of education status. Figure 10 also shows how the economy's heavy reliance on agricultural production means that the effects of a drought (Scenario 2) are greater than those expected from the economic crisis. Households headed by literate women suffer a minor impact from this shock, while the rest of the population is equally impacted, by more than XAF600.

Figure 10: Expenditures per capita/week, by sex and literacy of household head
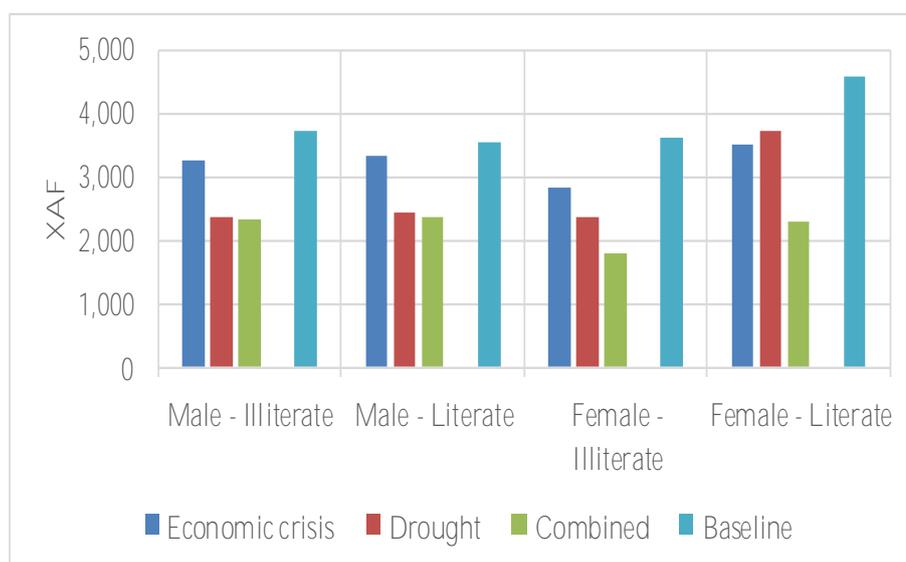
Source: ENSA 2015, author's estimates

In the economic crisis scenario, all four household groups spend more on food than during the baseline because of increasing real food prices. By contrast, the drought leads households to cut food expenditures as much as possible because incomes fall for the majority of the population. With average food expenditure down to XAF1,500 per capita/week, households headed by illiterate women are the most vulnerable. Households led by men cut their weekly per capita food expenditures to XAF1,610 (illiterate) and XAF1,680 (literate). The combination of the two effects further reduces the income allocated to food expenditures, with little variability for the average within a group. Households headed by literate men are estimated to spend XAF1,380 while those headed by illiterate women spend XAF1,180.

Figure 11: Food expenditures per capita/week, by sex and literacy of household head
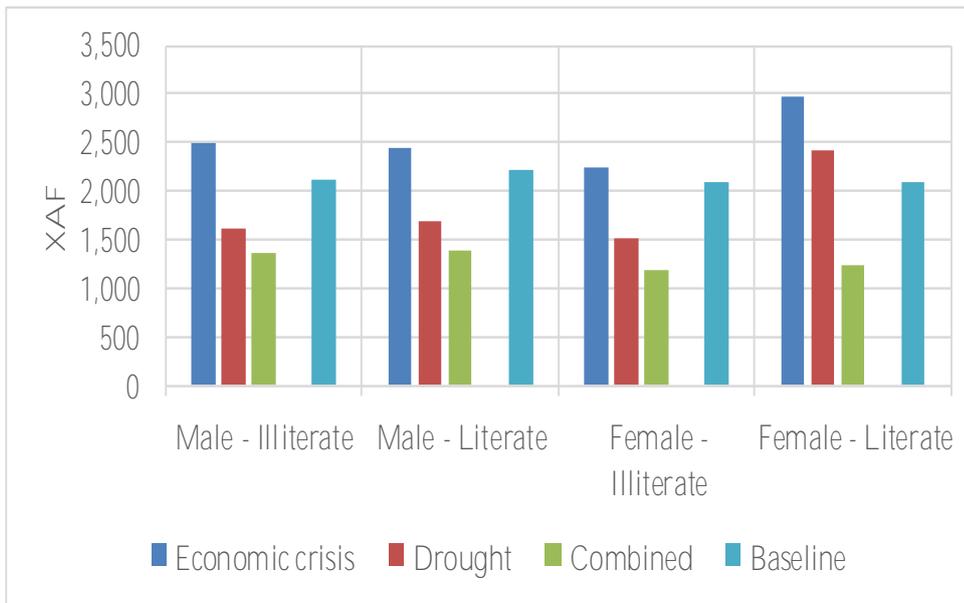
Source: ENSA 2015, author's estimates

From this gender analysis, we can conclude that the literacy of the household head only accounts for small differences in the levels of total expenditures for all scenarios, although households headed by literate women do see a minor reduction in their expenditures.

