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THE POLITICAL ECONOMY OF ARMED CONFLICTS AND CHRONIC HUNGER IN SUB-SAHARAN AFRICA (1990-2015)

A THESIS SUBMITTED TO THE BRAZILIAN SCHOOL OF PUBLIC AND BUSINESS ADMINISTRATION IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ADMINISTRATION

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In memory of Josué de Castro

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Abstract

During the Millennium Development Goals (MDG) period 1990-2015, sub-Saharan African countries attained an average reduction rate of 30.1% of chronic hunger prevalence. However, although some countries were successful in eradicating hunger by 2015, others have attained worse levels of chronic hunger than they previously had in 1990. Based on cross-sectional and time-series data, this research aims to explore the impacts of armed conflicts on chronic hunger prevalence in sub-Saharan African countries. A nested analysis and multimethod comparative research design are adopted as the empirical strategy for the causal analysis of the impact of armed conflicts on chronic hunger prevalence across 39 sub-Saharan African countries during the MDG period 1990-2015. Panel data models' estimations are used as large-N analyses (LNA) to test hypotheses on the regular effects of armed conflicts on chronic hunger. Subsequently, small-N analyses (SNA) based on the case studies of the Republic of Djibouti, Republic of Guinea-Bissau, Republic of Angola, Republic of Mali, and Republic of Zambia are used to explore and trace the causal mechanisms through which armed conflicts affect the prevalence of chronic hunger in the contemporary sub-Saharan region. Understanding the impact of armed conflicts on chronic hunger from a comprehensive comparative perspective across sub-Saharan African nations could help governments, stakeholders and specialized agencies to find evidence on how to prevent hunger, eliminate conflicts, combat extreme poverty, and promote sustainable development in the region.

Keywords – Chronic hunger; Armed Conflicts; Sustainable Development; Sub-Saharan Africa

Resumo

Durante o período dos Objetivos de Desenvolvimento do Milênio (ODM) 1990-2015, os países da África Subsaariana atingiram uma taxa média de 30,1% de redução da prevalência de fome crônica. No entanto, embora alguns países tenham conseguido erradicar a fome até 2015, outros atingiram níveis de fome crônica piores do que os observados em 1990. Com base em dados transversais e de séries temporais, esta pesquisa visa explorar os impactos dos conflitos armados sobre a prevalência de fome crônica nos países da África Subsaariana. Uma análise hierárquica, combinada com um desenho multimétodo de pesquisa comparativa, são adotadas como estratégia empírica para a análise causal do impacto dos conflitos armados sobre a prevalência de fome crônica em 39 países da África Subsaariana durante o período 1990-2015 dos ODM. Estimativas de modelos de dados em painel são usadas em análises estatísticas (LNA) para testar hipóteses sobre os efeitos regulares dos conflitos armados sobre a prevalência de fome crônica. Em seguida, estudos de caso (SNA) baseados na República do Djibouti, República da Guiné-Bissau, República de Angola, República do Mali e República de Zâmbia são utilizados para explorar e rastrear os mecanismos causais pelos quais conflitos armados afetam a prevalência de fome crônica nos países da região subsaariana contemporânea. Compreender o impacto dos conflitos armados sobre a prevalência de fome crônica à partir de uma perspectiva comparativa abrangente entre os países da África Subsaariana poderá auxiliar governos, tomadores de decisão e agências especializadas a encontrar evidências de como prevenir a fome, erradicar conflitos, combater a pobreza extrema e promover o desenvolvimento sustentável na região.

Palavras-chave: Fome crônica; Conflitos Armados; Desenvolvimento Sustentável; África Subsaariana

Introduction

In 2000 the General Assembly of the United Nations declared the global commitment to halve the percentage of people who suffer from hunger by 2015. The baseline of comparison for this goal was settled to be the 1990's levels of *prevalence of undernourished* (PoU) populations worldwide. This commitment has been ever since designated as the first goal of the *United Nations Millennium Declaration* (United Nations, 2000) of development (MDGs), alongside with the eradication of extreme poverty. In 1996 the *Rome Declaration on World Food Security* (FAO, 1996) had also pledged for the halving of the total *number of undernourished* (NoU) people by 2015 compared to the 1990's levels baseline. In the technical literature, chronic hunger and prevalence of undernourishment (PoU) are used as synonymous (FAO, 2016). By 2015, the prevalence of undernourishment in sub-Saharan Africa stood at about 20% - one in five people hungry (FAO, 2016). This research intends to answer what were the effects of armed conflicts on PoU across sub-Saharan African countries during the period 1990-2015? The main hypothesis is that armed conflicts contributed to increase PoU levels across the region. By favoring the study of conflicts and transitory acute hunger and famines rather than chronic hunger, previous studies do not explain the impact of armed conflicts on chronic hunger in contemporary sub-Saharan Africa nor the causal mechanisms through which armed conflicts affect chronic undernourishment in the region. This research aims to contribute with the literature of armed conflicts and chronic hunger in contemporary sub-Saharan Africa by filling this gap. Thereby, this research intends to advance the empirical and theoretical knowledge in the field of development administration, comparative politics, and the international political economy of human development and armed conflicts in sub-Saharan Africa.

The research strategy adopted is based on a nested multimethod research design, grounded in both econometric and qualitative tools of analysis (Goertz 2017; Lieberman 2005), to evaluate the effects of armed conflicts on the levels of prevalence of undernourishment (PoU) across sub-

Saharan African countries during the period of 1990-2015. The aim is to contribute with a comprehensive comparative perspective on the general impact of armed conflicts on chronic hunger, and provide original evidence on the mechanisms through which conflicts generate chronic hunger in the region.

In section 1, a literature review on the determinants of chronic hunger in contemporary sub-Saharan Africa is presented, highlighting the existing gap in the literature regarding the association of armed conflicts with chronic hunger in contemporary sub-Saharan Africa. Section 2 offers a statistical descriptive analysis of the sample, in which the patterns of PoU variation across 41 sub-Saharan African countries are presented. In addition, section 2 highlights the sample selection and data collection procedures, formulates the hypotheses to be empirically tested, and summarizes the variables to be operationalized in the statistical empirical analyses. Section 3 presents the empirical strategy for hypotheses testing, and formally describes the longitudinal econometric estimation designs to test the effects of armed conflicts on PoU. Section 4 presents and summarizes the results of panel data estimations identified in section 3. Section 5 classifies all countries included in the sample based on the large-N analysis (LNA) to identify "on-the-line" and "off-the-line" cases. Subsequently, a small-N analysis (SNA) of five nation-states' case studies nested within the analysis of 39 nation-states is proposed in section 5 to explore and trace the causal mechanisms through which armed conflicts affect the prevalence of chronic hunger in the contemporary sub-Saharan region. Section 6 presents the empirical strategy for the SNA. Sections 7, 8, and 9, respectively explore and present the results of three "on-the-line" case studies. Section 10 explores and presents the result of an "off-the-line" case study, equifinality, and synthesizes the results found on the SNA, presenting an original categorization for the mechanisms that linked armed conflicts to chronic hunger in the analyzed countries. Section 11 concludes with final remarks.

1. Literature Review

In the studies of poverty, and in particular among scholars dedicated to analyze the poverty of nations in the twentieth century, the mainstream theoretical approach has favored the nexus of aggregated measures of national economic production and growth (GNP/GDP) with local levels of economic poverty (Sen 1981; Sen 1987). In specialized research focused on chronic hunger, this tendency has been translated into an echo of neo-Malthusianism (Geoffrey 2008), which reduces the problem of hunger to a problem of aggregated economic poverty, obliterating potential mechanisms of wealth distribution, and favoring analyses focused on absolute scarcity rather than relative scarcity. The classical approach in the literature of poverty, and by far the overwhelming majority of studies on hunger, have therefore been focused on income growth as its main determinant. Along this line, authors have studied hunger primarily as a problem of economic growth, and income poverty. This has been a prolific approach, as highlighted by the diverse set of determinants raised as relevant factors to explain the association between economic poverty and hunger. In terms of income levels, Sachs et al. (2010) explored cross-sectional data from the World Bank Development Data Group (2007) for more than 170 countries to show that above some levels of income the burden of health penury drops significantly compared to lower income levels, while Wodon (2007) relied on longitudinal data from national household surveys across West African countries to show that economic growth had a positive impact on the reduction of poverty. Case and Deaton (2004, 2002), and Deaton and Paxson (1998), showed that perceived health declines are related to low levels of income quartiles based on cross-sectional and time-series data from self-reported health status (SRHS) national surveys, while Browning et al. (1985) explored panel data from seven years of the British Family Expenditure Survey to discuss the restriction effects of family labor supply and wages on household consumption patterns. Furthermore, Sachs et al. (2004) have tried to analyze the association of economic growth, health and poverty in a cross-sectional and

time-series design using longitudinal datasets from the World Bank (2003) and FAOSTAT, providing evidence that lower levels of human development and higher risks of health pandemics in Africa are mostly found across low-income countries in the region. Christiaensen et al. (2002) analyzed the association of macroeconomic growth and poverty dynamics in a mixed-method research design using cross-sectional and qualitative data from 1990's household surveys in African countries and found that, at the aggregate level, poverty reduction was overall related to episodes of growth. And Oyejide (1999) provided evidence that economic growth and trade policy rationalization led to sustainable human development across African countries, in a comparative historical study using cross-sectional and time-series data. Studies that used a mixed-method research design and cross-sectional data to examine the relation between natural resource intensity and economic poverty across developing countries, a fundamental aspect of rich-commodity sub-Saharan African economies, found that resource-rich countries have the opportunity to transform its resources into sustained growth (Frankel 2012), such as Botswana, or into welfare policy provisions (Sachs and Warner 1995). Finally, other studies have been proposed with specific focus on directly food-related economic determinants. Such studies focus on food production and their connection to agriculture economics. In their 2007 study, Christiaensen and Demery tested the association between agriculture growth with poverty reduction using cross-country data from African countries, and found evidence that, although agriculture growth is not significantly associated with economic growth, it may alleviate poverty by directly providing a livelihood to impoverished populations. All these studies focus on absolute scarcity, either as aggregated income poverty or food production shortage, to explain human poverty and hunger[1].

[1] Further studies on this regard that were reviewed have focused on the role of technology innovation (McKay and Thorbecke 2017), wealth accumulation (Case and Deaton 2006), structural reforms (Nissanke and Ndulo 2017; Rodrik

Other authors have emphasized, under the influence of the 1990 ul Haq's Human Development Index (HDI), that economic growth and income poverty are not the best parameters to study human poverty and hunger. Within this approach, authors highlight the relevance of wealth inequality, and relative scarcity. This approach can be labelled the macro-distribution approach, for its proclivity to emphasize macro-distribution mechanisms of resources, and public services with the final end of tackling inequality. In this sense, it is not a substantially distinct approach from the economic-oriented authors, but its focus is framed by inequality rather than aggregate poverty. Along this line, McKay and Thorbecke (2017) explored cross-sectional data from sub-Saharan African countries to show that economic policies from democratic and accountable governments have much better outcomes in terms of poverty and persistent inequality reduction. Kempe (2008) explored qualitative historical data from the Ibrahim Index dataset to show that democratization is positively related to social and economic development across African countries. In addition, Sen (1989) explored cross-sectional data from diverse developing countries to show that endowments

2016; Andreasson 2010), industrialization (Osberg 2017; Stiglitz and Noman 2015), production specialization (Rodrik et al. 2007), manufacturing sector (Rodrik 2006), de-industrialization (Rodrik 2006), capital markets (Moss 2003), market structure (Kanbur 2001), legal reforms (Drèze and Sen 1989), end of debt crisis (McKay and Thorbecke 2017), borrowing (Moreno-Dodson and Wodon 2008), debt sustainability (Moreno-Dodson and Wodon 2008; Sachs et al. 2006), returns on assets (Alwang et al. 2002), consumption patterns (Case and Deaton 2002), international constraints (Langan 2017; Sachs et al. 2005), labor market barriers (Rodrik 2017), market failures regulation policies (Rodrik 2012; Abdulai and Kuhlgatz 2011; Sachs et al. 2006), agricultural market liberalization (Abdulai and Kuhlgatz 2011), international agreements (Flint 2008; Nsouli 2004), international aid (Flint 2008; Sachs et al. 2006), World Bank role in developing countries (Kempe 2008; WBG 1997), globalization (Marysse and Reyntjens 2005), international interventions (Marysse and Reyntjens 2005), trade policy (Oyejide 1999; Davarajan and Rodrik 1991), physical geography (Ndulu et al. 2008), and climate change (Davidson et al. 2003).

related to democratic rights is fundamental to alleviate acute undernourishment. The main argument is that national economies with autocratic governments tend to be highly unequal societies. According to this logic, democracy and the institutionalization of transparency and accountability mechanisms should guarantee incentives for governments to redistribute wealth in a more equitable manner, thereby avoiding vast social crises driven by relative scarcity. In effect, if governments depend on the approval of voters to remain in power, they are compelled to distribute national wealth through public investments with fairness, and would not be inclined to let voters starve. Moreover, in his 2007 study, Wodon tested the relation of unequal consumption opportunities driven by income inequality and well-being levels using household survey data from West African countries and found that inequality may undermine the gains from aggregate growth for the poor. Christiaensen et al. (2002), by testing the relation of economic growth and poverty using cross-sectional data from African countries, provide evidence that overall income distributions remained unequal during episodes of growth. And in his 2001 study, Kanbur analyzed the relation of policy distributions and poverty reduction using qualitative and longitudinal data from development markets, suggesting that aggregative measures on policy to reduce income inequality may be at the same time relevant for policy makers while irrelevant, or not-transformative, for the people that it was intended to assist. Moreno-Dodson and Wodon (2008) used multiple regressions and panel data to support the relation between public spending and poverty reduction in countries of Africa and Latin America. In his 2014 study, Stein tested the association of biofortification programs and malnutrition using qualitative and longitudinal data from cross-country datasets, finding evidence that such programs were especially beneficial to citizens of rural areas, which are typically unequally covered by conventional programs. In their 2004 study, Banerjee et al. tested the association of public health care provisions and health status using cross-sectional and time-series data from self-reported health status (SRHS) national surveys, and demonstrate that low quality

public facilities had a negative impact on SRHS. By the same token, Drèze and Sen (1989) tested the association of asset provisions and hunger alleviation using qualitative historical data from in-depth case studies across Asian and African countries, and found that distributional mechanisms, in the form of public action and social security, were crucial tools to fight severe deprivation in the contexts of widespread famines. And in their 2011 study, Abdulai and Kuhlgatz tested the effects of food subsidies and state engagement in food storage on hunger eradication using longitudinal data from the World Bank and cross-country datasets, providing evidence that state interventions through policies that target food security are more successful when combining supply expansion of basic food commodities based on investments in agriculture on the one hand, and subsidized entitlement to food consumption to citizens on the other hand – ensuring thereby a sustainable balance of supply and demand of the food commodities system. Such studies highlight national political institutions as relevant determinants of inequality, relative deprivation, and poverty-driven hunger in sub-Saharan Africa. Such theoretical approaches thus do not disregard economic growth and income poverty as relevant determinants of resource deprivation, and human poverty. However, they nuance the importance of aggregative economic determinants as solely one part of the human poverty equation. In this context, macro-political factors arise as determinants intrinsically related to entitlement distribution, and therefore as a possibly crucial determinant of human poverty and hunger.[2]

[2] Further studies on this regard that were reviewed have focused on the role of decentralization (Crawford and Hartmann 2008), public education (Case and Deaton 2002; Drèze and Sen 1989), the multidimensional aspects of supra-national regional integration (Söderbaum 2004), small and large industrial policies (Rodrik et al. 2008; Rodrik 2008), labor structures (Case and Deaton 2004; Deaton and Laroque 2003), investments in human assets (Alwang et al. 2002), resilience of the financial sector in rural and peri-urban regions (Abdulai and Kuhlgatz 2011), taxation (Moreno-Dodson

Finally, some authors have developed research on hunger and human poverty focused on their connection with armed conflicts. Weezel (2018) has analyzed the impact of armed conflicts on dietary energy supply with a cross-section time-series analysis across 106 countries during the period of 1961-2011 and found that overall conflicts are associated to a significant decrease in food supply levels. In an event-study, using household data from Burundi, Verwinp and Muñoz-Mora (2013) provide evidence of a significant impact of civil war on undernourishment increase. Gates et al. (2012) used fixed-effects regression models to test the impact of armed conflicts on different human development indicators, and found that the gap between countries with higher levels on human development indicators with countries that present lower levels on human development indicators is partially explained by armed conflicts, including the gap of high and low levels of prevalence of undernourishment across countries. And Coyne and Mathers (2011) explored qualitative historical data from cross-sectional datasets to show that war and post-war conditions are related to institutional fragility and poverty. This body of evidence suggests that armed conflicts and civil war are significantly associated, and may potentially affect hunger by isolating populations from markets, goods, and services, and not only through the more immediate channels of negative economic growth, or destabilization of democracies. However, while Gates et al. (2012) openly recognized that there were no systematic cross-national studies of the association between conflict and undernourishment until the time of publication of their study, Weezel (2018)

and Wodon 2008), the role of Washington Consensus (Sachs et al. 2005), international relations of African countries (Dunn and Shaw 2001), time horizon policies (Kanbur 2001), civil society disputes (Drèze and Sen 1989), free media (Sen 1999; Drèze and Sen 1989), appearance of new public and private leaders (McKay and Thorbecke 2017), global food corporations (Sharma 2012), and war effects on infrastructure (Estache and Wodon 2014; Abdulai and Kuhlgatz 2011; Alwang et al. 2002).

has recently restated that despite the relevance of food security in the global development agenda there are few empirical studies on the field[3].

Therefore, although previous studies contributed to the advancement of the understanding of the general association between armed conflicts and the increase of undernourishment globally, especially on case studies of famines, to date no study have provided a comprehensive analysis of the association between armed conflicts and chronic undernourishment across sub-Saharan African countries during the period of the MDGs agenda. In effect, despite the existence of different theoretical and methodological approaches to the study of hunger and human poverty, current studies reveal a common empirical limitation concerning sub-Saharan African countries. By favoring the study of conflicts and temporary acute hunger and famines rather than chronic hunger, previous studies do not explain the impact of armed conflicts on chronic hunger in contemporary sub-Saharan Africa nor the causal mechanisms through which armed conflicts affect chronic undernourishment in the region. This research aims to contribute with the literature of armed conflicts and chronic hunger in contemporary sub-Saharan Africa by filling this gap. With the aim of investigating the effects of armed conflicts on PoU trends across sub-Saharan African countries during the 1990-2015 period, an analysis of the longitudinal evolution of chronic hunger trends in contemporary sub-Saharan Africa and its association to armed conflicts variation will be developed grounded in the combination of quantitative and qualitative research methods. The main hypothesis is that armed conflicts contributed to increase PoU levels across the region. Thereby, this research intends to advance the empirical and theoretical knowledge in the field of development

[3] A summary table of the dependent and explanatory variables operationalized in each study, ordered by year and alphabetically, is provided in appendix 1.

administration, comparative politics, and the international political economy of human development and armed conflicts in sub-Saharan Africa. The research results will thus be of interest to development practitioners, stakeholders, governments and ministries, and specialized agencies that seek to confront chronic hunger and armed conflicts in the context of developing countries in general, and African nations in particular.

2. Empirical Data

Based on the first MDG of halving PoU in sub-Saharan Africa by 2015, a pooled cross-sectional chronic hunger map is presented in figure 1. Countries were divided into four color categories by levels of undernourishment reduction for the period 1990-2015: countries that eliminated chronic hunger (*i.e.* achieved not-significant levels of PoU by 2015 - N.S.) and countries that reduced in more than 70% their levels of PoU (>70%), countries that achieved the goal of halving PoU (>50%), countries that despite presenting some improvement in hunger eradication did not achieve the goal of halving PoU (<50%), and countries that not only did not achieve the goal of halving PoU but rather reached higher levels of PoU than they previously had in 1990 (<0%). Overall, sub-Saharan African countries attained an average reduction rate of 30.1% of chronic hunger prevalence.

As highlighted in the map, while 31 countries reduced their PoU levels by 2015, only 18 countries achieved the goal of halving PoU by 2015, and 23 countries did not achieve the goal. Furthermore, among the 49 countries in the sub-Saharan African region, FAO does not provide data on PoU for 5 Eastern African countries (Comoros, Eritrea, Seychelles, Somalia, and South Sudan), and 3 Middle African countries (Burundi, Democratic Republic of the Congo, and Equatorial Guinea) during that period. It is relevant to highlight that many of these countries have no available

data on PoU due to enduring severe national armed conflicts or civil wars. Such is the case of the Democratic Republic of the Congo, as well as South Sudan that has immersed in a violent civil conflict in the aftermath of its state succession from former Sudan in 2011. The first sample of sub-Saharan African countries with available data on PoU for the 1990-2015 period is thus composed by 41 countries.

Although the chronic hunger map (figure 1) presents the overall variation of PoU during the period of 1990-2015, its cross-sectional comparison among sub-Saharan African countries is insufficient to account for the patterns of within variation of each country. Appendix 2 thus provides further evidence of PoU trends for the 41 sub-Saharan African countries during the 1990-2015 period.

Grounded on the literature review, the original research question to be addressed in this research can be formulated as: what were the effects of armed conflicts on PoU across sub-Saharan African countries during the period 1990-2015? The effects of armed conflicts, the main independent variable of interest, on PoU shall be controlled by three other factors theoretically hypothesized to be associated with the variation of PoU in this context, namely (2) income standards, (3) democracy levels, and (4) food production. Six complementary hypotheses will be operationalized to investigate such effects. A causal model is depicted in figure 2.

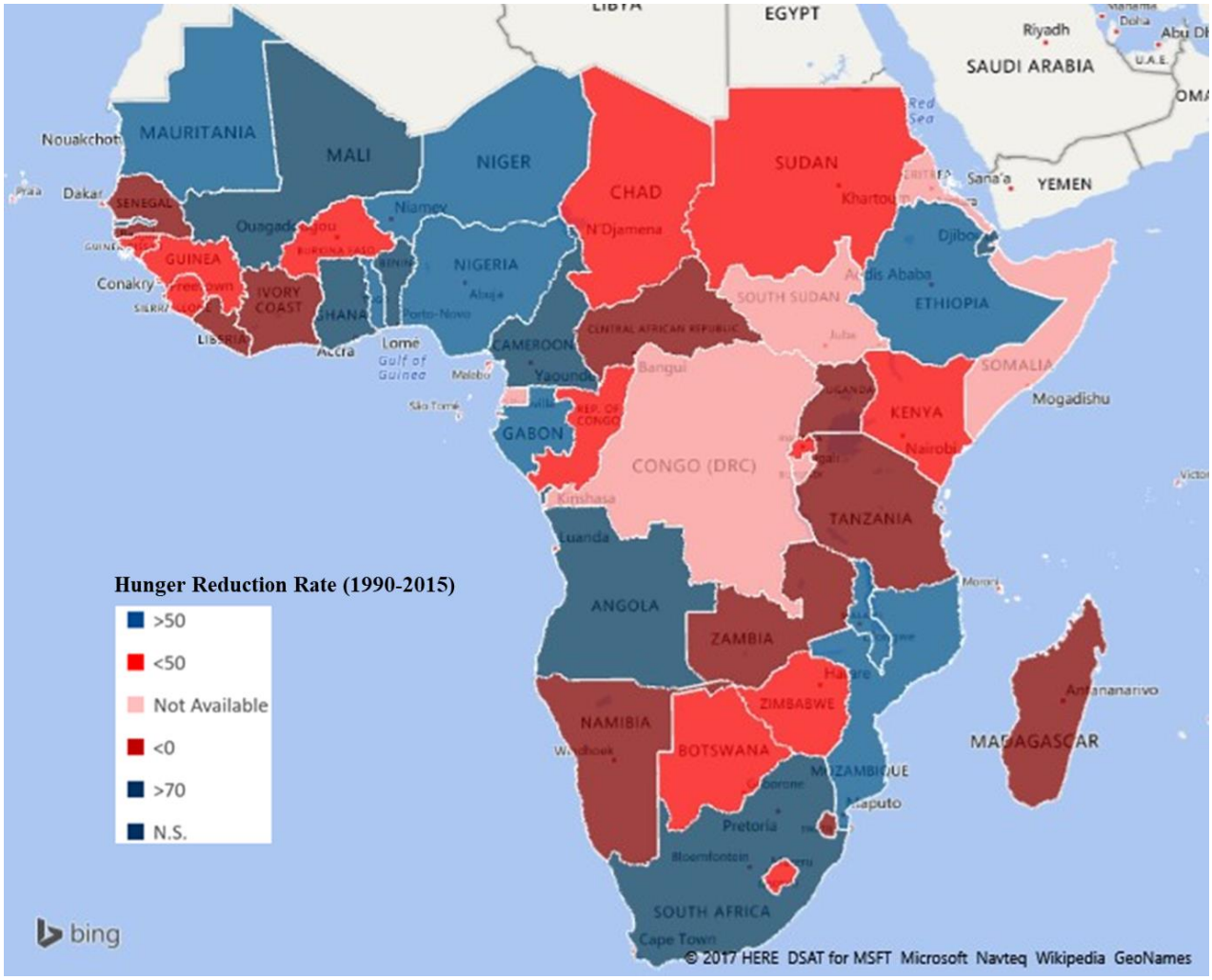

Figure 1. Chronic Hunger Map: PoU reduction between 1990-2015. Source: Developed by the author. Note: Results based on data from the Food and Agriculture Organization (FAO) Statistics. N.S. means not statistically significant levels of hunger prevalence (<5%).

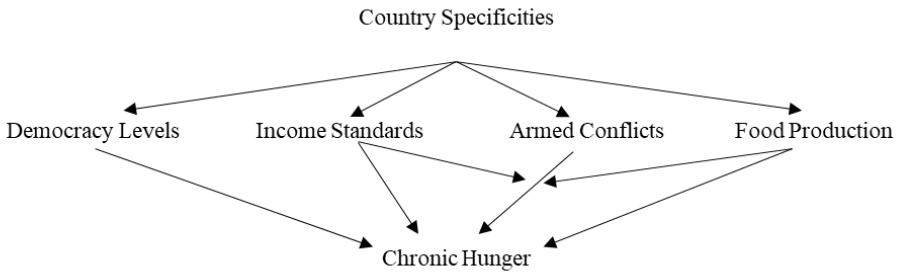

Figure 2. Causal diagram of hypothesized association between armed conflicts and PoU.

Main hypothesis:

Armed Conflict Hypothesis (H1) *Armed conflicts are positively associated to higher levels of Prevalence of Undernourishment.*

Auxiliary hypotheses:

Democracy Hypothesis (H2) *Strong democracies are negatively associated to higher levels of Prevalence of Undernourishment.*

Economic Hypothesis (H3) *Higher income standards are negatively associated to higher levels of Prevalence of Undernourishment.*

Production Hypothesis (H4) *Food production is negatively associated to higher levels of Prevalence of Undernourishment.*

Economic Moderation Hypothesis (H5) *Income standards negatively moderates the impact of armed conflicts on Prevalence of Undernourishment.*

Production Moderation Hypothesis (H6) *Food production negatively moderates the impact of armed conflicts on Prevalence of Undernourishment.*

2.1. Population & Sample

The population of interest for the empirical analysis is composed of 49 sub-Saharan African countries during the period of 1990-2015. Due to limitations of data availability on the dependent variable, only 41 countries (figure 1) were initially selected to compose the sample of analysis. Due to subsequent limitations of data availability on armed conflicts, 2 countries (Cape Verde, São Tomé

and Príncipe) were further withdrawn from the dataset, letting the final sample composition for the large-N empirical analysis with 39 countries (figure 3).

Moreover, based on the literature, several variables were collected to describe the sample. These variables are paramount to the development of longitudinal comparative analyses of the effects of armed conflicts over PoU trends. Table 1 provides a statistical descriptive account of the sample by summarizing the collected variables, and referencing their respective data sources. In the next section, the empirical methodology to test hypotheses 1-6 is presented followed by a thorough discussion of the variables to be operationalized in the LNA. In addition, the analytical logic of a nested analysis as a multimethod comparative empirical strategy is presented as the most suitable research design to achieve the goal of this research, namely through the combination of the specific analytical strengths of both LNA and SNA.

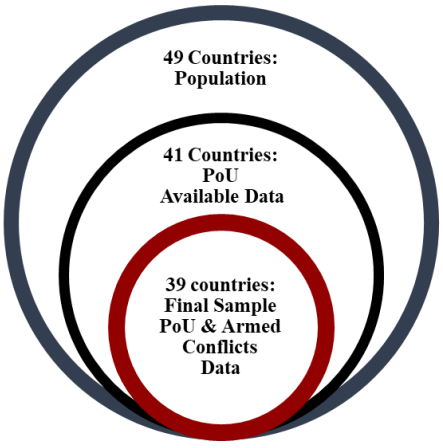

Figure 3. Diagram of Sampling Procedure Representation: From Targeted Population to LNA Final Sample. Source: Developed by the author.

Table 1. Descriptive Statistics – Sample of 41 sub-Saharan African Countries

Variable	Mean	Median	Min	Max	N
Children Mortality (rate per 1000 live births)[1]	75.99649	71.8	13.1	173.1	1025
Commodity International Price Index[2]	162.988	129	94.4	311.6	1025
Crude Oil ($ per barrel)[3]	46.32344	28.22083	13.07667	105.0125	1025
Democracy Levels (10=full Democracy, -10=full Autocracy)[4]	.942	0	-10	10	1000
Education (Primary Completion rate, % of relevant age group)[5]	57.83568	58.54636	13.93336	114.1379	639
Foreign Direct Investment, net inflows (% of GDP)[6]	3.959257	2.095116	-82.8921	89.47596	1009
GDP at market prices (constant 2010 US$, billion)[7]	23.087	6.8866	0.1184	452.2845	1015
GDP per capita (constant 2010 US$)[7]	1631.161	851.1836	115.7941	11925.78	1015
GINI Index[8]	45.01479	43.25	29.8	65.8	142
Human Development Index Levels (HDI)[9]	.4472427	.44	.194	.779	919
Inflation, consumer prices (annual %)[10]	50.26839	6.935526	-35.83668	24411.03	954
Investment in Agriculture (% of GDP)[11]	26.7624	27.17253	2.032283	65.97296	942
Metals and Minerals (price Index, real US$ 2010=100)[7]	64.09057	51.09047	37.23676	113.3027	1025
Gross per capita Food Production (constant 2006 US$, in millions)[11]	99.12539	98.82	51.81	158.22	1019
No. of Casualties in Armed Conflicts (best estimate)[12]	1015.391	218	25	49698	207
No. of Casualties in Armed Conflicts (high estimate)[12]	1627.068	445	29	52654	207
No. of Casualties in Armed Conflicts (low estimate)[12]	985.0773	209	25	49698	207
Number of Armed Conflicts (annual)[12]	.24	0	0	4	975
Number of Undernourished (NoU), total in millions[11]	3.83454	1.800026	0.0103118	39.57782	1020
Population (in millions)[7]	15.60304	9.199259	0.113893	176.4605	1025
Prevalence of Undernourishment (PoU)[11]	26.50784	25.5	2.5	76.8	1020
Private Health Expenditure (% of GDP)[7]	3.100686	2.554944	0.8127764	11.05463	812
Public Health Expenditure (% of GDP)[7]	2.53535	2.213764	0.4182265	9.546106	757
Temperature Change (Average Meteorological Year, in Celsius)[11]	0.6296626	0.611	-0.578	1.942	981
Territory (millions of sq. Km)[7]	0.5134588	0.32246	0.00096	2.50581	1025
Unemployment (% of Labor Force)[13]	12.61033	9.6	.3	59.5	213
Year	2002	2002	1990	2014	1025

Sources: [1]Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA Population Division). [2]Free Market Commodity Price Index from UNCTAD. [3]Crude petroleum average of UK Brent (light), Dubai (medium) and Texas (heavy), equally weighted ($/barrel). [4]Polity IV Project on Political Regime Characteristics and Transitions (variable *Polity2*). [5]United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics. [6]International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, International Debt Statistics, and World Bank and OECD GDP estimates. [7]World Bank national accounts data, and OECD National Accounts data files. [8]World Bank, Development Research Group. Data are based on primary household survey data obtained from government statistical agencies and World Bank country departments. [9]UN Development Program, Human Development Report data. [10]International Monetary Fund, International Financial Statistics and data files. [11]Food and Agriculture Organization Statistics (FAOSTAT). [12]An armed conflict is only counted if the No. of casualties is higher than 25. Uppsala Conflict Data Program: Allansson, Marie, Erik Melander & Lotta Themnér (2017) "Organized violence, 1989-2016". *Journal of Peace Research* 54(4); Gleditsch, Nils Petter, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand (2002) "Armed Conflict 1946-2001: A New Dataset". *Journal of Peace Research* 39(5). [13]International Labour Organization, Key Indicators of the Labour Market database.

3. Empirical Methodology: Nested Analysis as a Multimethod Comparative Strategy

Before specifying the empirical strategy for hypotheses testing, it is important to highlight the analytical framework behind it, as well as its logical foundations. This section thus presents both the rationale for adopting a multimethod comparative strategy, how a nested analysis can be used as a tool for multimethod triangulation combining LNA, SNA and causal mechanisms analytics, and the theoretical background for the first step of a multimethod analysis, namely the LNA identification.

3.1. The Multimethod Logic: From Regularity to Causation

The scientific method for the study of natural and social phenomena is linked to the tradition of analysis of regularities in the form of events succession in an orderly way such as: *a, b, c, d, etc.* (Mumford and Anjum 2014). Within this scientific tradition, empirical analyses have been subjected to various criticisms in terms of causal claims, being best summarized in Hume's critique to what he has called an unconnected mosaic in which events were conjoined, but never connected (Mumford and Anjum 2014). In other words, although an empirical mosaic is able to present a regular pattern in which A typically appears accompanied by B, this empirical regularity provides merely a factuality with no grounds to the observer claim that B is strictly caused by A. In this sense, *regularity* is the first and loose form of causality in empirical studies.

Faced by such analytical limitations, researchers have designed multiple methods of scientific inquiry with the aim of improving causal analysis. Particularly in the realm of the natural sciences the archetypal laboratorial experimental design, in which the impact of an exogenous intervention is randomly assigned to identical pre-treatment groups, allowed researchers to infer that the isolation of the intervention's effect could be measured by the post-treatment difference in outcomes between treated and control groups. This counterfactual difference in outcomes has thus

been adopted as the golden rule for strong causal claims in contemporary empirical studies, including empirical studies within the social sciences.

Nonetheless, due to the combination of possible ethical limitations and to the very nature of non-experimental observational data, the strong counterfactual causal inference from the natural sciences cannot always be easily transposed to empirical studies in the social sciences. For example, for the study of the effects of armed conflicts on chronic hunger, it would be morally unacceptable to impose armed conflicts as an experimental randomized treatment over a human population that could serve as a treated group in comparison to an ex-ante similar control group not affected by armed conflicts. In such cases, data-driven statistical approaches have enabled the artificial design of quasi-experiments based on observational data to be treated *as-if* it were experimental data. In quasi-experiment designs, such as in the versatile combination of matching with difference-in-differences (DiD) models, the counterfactual causal claim originated in the experimental method of the natural sciences is analytically rehabilitated by what has been called the Neyman-Rubin-Holland causal model (NRHCM) of inference (Sekhon 2008). According to the NRHCM, a quasi-experiment data-driven statistical model that reliably replicates the analytical characteristics of an experimental design, and therefore the possibility of analyzing a social phenomenon from the perspective of counterfactual differences in the outcomes of pre-treatment similar groups, can be used as an empirical strategy to infer causation where data was originally gathered from non-experiment observations.

In the case of longitudinal studies of sub-Saharan African countries, an added difficulty arises. Scarce data availability on key variables for wide cross-sectional and time-series studies regarding countries in the region limits the possibility of designing data-intensive statistical methods that enable researchers to move from factual correlational studies to causal claim designs. In this

context, the multimethod approach to comparative studies appears as an analytical empirical solution (Goertz 2017).

According to Goertz (2017), the multimethod research strategy overcomes the correlational inference limitations of observational studies through the design of a triangulation of different empirical analyses that structurally combine (a) LNA, (b) SNA, and (c) causal mechanisms analytics. The multimethod triangulation approach is represented in the methodological diagram depicted in figure 4, and summarizes the empirical strategy that will be employed in this research.

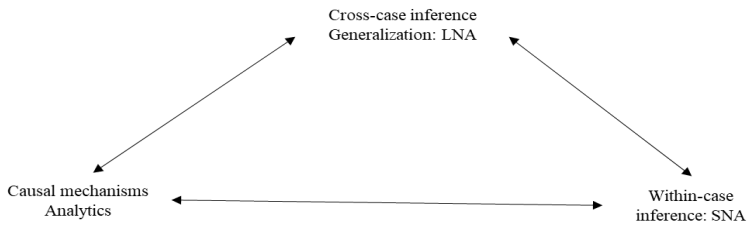

Figure 4. The research triad: cross-case inference (LNA), within-case causal inference (SNA), and causal mechanisms. Source: based on Goertz (2017), figure 1.1.

Based on the triangulation of the research triad (figure 4), the study of the impact of armed conflicts on chronic hunger in sub-Saharan Africa during the 1990-2015 period will correspondingly begin with a cross-case inference generalization based on panel data LNA and subsequently be followed by a within-case inference SNA, and causal mechanisms analytics. Following this plan, the LNA will serve as a first step of the empirical analysis to find regularities in the impact of armed conflicts on PoU, *i.e.* it will be used to test hypotheses 1-6 and analyze econometric correlations, not causation.

Following the LNA based on panel estimations, a SNA of 4 nation-states nested within the analysis of 39 nation-states is proposed to both explore and trace the mechanisms through which

armed conflicts affect the prevalence of chronic hunger in the contemporary sub-Saharan region. In this sense, Lieberman (2005) also highlighted that while LNA is useful to test general regularities in comparative research, SNA brings the possibility of exploring and tracing the causal mechanisms behind the regularities found in the results. In other words, the case studies nested SNA will allow us to assess "the causal mechanisms that give rise to [the observed] empirical regularities" (Fearon and Laitin 2008, 773, as cited in Goertz 2017, 7).

The outlined empirical strategy is based on the premises that for a comparative research, it is better to combine LNA with SNA in a triangulated-nested design adding up their specific analytical strengths than to rely solely in one of them. The complementary analytical gains of the multimethod nested analysis are represented by the inferential diagram in figure 4.1.

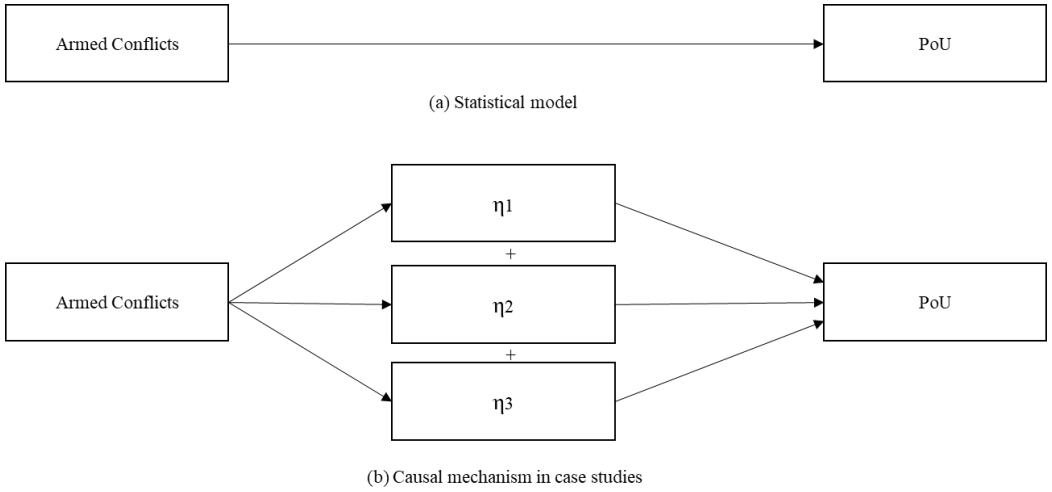

Figure 4.1. Causal mechanisms and statistical multimethod research: armed conflicts and PoU. Source: based on Goertz (2017), figure 1.2. Note: η represents a vector of potential causal mechanisms.

3.2. LNA Research Design

This unit discusses the empirical strategy to test hypotheses 1-6 and identifies the LNA model to test the empirical regularities regarding the correlation of PoU, armed conflicts, and selected control variables. The model presented next reflects the theoretical claim that the variation

of chronic hunger is a function of armed conflicts, income standards, levels of democracy, food production, the interaction effects of armed conflicts and income standards, the interaction effects of armed conflicts and food production, and country specificities. Moreover, it theoretically explains the potential association of these factors to chronic hunger variation.

Given that the empirical data cover both cross-section (countries) and time-series (years) statistics, panel models with random-effects, and robustness checks, are proposed for the LNA hypotheses' tests. The panel identification will consist of PoU as the dependent variable, and Armed Conflicts, Democracy Levels, the natural log of GDP per capita, Food Production, the interaction effects of armed conflicts and the natural log of GDP per capita, and the interaction effects of armed conflicts and food production on the right-hand side of the equation.

Identification: Panel Equation Model with Random-Effects

$$PoU_{it} = \beta 0 + \beta 1 ArmedConflicts_{it} + \beta 2 logGDPpercapita_{it} + \beta 3 DemocracyLevels_{it} + \beta 4 FoodProduction_{it} + \beta 5 ArmedConflicts*logGDPpercapita_{it} + \beta 6 ArmedConflicts*FoodProduction_{it} + \beta 7 DYear_{t} + \beta 8 DCountry_{i} + e_{it}$$

Dependent Variable: Chronic Hunger

The Prevalence of Undernourishment (PoU) is the main measure of chronic hunger calculated by the FAO based on "energy requirements normatively specified as averages corresponding to groups of individuals of given age, sex, body weight and activity [.] The implied variation within the group needs to be taken into account in determining whether an individual's intake is below, equal to or above their requirement" (Naiken, 2006). PoU, therefore, can be understood as a deviation from the mean required consumption of kcal/day in a given region for a given population. This formal definition becomes clearer when a cutoff point is applied as a local

average for a given group of a certain age, sex, body weight, and daily activity. For example, if the global average suggested by the World Health Organization (WHO) of a minimum of 2200kcal/day is established as the cutoff of daily necessary food intake for adults, all adults that consume <2200kcal/day suffer from hunger. The corresponding physiological process of ingesting less kcal than what is necessary for a daily basis is materialized in the body as a loss of sugar reserves followed by the loss of fat. In qualitative terms, it is the state in which the body starts to eat itself (Caparros, 2015). If a person is maintained constantly undernourished for over a year, then she is considered to be *chronically undernourished*. PoU counts the percentage of chronically undernourished people by country on a three-year moving average yearly basis (FAOSTAT). The corresponding normative measure of kcal/day is defined for each country based on specific local nutrition needs. Pooled data describing the Average Dietary Energy Requirement (ADER), as well as pooled data describing the Minimum Dietary Energy Requirement (MDER), for the 1990-2015 period across sub-Saharan African countries is provided in appendix 4. In the sub-Saharan African region, for example, the pooled ADER has been set to 2154 kcal/caput/day, while the pooled MDER has been set to 1726,52 kcal/caput/day.

The PoU definition is crucial to differentiate its rationale from the concept of acute famine. Although both concepts are a measure of hunger, famines are characterized by its transitory aspect, that is a short-term and temporary food insecurity crisis. Although the FAO Integrated Food Security Phase Classification (IPC) recognizes the urgent aspect of famines as a humanitarian catastrophe, chronic hunger tends to be a more prevalent, enduring, and widespread phenomenon (FAO 2008). For this reason, concurrent alternatives to measure hunger levels such as the computed deficit of Dietary Energy Requirements (Appendix 4) based on the ADER – MDER difference as utilized by Weezel (2018), are useful to measure hunger severity but inadequate to measure the prevalence of

hunger across populations overtime. The choice of utilizing PoU as a measure of chronic hunger in the empirical analysis is thus based on the practice established by the FAO as its standard approach, and by the conceptual cohesion of its methodology.

Explanatory Variables

Armed conflicts

The definition of armed conflicts will refer exclusively to dyad state-based armed conflicts, as defined by the Uppsala Conflict Data Program[4] (UCDP). This decision is grounded in the good practice established in the literature of utilizing UCDP's datasets as a standard measure of armed conflicts (Kadir et al. 2019), which is justified for the fact that it is the only dataset available with reliable comparative data across different countries over long periods of time, especially regarding Sub-Saharan African countries. According to the UCDP, state-based armed conflicts are technically defined and measured as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a calendar year" (Pettersson 2019).

The empirical restriction to data collection on this type of armed conflict is grounded both on the empirical verification that the overwhelming majority of armed conflicts in sub-Saharan Africa during the 1990-2015 period is categorized as dyadic state-based armed conflicts (UCDP 2019), as well as on the theoretical assertion that non-organized spontaneous violence or organized

[4] Uppsala Conflict Data Program: Allansson, Marie, Erik Melander & Lotta Themnér (2017) "Organized violence, 1989-2016". Journal of Peace Research 54(4); Gleditsch, Nils Petter, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand (2002) "Armed Conflict 1946-2001: A New Dataset". Journal of Peace Research 39(5).

violence that does not challenge government integrity or territory sovereignty would very unlikely be able to provoke and sustain systematic damages to food security in order to influence the trends of three-year moving averages of chronic hunger prevalence within nations. In other words, the data restriction on armed conflicts focusing on dyad state-based armed conflicts is a conceptually based empirical strategy that aims to reduce data noise while preserving discriminant validity. Table 2 summarizes the categorization matrix of dyad state-based armed conflicts and provide the definitions of its intrinsic components.

The UCDP computation of state-based armed conflicts frequency is made based on data crossing from different types of sources in order to provide an extensive reliable dataset. Conflicts are organized by date of occurrence, and the frequency of conflicts per year can thus be calculated by the aggregation of these observations. Given that the observations of the dependent variable (PoU) is provided annually, the frequency of armed conflicts has been aggregated by country/year to enable the construction of a longitudinal dataset.

In addition, data on the number of deaths in armed conflicts is estimated in three different ranges: high estimate, low estimate, and best estimate. Since the frequency of conflicts is not altered by the number of deaths, corresponding observations on armed conflicts is solely based on best estimates. It should be noted however, that although an armed conflict is always counted if the number of casualties is higher than 25, the number of deaths can be much higher. For instance, the maximum number of casualties in a single conflict during the period of 1990-2015 across sub-Saharan countries was estimated to be between 49000 and 52000 casualties, during the 1990 Ethiopian civil war.

The relevance of armed conflicts to understand sudden crises of famines or endemic acute undernourishment is well documented in the literature (Ó Gráda 2015; Vernon 2007; Sen 1999;

Drèze and Sen 1989). Nevertheless, their impact on the variation of chronic hunger trends are less clear and patently understudied (Weezel 2018). The nested small N analyses (SNA) presented in section 6 intend to explore the causal mechanisms behind the impact of armed conflicts on PoU. That said, if chronic hunger is ultimately a symptom of food consumption deprivation, its mediated causes must be related to either food production, food distribution or food access. The difference between food distribution and food access is related to the fact that even though food is distributed and available in a given region, access to food might be halted by income poverty, discrimination, or other socioeconomic factors. In the panel econometric model, the effect of armed conflicts over PoU is controlled by both food production, and income standards - that is a proxy for food market access. Therefore, it is plausible that the main channel of impact of armed conflicts on PoU is related to food distribution and food access, notedly in the form of food system disruption, including food market blockages, infrastructure destruction or forced massive migrations to areas with scarce food supply. The FAO names food system the various integrated stages that links food production to food distribution, food distribution to food access, and food access to food consumption, enabling human populations to be fed (Welvaert 2016). The impact of armed conflicts on PoU through such channels is consistent, in its turn, both with the poverty-led by relative scarcity literature, and with the potential widespread destructive effects of state-based armed conflicts.

The proposed empirical model also contemplates the hypotheses that an increase in income standards or an increase in food production might significantly reduce the impact of armed conflicts on chronic hunger. While an increase in income standards may elevate the local food access resiliency in face of armed conflicts-related food system disruption, by generating alternative food market supplies such as by recurring to food imports, an increase in food production may directly

decrease the impact of armed conflicts on PoU by providing in-kind food products to the affected population.

Table 2. Matrix definition of dyad state-based armed conflicts components.

Variable	Definition	Variable	Definition
State-based Armed Conflicts	contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a calendar year.	State	is an internationally recognized sovereign government controlling a specific territory or an internationally unrecognized government controlling a specified territory whose sovereignty is not disputed by another internationally recognized sovereign government previously controlling the same territory.
Use of armed force	use of arms resulting in deaths.	Incompatibility	the stated general incompatible positions.
Arms	any material means, e.g. manufactured weapons but also sticks, stones, fire, water etc.	Incompatibility concerning government or territory	the incompatibility, as stated by the parties, must concern government and/or territory.
25 deaths	a minimum of 25 battle-related deaths per year and per dyad.	Incompatibility concerning government	incompatibility concerning type of political system, the replacement of the central government, or the change of its composition.
Party	a government of a state or any opposition organization or alliance of organizations.		
Primary Parties	parties that form an incompatibility by stating incompatible positions.	Incompatibility concerning territory	incompatibility concerning the status of a territory, e.g. the change of the state in control of a certain territory (interstate conflict), secession or autonomy (internal conflict).
Secondary Parties	are states that enter a conflict with troops to actively support one of the primary parties. The secondary party must share the position of the primary party it is supporting in the incompatibility.		
Government	the party controlling the capital of a state.	Opposition Organization	any non-governmental group of people having announced a name for their group and using armed force to influence the outcome of the stated incompatibility. The UCDP only deals with formally organized opposition. The focus is on armed conflict involving consciously conducted and planned political campaigns rather than spontaneous violence.
Dyad	consists of two conflicting primary parties. At least one of the primary parties must be the government of a state. In interstate conflicts, both primary parties are state governments. In intrastate and extra systemic conflicts, the nongovernmental primary party includes one or more opposition organization(s). A conflict can include more than one dyad. If e.g. a government is opposed by three rebel groups over the same incompatibility, the conflict is made up of three dyads. Secondary parties (i.e. intervening states supplying troops to one of the primary parties) do not lead to the formation of additional dyads.		

Source: Developed by the author, based on definitions provided by the UCDP Dyadic Dataset Codebook v 19.1 (Pettersson 2019).

Finally, it is also relevant to highlight that countries have various factors related to the outset of armed conflicts, that such factors vary in time, and that the factors that originated a given conflict are not necessarily the same that sustained the conflict over time (Ginty and Williams 2009). In that sense, reductionist 'master narratives' such as racial tensions, minorities at risk, ethnolinguistic fractionalization, and socio-economic inequality must be avoided as easy "hand-waving explanations for violence emphasizing collective emotions, ideologies, and cultures" (Kalyvas 2006: 388). The origins of armed conflicts are intrinsically related to a complex set of historical country specificities, and will be thoroughly analyzed during the SNA in section 6. Although the main research question is focused on the impact of armed conflicts on PoU, understanding, in the case studies analyses, the outsets and dynamics of specific armed conflicts will contribute to elucidate the causal mechanisms that connect armed conflicts to chronic hunger.