The assessment data that form the baseline of the model and the estimates are representative by region. The sample size by region is presented in Table 4 for reference, together with population estimates for 2017. N'Djamena and Tibesti are also listed for completeness, even though no households were sampled in these regions.

The three different scenarios simulated with SISMod show a large difference in the estimated effect of a reduction in income between scenarios 1 and 2. The additional effect of the economic crisis during a possible drought, i.e. scenario 3, would redistribute the variation across regions and livelihoods, with low additional food insecurity.

Exploring the estimated drop in income already presented in Figure 8 , breaking this down by region, as we can see in Figure 12, we still find the highest levels in Borkou, Chari Baguirmi and Ennedi. Deflation, combined with variations in agricultural production, shows how average income easily falls below the poverty line.[19] Bartha, Guera and Lac would suffer the most under scenario 3, with income falling by two thirds. Ouaddaï would follow a similar trend, with a 62 percent drop in income, down to XAF430 per capita a day, corresponding to just over 2 kg of sorghum in the region at the forecasted price of XAF200/kg. In scenario 3, Salamat, Sila and Barh el Gazel would see average income fall by around 45 percent: in the latter, income would drop from XAF350 to XAF175, which is barely sufficient to buy a kilo of sorghum.[20]

In Wadi Fira, Logone Occidental and Moyen Chari, income is estimated to fall by a third between scenario 1 and scenario 3.

Table 4: Sample size in baseline assessment ENSA 2015

	Sample size		Population
	Count	Share	2017
Barh el Gazel	319	4%	340,157
Batha	286	3%	633,679
Borkou	280	3%	125,765
Chari Baguirmi	454	5%	766,676
Ennedi	259	3%	225,188
Guera	622	7%	626,230
Hadjer Lamis	469	6%	748,540
Kanem	336	4%	449,621
Lac	303	4%	578,839
Logone Occidental	611	7%	929,792
Logone Oriental	849	10%	1,048,862
Mandoul	402	5%	842,782
Mayo-Kébbi Est	550	6%	1,034,289
Mayo-Kébbi Ouest	475	6%	758,795
Moyen Chari	428	5%	792,368
Ouaddaï	398	5%	967,467
Salamat	314	4%	406,547
Sila	321	4%	513,097
Tandjilé	456	5%	895,031
Wadi Fira	384	5%	680,206
N'Djamena	0	0	1,367,106
Tibesti	0	0	34,221

*Figure 12: Daily income per adult, by region*
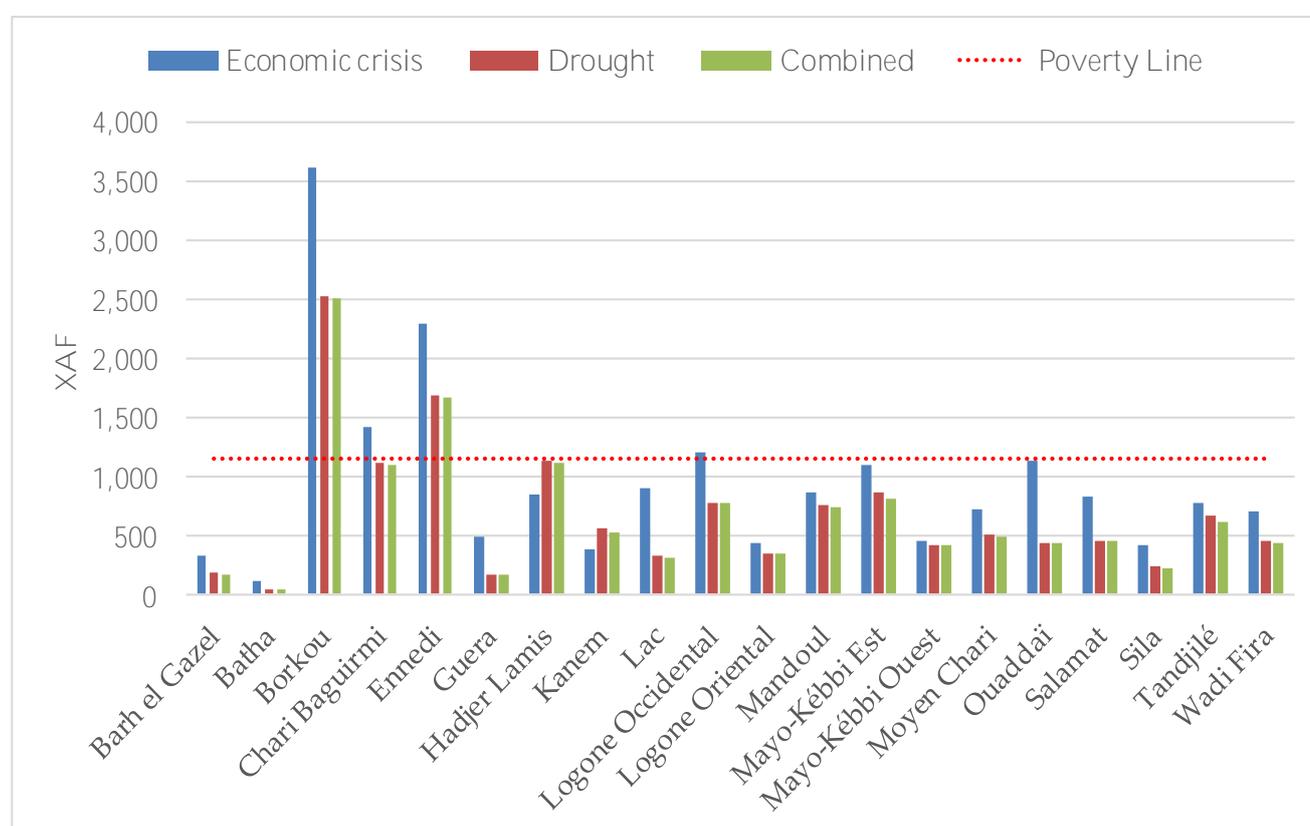
Source: ENSA 2015, author's estimates