Income Standards

In economies where final consumers depend on household's purchasing power to access food markets, a strong connection between income poverty and restricted access to food supply based on market prices is expected. For instance, not having enough money to buy the required household food needs at the market may lead to household food deprivation, a general consequence of the Engel's Law (Houthakker 1987). In effect, the calculation of poverty and living standards has traditionally relied on a function of household basic needs such as food, housing and clothing on the one hand, and household purchasing power based on income standards on the other hand (Atkinson 1987). Thereby, lower income standards are related to poverty through the deprivation of household consumption of basic needs. In that sense, while an income shortage related to multiple basic needs such as food, housing and clothing leads households to suffer 'multiple deprivation' poverty, an

income shortage related to food access leads households to be specifically food deprived. In other words, low income standards may lead to insufficient food consumption, and therefore increase their risk to suffer from undernourishment. By the same token, sustained improvements on household income standards could lead impoverished households to better levels of food consumption, and higher kcal/caput/day intakes, consequently leading to a decrease on PoU.

To test the relationship between PoU and income standards, GDP per capita (in constant 2010 US$) is included as a control variable in the model. While GDP typically serves as a measure of various aggregate determinants of economic growth, GDP per capita also accounts for the size of countries' populations and overall economic growth. The data on GDP per capita is based on World Bank national accounts data, and OECD National Accounts data files. Given the extremely high variation of GDP per capita values across countries and time in the sample, a natural log of GDP per capita is used as the parameter of income standards in order to deal with scale effects, while also being useful to provide an elasticity understanding of the parametric results.

Although GDP per capita is not a perfect parameter to represent real average income standards at the national level, namely due to the fact that it takes no account of within-country income inequality levels (Stiglitz 2013) or other household wealth assets (Piketty 2013; Piketty 2019), it is the only income standard-related data to be widely available for sub-Saharan African countries during the 1990-2015 period. For this reason, additional variables such as the GINI index will be included to analyze poverty and inequality in the SNA section. While such variables offer significantly fewer observations, they will be used as a robustness check for the LNA results.

Hence, income standards are theoretically connected to chronic hunger prevalence through a direct channel of income-led food deprivation. Notedly, in countries with persistent levels of income poverty, it is expected to be observed, ceteris paribus, higher levels of chronic

undernourishment, while higher income standards are expected to be negatively associated to PoU levels. In addition, as previously stated, an increase in income standards might significantly reduce the impact of armed conflicts on chronic hunger through moderation effects that elevate the local food access resiliency in face of armed conflicts-related food system disruption, such as by enabling the access to alternative food market supplies through food imports from external markets.

Food Production

Food production data is calculated as Gross per capita Food Production (constant 2006 US$, in millions) by the Food and Agriculture Organization Statistics (FAOSTAT), and has been aggregated to annual series observations in the panel model. With this definition, national levels of food production are also hypothesized to be a key factor, ceteris paribus, to explain PoU variation. The association between food production and PoU variation may be explained through two core mechanisms: (i) direct supply, which halts or causes food shortages, (ii) and food prices, which restrict or facilitate consumers' access to market food products.

Regarding the (i) direct food supply mechanism, an increase in food production increases local food supplies and simultaneously reduces the risk of absolute food scarcity. Moreover, a reduction in food production can lead to an absolute food supply decrease, thereby generating food scarcity that may threat local populations with food shortages given their actual demand for food products. Food shortages, in turn, tend to have a negative impact on food access and overall food consumption, fueling the increase of PoU levels.

An alternative mechanism to explain the impact of food production on PoU is related to the (ii) market prices effects on food products. Within this mechanism, an increase in food

production not only leads to an increase on absolute food supply, but may consequently stabilize or decrease prices of basic food products, assisting the local consumption demands of dietary energy requirements. In that sense, by increasing national food production, countries may provide accessible food products to their citizens. And with a wider access to more affordable food products, food consumption tends to increase among consumers, leading to reduced levels of PoU. This is especially relevant since countries that rely substantively on food imports of globalized markets may become dependent on global price fluctuations.

Moreover, an increase in food production might directly decrease the impact of armed conflicts on PoU by providing enough in-kind food products supply to sustain public-led initiatives of poverty relief designed by governments with the aim of sharing food resources among the affected populations during periods of armed conflicts. Food production thus moderates the impact of armed conflicts on PoU trends.

Finally, it is also relevant to notice that food production indirectly channels several climate change effects over PoU: factors such as average or total rainfall, presence of droughts, and temperature can only impact hunger prevalence through its impact on food production (Feitelson and Tubi 2017).

Levels of Democracy

Empirical evidence demonstrates that while famines were rather recurrent events in colonial administrations in Africa, Asia and Latin America, they rarely occur in democratic states (Vernon 2007; Sen 1989). According to Sen (1999), democracy plays an 'instrumental role' in the achievement of human development targets. Notedly, in states where "voting, criticizing, protesting and so on" (Sen 1999: 151) is allowed as part of the exercise of political rights, governments are

urged to respond to pressures and demands related to the acute suffering of the people. Additionally, Sen (1999) highlights that the very conceptualization of human poverty and economic needs within nation states depends on the existence of political freedom to vindicate fundamental rights, and that successful rights protection depends on the sense of proximity between the rulers and the ruled. As such, political systems based on the model of representative democracies offer a solution to reduce the distance between governments and the people. By the same token, democratic governments have higher standards of public accountability and transparency. For this reason, incumbent governments have electoral incentives to represent the electorate, and are unlikely to remain in power in democratic countries where most voters suffer from hunger.

In general, the levels of democracy of a given country serves as a channel of representation of public interests of the local electorate. In the case of nation states that suffer from significant levels of chronic hunger, ceteris paribus, democratic governments are responsible for planning and executing policies that promote food entitlement protection. For instance, such protection can take the form of macro-distribution of resources, goods and public services associated to poverty alleviation, food security, and social security. Government provisions that seek to combat chronic hunger often are allocated through provisions in kind, such as school meals or public restaurants, or through financial assistance. While provisions in kind have a direct impact on the average dietary energy consumption, financial assistance may indirectly grant access to food markets among the targeted populations. In sum, democracies offer, in the form of policy implementations, different channels of food deprivation alleviation associated to the electorate's preference of being well-nourished and food secure. Therefore, strong democracies must be negatively associated to chronic hunger prevalence.

Data regarding the measurement of democracy levels is provided by the Polity IV Project on Political Regime Characteristics and Transitions (variable *Polity2*). The Polity IV scale is widely used as a measure of democracy and autocracy: it is calculated by the Center for Systemic Peace, and the values range from -10 (full Autocracy) to 10 (full Democracy). Based on its 20-point scale amplitude, the parameter for democracy can be estimated as a continuous variable, only requiring the consideration of the limits of its function (-10 and 10).

Countries Specificities

In figure 2, behind the empirical identification of the panel data, the conceptual causal model displays connection arrows that link countries specificities to the panel explanatory factors. The rationale behind this conceptual framework is related to previous empirical research conducted with economic, social, and political data of African countries (Bates et al. 1999). Notedly, countries specificities variables account for factors such as colonial historical legacies – in the form of dummies of previous colonial administrations (e.g. 1 for French ex-colonies and 0 otherwise), date of independence, official languages, among others.

Although these factors are not directly connected to the dependent variable of the model, and thus are not identified in the panel data, they might be subsequently relevant to explore the mechanisms through which the explanatory variables impact PoU, especially regarding the outset of armed conflicts, their dynamics and their effects over PoU. In effect, colonial legacies may be significant related to the different models of development adopted by independent African countries, explaining how democracy levels, economic growth in the form of income standards, armed conflicts, and food production webs were formed in the aftermath of the colonial period. Countries

specificities factors will thus be further analyzed in section 6, during the SNA case studies, as auxiliary variables to an in-depth understanding of causal mechanisms dynamics.

Climate Change

Recent studies have highlighted the urgent need of considering the impact of climate change variables on countries' development patterns (Davidson et al. 2003). In particular, it is crucial to ponder if climate change might be associated to an increase of armed conflicts, to a decrease in food production, and, mediated through such variables, to an increase in the different forms of hunger, namely acute and chronic hunger. To date, empirical studies have found mixed evidence on the impact of climate change on armed conflicts, food production, and hunger (De Waal 2018). Moreover, the emphasis on climate change variables as explanatory factors are leading researchers to take the risk of naturalizing political and social phenomena, such as droughts caused by government resource mismanagements and their consequent armed conflicts (De Waal 2015). Accordingly, Feitelson and Tubi (2017) have demonstrated that climate change factors typically operate as intermediate variables rather than main drivers.

That said, it is relevant to stress that this research acknowledges the role of climate change factors in the field of food security studies. For example, Kubota (2019) provides recent evidence that the increase in Co2 is leading, through a direct channel, to a decrease in crops nutrients like zinc and iron. However, the question being addressed here is not centered on hidden hunger, that is nutritional deficits with adequate levels of kcal/day intakes. Therefore, given that climate change factors such as average or total rainfall, presence of droughts, and temperature can only impact chronic hunger prevalence through its impact on food production, climate change variables were not included in the panel identification models.

4. Panel Estimations

The panel data estimations will be computed to test hypotheses 1-6. By presenting the general effects of armed conflicts, income standards, democracy levels, food production, the interaction effects of armed conflicts and income standards, and the interaction effects of armed conflicts and food production on PoU, this section intends to provide empirical evidence on the hypothesized general regularities.

The selected variables that compose the panel parametric model present low levels of missing-data attrition, enabling empirical estimation analyses that do not sacrifice nomological validity. Table 3 describes and summarizes the variables identified in the general model.

Table 3. Description of Panel Variables

Variable	Description
Dependent Variable	
Prevalence of Undernourishment (PoU)[1]	(three-year moving average) percentage of total population chronically undernourished within a country
Independent Variables	
Armed Conflicts[2]	Frequency of Armed Conflicts (with at least 25 casualties)
Polity IV[3]	levels of democracy, from -10 (full Autocracy) to 10 (full Democracy)
(log)GDP per capita [4]	in constant 2010 US$
Gross per capita Food Production[5]	In constant 2006 US$ (millions)
Year dummy variables	
Y1990, Y1991, Y1992 … Y2014	= 1 if observation is from Y1990, Y1991, Y1992 … Y2014

Sources:[1]Food and Agriculture Organization Statistics (FAOSTAT). [2] Uppsala Conflict Data Program. [3]Polity IV Project on Political Regime Characteristics and Transitions (variable *Polity2*). [4] World Bank national accounts data, and OECD National Accounts data files. [5]Food and Agriculture Organization Statistics (FAOSTAT).

To test H1, H2, H3, H4, H5, and H6 different econometric models will be estimated: first, a cross-sectional pooled OLS regression model (i); second, a panel data model with a random-effects estimator (i); and third, a panel data model with a fixed-effects estimator (ii). In addition, models with dummies for year (DYear) will be tested among the panel data models, and models with

dummies for country (DCountry) will be tested among the pooled and random-effects estimator models. For each method (pooled OLS regression and panel data), estimations will start with a basic setup using PoU as the dependent variable, and armed conflicts on the right-hand side of the equation. Next, it will be included one by one the variables Democracy Levels, the natural log of GDP per capita, and Food Production in order to enhance the basic model, and test the reliability and validity of the estimates. Finally, the full setup will consist of PoU as the dependent variable, and armed conflicts, democracy levels, the natural log of GDP per capita, food production, the interaction of armed conflicts with the natural log of GDP per capita, and the interaction of armed conflicts with food production on the right-hand side of the equation.

The full setup equation for the cross-sectional pooled OLS regression model, and the panel data model with a random-effects estimator can be expressed as:

$$(i)\ PoU_{it} = \beta 0 + \beta 1 ArmedConflicts_{it} + \beta 2 DemocracyLevels_{it} + \beta 3 logGDPpercapita_{it} + \beta 4 FoodProduction_{it} + \beta 5 ArmedConflicts*logGDPpercapita_{it} + \beta 6 ArmedConflicts*FoodProduction_{it} + \beta 7 DYear_t + \beta 8 DCountry_i + e_{it}$$

As for the panel data model with a fixed-effects estimator, which separates the error term (ε) in two components (a fixed-effects term, α, and an idiosyncratic error term, e), and is robust to variables that are time-invariant, the following setup was used:

$$(ii)\ PoU_{it} = \beta 0 + \beta 1 ArmedConflicts_{it} + \beta 2 DemocracyLevels_{it} + \beta 3 logGDPpercapita_{it} + \beta 4 FoodProduction_{it} + \beta 5 ArmedConflicts*logGDPpercapita_{it} + \beta 6 ArmedConflicts*FoodProduction_{it} + \beta 7 DYear_t + \alpha_i + e_{it}$$

In order to find support for hypothesis H1, the results are expected to provide a positive and significant coefficient for armed conflicts, which would indicate that the variation of armed conflicts are positively associated with the variation of the prevalence of undernourishment (PoU) across

countries in sub-Saharan Africa. In addition, to find support for H2, H3, and H4 the results are expected to provide a negative and significant coefficient for democracy levels, the natural log of GDP per capita, and food production, which would indicate that the variation of democracy levels, GDP per capita, and food production are associated with the decrease of the prevalence of undernourishment (PoU) across countries in sub-Saharan Africa. Finally, to find support for H5, and H6 the results are expected to provide negative and significant coefficients on the interaction terms, indicating that income standards or food production increase lead to a decrease on the impact of armed conflicts on PoU levels.

4.1. Panel Results

The full setup forms of the cross-sectional pooled OLS regression models presented different results between the model without dummies for year and country with moderation effects of GDP per capita and armed conflicts (model 6), the model without dummies for year and country with moderation effects of food production and armed conflicts (model 7), the model with dummies for year with moderation effects of GDP per capita and armed conflicts (model 13), the model with dummies for year with moderation effects of food production and armed conflicts (model 14), the model with dummies for country with moderation effects of GDP per capita and armed conflicts (model 18), the model with dummies for country with moderation effects of food production and armed conflicts (model 19), the full setup model with dummies for year and country with moderation effects of GDP per capita and armed conflicts (model 24), and the full setup model with dummies for year and country with moderation effects of food production and armed conflicts (model 25). However, among the pooled OLS regression models, model 25 presented the best fit model, since it has the highest R2 ($R2$ = .883), and should be the one initially considered for analysis. According

to model 25, the positive association between the variation of PoU with the variation of armed conflicts (β = 16.62, significant at $p < .01$), and the negative association between food production and PoU (β = -.175, significant at $p < .01$) were found to be statistically significant. In addition, the negative moderation effect of food production on the association of armed conflicts and PoU (β = -.145, significant at $p < .01$) was also found to be statistically significant, while the association between democracy levels and PoU, as well as the association between GDP per capita and PoU were found to be not statistically significant. Consequently, based on the pooled OLS results, only H1, H4 and H6 were supported, while H2 and H3 were not supported, and H5 was not part of the best fitted model. Table 4 summarizes the results for the pooled OLS regression models.

After running the full setup of pooled OLS cross-sectional models, time-series variation was included in the analysis by running panel data models with a random-effects estimator, and panel data models with a fixed-effects estimator. Post-estimation tests were subsequently performed, and indicated that models with a random-effects estimator should be preferred over pooled OLS regression models and models with a fixed-effects estimator.[5] Table 5 summarizes the results of

[5] A Breusch and Pagan Lagrangian multiplier test for random effects was significant for all the random-effects models, indicating that panel data models with a random-effects estimator should be considered instead of the pooled OLS estimators. Moreover, a Hausman test between random-effects models and fixed-effects models indicates that the difference between coefficients of such models are not systematic (H0 not rejected). Given that the random-effects estimator is more efficient than the fixed-effects estimator, and is supported by the Hausman test, it should be the one considered for analysis. A test of overidentifying restrictions corroborates that models with a random-effects estimator should be preferred over models with a fixed-effects estimator. In addition, a Wooldridge test for autocorrelation revealed the presence of first order autocorrelation. To deal with both autocorrelation and heteroskedasticity, when estimated with robust standard errors, panel data models were estimated with cluster standard errors which provide results that are robust to both heteroskedasticity, and autocorrelation.

panel data models. Once more, results varied across the different setup models. However, by testing the robustness of estimation across full panel data models, the results showed that the full model with a random-effects estimator with moderation effects of food production and armed conflicts (model 25), and the full model with a fixed-effects estimator with moderation effects of food production and armed conflicts (model 31) corroborate the preliminary results of the pooled OLS regression models. While the associations between the variation of PoU with the variation of democracy levels and GDP per capita were found to be not statistically significant, the associations of the variation of armed conflicts (β = 16.62, significant at $p < .05$) and Food Production (β = -.175, significant at $p < .01$) with PoU remained statistically significant. Additionally, the negative moderation effect of food production on the association of armed conflicts and PoU (β = -.145, significant at $p < .01$) remained statistically significant. Among the panel data models with a random-effects estimator, model 25 presented the best fit model, since it has the highest R2 ($R2 = .548$), and it should be the one considered for final analyses. Based on panel data estimations (model 25), H1, H4 and H6 were therefore supported, while the variables related to democracy levels (H2) and GDP per capita (H3) were found to be not statistically significant in their association with the variation of PoU. Moreover, H5 not only was not part of the best fitted panel data model, but also was found to be not statistically significant when considered in the full setup panel data model with dummies for year and country (model 24), which corroborates the fact that the association between GDP per capita (H3) and armed conflicts was found to be not statistically significant (models 24 and 25).

In substantial terms, the econometric results indicate that on average for each armed conflict that took place in sub-Saharan Africa during the 1990-2015 period, a corresponding 16.62% increase in PoU was verified (figure 5). The empirical support of hypothesis 1, thereby, reveals that

armed conflicts not only had a significant impact on chronic hunger levels, but an eminently elevated one. Furthermore, for each US$ 1.0 million (constant US$ 2006) in gross per capita food production, on average a corresponding 0.175% decrease in chronic hunger was verified, demonstrating that food production was beneficial to the improvement of food security in sub-Saharan African countries. The negative association between gross per capita food production and chronic hunger levels was also found to be significant when it interacted with the presence of armed conflicts. Notedly, for each US$ 1.0 million (constant US$ 2006) in gross per capita food production, on average a corresponding reduction of the impact of armed conflicts on chronic hunger was also verified (0.145% decrease). In other words, countries that experienced armed conflicts but that also presented higher levels of food production were able to reduce the impact of armed conflicts on national levels of chronic hunger prevalence by 0.145% for each US$ 1.0 million (constant US$ 2006) gross per capita food production. Although it might represent a high investment cost among developing African countries, investing in food production had a significant impact on food security during armed conflicts. Finally, across the pooled OLS models and panel data models, the final empirical results were robust to the different estimation designs.

In the next sections, a nested analysis based on SNA analytical methods will be proposed to explore how armed conflicts impact chronic hunger variation, throwing new light on the mechanisms that explain the regularities found on the LNA.

Table 4. Results of Pooled OLS Regression Models

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS	(9) OLS	(10) OLS	(11) OLS	(12) OLS	(13) OLS	(14) OLS	(15) OLS	(16) OLS	(17) OLS	(18) OLS	(19) OLS	(20) OLS	(21) OLS	(22) OLS	(23) OLS	(24) OLS	(25) OLS
VARIABLES	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU	PoU
Armed Conflicts	10.39***	10.39***	9.265***	7.046***	6.108***	7.323	34.76***	9.901***	4.900***	9.272***	7.188***	6.510***	5.818	33.71***	4.076***	3.774***	2.426***	-12.27**	17.69***	3.739***	3.708***	3.682***	2.470***	-8.904	16.62***
	(0.902)	(1.069)	(1.082)	(1.083)	(1.052)	(7.904)	(4.931)	(0.953)	(1.160)	(0.983)	(0.987)	(1.019)	(7.488)	(4.904)	(1.133)	(0.956)	(0.749)	(6.100)	(2.749)	(0.818)	(0.821)	(0.807)	(0.643)	(5.569)	(2.449)
Democracy Levels (Polity IV)			-0.486***	-0.406***	-0.347***	-0.347***	-0.366***			-0.302***	-0.239***	-0.228***	-0.228***	-0.254***	-0.622***	-0.429***	-0.318***	-0.333***	-0.361***		-0.0389	-0.0393	0.0253	0.0104	-0.0275
			(0.0873)	(0.0801)	(0.0786)	(0.0787)	(0.0779)			(0.0878)	(0.0802)	(0.0802)	(0.0805)	(0.0791)	(0.0833)	(0.0839)	(0.0741)	(0.0755)	(0.0758)		(0.0760)	(0.0749)	(0.0636)	(0.0646)	(0.0646)
GDP per capita (log)				-5.079***	-4.890***	-4.863***	-5.065***				-4.755***	-4.675***	-4.690***	-4.846***		-15.29***	-8.431***	-9.194***	-7.506***			-3.450**	0.620	-0.0621	1.503
				(0.445)	(0.433)	(0.426)	(0.420)				(0.442)	(0.434)	(0.434)	(0.425)		(1.440)	(1.121)	(1.152)	(1.125)			(1.541)	(1.337)	(1.335)	(1.319)
Food Production					-0.143***	-0.144***	-0.0496					-0.0779**	-0.0777**	0.00980			-0.242***	-0.238***	-0.198***				-0.217***	-0.215***	-0.175***
					(0.0327)	(0.0325)	(0.0353)					(0.0345)	(0.0343)	(0.0378)			(0.0173)	(0.0168)	(0.0191)				(0.0160)	(0.0157)	(0.0182)
X Armed Conflicts, with GDP per capita (log)						-0.191							0.109					2.232**						1.727**	
						(1.304)							(1.235)					(0.932)						(0.846)	
X Armed Conflicts, with Food Production							-0.297***							-0.282***					-0.157***						-0.145***
							(0.0503)							(0.0504)					(0.0263)						(0.0234)
Constant	24.65***	24.65***	25.28***	60.53***	73.58***	73.43***	65.39***	18.53***	30.63***	19.48***	53.25***	68.58***	60.90***	53.28***	15.16***	128.4***	107.4***	126.2***	110.5***	23.73***	-0.829	58.21***	27.12**	55.60***	40.70***
	(0.500)	(0.478)	(0.494)	(3.081)	(4.181)	(4.219)	(4.369)	(2.294)	(0.719)	(2.261)	(3.767)	(4.692)	(4.964)	(5.164)	(1.086)	(8.863)	(10.48)	(8.399)	(8.364)	(1.623)	(1.677)	(9.458)	(12.32)	(9.887)	(9.880)
Dummies	None	None	None	None	None	None	None	Year	Country	Year	Year	Year	Year	Year	Country	Country	Country	Country	Country	Year and Country	Year and Country	Year and Country	Year and Country	Year and Country	Year and Country
Robust SE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	970	970	970	970	967	967	967	970	970	970	970	967	967	967	970	970	967	967	967	970	970	970	967	967	967
R-squared	0.121	0.121	0.151	0.249	0.253	0.253	0.280	0.205	0.753	0.216	0.301	0.289	0.289	0.313	0.772	0.806	0.848	0.850	0.854	0.846	0.846	0.847	0.878	0.879	0.883

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

Table 5. Results of Panel Data Models

VARIABLES	(1) Random PoU	(2) Random PoU	(3) Random PoU	(4) Random PoU	(5) Random PoU	(6) Random PoU	(7) Random PoU	(8) Random PoU	(9) Random PoU	(10) Random PoU	(11) Random PoU	(12) Random PoU	(13) Random PoU	(14) Random PoU	(15) Random PoU	(16) Random PoU	(17) Random PoU	(18) Random PoU	(19) Random PoU	(20) Random PoU	(21) Random PoU	(22) Random PoU	(23) Random PoU	(24) Random PoU	(25) Random PoU	(26) Fixed PoU	(27) Fixed PoU	(28) Fixed PoU	(29) Fixed PoU	(30) Fixed PoU	(31) Fixed PoU
Armed Conflicts	5.101***	5.101**	4.243*	3.820*	2.484	-11.06	18.15***	3.886**	4.900**	3.845**	3.778**	2.598**	-9.038	18.15***	4.076*	3.774*	2.426	-12.27	17.69***	3.739**	3.708**	3.682**	2.470*	-8.904	16.62***	3.739**	3.708**	3.682**	2.470*	-8.904	16.62**
	(0.739)	(2.370)	(2.282)	(2.005)	(1.548)	(11.22)	(6.655)	(1.633)	(2.470)	(1.622)	(1.611)	(1.303)	(10.40)	(6.655)	(2.373)	(1.991)	(1.582)	(11.34)	(6.826)	(1.695)	(1.679)	(1.659)	(1.353)	(10.65)	(6.428)	(1.661)	(1.645)	(1.625)	(1.326)	(10.43)	(6.296)
Democracy Levels (Polity IV)			-0.618***	-0.457**	-0.325*	-0.339*	-0.367*			-0.0497	-0.0482	0.0144	9.55e-05	-0.367*	-0.622***	-0.429*	-0.318	-0.333	-0.361*		-0.0389	-0.0393	0.0253	0.0104	-0.0275		-0.0389	-0.0393	0.0253	0.0104	-0.0275
			(0.216)	(0.218)	(0.195)	(0.199)	(0.192)			(0.191)	(0.189)	(0.156)	(0.158)	(0.192)	(0.224)	(0.229)	(0.204)	(0.208)	(0.202)		(0.199)	(0.197)	(0.161)	(0.162)	(0.159)		(0.195)	(0.193)	(0.158)	(0.159)	(0.156)
GDP per capita (log)				-12.57***	-7.606***	-8.240***	-6.906***				-4.057	-1.077	-1.639	-6.906***		-15.29***	-8.431***	-9.194***	-7.506**			-3.450	0.620	-0.0621	1.503			-3.450	0.620	-0.0621	1.503
				(3.298)	(2.400)	(2.455)	(2.304)				(3.277)	(3.036)	(2.978)	(2.304)		(4.352)	(3.109)	(3.196)	(3.029)			(4.526)	(3.989)	(3.926)	(3.892)			(4.434)	(3.907)	(3.846)	(3.813)
Food Production					-0.245***	-0.241***	-0.198***					-0.212***	-0.210***	-0.198***			-0.242***	-0.238***	-0.198***				-0.217***	-0.215***	-0.175***				-0.217***	-0.215***	-0.175***
					(0.0478)	(0.0450)	(0.0450)					(0.0410)	(0.0388)	(0.0450)			(0.0478)	(0.0449)	(0.0456)				(0.0418)	(0.0395)	(0.0401)				(0.0409)	(0.0387)	(0.0393)
X Armed Conflicts, with GDP per capita (log)						2.057							1.767					2.232						1.727						1.727	
						(1.752)							(1.630)					(1.758)						(1.666)						(1.632)	
X Armed Conflicts, with Food Production							-0.161***							-0.161***					-0.157**						-0.145**						-0.145**
							(0.0613)							(0.0613)					(0.0630)						(0.0588)						(0.0576)
Constant	25.88***	25.88***	26.54***	112.6***	103.1***	107.2***	93.59***	19.24***	40.58***	19.38***	48.13**	48.99**	52.73**	93.59***	38.59***	145.0***	121.3***	126.2***	110.5***	33.68***	33.63***	58.31*	51.13*	55.60*	40.70	19.28***	19.39***	43.84	37.46	42.01	27.09
	(1.934)	(1.896)	(1.938)	(22.28)	(17.21)	(17.94)	(16.26)	(2.167)	(0)	(2.194)	(22.95)	(21.77)	(21.58)	(16.26)	(0.715)	(30.36)	(22.50)	(23.21)	(21.86)	(1.272)	(1.313)	(32.43)	(28.91)	(28.59)	(28.08)	(1.390)	(1.440)	(31.11)	(27.83)	(27.53)	(27.07)
Dummies	None	None	None	None	None	None	None	Year	Country	Year	Year	Year	Year	Year	Country	Country	Country	Country	Country	Year and Country	Year and Country	Year and Country	Year and Country	Year and Country	Year and Country	Year	Year	Year	Year	Year	Year
Robust SE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	970	970	970	970	967	967	967	970	970	970	970	967	967	967	970	970	967	967	967	970	970	970	967	967	967	970	970	970	967	967	967
R-squared	0.044	0.044	0.117	0.247	0.413	0.419	0.436	0.401	0.044	0.401	0.405	0.527	0.531	0.436	0.117	0.250	0.413	0.419	0.436	0.401	0.401	0.405	0.529	0.532	0.548	0.401	0.402	0.406	0.529	0.532	0.548
Number of ID	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39

Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

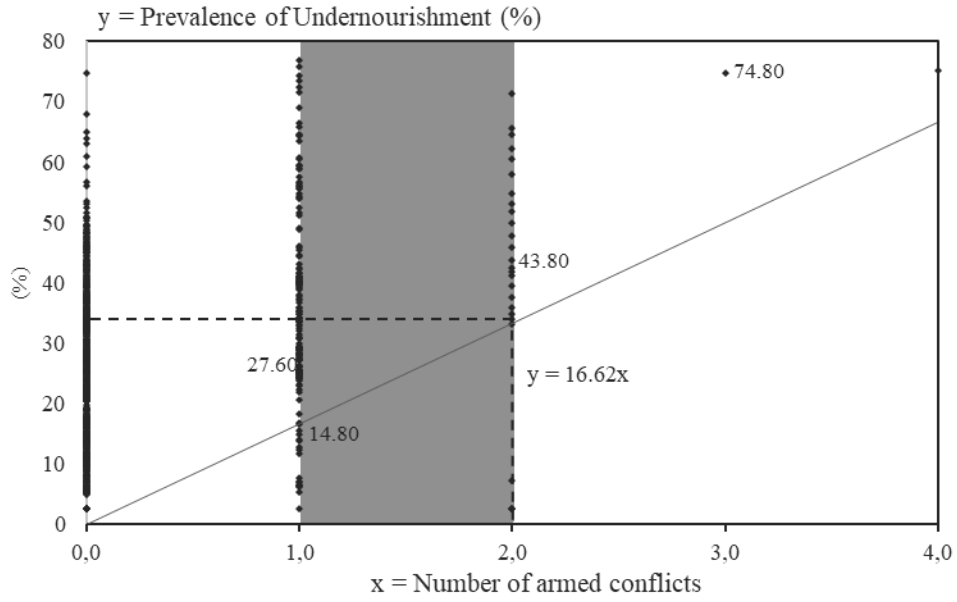

Figure 5. Average impact of armed conflicts on chronic hunger variation (ceteris paribus) across sub-Saharan African countries during the 1990-2015 period. Source: Author's construction from panel data estimations.

5. Small-N Analysis: Case Selection

Given that this study seeks to analyze the effect of armed conflicts on PoU, and that panel results support the main hypothesis (H1), the LNA regularities must now be scrutinized through a nested SNA empirical strategy. For this purpose, the analysis of 4 nation-states nested within the analysis of the 39 nation-states is proposed as a method to examine how armed conflicts affected chronic hunger prevalence in sub-Saharan African countries during the period 1990-2015. Case studies will, therefore, enable the exploration of within-countries causal mechanisms at play, fulfilling the requirements of the causation triad analysis as previously discussed in the display of the multimethod analytical structure (figure 4).

The case selection procedure will be based on the categorization of countries comprised in the LNA sample. Notedly, countries will be categorized according to Lieberman's "On-the-line"

and “Off-the-line” typology (Lieberman 2005). According to Lieberman, cases that empirically instantiate the LNA regularities can be categorized as “On-the-line” cases, while cases that contradict such regularities can be categorized as “Off-the-line” cases. In that sense, “On-the-line” countries that present covariation trends as predicted by the LNA regularities follow the analytical function of the type X1→Y1, or X0→Y0, where X denotes the explanatory variable input, Y denotes the outcome related to the dependent variable, and 1 or 0 represent a dummy variable for presence (1) /absence (0) (Goertz 2017). Correspondingly, where armed conflicts are observed (X1), an increase of PoU levels should also be observed (Y1), and where armed conflicts are not observed (X0), a decrease of PoU levels should be observed (Y0) across “On-the-line” cases. On the other hand, “Off-the-line” countries that present covariation trends not predicted by the LNA regularities either follow the analytical function X1→Y0, meaning that the presence of armed conflicts is not followed by PoU increase, or X0→Y1, meaning that PoU increase took place in the absence of armed conflicts.

In addition to this typological categorization, countries will be ranked in an orderly way that allows the identification of the most representative “On-the-line” and “Off-the-line” cases grounded in the empirical covariation strength (Goertz 2017) of their respective analytical functional forms (X1→Y1, X0→Y0, X1→Y0, and X0→Y1). Table 6 summarizes countries’ classification types, and thus provides an evidence-based guide for case selection.

The functional form classification of cases as proposed by Lieberman (2005) assists the SNA country selection procedure based on the LNA results, but also provides a theoretical framework for the analytical relevance of cases that represent each type of functional form. In this regard, while X1→Y1 cases are analytically relevant for Model Testing Small N Analysis (Mt-SNA), that is to provide a compelling theoretical story regarding the LNA regularities through the examination of

causal mechanisms, the observed occurrence of X0→Y0 cases play an auxiliary role by corroborating the X1→Y1 rule verified in the LNA estimations. That said, given that most cases are either X1→Y1 or X0→Y0 types, the proposed table of functional forms categorization (table 6) presents empirical classification validity based on the support of the main hypothesized association (H1).

Therefore, among the X1→Y1 cases, the Republic of Djibouti, Republic of Guinea-Bissau, and Republic of Angola were selected. The Mt-SNA will be based on these three nation-states because they are the three cases that best represent the X1→Y1 functional form. In practical terms, they are relevant because they will provide compelling empirical evidence to the examination of the microdynamics of armed conflicts (Kalyvas 2006) and their relationship to chronic hunger variation. Given their stronger empirical data covariance of increased armed conflicts with increased PoU levels, they will likely present clearer evidence of how X1 is associated to Y1 rather than other countries among the LNA sample (Goertz 2017).

Furthermore, the X1→Y0 functional form can play a complementary analytical role to X1→Y1 Mt-SNA. While X1→Y1 cases serve as Mt-SNA, X1→Y0 cases can be utilized in the nested analysis in order to explore and make sense of the empirical regularity deviances. In other words, X1→Y0 case studies offer the opportunity of fine graining the Mt-SNA (Lieberman 2005). In particular, by selecting one X1→Y0 "Off-the-line" case to be studied alongside three "On-the-line" cases, further evidence will be gathered to examine not only how armed conflicts affect chronic hunger prevalence, but how and in which specific scenario might armed conflicts not affect chronic hunger prevalence. Based on empirical data, the Republic of Mali will be selected as a X1→Y0 country for analysis. Although the Central African Republic appears at the top of the X1→Y0 ranked list, Mali was rather selected given that the Central African Republic presents very low

variation of armed conflicts frequency and PoU levels over the 1990-2015 period. By analyzing the microdynamics of armed conflicts in Mali, and the unpredicted absence of national chronic hunger increase, the "Off-the-line" case study intends to advance the understanding of which regular causal mechanisms that link armed conflicts to chronic hunger were not operating in such case. Finally, although X0→Y1 cases can be classified simply as unexplained noise (Lieberman 2005) within the nested mixed-method LNA-SNA, Goertz (2017) has recently raised awareness to the empirical relevance of considering such cases to illuminate equifinality patterns. In other words, analyzing the X0→Y1 path reveals different causes that lead to similar outcomes. Following the same case analytical selection procedure, Zambia will thus be analyzed as an example of equifinality based on the empirical observation that it has been the country with the highest PoU levels during the 1990-2015 period, without the occurrence of a single armed conflict.

Case selection based on Lieberman's (2005) nested analytical method, however, is not without controversy. Notedly, Rohlfing (2008) stresses the risk that any misspecification on the LNA model may lead to a problematic and questionable SNA case selection procedure in a nested analysis. As such, an omitted variable bias, a model underfitting or overfitting, could result in a totally different choice of cases during the SNA. In fact, Rohlfing (2008) even suggests that utilizing nested analysis as a cross-validation method for case selection may result in a difficult, if not impossible, validation of ontological modeling decisions. In other words, there is a risk that no cross-validation may be enough to eliminate the risk of not selecting the best cases for SNA based on LNA results. That said, there are two possible answers to Rohlfing's interesting problematization. The first one is that utilizing robust specifications and verifying the validity of results across several different econometric models, as presented in the previous section, reduces the risk of model misspecification that could lead to imprecise or arbitrary SNA case selection. The

second one is that the craft of research sometimes requires restricted optimization of the methodological decisions, implying that relevant research questions should still be made even if the perfect answers cannot be reached due to methodological constraints. In other words, less relevant scientific research questions should not be favored only because it is easier to find their correct answers.

Table 6. Categorization of Countries as Case-Types based on Functional Forms, ranked by covariation strength

X1→Y1	X0→Y0
Angola*	Benin
Djibouti*	Togo
Guinea-Bissau*	Cameroon
Senegal	Ghana
Sierra Leone	Mauritius
Niger	Malawi
Cote d'Ivoire	Sudan
Mozambique	Zimbabwe
Rwanda	Kenya
Guinea	Gabon
Chad	Gambia, The
Liberia	South Africa
Congo, Rep.	Burkina Faso
Lesotho	Botswana
Uganda	
Ethiopia	
X1→Y0	**X0→Y1**
Central African Republic	Zambia*
Mali*	Swaziland
Nigeria	Tanzania
Mauritania	Madagascar
	Namibia

Note: Countries listed from top to bottom according to their correlation strength between X and Y. X1 corresponds to Armed Conflicts, and Y1 to PoU increase. X0 corresponds to the absence of armed conflicts, and Y0 to PoU decrease. *Denotes countries selected for case studies.

Section 6 describes the framework and structural elements for the within-case and causal mechanism analyses in the context of armed conflicts and chronic hunger variation across the

Republic of Djibouti, Republic of Guinea-Bissau, Republic of Angola, Republic of Mali, and Republic of Zambia during the 1990-2015 period.

6. Case Studies and Causal Mechanisms Analytics

Following the LNA and the case studies selection procedure, this section presents the common empirical framework that will be used for the causal mechanisms analytics in the study of the Mt-SNA "On-the-line" countries, namely Djibouti, Guinea-Bissau, and Angola, and the "Off-the-line" country, namely Mali.

The case studies analysis will follow a threefold strategical plan. First, the microdynamics of armed conflicts will be examined across all 4 case studies under a multilevel logical guideline (Oliva and Charbonnier 2006) which will reveal the main empirical factors that compose the explanatory variable, notedly through the understanding of the armed conflicts' situation profiles, causal mechanism analysis, stakeholder analysis, and the analysis of peace and conflict dynamics. Such elements of analysis are necessary because they will enable a clear understanding of the core dynamics of armed conflicts, and will be subsequently used for the discrimination of potential transmission channels that linked armed conflicts to PoU variation. Table 7 summarizes the methodological guidelines of this first step.

Secondly, the increase of chronic hunger across the 3 "On-the-line" countries will be examined in the context of their specific conflicts with the aim of comprehending how the intrinsic elements of such armed conflicts affected either food distribution, food production, or food consumption channels ultimately resulting in increased levels of PoU. Through the identification of processes that linked armed conflicts' channels to PoU variation, that is the identification of the causal

mechanisms, the Mt-SNA procedure will provide an in-depth understanding of the regular association between armed conflicts and PoU. Furthermore, the "Off-the-line" case study will follow the same analytical procedure. However, its aim will be to identify how the possible channels that linked armed conflicts to PoU increase across the "On-the-line" cases were possibly not connected in the case of Mali. The key relevant factors to be taken into account in the causal mechanisms analytics are divided into: armed conflict characteristics, food market structure and consumers, and external constraints (table 7.1.). Identifying these elements will be of crucial importance to trace the set of mechanisms that regularly leads armed conflicts dynamics to the disruption of food systems, notedly through the interference on food production, food distribution, or food consumption channels that directly affect the final consumers.

Table 7. Armed Conflicts' Multilevel Analysis Guidelines

Level of Analysis	**Description**	**Guiding Questions**
1. Situation Profile	General overview of the situation	What are the key historical events in the country? Is there a history of conflict? What is the political, economic and socio-cultural context? What are the gendered impact of the conflict on women, men, boys and girls? What are the emergent political, economic, ecological and social issues? What specific conflict-prone/affected areas can be situated within the context?
2. Causal Analysis	Survey of the issues and factors of conflict and instability	What are the key sources of tension and the underlying structural causes that could lead to structural instability in the society? What issues can be considered proximate causes of conflict? What factors can contribute to promoting peace?
3.Stakeholder Analysis	Mapping of main conflict players and review of their role and influence on the conflict	What are the main stakeholders? What are their main positions, interests and needs? What are their capacities, constituencies, power bases and resources? What are the relationships between all stakeholders, and how are they connected? What stakeholders can be identified as peace agents? Why?
4. Analysis of Peace and Conflict Dynamics	Examination of the interaction among background situation, conflict causes and stakeholders and the trends and changes produced over time	What consequences may conflict triggers have on the causes and key stakeholders? What are the main mechanisms and logics driving the conflict? Are there any redundancies in behaviours and actions? Can specific patterns be identified in the occurrence of violence? What likely scenarios can be developed from the analysis of the conflict profile, causes and actors? What are the main capacities for managing conflict?

Source: Developed by the author, based on Oliva & Charbonnier (2016).

Finally, following the 4 within-case studies, a cross-country pattern matching analysis of the SNA results will compare the transmission channels observed across case studies. Through a pattern matching approach, a classification of the identified causal mechanisms will be proposed. The classification aims to analytically order the empirical regularities represented by the transmission channels verified in the association of armed conflicts and chronic hunger in contemporary sub-Saharan African countries. The cross-country pattern matching analysis will be followed by the examination of equifinality in the Republic of Zambia.

Table 7.1. Causal Mechanisms Analytics: Armed Conflicts & PoU

	Elements for causal mechanisms exploration
Armed Conflict Characteristics	Armed conflicts participants Conflict history Background characteristics of communities affected Intended outcomes of groups taking part in the conflicts Armed groups' resources/public resources Personnel Military skills of personnel involved Technology utilized
Food System	Main people affected by food shortage Food market organization Supply chain distribution Food production characteristics Food consumption patterns Market prices
External constraints	Aspects of social change Political constituencies External stakeholders Gender disparities Environmental factors Availability of relief programs Unplanned events

Source: Developed by the author. Note: Adapted from Brandon & Ah Sam 2014:487.

7. The Republic of Djibouti: Electoral Conflicts, Food terrorism, and Chronic Water Shortage

During the 1990's decade, the Republic of Djibouti presented one of the highest levels of prevalence of undernourishment in sub-Saharan Africa. From 1990 to 1995, the prevalence of chronic hunger of the Djiboutian population averaged 73.6%, striking around 450 thousand people in a country with less than 600 thousand people. But although population growth was consistent throughout the 1990-2015 period, growing 154% from 590 thousand people in 1990 to 910 thousand people by 2015, in less than thirty years Djibouti was able to reduce its national prevalence of chronic hunger levels from 74.8% in 1990 to 15.9% in 2015. Figure 6 outlines these demographic trends.

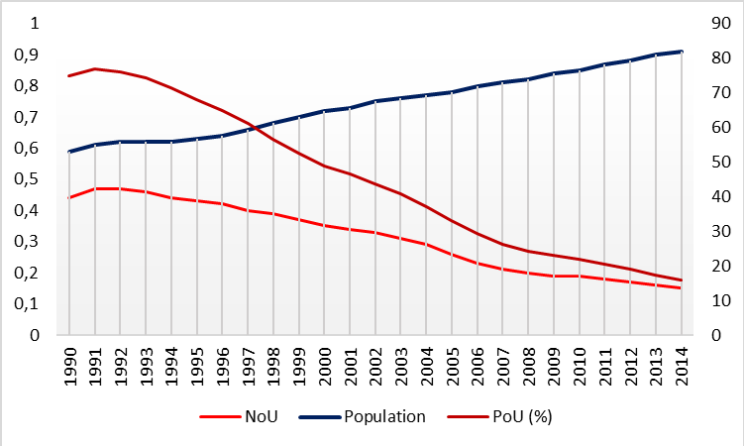

Figure 6. Demography and chronic hunger time-series: The Prevalence of Undernourishment (PoU), Absolute Number of Undernourished people (NoU), and Total Population in the Republic of Djibouti from 1990-2015. Note: NoU and Total Population values, in millions, displayed on the primary vertical axis. PoU (%) values displayed on the secondary vertical axis. Source: FAOSTAT.

In Djibouti, the highest rates of chronic hunger prevalence (PoU) were observed during the period between 1990 and 2000. It was also exclusively in this period that all dyad state-based armed conflicts, between 1990 and 2015, took place in the country. This section intends to explore how armed conflicts were associated to increased levels of chronic hunger in Djibouti. To understand the dynamics of the armed conflicts and their impact on the prevalence of chronic hunger, however, it

is first necessary to understand the background scenario of such events. Following the background scenario contextualization for the period, next sections provide a political-historical account of the armed conflicts dynamics, presents the national standard food system layout, and explores the mechanisms through which armed conflicts affected the functioning of the food system fabric ultimately leading to increased PoU levels.

Background: Genealogy of the land of the 'Afars and the Issas'

The Republic of Djibouti can be considered an outstanding case of what Santos (2017) has technically defined as a *territorial system*: a geographic space that operates as a system of material objects and actions that determines the social-historical dynamics of a given territory. In other words, it is a region in which the geography of space itself is a crucial historical actor.

Located in the Horn of Africa coastal region with only 23,000 km^2, the Republic of Djibouti has had a strategic geopolitical position for centuries between the Red Sea, and the Indian Ocean. Although its climate is characteristically torrid and dry in a volcanic desert setting, its geographic location has putted the region of modern Djibouti in the regional and international trade route for crops and commodities of the Gulf of Aden since at least 1200 A.D., when the region was occupied by the kingdom of Ifat (Ajayi and Crowder 1992).

Little information is available from medieval Djibouti, but historians agree that the region occupied today by the country was culturally formed mostly during the kingdom of Adal (Nave 2005), a federation of small sheikhdoms, between approximately 1450 and 1600 A.D. Highly influenced by the spread of Islam in its neighbor Western Asian Arabian Peninsula, the main commodities exchanged by that time in the region was composed of two highly valued commodities of the Arabic trade route: enslaved humans, and silver. The enrichment of Adal's kingdom based

on these commodities enabled an autonomous economic and political development from the northern powerful Christian kingdom of Abyssinia, modern-day Ethiopia. At that time, massive migrations of Issas populations from the southern regions of modern Somalia took place, attracted by the relative affluence of Adal. Such migration flows pushed the previous inhabitants of Adal, the Afars people, to the northern regions of the kingdom (Nave 2005).

By 1600 A.D., the Arabic kingdom of Adal suffered several attacks from its Christian neighbors of Abyssinia, leading subsequently to the overthrow of Adal, and to a new composition of power that resettled the regional order. In the vacuum of power resulted from the Christian attacks, different Afar sultanates imposed their rule across a new territorial division, comprising areas that remain politically relevant today in contemporary Djibouti, such as Tadjoura, with its strategic port, Raheita, and Aussa (Nave 2005). In this new division of power and territory, the Afars occupied the northern lands of modern-day Djibouti, and parts of southern Eritrea, while the Issas predominantly occupied the southern lands of Djibouti, and parts of modern-day Somalia and Ethiopia.

With the stabilization of a new territorial configuration in the region, the ports of Tadjoura and Obock became a central commercial hub in the Gulf of Aden in the 17th century. The expansion of trade between the Indian ocean routes, the Arabian Peninsula, and the Horn of Africa was driven by the new maritime technologies pushed forward by the Portuguese colonial thalassocracy in Asia, and coastal regions of Africa. In this context, the ports of Obock and Tadjoura not only intensified their pivotal role in the commercialization of enslaved humans and silver, but also expanded their activities to the export of coffee and perfume, in exchange for firearms, salt, and cloth to be consumed by the inland markets of the Horn of Africa, particularly in Abyssinia (Nave 2005). With this increasing prolific dynamic trade, during the 19th century the attention of the French Empire

was drawn to the region, an external player that would redefine the existing political order, and ultimately lead to the creation of the modern state of Djibouti.

After the construction of the Suez Canal in the mid-19th century, the regional strategic position of the Sultanate of Aussa in the Gulf of Aden gained an entirely new dimension. Not only it remained connected to its traditional Arabian and Indian trade routes, but it also became a necessary connection between these routes and the vastly rich Mediterranean trade web through the Red Sea. Economically, it represented an exponential gain in commercial opportunities. Its new wealth, however, would become its doom. In 1888, 19 years after the opening of the Suez Canal, the French would establish, first by agreement with local Sultans and subsequently by imposition, the colony of French Somaliland in the Aussa lands, later called the French Territory of the Afars and the Issas (1967).

Initially based in the port city of Obock, the French would later move its colonial administration to the City of Djibouti, for its geographic proximity to the inner lands of the Horn of Africa. The rail line that still today connects the port of Djibouti City to the capital of Ethiopia, Addis Ababa, was inaugurated in 1917 as part of this French colonial project (Nave 2005), despite the City of Djibouti be scarcely populated by then, and the rail line be not a priority to Djiboutian themselves. The interaction between the local diverse populational composition of Arabs, Afars and Issas, previously inhabitants of the Aussa Sultanate, and the new exogenous political and territorial rules imposed by the French colonial power putted down the roots of future armed conflicts in the post-independence Djibouti.

Electoral Armed Conflicts: Postcolonial Asymmetric Representativeness, the Government of Djibouti, and The Front for the Restoration of Unity and Democracy (FRUD)

After virtually ignoring the demands of its impoverished population during the first half of the 20th century, the government of French Somaliland adopted a representative council in the aftermath of the World War II, in March 10th, 1946 (Oberlé and Hugot 1985). In part as an effort to recognize the role played by African soldiers in the victory against the Italian and German military offensives in Africa (Roberts 1997), the representative council was designed to appease the popular dissatisfaction with the colonial rule through the formal inclusion of the local population in the colonial administrative bureaucracy.

However, the representative council composed to include the local population into the representative political system of the French Somaliland was still based on colonial administrative preferences, not in the fair democratic principle of 'one person, one vote'. Notedly, a significant asymmetry between the demographic composition of the French Somaliland society and the representative council intensified pre-existing political differences among the social groups. While the representative council was designed to be a political institution with 20 seats, from which 10 were assigned to French nationals, 4 to Afars, 3 to Arabs, 2 to non-Issa Somalis, and 1 to an Issa representative (Figure 7), the population of French Somaliland "was roughly 20% Afar, 35% Issa, 20% non-Issa Somali, 5% Arab, and 5% French; the remainder […] other foreigners" (Nave 2005, p. 403). In practical terms, it meant that the majority of the population, the Issas, got the smallest share of seats in the representative council, while the Afars got a balanced share of seats (20%) for their population size, Arabs and non-Issa Somalis were somehow overrepresented, and French nationals remained absolutely overrepresented, holding 10 times more seats than their effective population size.

Beyond the demographic factor, the Issas and Afars traditionally held different cultural and political customs. According to Oberlé and Hugot, even though both social groups are characterized by nomadic pastoralist practices, the Afars belong to an unified hierarchical society bounded to traditional values and divided into noble and common class (Nave 2005), while the Issas are recognized by their 'fierce republicanism' expressed in the autonomy and independence of each small group of Issas who get united only when major political events risk to impact their people as a whole (1997).