With SISMod, we estimated the share of the population facing severe food insecurity.[21] The results are illustrated in Figure 13. The baseline assessment, after a favourable harvest, shows relatively low levels of food insecurity, with peaks in Barh el Gazel (38 percent) and Logone Oriental (23 percent). Scenario 1 foresees a rise in food insecurity in all regions except Barh el Gazel, where the population benefits from lower prices, even though it remains one of the most food-insecure regions (30 percent), along with Kanem (49 percent), Guera (43 percent), Lac (55 percent) and Logone Oriental (42 percent).

The effect of a drought is visibly deeper because of the large portion of the population whose economic activities revolve around agriculture. In some cases, almost the entire population sampled is estimated to be food insecure. Some regions confirm the vulnerability already seen in the baseline. Barh el Gazel is among the most vulnerable regions in drought conditions with 96 percent of the population food insecure, together with Guera (95 percent), Sila (96 percent), Salamat (93 percent) and Ouaddaï (88 percent).

Food security in Borkou, Ennedi, Hadjer Lamis, Mandoul and Mayo-Kebbi Ouest is estimated to be less impacted by scenarios 1 and 2. In scenario 3, these better-off regions would have food-insecure populations ranging from 34 percent (Borkou) to 10 percent (Mayo-Kebbi Ouest). However, a large part of the income of these regions comes from livestock. Their terms-of-trade could deteriorate if households are forced to sell part of their herd to cope with lower earnings, increasing the risk of food insecurity.