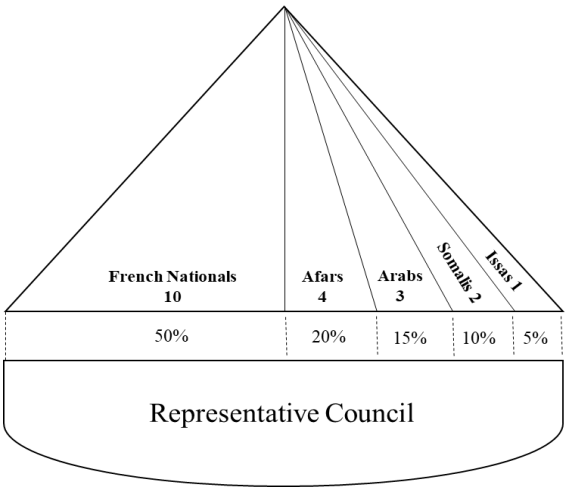

Figure 7. Representative Council of the French Somaliland in 1946, as described by Oberlé and Hugot (1985). Source: Developed by the author.

The political system instituted by the colonial French Somaliland government during the second half of the 20th century thus tended to favor the overrepresentation of the Afar people in detriment of Issas' interests. France rapidly understood that by holding a minority group on their side, through political institutional incentives, part of the local population would maintain the support for the French colonial rule. In effect, in the face of a majoritarian Issa government, the Afars would reasonably prefer the French Somaliland system that guaranteed their prominent role in political affairs, rather than venturing an independence secession to create a state in which they would certainly become a political minority. This reluctance would only be confirmed during the

three popular referendums organized by France after 1958 to decide if the French Somaliland would remain a part of France or become an independent state.

In the first popular referendum on independence of French Somaliland, approximately 75% of the electorate chose to remain under the French colonial rule, mainly due to the apprehension of either being forcibly annexed by independent Somalia, or by the risk of an unsustainable poor independent French Somaliland (Nave 2005). Notwithstanding this absolute majority result of the first referendum, a decade later in 1967 a second referendum was proposed, and again an absolute majority of the electorate supported the remain of French Somaliland under the French colonial rule. But this time with a significant difference. Shortly before the second referendum, France expelled thousands of Issas and Somalis from the territory (Nave 2005), who would likely vote for the independence of the country due to their persisting underrepresentation in the colonial system, biasing *a priori* the independence referendum results in favor of the colonial rule. That is to say that mostly Afars only, who were likely to choose to maintain a political system that favors them, were allowed to vote. As a symbolic reward for the loyalty of the Afars to the colonial rule, and as a punishment to the opposite Somali population, France renamed the territory of the French Somaliland to 'French Territory of the Afars and the Issas', dropping the explicit mention to Somalis in the new name of the territory.

In 1977, in the context of an escalating Cold War in the Horn of Africa, a third and final popular referendum was held by the French colonial government. Reticent that the Territory of the Afars and the Issas, governed by its unequal political system of representation, could be influenced by the egalitarian promises of the neighboring revolutionary Ethiopian Communist Government implemented in 1974, the Derg, France allowed what seemed to be an impartial and fair referendum process (Nave 2005). Knowing their unlikely chance to reject independence, however, most of the

Afars boycotted the 1977 referendum (Kadamy 1996). Therefore, and as expected, an overwhelming majority of the electorate, estimated in more than 95%, voted for independence.

In June 27, 1977, the new and independent presidential Republic of Djibouti was created, simultaneously giving place to the first Issa government presided by Hassan Gouled Aptidon, an Issa himself, and a member of the political party Rassemblement populaire pour le Progrès (RPP), the only authorized political party by that time. After taking office, Hassan Gouled Aptidon was accused of capturing the RPP and transforming it in an Issa clan political party (Kadamy 1996), subsequently ruling the Republic of Djibouti continually for 22 years, until 1999. Although presidential elections took place in 1981 and 1987, Hassan Gouled was the only authorized candidate to run for the post of head of state. The systematic exclusion of the Afars from the formal political sphere, encouraged part of the outlawed Afar opposition to resort to violent uprisings and to the organization of non-conventional political opposition, including armed guerrillas.

The first major conflict that occurred in independent Djibouti took place in 1986, when the RPP headquarter was bombed by the Front Démocratique pour la Libération de Djibouti (FDLD), an Afar armed group that saw the government of Hassan Gouled as an ethnocratic dictatorship (Kadamy 1996), claiming for the political liberation of the Republic of Djibouti from Issas' power. The political hostilities based on political exclusions would only intensify when the government of Djibouti harshly punished the Afar opposition in the aftermath of the 1986 bombing, eventually leading to the outbreak of the Djiboutian Civil War in 1991.

The historical contextualization made so far is crucial, for the armed conflicts that occurred in the country during the MDG period have been an expected result derived from the long gestation of rivalries between different societies that previously cohabited the same region, the Issas and Afars. Notedly, five different dyadic armed conflicts were observed between 1990-2015 in Djibouti.

The first took place in 1991, followed by armed conflicts in 1992, 1993, 1994, and 1999. These armed conflicts represented different phases of the Djiboutian Civil War, but in each one of them two major political actors were at play: the Government of Djibouti, standing for its right to rule under a presidential system dominated by a single political party, and the Afar armed groups Front for the Restoration of Unity and Democracy (FRUD), or Front for the Restoration of Unity and Democracy – Combatant (FRUD-C).

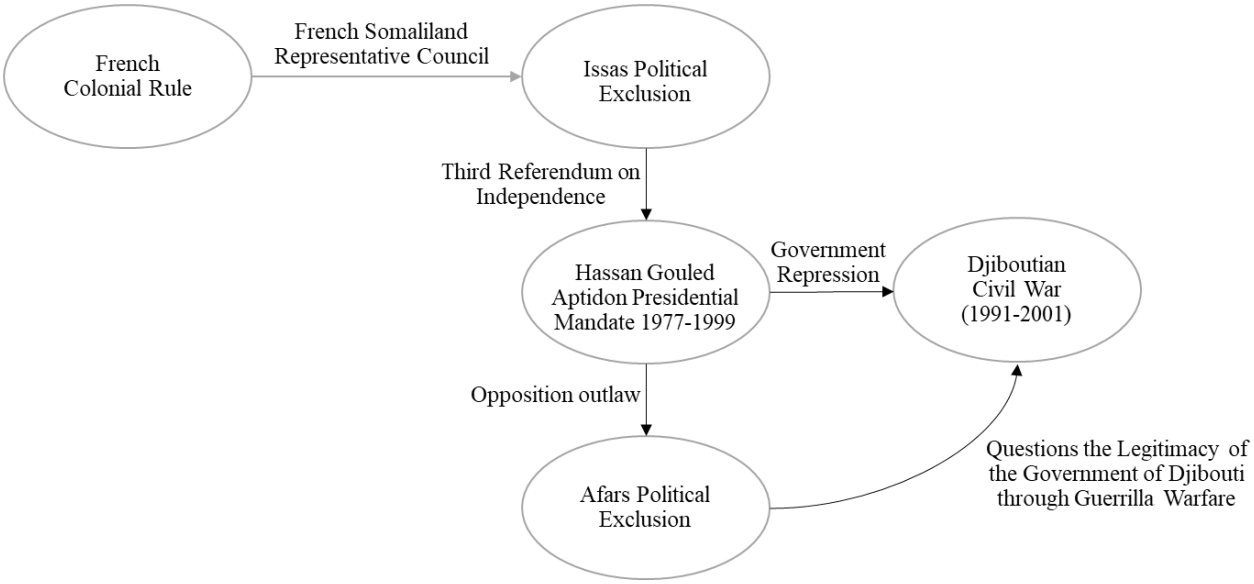

Figure 8. Diagram of the Djiboutian Civil War Outbreak. Source: Developed by the author.

Although both FRUD and FRUD-C had as their ultimate goal to be recognized as legitimate political actors in the country, implying the overthrow of the Government of Djibouti represented by the Issas' RPP, FRUD-C was a later derivation from the FRUD, and whose origin in 1994 is linked to the FRUD adoption of a non-armed strategy after successive armed conflicts. In that sense, FRUD-C was a radical franchise of the FRUD, which sustained an armed revolution against the central government of Djibouti, being at the forefront of the 1999's armed conflict.

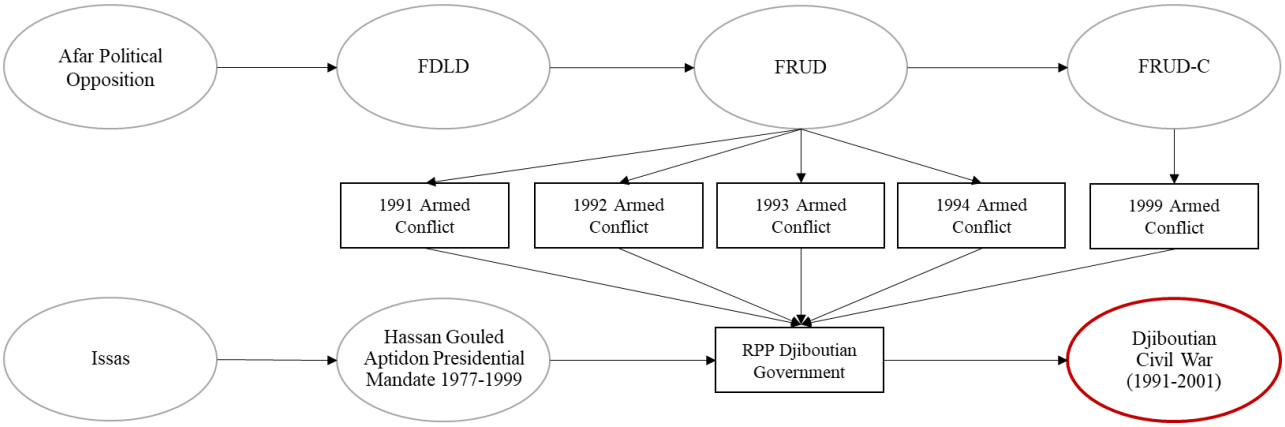

Figure 9. Diagram of the five Djiboutian Civil War's Armed Conflicts. Source: Developed by the author.

The armed conflicts during the Djiboutian Civil War were characterized however by narrative disagreements around the final goal of each side attacks. While the Afars behind the FRUD claimed for political legitimacy and institutional space for representation, accusing the RPP government of an ethnic dictatorship, the Government of Djibouti accused the FRUD of igniting a dangerous secession war to create the 'Greater Afar land' in the northern region of Djibouti. Such disagreements determined the inner dynamics of the armed conflicts during the Civil War. As of 1991, while the FRUD claimed for the opening of the political system to a multiparty regime in which the Afars could legitimately compete, Hassan Gouled's government released an official statement declaring that the RPP single-rule was the only possible course of action in order to preserve the territorial unity of the country (Kadamy 1996). To control the discontentment of FRUD's militants and civilian Afars, the National Assembly dominated by the RPP approved Article 13 of Law 200 in October 1991, which provided automatic acquisition of Djiboutian nationality to any foreigner enlisted into the national army (Kadamy 1996), composed mainly by South-Ethiopian and Somali Issas, with the aim of strengthening the security forces of the state. By the end of 1991, an armed conflict took place in the Tadjoura region, north of Djibouti.

In February 1992, Gouled's regime demanded security support from France, whose government decided not to intervene directly with its armed forces, leading instead a blockade of economic, humanitarian and medical aid to the northern regions controlled by FRUD guerrillas, which ultimately weakened the FRUD forces but disproportionately affected the Afars civilians (Kadamy 1996). In 1993, confronted with weakened FRUD groups that were not equipped for conventional warfare, the offensive launched by the government of Djibouti with military strategic support from France made it possible to recapture the town of Randa, further pushing the Afars north into the Mabla mountains. In parallel, the French encouraged the Gouled's regime to pursue a political reform in order to appease the FRUD in 1993, after the reelection of Gouled for a third presidential mandate. This political move opened space to incorporate some Afar representatives into national government bodies although their influence was *de facto* limited and the RPP remained in control of the national government, what was criticized by FRUD leaders as a cooptation strategy to divide FRUD militants. In effect, by doing so, Gouled successfully divided the FRUD after the armed conflict of February 1994 in Randa, obtaining a peace treaty with the FRUD on December 1994 (Kadamy 1996). After the peace treaty was established, the FRUD was finally divided into the group of Afars that sustained the treaty and the newborn FRUD-Combatant (FRUD-C), a franchise of the FRUD that continued in the armed struggle to overthrow the RPP government.

Between 1995 and 1999, although the FRUD-C represented a constant threat to the government of Djibouti, the only effective armed conflict between both sides took place in 1999 at different regions, including Tadjoura, Mdho, and Adailou town (Allansson et al. 2017). The 1999 armed conflict was utterly a result from the political destabilization generated by the international debts contracted by the government of Djibouti during the first period of the Djiboutian Civil War for military expenses (1991-1994), which forced the government to adopt austerity measures that

increased taxes while reducing public spending. Coincidentally, the period of political economic austerity started when Gouled himself was in France for medical treatment, and continued upon his return in 1996. When returning to Djibouti, Gouled suspended the civil rights of his opponents fostering a violent upheaval of FRUD-C in 1999, before his nephew Ismail Omar Guelah substituted him in another presidential election victory, not without fraud contestations, by the RPP (Nave 2005). 1999 was the last year of armed conflicts in the Republic of Djibouti during the MDG period, due to the subsequent peace agreement signed in 2001 between Afars representatives with the government. Figure 10 presents the number of armed conflicts that occurred in Djibouti by region, highlighting the concentration area of armed conflicts in the Afar lands in the North.

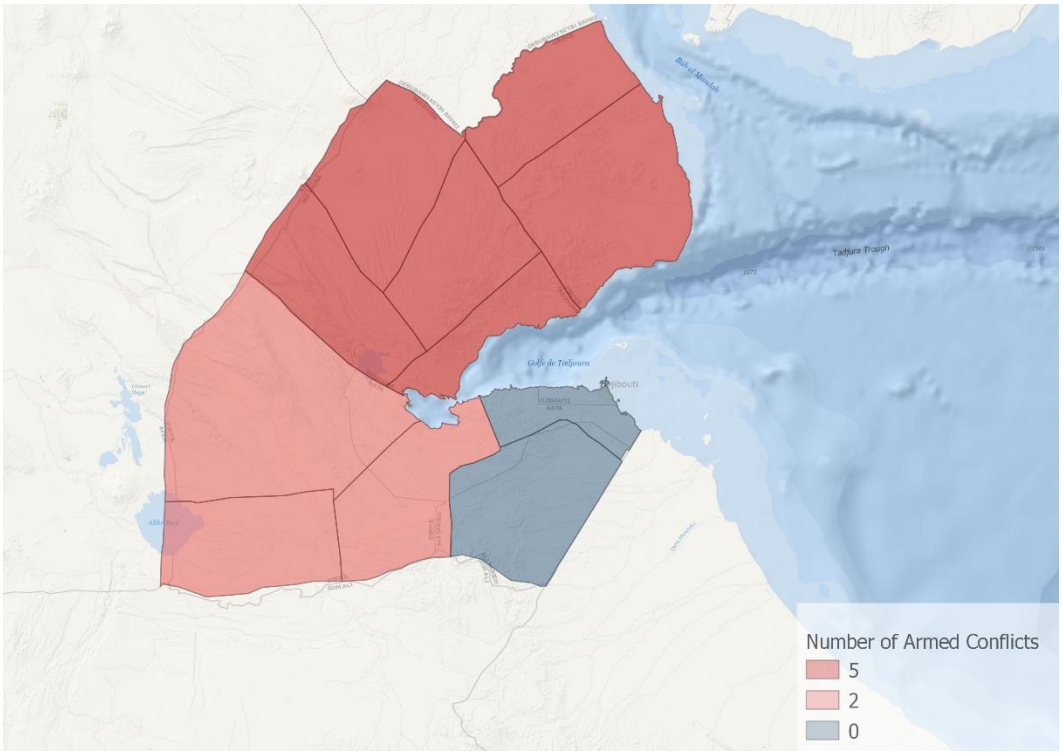

Figure 10. Map of Armed Conflicts in the Republic of Djibouti between 1990-2015. Source: Developed by the author with data from the Uppsala Conflict Data Program. Note: The attribution of color categories to each region is based on the cumulative number of armed conflicts occurred in the area (ESRI Reference Overlay).

Based on this historical account, it can be inferred that the late independence acquired by the Republic of Djibouti from France in 1977 would set the ground for the post-independence electoral-ethnic conflicts that occurred at the center of the Djiboutian Civil War. Nevertheless, it is relevant to stress that the Djiboutian Civil War cannot be defined as an Ethnic Civil War, as a reductionist analysis could suggest (Kalyvas 2006). Rather, it was an electoral Civil War with ethnic characteristics derived from the colonial and post-colonial institutional arrangements operating in the country. The Djiboutian Civil War can thus be understood as a war for political recognition, within an institutional system of rotative political exclusion, in a region where significant segments of the population had been ignored by the colonial and the newly independent governments.

Effects of Armed Conflicts on Chronic Hunger: the Djiboutian Civil War

The effects of armed conflicts on chronic hunger prevalence during the 1990-2015 period in Djibouti can now be understood by highlighting the ordinary food system structure in the country, followed by how the Djiboutian Civil War's armed conflicts disrupted the fabric of the national food system in its production, distribution, access, and consumption dimensions (FAO 2004B). In this section, in addition to available secondary data, the analysis relies on primary data collected during a field study realized between March 24th and April 1st of 2019 in Djibouti City, the Republic of Djibouti. The field study consisted in several semi-structured interviews conducted with food security experts under anonymous conditions at the Ministry of Agriculture, FAO Djibouti, University of Djibouti, and the Intergovernmental Authority on Development for the Horn of Africa (IGAD) headquartered in Djibouti City. The interviews were crucial to provide historical data not available on secondary sources both on the functioning of the Djiboutian food system, and expert's narratives of how Djibouti's armed conflicts might have affected national levels of chronic hunger

variation. The insights brought by the expert opinions of the interviewees were particularly valuable to understand the potential causal mechanisms behind the high levels of chronic hunger observed during the period of civil war. This section thus exposes the food chain that connects production, distribution, access, and consumption of food in Djibouti, and the disruptive consequences caused by the Djiboutian Civil War's armed conflicts.

Food supply in Djibouti is overall limited qualitatively and quantitatively (FAO-CPP 2013). Its traditional primary crops can be grouped into three main categories: (i) food crops composed by fruits, vegetables, rice, flour-based flatbread (*luḥūḥ*), and khat; (ii) raising livestock, mainly goats, sheep, and camels traditionally in a culture of nomadic pastoralism; and only marginally (iii) fishing and hunting (Nave 2005; Stock 2004). Given the torrid and arid environmental conditions of the country, the average annual rainfall is irregular and amounts to 150mm/year (FAO-CPP 2013). Additionally, surface water and groundwater are scarce, placing Djibouti in the 50th place in a survey that covered 51 African countries regarding total water availability, by country, in the continent (Njoh and Akiwumi 2011), with only 475 m^3/capita/year[6]. Water scarcity, in turn, hinders the implementation of water-intense irrigated agriculture. The few available freshwater sources, combined with an enduring shortage of human capital qualified to use modern agricultural technologies that require complexification of massified mechanized production (FAO-CPP 2013), is translated into a rate of 100% artisanal agricultural production output, and is met with greater obstacles in rural areas (Rayaleh 2004). Based on the widespread low-output food production methods traditionally employed and local chronic water scarcity, Djibouti is only able to produce an estimated 10% of its required national dietary energy demands, making it an intensively food-

[6] Based on the same study (Njoh and Akiwumi 2011), Djibouti ranks 164 out of 180 countries in the international ranking.

import dependent country, vulnerable to regional and international food chain factors (FAO-CPP 2013). The massive traditional consumption of khat, a stimulant plant with the property of alleviating hunger's symptoms through the reduction of appetite (Stock 2004), can be seen as a popular hunger masking method which is a proxy for endemic historical levels of chronic hunger.

Water availability also shapes the channels of food distribution in Djibouti (Rayaleh 2005). Because 90% of the food consumed is imported, Djibouti City plays a leading role on the storage and distribution of food products with its major seaport depot, and a railway connecting the capital to Addis Ababa[7]. The rural areas of the country rely mostly on local roads connected to the capital, nomadic routes, informal foreign border routes, street markets, local retailers, and rural traders for food access. Thus, if on the one hand Djibouti is dependent on foreign food imports to fulfill its national demand for food products, on the other hand rural cities in Djibouti depend in some degree of Djibouti City as their major source of food supply. This concentration of food resources in the capital contributes to a demographic saturation of the urban space, with more than 75% of the country's population living in the capital, as well as an imbalance of economic and political power between Djibouti City and the rest of the country, reason why some authors suggest that Djibouti City can almost be considered a city-state (Nave 2005), and although most of the country's territory is not urbanized, Djibouti is considered a highly urbanized country. Moreover, as Grant (2015, p. 185) points out, safe water is not only required for food production, but also for drinking, hygiene, and food preparation. Reason why where water is scarce "aquifers may represent an untapped resource" (Grant 2015, p. 186). The fact that most of the food consumed in Djibouti is produced in

[7] Between 2010-2017, the railroad Ethiopian corridor was underutilized and eventually closed due to lack of infrastructure investments. In 2018 the railroad was reactivated with an updated technology built in partnership with China.

other countries means that Djibouti uses food import as an indirect strategy of water import, and the few water sources available in the country are therefore primarily intended for uses other than food production. This set of circumstances, observed during the whole period of 1990-2015, still remains a crucial concern of the national government of Djibouti. In effect, in the 2016-2020 pluriannual budget of the National Agricultural and Food and Nutritional Investment Program (PNIASAN), the main program at the national level on food security coordinated by the Ministry of Agriculture, 53% of its budget has been allocated to water mobilization, and water management (PNIASAN 2016). It means that guaranteeing access and control of water sources is of vital importance for the government and its sovereignty (Collins and Burns 2007, p. 382).

Based on this food distribution system, food access conditions vary across the country. While the City of Djibouti relies mostly on food imports and local retail webs for food products supply, the rural regions, especially in the Northern regions of Obock and Tadjoura, have secularly relied on nomadic pastoralism (FAO-CPP 2013; Stock 2004) structured around well-established routes of trade for food consumption and barter, a dynamic much less dependent on cash-based commercial institutions. For instance, for pastoralists, livestock typically is not only a direct source of food, but also can play the role of cash crop at the informal trade market. Whenever possible, rural farmers rely partially on their non-irrigated family farm productions to have direct access to food. For this reason, direct access to water points is of vital importance for farmers. According to the PNIASAN survey on food security (2016), given the limited sources of food supply in the country, a significant parcel of the population relies on government procurement, government subsidies, public food and nutrition programs, and social services to have access to food products. Such channels of food access serve as public strategies of indirect food buying to final consumers, mostly relying on public expenses, and only marginally on foreign aid (PNIASAN 2016). Finally,

although Djibouti has a relatively large seacoast in relation to its territorial size, fishing has never become a widespread practice, and by 2010 the national average fish consumption was rather low at 2.0kg/capita/year (FAO-CPP 2013). Figure 11 provides a diagram that synthetically represents the full Food System Cycle in Djibouti for the period.

The political power derived from the centralized control of the national food market, and of food distribution channels by the City of Djibouti is key to understand how the increase of chronic hunger took place during the Civil War period. As presented in figure 13, the peak of chronic hunger levels is observed during the first years of armed conflicts, between 1991-1994. Moreover, since the food and economic embargo of 1992-1993 led by the national government during the Civil War overtly targeted the Northern provinces, mostly inhabited by Afar populations, we can see with no surprise the fact that the highest cumulative numbers of armed conflicts were concentrated in those regions (figure 10). But if on the one hand, Tadjoura and Obock were the only regions to host armed conflicts during the active 5 years of Civil War (1991-1994, and 1999), on the other hand it is relevant to consider that Afars only comprised an estimated 25-35% of Djibouti's population (Nave 2005) during that time, and that the average 74.6% prevalence of undernourishment during the 1991-1994 years thus affected a much wider part of the civilian population. In that sense, if Afars and Issas were the main contenders of Civil War, the country's population groups were impacted regardless of their ethnic identities. This outcome can only be understood in light of the mechanisms through which the armed conflicts triggered a generalized disturbance of food access channels.

The dynamics of Djibouti's armed conflicts can overall be characterized by its rather low technological component. The limited economic resources available for professional warfare funding, both from the side of FRUD guerrillas and from the government armed units, led to the weaponization of non-traditional tools for warfare. In light of this evidence, the food and economic

embargo of 1992-1993 must be understood as the consolidation of a crucial tactical dimension of the Civil War dynamic: namely, the weaponization trend of food, land, natural resources, and civil infrastructure as instruments of warfare (King 2015; On 2014). From the standpoint of the government of Djibouti, the concentration of FRUD forces in the northern regions of Tadjoura and Obock represented a threat to territorial sovereignty, and integrity of the country (Kadamy 1996). In order to dismantle the FRUD armed guerrilla, government armed forces focused their counterinsurgent strategy on measures aimed at gaining control of the necessary resources for ordinary maintenance of the guerrilla groups. This strategy can be understood as a 'closing the tap' form of warfare, with the aim of expanding the centralized control of the government to the entire extension of the country through the monopolistic dominance of strategic resources. Similarly, the response to the national government offensives predominantly took the form of insurgent attacks to government strategic resources, more than direct armed confrontations. This dynamic of resource weaponization and indirect confrontation may explain why the total number of deaths, resulted from direct armed confrontations, in the entire Civil War was relatively low amounting to 312 casualties (UCDP 2019).