Figure 13: Share of households consuming less than 1,850 calories per day
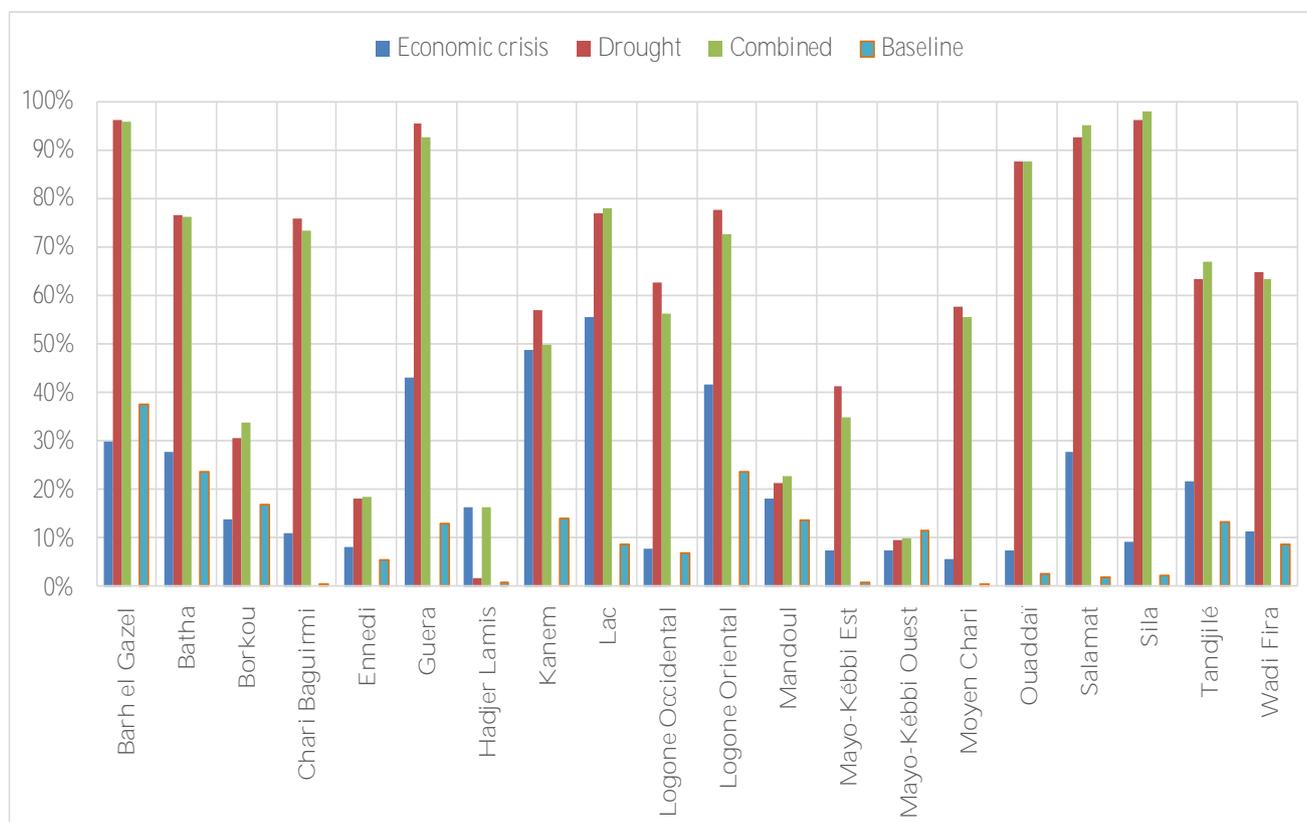
Source: Author's estimates based on SISMod

Given the depth of the gap between the food security threshold and estimated consumption, the cereal equivalent needed to fill the caloric deficit has been calculated for each region and scenario (Table 5). The caloric needs distribution has been weighted by the population estimates in Table 4.

In Lac and Kanem, households are less able to buy food on the market, and connecting with the network of local traders is difficult. These two regions face a large increase in their food-insecure populations because of the economic crisis. If the current economic situation persists, Logone Oriental, Lac and Kanem will have the greatest need for food aid: an estimated 6,850 mt per month – 63 percent of Chad's total requirements. Scenarios 2 and 3 depict a situation of great distress, with an almost tenfold increase in needs across the country. Under these conditions, food aid requirements in Kanem and Lac would represent 16 percent of the national total, and those in Logone Oriental would represent 17 percent, reaching a total of 16,500 mt per month.

Ouaddaï, Salamat and Sila, in the east of the country, would require 50,000 mt per month of food aid to cope with the drop in agricultural production and the current economic crisis (scenario 3); estimates shows that this combination increases needs by 8.8 percent compared with the impact of the drought alone. Under scenarios 2 and 3, this area accounts for over 50 percent of total national requirements.

The region with the highest estimated number of severely food-insecure people in scenario 1 is Logone Oriental (388,000); in Salamat, although food aid needs are much lower, 379,000 people fall short of the 1,850 kcal threshold.

Table 5: Metric tons of food aid per month to fill the caloric gap, by scenario and region

Region	Economic crisis	Drought	Combined
Barh el Gazel	412	7,438	7,263
Batha	926	8,980	8,535
Borkou	39	172	198
Chari Baguirmi	84	2,827	2,601
Ennedi	18	50	59
Guera	106	1,879	1,916
Hadjer Lamis	138	1	55
Kanem	2,034	4,022	3,363
Lac	1,986	5,100	5,273
Logone Occidental	44	1,903	1,494
Logone Oriental	2,828	7,272	6,885
Mandoul	578	660	796
Mayo-Kébbi Est	55	863	684
Mayo-Kébbi Ouest	79	121	133
Moyen Chari	30	1,897	1,739
Ouaddaï	63	10,094	10,709
Salamat	824	18,331	20,630
Sila	147	17,591	18,709
Tandjilé	343	2,650	3,301
Wadi Fira	93	2,830	2,646
Chad	10,826	94,680	96,989