The government offensives took the form of control and closure of national routes that supplied food products from the capital to the northern regions, armed surveillance of nomadic route nodes affecting the circulation between lower and higher plateaus of nomadic pastoralists in different seasons, aquifer poisoning in water scarce rural areas, food imports and economic embargo to the seaports of the northern regions, and sometimes direct armed attacks against insurgents. The offensives generated a chaotic state of food production, distribution, and access in Tadjoura and Obock. By compromising water safety for rural farming, drinking, and nomadic pastoralism, local farmers were forced to abandon their lands, leading to a decrease in local food production and to an

increase in the dependency of food products from the capital at the same time that national routes were being controlled. The region was effectively gridlocked because entire areas of the country that could not rely on its own were suddenly forced to do it. This set of conditions liquidated the assets for the functioning of traditional nomadic trading routes, making people living in the area extremely vulnerable to increasing risks of food scarcity.

In response to the government's occlusion of production and distribution channels of food resources, FRUD units also poisoned aquifers in populated urban areas, and attacked strategic government buildings throughout the country. Their major strike, however, consisted in the consequent state drain of civilian resources to warfare, which simultaneously debilitated the fiscal equilibrium of the state and provoked civilian dissatisfaction with the government from non-Afar groups. Indeed, the state drain of civilian resources, allocated to warfare, decreased the state capacity of executing government procurements, government subsidies for national agricultural production, and funding of social assistance, food and nutrition programs. The combination of an overall decrease of food availability, measured as the average dietary energy supply, with a reduced capacity of public assistance for food access, led to the dual outcome of food access depletion in a period of decreased supply.

Secondary data shows that during that period occurred a decrease in household food access, ultimately reducing the average food intakes for physiological consumption (figure 13). The inevitable outcome of this dynamic was a generalized disruption of the food system, resulting in the years of lowest dietary energy supply and highest levels of chronic hunger (1991-1994) for the whole 1990-2015 period. A diagram of the food system disruption during Civil War is presented in figure 12.

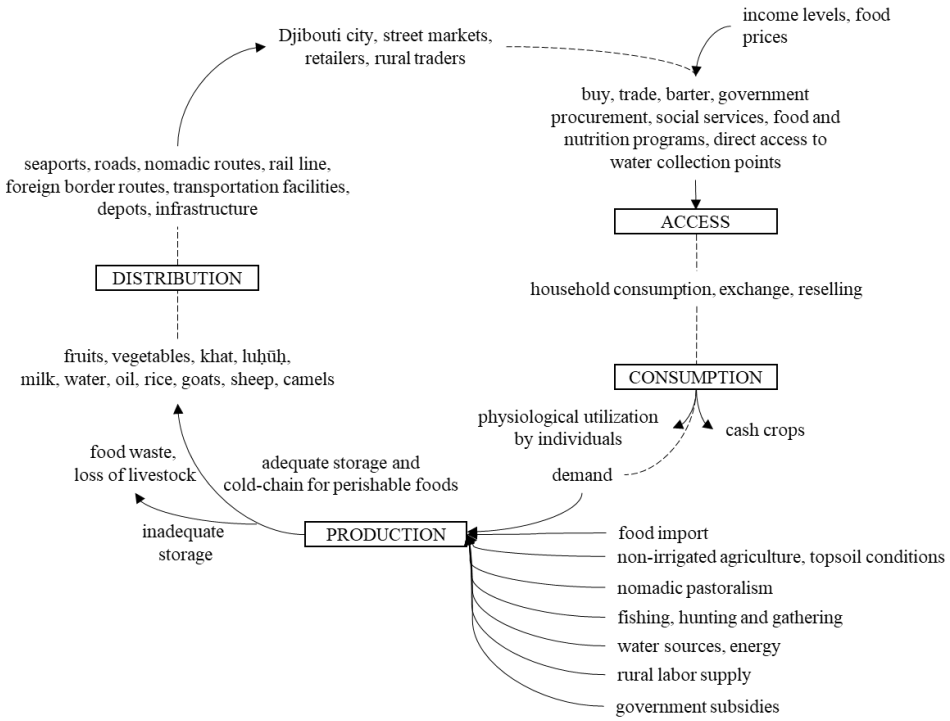

Figure 11. Food System Cycle: Republic of Djibouti (1990-2015). Source: Developed by the author.

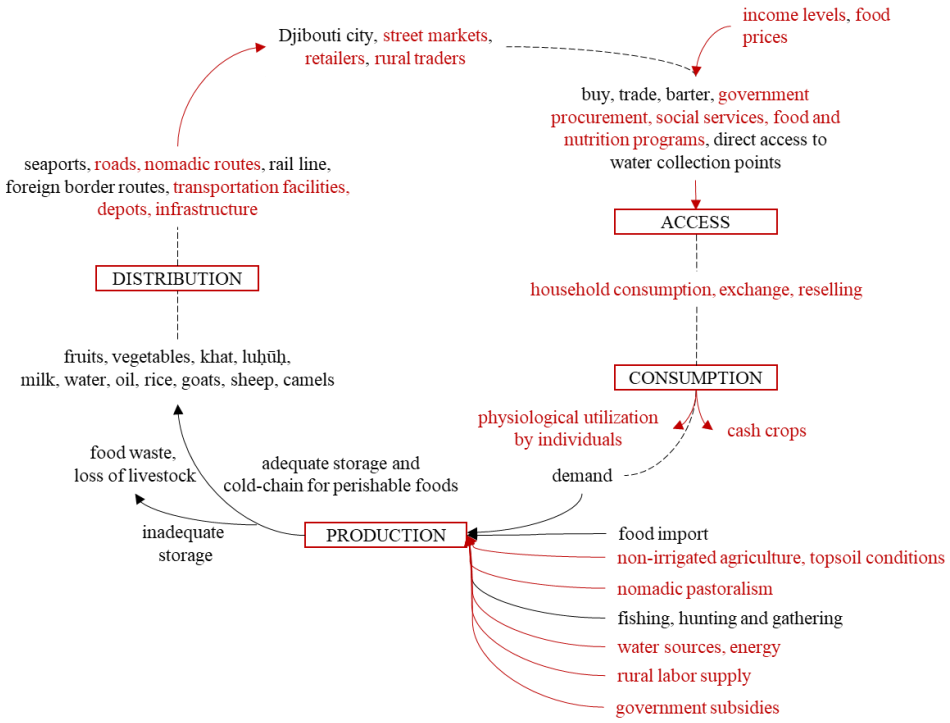

Figure 12. Food System Disruption: The Impact of the Djiboutian Civil War. Note: Red color denotes disruption points along the food system nodes caused by armed conflicts. Source: Developed by the author.

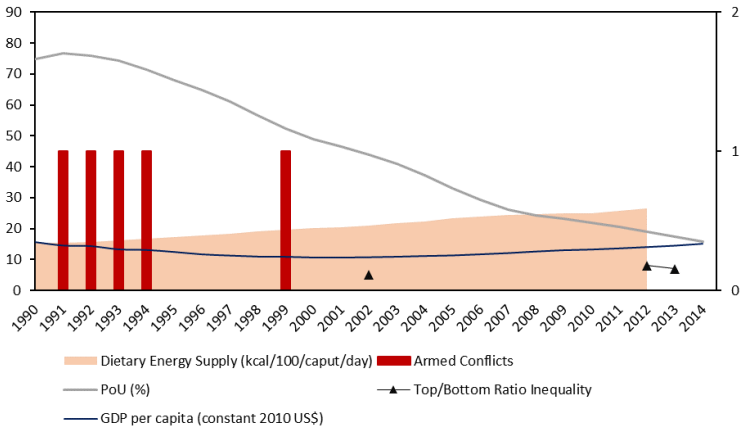

Figure 13. Armed conflicts and Chronic Hunger in Djibouti: 1990-2015. Note: Dietary Energy Supply (kcal/100/caput/day), Prevalence of Undernourishment (PoU), per capita GDP (in constant 2010 US$/100), Top/Bottom Ratio Inequality (income share held by highest 10% divided by income share held by lowest 20%) displayed on the primary vertical axis. Original values of Dietary Energy Supply, and per capita GDP (in constant 2010 US$) were divided by 100 to fit on the common primary vertical axis. Armed Conflicts values displayed on the secondary vertical axis. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data and OECD National Accounts data files, and Uppsala Conflict Data Program.

An explanation for why the endemic food crisis of the 1991-1994 period did not turn out to be a famine is that rural and informal trade routes with Ethiopia and Yemen remained opened, making possible the survival of northern populations, even though food consumption was generally reduced to one meal a day. In other words, remaining chronically undernourished was the price Djiboutians paid for surviving the armed conflicts. Furthermore, considering the post-1993 peace agreement negotiations between the FRUD and the national government (Kadamy 1996), and the institutional reforms that followed the agreement with the aim of including Afar representatives into bureaucratic and political bodies, it is comprehensible that the trend of undernourishment prevalence levels only sustainably decreased in the post-1994 period, most likely due to the end of state drainage of national resources for warfare combined with the stabilization and reactivation of strategical nodes of food products distribution. Finally, looking at both per capita GDP and

economic inequality trends in Djibouti, it is possible to notice that household incomes have stagnated in the country during 1990-2015, even though PoU has drastically fell down. This evidence rules out the potential explanation of income levels as a significant intermediary factor between armed conflicts and chronic hunger prevalence in the case of Djibouti.

The Issue of Gender in Djibouti: Cumulative Effects of endemic FGM and Chronic Hunger

To analyze the gender dimension of the impact of armed conflicts on chronic hunger in Djibouti it is necessary to differentiate between the prevalence of chronic hunger sorted by gender, and the impact of armed conflicts and chronic hunger to both genders. While potentially related, these two dimensions represent distinct angles of pondering the PoU and gender relation. In this respect, although FAO does not provide data on national PoU levels discriminated by gender prior to 2015, it is still possible to make some considerations of the uneven consequences of armed conflicts and chronic hunger for men and women in Djibouti. It is thus crucial to consider the concomitancy of factors that affected women in this context.

In Djibouti, surveys on the health conditions of women indicate that between 99-98% (Klein et al. 2018; Collinet et al. 2002) and 93% (UNICEF Childinfo 2006) of women were submitted to female genital mutilation (FGM) at some age during their lives. The standard FGM practice in the country consists in the so called FGM Type III, the most severe form of FGM, also known as infibulation[8]. The health consequences of infibulation, and the extremely high rate of occurrences

[8] Infibulation is defined by the World Health Organization as the act of "Narrowing of the vaginal opening with the creation of a covering seal by cutting and appositioning the labia minora or labia majora with or without excision of the

observed, covering almost entirely the female population, make it one of the major gender-based health hazard conditions in the country. Notedly, infibulation may cause local infections, hemorrhaging, and chronic pain, while also leading to long-term development of keloid scar tissue, neuromas associated to entrapped nerves within the scar, cysts, infertility, and posttraumatic stress disorders (Klein et al. 2018). Considering the debilitation of the immunological system driven by chronic undernourishment (Gödecke et al. 2018), and the co-occurrence of infibulation in the context of Djibouti's restricted access to adequate water for hygiene (Grant 2015), women become much more vulnerable to chronic health malaises (Klein et al. 2018) than men. Other conditions that aggravate the risks associated to women's health in Djibouti include forced young marriage, and the socio-economic precarity of women in nomadic or semi-nomadic conditions who have limited access to health services. Based on such evidences, it is possible to infer that, even though no data on chronic hunger is available sorted by gender, women are severely more affected by the consequences of chronic hunger than men in Djibouti.

CONCLUSION

The launch of Djibouti's Civil War in 1991 led, between 1991-1994, to the highest peak of chronic hunger levels observed during the 1990-2015 period in the country. The political background disputes between Gouled Aptidon's RPP government and FRUD's revindication agenda for formal political representation shaped both the inner dynamics of the armed conflicts and how those conflicts disrupted the national food system supply.

clitoral prepuce and glans" (WHO 2018, p. 30). According to Klein et al. (2018, p. 2) "thorns or stitches may be used to hold the two sides of the labia majora together and the legs may be bound together for up to forty days [.]"

This section examined how cyclical dynamics of political exclusion between Issas and Afars, introduced by the French colonial divide based on ethnic grounds in Djibouti, was consequently transformed in armed conflicts resulting in territorial, and political disputes. Such disputes, characterized by their low technological profile, were materialized as agroterrorism warfare based on the nonconventional weaponization of food and economic resources. Notedly, between 1991-1994, RPP used embargo's artificial food shortage, physical route controls, and water terrorism as strategies to regain sovereignty over the Northern territories controlled by the FRUD. In turn, FRUD's responses and counter-agroterrorism attacks led the Djiboutian state to the brink of financial insolvency through state-drain of civilian resources for warfare, limiting the state's capacity to import and distribute food. The result was an overall restriction to food access. Thereby, armed conflicts increased PoU levels through the reduction of food production and import outputs, and by restricting food distribution and access to civilians. Figure 14 synthesizes Djibouti's case, and highlights the role of political stability and food supply on PoU variation.

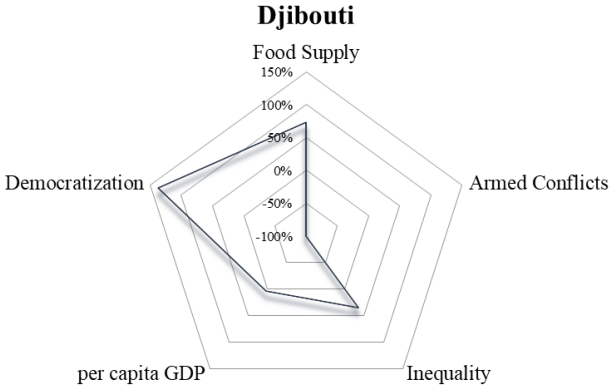

Figure 14. Key determinants of Chronic Hunger in Djibouti. Note: percentage points stand for the variation of each factor between the observed highest and lowest PoU values between 1990 and 2015. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data, Polity IV, and Uppsala Conflict Data Program.

8. The Republic of Guinea-Bissau: Institutional Instability, Civil War, and Trade Deficit

Contrarily to Djibouti, chronic hunger prevalence in Guinea-Bissau never achieved extreme levels higher than 50% during the 1990-2015 period. Its major setback, however, consisted on the fact that chronic hunger decreased by solely 2.4% between 1990 (23.10%) and 2015 (20.70%). The consequence of a semi-stagnant PoU reduction rate (0.1%/year), especially in the context of an average demographic growth of 2.26%/year, meant an increase in the total number of people chronically undernourished in the country. Notedly, absolute NoU increased from 230 thousand people in 1990 to 360 thousand people by 2015 in a country with less than 2 million inhabitants.

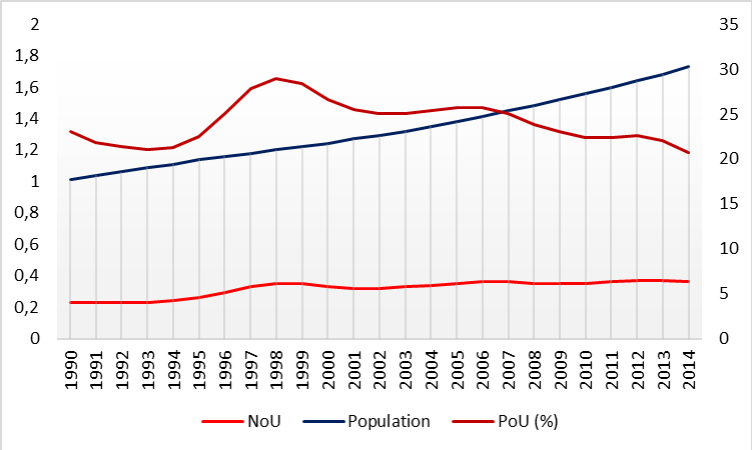

Figure 15. Demography and chronic hunger time-series: The Prevalence of Undernourishment (PoU), Absolute Number of Undernourished people (NoU), and Total Population in the Republic of Guinea-Bissau from 1990-2015. Note: NoU and Total Population values, in millions, displayed on the primary vertical axis. PoU (%) values displayed on the secondary vertical axis. Source: FAOSTAT.

As Figure 15 shows, PoU variation trends were evenly distributed throughout the time-series, achieving the highest values in 1998, and 1999. Respectively, the two years of armed conflicts that were observed in Guinea-Bissau took place from the onset, in June 7th, 1998, of the Guinea-Bissau Civil War, until coming to an end in May 10th, 1999. This section analyzes how the 1998 and 1999 armed conflicts were linked to the increase of chronic hunger in Guinea-Bissau. Following the analytical methodological steps established in the case study of Djibouti, the next

sections present the background scenario within which Guinea-Bissau's armed conflicts took place, provide a political-historical examination of the armed conflicts dynamics, and present the national food system functioning while also exploring the links through which armed conflicts affected the food system fabric, leading to increased chronic hunger rates in the country.

Background: Rural Economy, Cabralism, and the PAIGC One-Party Dominance

As a former country colonized by the Portuguese empire, Guinea-Bissau has been one of the last countries of the African continent to declare independence in September 24th, 1973, subsequently recognized by Portugal in September 20th, 1974. Due to Portugal's 1920-1974 fascist dictatorship under Carmona, Salazar and Caetano's administrations, Portuguese late colonialism was characterized by its widely brutal exploitation of forced labor, and for the refusal of planning a negotiated transition towards decolonization (Davidson 2017; Hawthorne 2003; Mendy 1994). In fact, five out of the 11 sub-Saharan African countries that obtained independence after 1970 were former colonized by Portugal. In practice, it meant that decolonization across ex-Portuguese colonized states has been only possible through armed upheavals. In West Africa, the name of the charismatic revolutionary leader Amílcar Cabral became a synonym of struggle for freedom, and his role at the independence of Guinea-Bissau and Cape Verde would transform him in a central figure to understand the dynamics of post-independence politics in Guinea-Bissau[9], a phenomenon called 'Cabralism' (Rabaka 2014).

Officially founded in 1956 by Amilcar Cabral and other political leaders, the Partido Africano da Independência/União dos Povos da Guiné e Cabo Verde (PAIGC) was born as a

[9] Amilcar Cabral was killed at the Southern neighboring country of Guinea-Conakry, before independence in January 20th, 1973, by the Portuguese International and State Police (PIDE), later known as Direcção-Geral de Segurança (DGS).

socialist political movement for independence (Policarpo 2006). With the onset of independence in Guinea-Bissau by the end of 1974, the PAIGC immediately turned out to be the only legitimate political party in the country, adopting the model of other Cold War socialist nations with one-party systems. The martyrdom associated with the murder of Amilcar Cabral helped to sustain the legitimacy of the PAIGC as a one-party rule.

Guinea-Bissau's location in the coastal region of West Africa supplies the country with a rich stock of natural resources. The nation's territory physical characteristics can be divided between its coastal alluvial plains and mangrove swamps, and eastern savannas (Young 2005). Out of 51 African countries, Guinea-Bissau is positioned at the top 8th regarding total water availability per capita/year (Njoh and Akiwumi 2011). Its many rivers provide adequate water for traditional agriculture with manual irrigation, while its coastal mangrove swamps have traditionally been used in tidal agriculture, and the savannas for livestock raising (Young 2005). During the colonial occupation, state-run agricultural estates took advantage of this natural landscape, turning agriculture into the main economic activity across the territory, in which the primary agrarian commodities were cashew nuts, peanuts, and palm oil production for exportation with heavy tax loads burdening on local farmers. With the advent of independence, farmers started to receive better payments and were allowed to have private estate ownerships, but the new socialist government continued to sustain state-run trade monopolies on agricultural goods (Young 2005) ultimately preserving the former colonial productive economic matrix.

Until today agricultural production lies at the center of Guinea-Bissau's economy. According to recent data from the national Ministry of Agriculture and Rural Development (MARD 2014), more than 50% of the nation's GDP derives from agricultural sectors, while at the same time being responsible for more than 85% of employment supply, and 80% of total exports. Furthermore,

cashews alone stand for 93% of the exports revenues characterizing Guinea-Bissau as a rather rural economy, a feature that might thus be considered valid for the entire period of 1974-2015. Despite this unchanging trend, it was during the first two decades of independence under an agrarian state-centered economy, and under the PAIGC one-party dominance, that the political and economic conditions for the 1990's national crises that preceded the outbreak of the Guinea-Bissau Civil War (1998-1999) were generated.

Guinea-Bissau Civil War: Liberalization, PAIGC, and the Military

By the end of the 1980's, the wave of liberalization associated with the end of the Cold War affects many former socialist states, including Guinea-Bissau (Reno 1997; Ellis 1996). Ranked among the 10 poorest countries in the world at the beginning of the 1990's (UNDP 1997), Guinea-Bissau's experience of socialist economic planning had not fulfilled the aspiration of achieving shared prosperity for all as dreamt by the independentist movements behind the PAIGC origins. Rather, the country struggled to liberate itself from the economic trends of its colonial past.

The overall scenario of economic degradation at the national level backed the adoption of structure adjustment plans of economic liberalization (Cardoso 1995). Moreover, the political discontent with the unfulfilled promises of progress after years of PAIGC's one-party socialist government, gave rise to the adoption of a multiparty political system. In May 9th of 1991, a constitutional reform enacted the adoption of a multiparty electoral political system in Guinea-Bissau, formally putting an end to the PAIGC one-party rule, and materializing the liberalization trend in the political realm (Lars 2011).

The democratic overture followed by the 1991 constitutional reforms determined that the first multiparty general election should take place in 1994. João Bernardo 'Nino' Vieira, PAIGC's

presidential candidate and the president of the State Council of Guinea-Bissau since November 1980, was elected president with 52% of the votes in the second round of ballots against Kumba Ialá, the candidate of the Partido da Renovação Social (PRS) founded in 1992. The PAIGC won 62 of 92 legislative seats in the national assembly as well (Nohlen et al. 1999). The electoral results represented the maintenance of the PAIGC political elite in power, but the narrow victory of the PAIGC to occupy the presidency indicated the boiling political division growing in the country.

The first government democratically elected took several measures to effectively liberalize the national economy. From the support of market-oriented initiatives in the agricultural sector favoring international demands for commodity exports, to the adoption of the common CFA Franc (XOF) in 1997 with the aim of integrating Guinea-Bissau into the Economic Community of West African States (ECOWAS) and controlling chronic inflation, the PAIGC tried to boost the economy (Cateia et al. 2018; Kovsted and Tarp 2003) achieving an yearly average GDP growth rate of 6.42% between 1994-1997.

Economic growth, however, was not perceived by many rural workers who accused the government of capturing the exports gains in corruption schemes. Following worker strikes against inflation, and popular revindications for better salaries and social rights, units of the nationalist military class decided to join the protests with a marked opposition to Nino Vieira's government. Although the military alleged a general dissatisfaction with the low wages and pensions of those who previously fought for the independence of Guinea-Bissau, direct confrontation only took place after Nino Vieira dismissal of the army chief General Ansumane Mané based on corruption charges (Temudo 2008). The resultant institutional instability gave way to military attacks to overthrown Nino Vieira from the presidency, and rapidly escalated into the onset of the armed conflicts in the Guinea-Bissau Civil War in June 7th, 1998. The inner dynamic of the armed conflicts involved

external actors as central players in the unfolding of the Civil War. While the government of Guinea-Bissau requested support from Senegal's troops to confront the military insurrection, insurgent militaries were accused of receiving support from Southern Senegalese Casamance separatists, who were fighting for secession of the Casamance region in Senegal, in exchange of a gun smuggling international scheme (Shaw 2015).

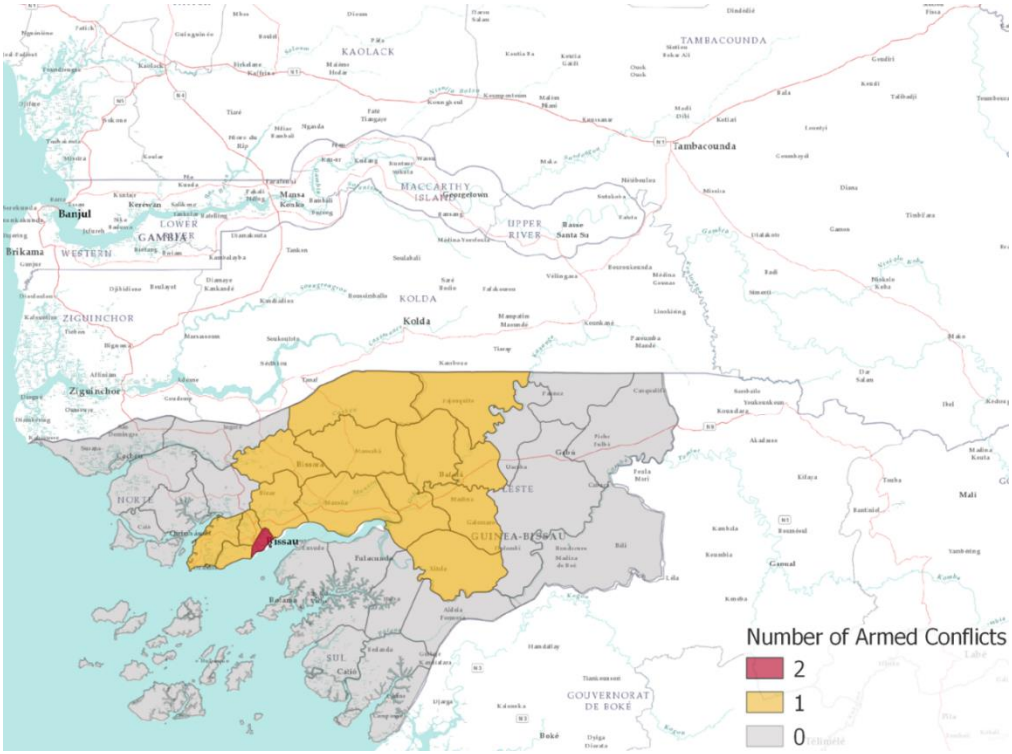

Figure 16. Map of Armed Conflicts in the Republic of Guinea-Bissau between 1990-2015. Source: Developed by the author with data from the Uppsala Conflict Data Program. Note: The attribution of color categories to each region is based on the cumulative number of armed conflicts occurred in the area (ESRI Reference Overlay).

Civil War ended in May 10th, 1999 after the defeat of the last Nino Vieira's support troops in the capital region of Bissau, leading to the overthrown of Viera from the presidency, which was subsequently occupied by the then PAIGC member and speaker of the National People's Assembly, Malan Bacai Sanhá, as an interim president. In February 2000, the first opposition government led by the PRS was elected under the presidency of Kumba Ialá with more than 71% of the votes against

the candidature of Malan Bacai Sanhá. In figure 16 it is possible to visualize the spatial transition of the armed conflicts from the rural areas of Guinea-Bissau and the bordering regions of South Senegal's Casamance in 1998, to the last confrontations that took place in Bissau in 1999. The direct consequence of the conflicts was an immediate wide-ranging disruption of the national production system predominantly based on agricultural production (Barry et al. 2007), and a respective severe economic recession that led to a 28.1% decrease of Guinea-Bissau's GDP in 1998 (OECD).

Effects of Armed Conflicts on Chronic Hunger: the Guinea-Bissau Civil War

This section analyzes how the 1998-1999 Guinea-Bissau Civil War's armed conflicts led to the highest levels of chronic hunger rates observed during the period of 1990-2015 in the country. It first exposes the food chain that connects production, distribution, access, and consumption of food in Guinea-Bissau. And then it examines the distribution channels through which armed conflicts disrupted the fabric of the national food system in its different dimensions (FAO 2004B), leading to increased chronic hunger rates.

According to the Observatory of Economic Complexity (OEC)[10], during the 1990-2015 period the main export products of Guinea-Bissau consisted of palm nuts and kernel, crustaceans and molluscs, frozen fish, cocoa beans, coconuts, raw cotton, rubber, sawlogs and rough woods, crude petroleum, and above all nuts and cashews. The matrix of production output for exports shows the preponderant role of the primary sector in the economy of Guinea-Bissau, especially associated to agriculture and fishing. Production outputs primarily directed for national consumption also

[10] The permanent online database of the MIT Observatory of Economic Complexity (OEC) can be accessed at: https://oec.world/en/profile/country/gnb/.

consisted of food products (MARD 2014), notedly rice, peanuts and cashew nuts, maize, beans, cassava, fish, and palm kernels (Young 2005). However, the use of labor intensive traditional and tide farming due to the absence of mechanized production systems technology, and increased irregular rain precipitation patterns in the region, limited the food self-security potential of the national food production system (Temudo 2011). In practical terms, the production matrix of Guinea-Bissau implied that the dietary needs of national households were only partially met by local agricultural production. The resulting dietary deficit based on the unmet national demand for food products meant that food imports, composed mostly of rice, sugar, and beverages (OEC) played a compensatory role on the dietary energy supply not offered by national producers. The financing of such foodstuff imports however, relying mostly on cashew exports earnings, has proved to be a chronically fragile strategy due to international price variations of agricultural commodities, including volatile cashew nuts values (Catarino et al. 2015; Barry et al. 2007). In addition, national inelastic demands for other imports such as cement, refined petroleum and manufactures, restrained the trade balance potential between cashew exports earnings and total foodstuff imports.

Studies on the food distribution chain in Guinea-Bissau reveals how the dynamics of cashew exports, the national food products market distribution, and food imports are mutually affected by the poor infrastructure conditions observed in the country (Samate 2018; Barry et al. 2007). On the one hand, private retailers and wholesalers, carrier men, and other informal sellers such as bideiras or djilas merchants link both local producers, artisanal fisheries on anchored ships in Bissau and private food imports to final consumers (Lourenco-Lindell 1995). On the other hand, state-based food imports are connected from the Bandim port of entry to final consumers through Bissau's quay, state's cold stores, state's warehouses, public servants, private intermediaries and retailers (Lourenco-Lindell 1995). This entire distribution chain, however, relies on precarious transport

modes combined with inadequate retailers' storage facilities, and poorly maintained roads (Samate 2018). The resulting consequence of the distribution chain based on such deficient infrastructures is twofold: an increased cost for local farmers to distribute their products, and the reduction of their earnings due to the need of incorporating the high distribution costs in their selling without increasing the final price due to market restrictions (Samate 2018). In other words, local producers bear the costs of food distribution due to poor national infrastructure. At the regional level, the port of Banjul and the port of Senegal also end up being more attractive for international trade given the better infrastructure available in Gambia and Senegal, reducing the foreign demand for local products and restricting potential trade agreements between Guinea-Bissau with international partners (Carneiro et al. 2005).

Given the preponderant role of agriculture as the main employment occupation for over 80% of the workforce in the country during the analyzed period, food access is largely dependent on direct access to family farming outputs and fishing at the bolanha mangroves, the Bandim port or across the Bijagós Archipelagos (Samate 2018; Bigman 1993). However, as previously mentioned, the widespread use of traditional agricultural methods does not allow a complete independence from food imports for household consumption. The production of cashew nuts, palm kernels, peanuts and fish serve therefore as cash crops for farmers to generate income that enable their households to access food products from market retailers (Mendes 2010). Among merchants and informal sellers, food access also depends on income generated by their work activities, and sometimes through bartering especially among Islamic djilas merchants. The state, although having transitioned from a socialist system of government to a liberal electoral democracy that adopts market mechanisms as its main economic development strategy, still plays a crucial rule on food access dimensions through

its efforts of cash crops' prices regulation, government procurements, public subsidies to enhance national production, and health-related food and nutrition programs.

With the outbreak of the Civil War in 1998 national food production levels kept increasing (FAOSTAT), including in the following years without interruption until 2010. However, even though farmers kept producing food for consumption and cash crops for sale at a normal rate, the country faced a severe economic crisis with a retraction of 28% of the national GDP in 1999 (OECD). The relationship between cash crops production, exports dependency, and income decrease is essential to understand why chronic hunger increased with the armed conflicts. According to the UNCTAD (2017), household consumption accounts for 84.1% of total GDP in Guinea-Bissau. The 1998 economic crisis thus meant a critical restriction on household expenditure, serving as a strong indicator of food access restriction. Notedly, the concomitance of the outset of the Civil War in the month of June in 1998 with the period of farmers' commercialization of cashew outputs that take place every year from March-April to August (Catarino et al. 2015), known as the 'cashew campaign', generated an atypical situation in which the national economy did not incorporate its major commodity export in the market that year. Due to the reliance on government procurements that promote national exports, and on the temporary closing of local banks, the institutional instability caused by the armed conflicts halted the ordinary remittances received by farmers to sell their cash crops (Barry et al. 2007). Moreover, the total decrease in exports earnings led the government to a deficit of nearly 16% of the GDP in its external current account, and to a primary budget balance deficit of 7% of the GDP in 1998 (Barry et al. 2007). In practical terms, agricultural production was not being converted in income gains for the majority of the workforce.

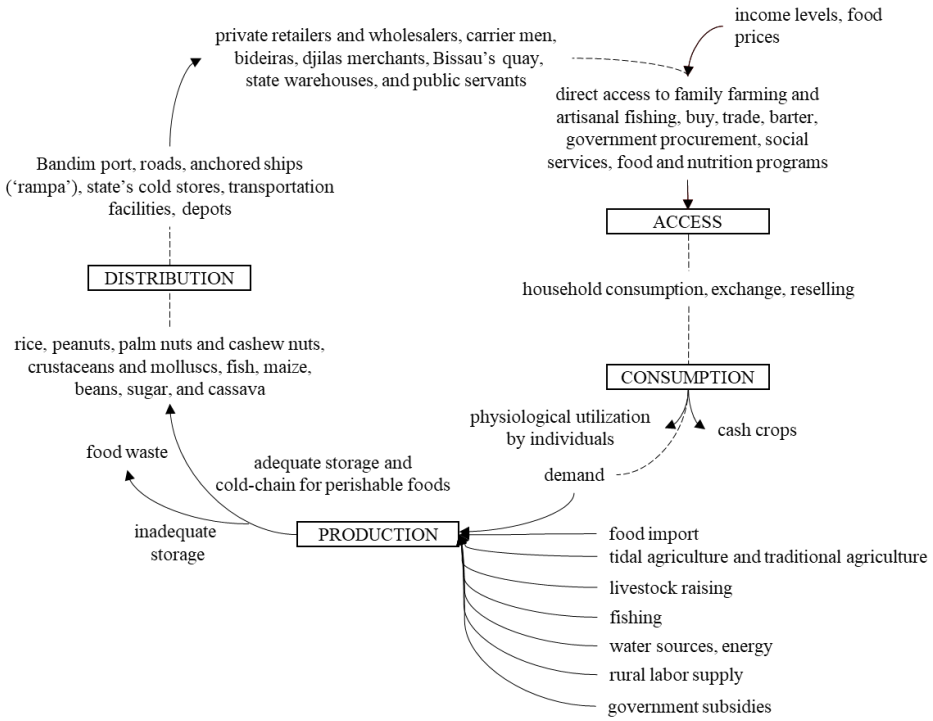

Figure 17. Food System Cycle: Republic of Guinea-Bissau (1990-2015). Source: Developed by the author.

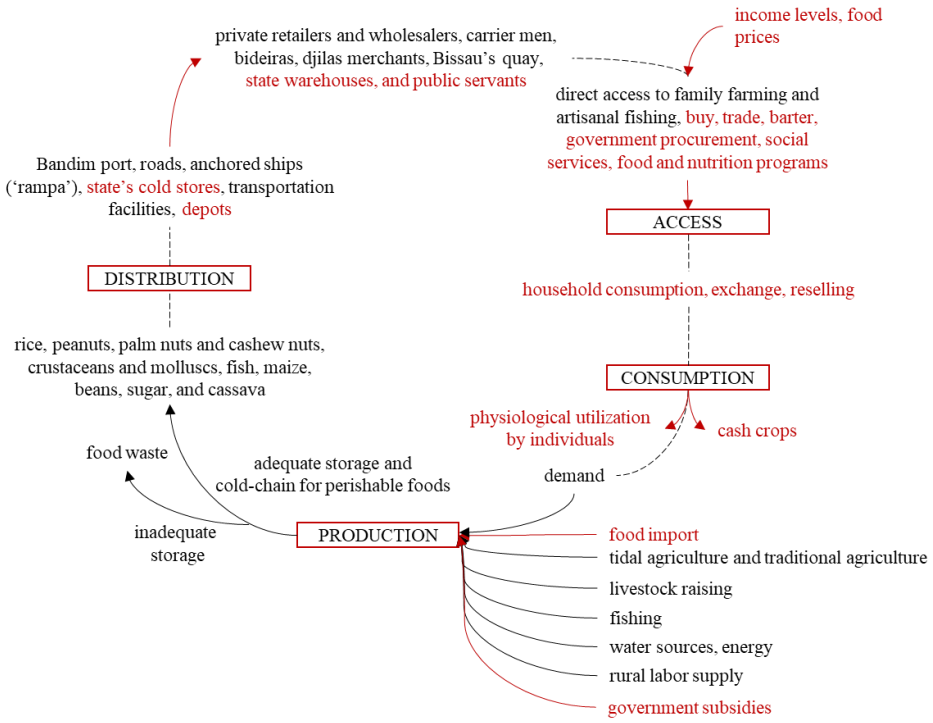

Figure 18. Food System Disruption: The Impact of the Guinea-Bissau Civil War. Note: Red color denotes disruption points along the food system nodes caused by armed conflicts. Source: Developed by the author.

Furthermore, fiscal insolvency of the state generated by the reduction of total cash crops exports in 1998 forced the government to both suspend national programs of social assistance, including food and nutrition programs (Sangreman 2016), and redirect part of civilian resources to warfare. For the Ministry of Agriculture and Rural Development, it implied a programmatic discontinuity at the policy level, accompanied by a preclusion of the planning and execution of a national agenda of food security, disproportionately affecting the rural population. Guinea-Bissau's chronic hunger increase in the aftermath of the Civil War was thus not a consequence of food production disruption, but rather an indirect consequence of institutional instability and its consequential income decrease restricting consumer's access to food products.

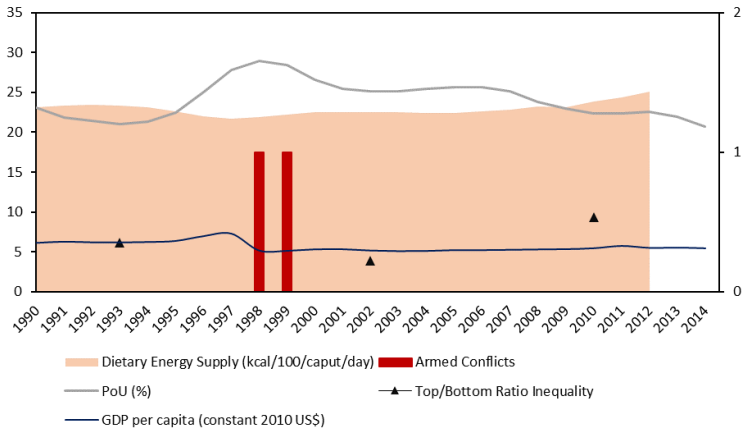

Figure 19. Armed conflicts and Chronic Hunger in the Republic of Guinea-Bissau: 1990-2015. Note: Dietary Energy Supply (kcal/100/caput/day), Prevalence of Undernourishment (PoU), per capita GDP (in constant 2010 US$/100), Top/Bottom Ratio Inequality (income share held by highest 10% divided by income share held by lowest 20%) displayed on the primary vertical axis. Original values of Dietary Energy Supply, and per capita GDP (in constant 2010 US$) were divided by 100 to fit on the common primary vertical axis. Armed Conflicts values displayed on the secondary vertical axis. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data and OECD National Accounts data files, and Uppsala Conflict Data Program.

Institutional instability remained an obstacle in the country even after the end of the Civil War. In fact, the first elected government that effectively ended its entire mandate only took place between 2014-2019 under the presidency of PAIGC's member José Mário Vaz. That means that between the political liberalization period in the 1990's until 2015 the strengthening of democracy would be a constant work in progress, with substantial democratic gains for Guinea-Bissau's institutions over time. Finally, it is plausible to infer that the abundant water resources across the country, relatively fertile lands, and the direct access to food through family farming and artisanal fisheries explain why although Guinea-Bissau remain one of the poorest countries in the world, with an average yearly per capita income of US$ 569,37 (figure 19) during the 1990-2015 period, chronic hunger levels never reached extreme rates as those observed in Djibouti.

The Issue of Gender in Guinea-Bissau: Between Leadership and Vulnerability

The first woman to occupy the presidency of a contemporary sub-Saharan African country was Carmen Pereira, a member of the PAIGC in Guinea-Bissau (Young 2005). However, her mandate only lasted 2 days between May 14th and May 16th in 1984, enough time to promulgate a new Constitution granting Nino Vieira the necessary legal tools to expand his time in presidency from 1980 to 1999. This historical episode illustrates that even when in positions of power, women had institutional restrictions to act only as auxiliary players. The contradiction of leadership and subjugation was also verified in other areas of social life during the period of 1990-2015.

In the realm of traditional and tidal agricultural production, women played a central role in the use of indigenous knowledge and technology to distinguish and select the most appropriate seeds to be planted according to each time of the year, helping to increase total crops outputs during the harvest time (Davidson 2015; Bolonha 2013). Nevertheless, based on gender unequal work roles,

their leadership within the agricultural knowledge economy also meant multiple work shifts (Urdang 1980). Notedly, in Guinea-Bissau women are responsible for household tasks, and also almost exclusively responsible for raising and taking care of children, many of whom are 'orphans of living fathers'. In that context, women that have not gave birth themselves are also socially responsible of raising the children, reason why it is a popular saying in the country that every woman is also a mother (Einarsdóttir 2004). Considering that women are underrepresented among the best qualified work positions, such as in the public sector, politics, or bigger private organizations, their multiple work shifts typically means high workloads with small wages (Mendes 2010). This overall characterization of the division of labor shows an unequal restriction to access food products in the market due to smaller incomes. Therefore, even if PoU data by gender is not available during the period, women are more likely than men to experience chronic hunger in the country.

Lastly, women face in varying degrees the burden of intersectional health problems. While clitoridectomy with 'flesh removed' (FGM type 1) prevalence reach nearly 50% of women in the country, in the Eastern regions of Bafatá and Gabú where Islamic religion is more present, 86.8% and 96.3% of women are respectively affected. These are much higher rates than those observed among women living in the Western regions of Bissau (<10%), Cacheu (16%), or Bolama (21.8%) (MICS 2014). As previously analyzed in the case of Djibouti, concomitant health burdens mean a more serious impact of PoU in the lives of women. In Guinea-Bissau it also varies geographically.

CONCLUSION

This section examined how the armed conflicts of 1998 and 1999 during the Guinea-Bissau Civil War caused an increase of chronic hunger levels in the country, leading to the highest prevalence rates observed during the 1990-2015 period. The analysis showed that the 1990's liberalization initiatives promoted by the government, both in the economic and political spheres,

generated an economic dissatisfaction that took the form of protests and strikes among the population, followed by an increased dissatisfaction among the military that, having previously fought for national independence, no more felt they were valued by the PAIGC ruling class.

In 1998, the military offensives against the government of Nino Vieira (PAIGC) took the form of armed conflicts. The coincidence of the onset of armed conflicts with the cashew campaign, which is the foundation of the national economic matrix, caused an economic standstill that reduced the national GDP by 28% due to commodity exports interruption. The ensuing consequences of the crisis were an immediate reduction of the national economic capacity to import food products combined with the decrease of income levels of farmers, most of whom produce cash crops for exports. Thereby, armed conflicts increased PoU levels in the country by both restricting food access through the reduction of income, and through the reduction of food availability caused by reduced food imports. Figure 20 synthesizes Guinea-Bissau's case, while highlighting the preponderant role of institutional stability, represented by democratization levels (Polity IV), on PoU variation.

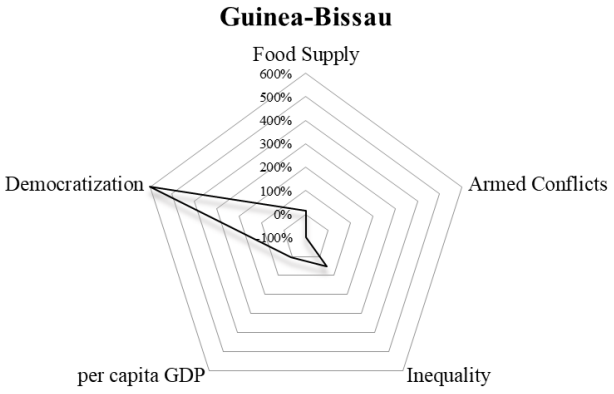

Figure 20. Key determinants of Chronic Hunger in the Republic of Guinea-Bissau. Note: percentage points stand for the variation of each factor between the observed highest and lowest PoU values between 1990 and 2015. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data, Polity IV, and Uppsala Conflict Data Program.

9. The Republic of Angola: From Civil Warfare to Civil Welfare

The highest populated country among the SNA case studies, Angola presented on the one hand one of the most dramatic human costs of hunger caused by armed conflicts in sub-Saharan Africa, and on the other hand also one of the best improvements on chronic hunger reduction for the 1990-2015 period. With a population size of approximately 11.9 million people in 1990, and a 63.5% prevalence of chronic hunger, approximately 7.5 million people (NoU) were chronically undernourished in Angola at the beginning of the 1990's. This is the equivalent of 7.6 times the entire population of Guinea-Bissau, or 12.7 times the entire population of Djibouti at the same year. By 2015, however, PoU levels had substantially decreased, reaching the rate of 14% of the total population in Angola, estimated to be approximately 27.8 million people by then. Thereby, despite a steady growth on population size, the total number of chronically undernourished (NoU) decreased from 7.5 million to 3.77 million people between 1990-2015 (figure 21).

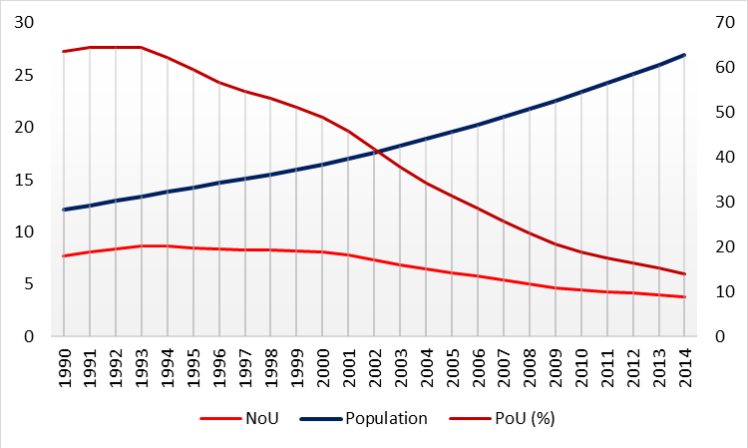

Figure 21. Demography and chronic hunger time-series: The Prevalence of Undernourishment (PoU), Absolute Number of Undernourished people (NoU), and Total Population in the Republic of Angola from 1990-2015. Note: NoU and Total Population values, in millions, displayed on the primary vertical axis. PoU (%) values displayed on the secondary vertical axis. Source: FAOSTAT.

The highest rates of PoU in Angola, during the 1990-2015 period, were concomitantly observed with the highest rates of armed conflicts. Notedly, between 1990 and the end of the Angolan Civil War in 2002, when PoU rates averaged 56.23%, 17 armed conflicts occurred in different regions of the country, while only 3 armed conflicts took place between 2003-2015, a period in which PoU averaged 23.63%. This section analyzes how the 1990-2002 armed conflicts, within the Angolan Civil War context, were linked to increased levels of chronic hunger in Angola.

Background: Anti-Colonial War, Commodities, and the formation of the FNLA, FLEC, MPLA, and UNITA

This section presents the background scenario from which Angola's armed conflicts during the 1990-2015 period originated and is followed by a political-historical examination of its armed conflicts dynamics. Subsequently the analysis of the national food system functioning, and its disruption led by armed conflicts is developed.

Together with Guinea-Bissau, Angola was one of the last countries in sub-Saharan Africa to become independent in 1975 due to the enduring Portuguese fascist colonialism which ended in the Carnation Revolution (Birmingham 2015). The contemporary Angolan history has been marked by one of the longest series of armed conflicts in sub-Saharan Africa, starting with the Anti-Colonial War during the period of 1961-1974, and followed by the long Civil War that took place between 1975-2002.

In March 15th of 1961, a generalized rebellion of Angolan peasants, who worked in Portuguese owned colonial farms, called 'senzalas', broke out against the Portuguese white settlers in the coffee rich province of Uige, claiming for fair work conditions and the end of Portuguese settler colonialism under the cries of 'Upa Upa Lumumba' (Furtado 2012). The attacks were

especially directed to coffee and cotton farms, and were quickly reclaimed by the anti-colonial leader Holden Roberto. Holden Roberto participated in the foundation of the Uniao dos Povos de Angola (UPA), in 1954, which became the first major consolidated movement of independence in Angola, successfully mobilizing in a persistent manner northern populations that worked in enslavement-like conditions to strike against the colonial order, strategically affecting the main colonial commodity markets that consisted in coffee and cotton production for exportation (Cilliers and Dietrich 2000). By that time, the government of Patrice Lumumba in Angola's neighboring Congo, independent since 1960, was a sanctuary of armed guerrillas training, providing both basic means for armed struggle and ideological instruction to the UPA. In the global context of the Cold War, Lumumbist movements were characterized by African nationalism, Pan-African solidarity, and political non-alignment in respect of global powers (Fuller 2014; Ohaegbulam 1969). In that sense, 'Upa Upa Lumumba' was the rebel onset cry for Angolan nationalism with Lumumbist characteristics that would define the UPA anti-colonial and post-independence agenda.

Shortly after the first attacks conducted in March 15th of 1961, further assaults were realized by anti-colonial groups led by the UPA, expanding the revolutionary march to the province of Bengo. In a strong response to peasant strikes, a counter-insurgent onslaught that included napalm bombing, and systematic torture, was commanded by the Portuguese colonial armed forces, with local support of colonial settlers, killing more than 1000 Angolans in less than a month (Beck 2012; Weigert 2011). The widespread colonial repression, however, and the growing reputation of the UPA among Angolans, instead of dissuading the peasantry of adhering to independentist movements, led to the expansion of anti-colonial groups acting in the Northern provinces of Angola. The alliance of the UPA with such movements consolidated the National Liberation Front of Angola (FNLA), which would remain one of the main political powers in post-independence Angola.

In addition to the forces of the FNLA, the communist revolutionary movement Movimento Popular de Libertação de Angola (MPLA) competed for peasants' support against the colonial rule, especially in the Northern provinces of Angola, including the oil-rich Cabinda exclave, and in the capital Luanda (Cilliers and Dietrich 2000). Its tactics and ideological agenda were thus different from the FNLA. Contrarily to the Lumumbist FNLA's orientation, the MPLA had a communist ideological orientation, aligned with the Soviet Union (USSR) program (Thaler 2012). Furthermore, instead of mainly attacking the countryside senzalas, where official colonial control was weaker, it played a major role in direct confrontations with the Portuguese central administration in Luanda (Pearce 2015; Andrade and Ollivier 1971). To the South of Angola, including the provinces of Huambo, Moxico, and Cuando Cubango, a third major anti-colonial movement, the National Union for the Total Independence of Angola (UNITA), led by Ovimbundu Jonas Savimbi organized regional assaults against the Portuguese (Beck 2012). Finally, in parallel to such movements that had the common goal of achieving Angola's independence, the Frente da Libertação do Enclave de Cabinda (FLEC) mobilized local uprisings in the Cabinda province against the Portuguese colonial rule, but with the distinct aim of achieving Cabinda's independence separated from Angola, through an independent secession process (Figueira 2018; Adelman 1975).