Table 6: Number of severely food-insecure people, by scenario and region

Region	Economic crisis	Drought	Combined
Barh el Gazel	101,301	327,361	326,295
Batha	175,037	485,230	483,014
Borkou	17,517	38,179	42,221
Chari Baguirmi	84,436	580,918	562,342
Ennedi	11,668	26,113	26,669
Guera	34,894	77,498	75,146
Hadjer Lamis	101,479	9,347	101,479
Kanem	365,359	425,509	372,042
Lac	249,295	345,748	350,200
Logone Occidental	43,579	362,840	324,946
Logone Oriental	387,687	720,616	673,524
Mandoul	190,465	221,774	237,429
Mayo-Kébbi Est	62,826	346,307	294,208
Mayo-Kébbi Ouest	76,211	97,985	100,163
Moyen Chari	42,549	437,903	420,174
Ouaddaï	57,735	694,815	694,815
Salamat	378,784	1,266,968	1,301,798
Sila	87,404	931,300	946,370
Tandjilé	88,263	257,658	271,923
Wadi Fira	57,456	331,375	324,694
Chad	2,613,944	7,985,444	7,929,450

Source: Author's calculation based on VAM–Chad population estimates

4. CONCLUDING REMARKS

The estimated impacts of a drought and of an economic slowdown both point to a country in distress. With an economy based on agriculture added value and private consumption, Chad is at risk from a vicious circle in which a lower demand for goods triggers a rise in unemployment and depletes stocks of products and liquid money.

In the event of drought, operations need to be scalable and responsive, ready to deploy in places far from those currently most in need, who are in the western part of the country, close to Lake Chad. Advocacy to donors and coordination with local and global NGO partners – who represent 70 percent of WFP partners in the country – will be crucial, since a drought would require a rapid, ten-fold increase in response.

The type of intervention needs to be tailored to the specificities of each region, as different markets may respond differently to an injection of food products or a cash-based intervention.

In the long term, higher levels of education are positively correlated with household resilience. This is particularly the case for households led by women, which are more vulnerable.

Even if prices do not increase in all markets, a comparison of prices and wages shows that household spending capacity is reducing overall, and so is food security. In the coming months, an estimated 11,000 mt of food aid will be needed, mostly in the western part of Chad. Meanwhile, the eastern regions would be worst hit in the event of a drought.

FOOTNOTES

1. Système d'Information durable sur la Sécurité Alimentaire et d'Alerte Précoce.

2. Excluding Ville de N'Djamena and Tibesti.

3. A summary of the results can be found on the Vulnerability Analysis and Mapping website here.

4. This paper uses a light version of SISMod to overcome the limitation of missing quantities consumed. For more information on the full version of SISMod, please see Fang, Cheng, Sanogo and Issa, 2014. *Food price volatility and natural hazards in Pakistan.* FAO/WFP.

5. At-a-glance information about SISMod is available here. For further details, visit the SISMoD site or write to *wfp.economicanalysis@wfp.org*

6. The dashboard is available here.

7. Singh, Inderjit; Squire, Lyn, Strauss and John [eds]. 1986. *Agricultural household models: extensions, applications, and policy.* Baltimore, MD: The Johns Hopkins University Press.

8. **Angus Deaton and John Muellbauer, 1980. "An Almost Ideal Demand System" in** *American Economic Review*, 1980, vol. 70, issue 3, 312–26.

9. FAOSTAT – Food Balances.

10. We used the NutVal 4.0 edition.

11. **In this section, "acceptable food consumption" is defined as a Food Consumption Score equal** to 42, the threshold level for Chad.

12. Borkou, Ennedi and Barh el Gazel.

13. IMF World Economic Outlook.

14. Husain and Renk, 2017. *Economic Situation in Chad and Potential Impact on Food Security.* WFP. Available here.

15. Source: The Economist Intelligence Unit, extracted on 28 June 2017.

16. In 2015 Chad exported US$1.9 billion worth of petroleum, 93 percent of its total exports. Source: The Observatory of Economic Complexity.

17. The F.O.B. price (free on board price) of exports and imports of goods is the market value of the goods at the point of uniform valuation, (the customs frontier of the economy from which they are exported).

18. Income is calculated as the average income of July, August and September 2015, reported as daily income per adult.

19. Set at XAF1,150 using the current exchange rate of XAF575 per US$, with currency further depreciating in 2017.

20. **Author's estimate based on WFP VAM price data.**

21. According to the threshold of 1850 calories.

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