The main anti-colonial movements of Angola, therefore, were aligned in their interest for achieving independence from Portugal, but divided in other relevant political aspects as well as in their territorial coverage. Starting in 1961, the War for Independence that summed various anti-colonial movement efforts against the Portuguese empire, was in turn affected by a competing global order in the Cold War context. In effect, not only such movements had their own political agenda, they also represented distinct global actors disputing for political influence in the Third World (Birmingham 2015). As such, while the FNLA received financial and military support from the

United States government to achieve an American vision of the global order against the European colonial empires through independent states (Sá 2011), even if sustaining a rhetoric of non-alignment, the MPLA received support from the USSR to create an emancipated socialist state, and the UNITA received support from Maoist China without a clear political plan beyond achieving independence mainly due to the Cold War period marked by a Sino-Soviet split which divided the international communist political programs (Radchenko 2017).

Beyond the international support of global powers to each regionalized anti-colonial movement, the regionalization of insurgent actions was also determined by the local capacity of dominating specific commodity markets, which were the core of the colonial economic system. Notedly, while the FNLA led the insurgent peasantry in the coffee rich provinces, the MPLA dominated the rebellion actions in oil-rich regions, including in dispute with the FLEC in Cabinda, and UNITA used illegal diamond mining and trafficking to finance its operations in the South. Between 1961-1974, the concomitant insurgent acts in several regions of Angola, utilizing commodity markets and disturbing the central engine of the colonial economy, made the Portuguese government abdicate of its colonial intentions to continue in Angola due to a high and unpopular economic cost of maintaining the empire (Cilliers and Dietrich 2000). In this context of a weakened Portuguese colonial administration, the MPLA declared in 1974 the independence of Angola in Luanda. The end of the colonial period by 1975, and the presence of the MPLA in the capital of Luanda at the time, would profoundly impact the new political disputes and armed conflicts of post-independence Angola.

Angolan Civil War: MPLA, UNITA, and the Cabinda Exclave

With the end of the anti-colonial war in Angola, a new series of political disputes and armed conflicts broke out. If in the pre-independence era the various anti-colonial armed movements were

allied in their goal to achieve independence, despite divergent international support and ideological and political agenda differences, when Angola achieved independence the political incentives for alliances based on a common colonial opposition disappeared (Birmingham 2015). The Angolan Civil War started in 1975 in the form of these new political disputes for power, and lasted until the beginning of the 21st century.

The MPLA control of Luanda, following the 1974 declaration of independence, placed the movement led then by Agostinho Neto in a strategical position to take over the capital, and rule the biggest and richest urban center of Angola. As a transition to a new independent political order, the MPLA, and other major anti-colonial political movements such as the FNLA and UNITA were transformed in political parties (Weigert 2011). But in an asymmetric context of territorial control, the MPLA was able to secure the Angolan national government based in Luanda. Taking advantage of its leading position, the MPLA quickly implemented a one-party state political regime, in accordance with its soviet international communist standard (Thaler 2012), outlawing the FNLA and UNITA from the list of officially recognized political parties. For this reason, between 1975 and 1992, Angola had only 2 presidents, and 1 interim president between them, both from the MPLA. Notedly, after the decease of the revolutionary MPLA leader Agostinho Neto, his successor José Eduardo dos Santos would be the sole person to rule Angola from 1979 until 2017, first without multiparty elections, and then elected in a contested polling in 1992 (Pearce 2015).

The presence of the MPLA in Luanda, however, did not grant immediate sovereign control over the national territory in the aftermath of independence. In effect, the FNLA, UNITA, and the FLEC continued with their own decentralized agenda of political quarreling over other provinces of Angola. While the FLEC maintained its own secessionist agenda in the province of Cabinda, the FNLA and UNITA formed a coalition-movement to attack the MPLA's political hegemony in an

attempt of capturing the government, including an attempt to establish a parallel government in Huambo, the second biggest city of Angola, in 1976 (Sá 2011). Thereby, while the MPLA had already captured Cabinda by 1976, the newborn Civil War became a war for national territorial occupation (Weigert 2011). In the midst of this new order of disputes, international actors continued to intervene with resources, armed personnel, and weaponry within the Cold War scenario (Sá 2011). While the MPLA government appropriated former Portuguese military resources left in the country, such as motorized vehicles, horses, weaponry and munitions, helicopters and war tanks, it also received strategic training, financial aid, Kalashnikovs and mines from the soviets, and direct support of armed Cuban forces to protect the new established government and Angola's territorial integrity (George 2005). The opposition, led by UNITA, accused the government of promoting a 'Cuban colonialism' after a long period of Portuguese colonialism (Weigert 2011). However, UNITA and its FNLA allied continued to receive both U.S. and Chinese support, in clear contestation of the soviet presence in Angola, besides receiving new foreign support from apartheid South Africa, which by that time was a colonial power occupying Angola's south neighboring South West Africa (today Namibia) (Sá 2011). If on the one hand, therefore, global powers influenced local political agendas, on the other hand each Angolan movement also explored the rivalries of Cold War players in their favor.

The result of the combination of local enduring disputes, with international warfare support in the Angolan territory, led to a rapid conflict escalation. The strategic territorial guerrilla operations led by the armed opposition against the MPLA also took advantage of the commodity markets in its control. Notedly, UNITA in alliance with the South African apartheid regime was able to organize a large-scale diamond smuggling industry mainly based across the southern provinces of Angola, which helped financing a sizeable and well-armed guerrilla fighting force of

40,000 rebels (Cilliers and Christian 2000). In contrast to the previously analyzed case of Djibouti, in which a rather low technological component characterized its armed conflicts' dynamics, Angola's armed groups were very heavy armed, and disposed of large commodity-driven financial resources (Cilliers and Christian 2000). The size of the opposition armed groups against the MPLA government, and the modern technological component of their weaponry, made Angola's Civil War one of the most brutal fratricide conflicts of the 20th century (Beck 2012). In effect, by the beginning of the 21st century Angola accumulated the sad record of the highest concentration rate of amputees in the world (Young 2005b) as a historical sequel of these enduring conflicts.

By the end of the 1980's, with a decaying USSR leading to a financial support depletion of the MPLA from the soviets, and facing a generalized loss, the players involved in the Angolan Civil War reached an international agreement in 1988 that consisted in the first systematic institutional attempt to end the Civil War. The agreement received the name of 'Tripartite Agreement', and pledged the withdrawal of foreign troops from Angola, notedly from Cuban and South African troops, as well as Namibia's independence (UN 1988). With the independence of Namibia from South Africa in 1990, followed by the dissolution of the USSR in 1991 and the consequent end of the Cold War, the Angolan Civil War entered in its final phase in the 1990's.

The Namibian independence forced the apartheid South African regime to retreat its troops from Angola's south borders, restraining South Africa's support to UNITA's actions in Angola's southern provinces, especially in Cuando Cubango (Weigert 2011). In this context, the first multiparty general elections were organized in Angola in 1992, allowing UNITA's, represented by Jonas Savimbi, and FNLA's, represented by Holden Roberto, participation against the ruling MPLA party, represented by the president in office José Eduardo dos Santos. In the first round of the ballots, José Eduardo dos Santos received 49.57% of the votes, followed by Jonas Savimbi with 40.07%

(AED 2012). The results of the first round should then be followed by a second ballot, to finally determine if José Eduardo dos Santos or Jonas Savimbi would be the first president of Angola elected in a multiparty election. The second turn never happened, however, because Savimbi contested the results of the first round and decided to resume UNITA's armed struggle against the government (Birmingham 2015). Such decision led the United States, a long-term international supporter of UNITA, to cut financial and in-kind contributions from UNITA, grounded in the recently adopted Tripartite Agreement. Furthermore, with the end of the apartheid regime in South Africa in 1994, UNITA also lost South African regional help, fragilizing UNITA's actions against the MPLA (Sá 2011). In a new attempt to end Angola's Civil War, the presidents of South Africa, Nelson Mandela, and Zimbabwe, Robert Mugabe, promoted a disarmament protocol that prohibited UNITA's foreign acquisition of weapons, besides promoting a demobilization of armed guerrillas in Angola. The official meeting that took place in 1994 in Zambia's capital, Lusaka, gave the name of Lusaka Protocol to the agreement, and reached some success leading to a reduction of armed conflicts in the years of 1996 and 1997.

Nevertheless, UNITA's control of the diamond smuggling industry enabled UNITA to keep financing its armed confrontations against the government even without American or South African support. In addition, the parallel front against Angola's central government in Cabinda, led by both the Frente da Libertação do Enclave de Cabinda-Renovada (FLEC-R) and its stronger corresponding organization Frente da Libertação do Enclave de Cabinda-Forças Armadas de Cabinda (FLEC-FAC), made it costlier to the government to suppress UNITA's armed actions across the country. Only in 2002, when the MPLA captured and killed UNITA's leader, Jonas Savimbi, the movement disintegrated, ending the long period of Civil War led by UNITA against the MPLA.

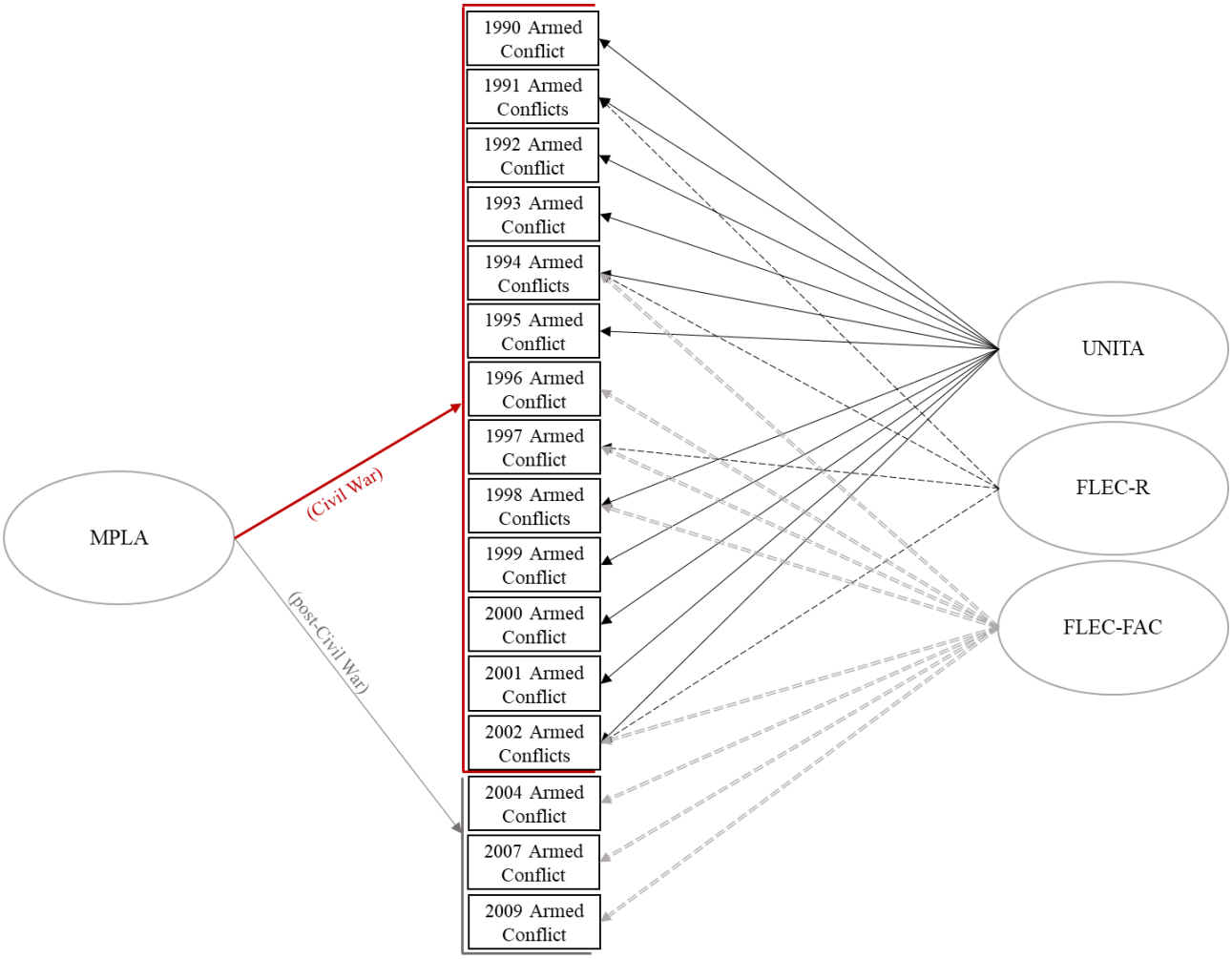

Figure 22. Web of Armed Conflicts between 1990-2015 in Angola. Source: Developed by the author.

The end of the Angolan Civil War in 2002 explains why while 17 armed conflicts occurred between 1990-2002, the period of highest rates of chronic hunger in the country, only 3 took place in the post-Civil War period between 2003-2014, led by the FLEC-FAC (figure 22). Furthermore, the last armed conflict in the 1990-2015 period in Angola happened in 2009 between the FLEC-FAC and the MPLA, due to a gradual enforcement of a Memorandum of Understanding on Peace and National Reconciliation in Cabinda province promoted by the government in partnership with the local Cabinda Forum for Dialogue which occurred in 2006 (Figueira 2018). With the end of UNITA's guerrillas in 2002, and a gradual pacification process with Cabinda's representatives since

2006, the MPLA would be able for the first time to organize a government in which sovereign warfare was not its main priority, potentially enabling the government to promote developmental improvements, economic stabilization plans, and civil welfare. Figure 23 illustrates the widespread territorial coverage of armed conflicts in the period. In the next section an analysis of the causal mechanisms that link Angola's armed conflicts to higher rates of PoU will be presented, accompanied by the empirical evidence of consistent PoU reduction during the 2003-2015 period in the country.

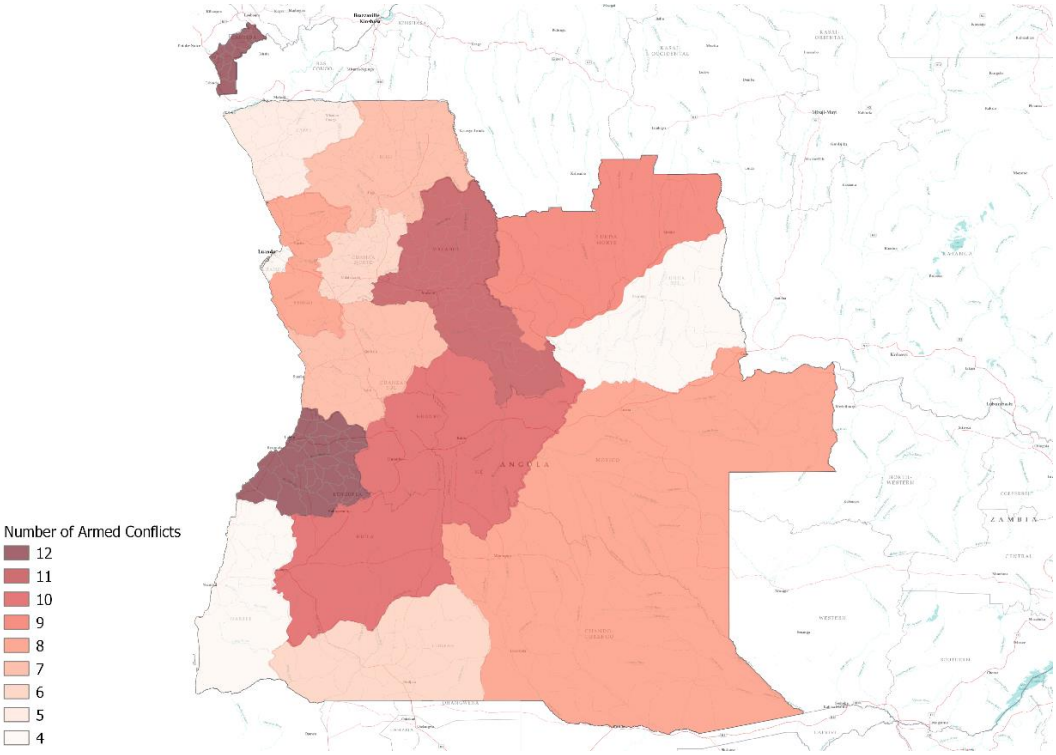

Figure 23. Map of Armed Conflicts in the Republic of Angola between 1990-2015. Source: Developed by the author with data from the Uppsala Conflict Data Program. Note: The attribution of color categories to each region is based on the cumulative number of armed conflicts occurred in the area (ESRI Reference Overlay).

Effects of Armed Conflicts on Chronic Hunger: The War Economy, Oil, and Food Import

This section analyzes how the 1990-2015 armed conflicts in Angola, predominantly during the end of the Angolan Civil War (1990-2002), led to the highest levels of chronic hunger rates observed during the period of 1990-2015 in the country. It first exposes the food chain that connects production, distribution, access, and consumption of food in Angola. And then it examines the channels through which armed conflicts disrupted the national food system, leading to increased chronic hunger prevalence rates.

According to the Observatory of Economic Complexity (OEC)[11], during the 1990-2015 period the main export products of Angola consisted of crude petroleum, and diamonds, making up more than 95% of total exports from the country during the entire period of 1990-2015. As such, the matrix of production output for exports shows the preponderant role of natural resource commodities in the national economy. The core economic activities consist of crude petroleum and gas extraction, mining of diamond, iron ore, phosphates, coal, timber, feldspar, bauxite, uranium, and gold. On the agricultural segment, the economy is based on fish processing, food processing, brewing, and production of tobacco, coffee, cotton, sisal, cassava, bananas, cereals, oil, sugar cane, corn, cotton, manioc, tobacco (Pinto 2008). The technological component of the agricultural sector is rather low, utilizing traditional small-scale production methods with hoes and catanas, with only a few farms resorting to animal traction (FAO Ang 2004). And although public farming was widely promoted by the national government as a national priority during the period, the lack of technical assistance and the scarcity of agricultural credits to support local farmers yielded low production

[11] The permanent online database of the MIT Observatory of Economic Complexity (OEC) can be accessed at: https://oec.world/en/profile/country/ago/.

otuputs (FAO Ang 2004). The national food system in Angola can thus be divided in complementary segments: subsistence agriculture, commodity markets, food imports, and public farming. Regarding the national food supply chain, Angola heavily relies on its oil and diamond exports to import food, especially rice, wheat, beans and corn, and other manufactured goods and machines used in the food system distribution chain (Pinto 2008).

The distribution chain of food products, from local production and foreign imports to final consumers, is supported by the seaports of Lobito, Luanda, and Moçâmedes, the railroads that connect the seaports to country food deposits and retailers, waterways and local roads. The distribution channels are operated by private Luanda importers, public markets, retailing markets, street sellers, Zungueiras, and public logistic centers of distribution (Pinto 2008). The access to food products is either market-based or the result of direct consumption of subsistence agriculture. While subsistence agriculture consisted of one of the main income sources, crucial to Angola's rural populations in a country with low rates of urbanization (FAO Ang 2004), a significant part of market-based consumption of food directly derived from income generated by activities of commodity extraction and commodity trading (figure 24).

The armed conflicts during the 1990-2002 period of the Angolan Civil war disrupted the production, distribution, and access to food products. For instance, through a warfare dynamic that consisted in widespread sabotage and use of strategic economic resources to destabilize the national MPLA government, UNITA's attacks targeted roads, railroads, bridges, agricultural outputs destruction, ambushes and heavy use of terrestrial mines (Furtado 2012), while the FLEC targeted oil production chains in Cabinda (Figueira 2018). The territorial factor of the armed conflicts can be observed by the highest cumulative number of conflicts in the central and southeast provinces of Angola, where UNITA's presence was stronger, and in Cabinda due to FLEC's activities (figure

23). By attacking the Malanje-Benguela corridor, and with its strong presence in the provinces of Moxico and Cuando-Cubango, UNITA destabilized the central artery of Angola's national channel of mining and food products distribution. Oscillating between highly planned attacks and spontaneous popular upheavals, UNITA's attacks either took the form of railroad assets hijacking of public goods, surprise attacks to MPLA troops, bridge explosions and plantation burning or road obstruction with trees and hand-maiden road holes (Furtado 2012). Since UNITA's and FLEC's armed group activities were locally financed by oil, agricultural commodities, and diamond markets, the main economic surplus of such activities were directed to warfare. In response, the national government needed to constantly finance its armed troops, diverting public funds from civil welfare to state warfare. The main consequences of the armed conflicts between 1990-2002 consisted in limiting food supply and consumption to subsistence levels, with very limited surpluses for commercial use or exports (FAO Ang 2004). The resulting infrastructural channels of national distribution for economic goods and food products also reached a systematic dismantling point that broke the connection nodes between rural and urban markets, while at the same time generated an illegal widespread practice of fees extortion by local armed groups (FAO Ang 2004). Furthermore, the destruction of infrastructure distribution channels impeded the government of accessing Angola's country areas to distribute public services such as road paving, sanitation, waste treatment, food assistance, education and human capital training, and overall transport services (FAO Ang 2004). The combination of such factors led to decreased levels of commercial activities and food access, while increasing the contamination risk of innocuous food outputs.

In a commodity export country like Angola, the financing of public services and goods, including programs of social assistance, depends on foreign trade stability and available income for civilians.

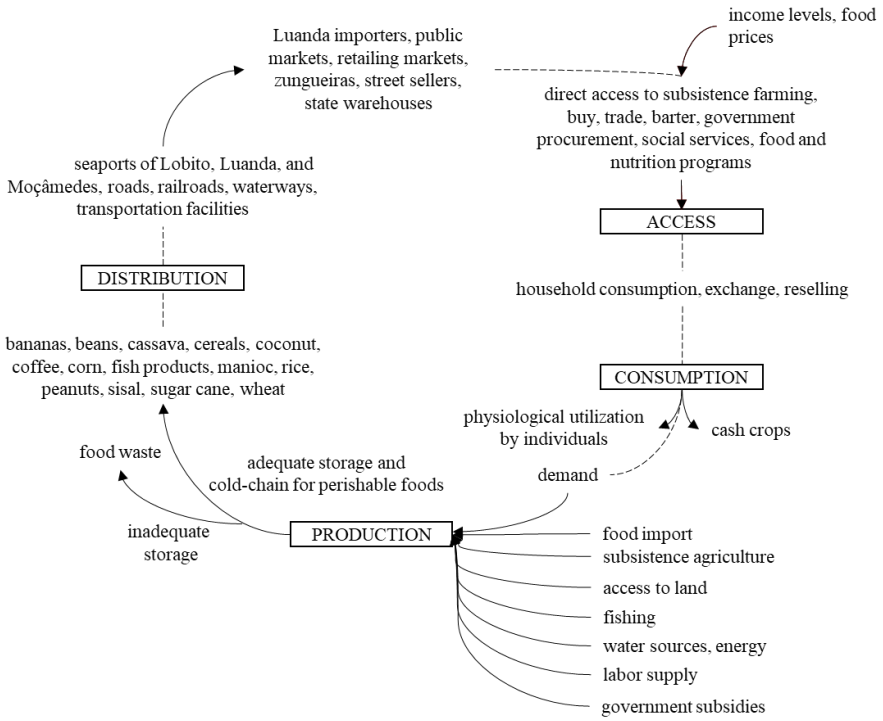

Figure 24. Food System Cycle: Republic of Angola (1990-2015). Source: Developed by the author.

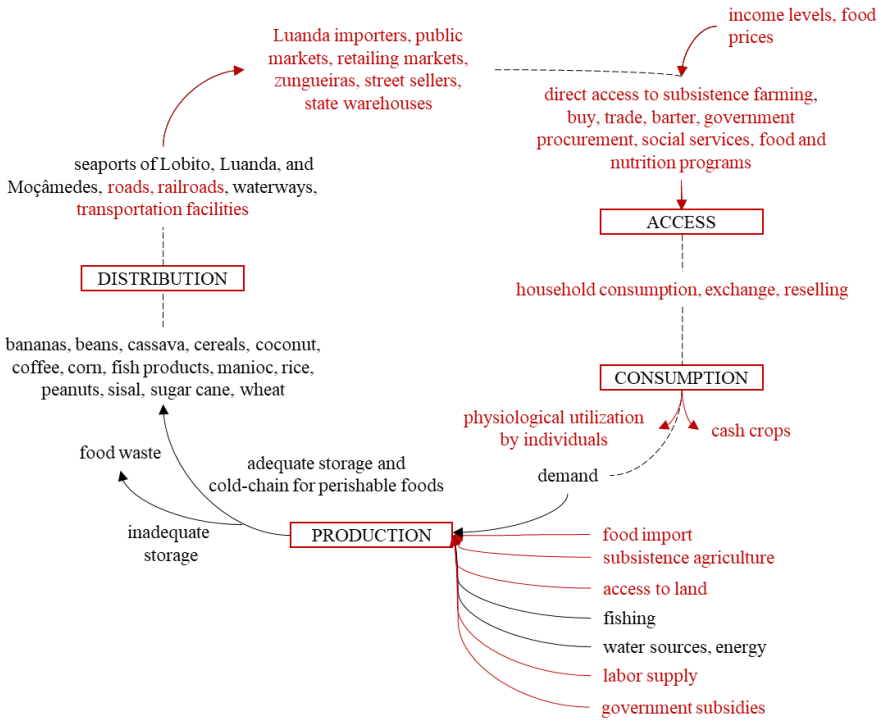

Figure 25. Food System Disruption: The Impact of the Angolan Civil War. Note: Red color denotes disruption points along the food system nodes caused by armed conflicts. Source: Developed by the author.

This explains why, if oil and diamonds must be converted in food to fill up the national stock of food supply, when commodity rents are diverted to warfare the total available dietary energy supply decreases (figure 26). Only with the end of Civil War, the economic gains of commodity-based markets started to be primarily allocated to civilian purposes. Post-civil war stabilization and peace thus enabled the economy to be better organized and more efficient in its productive and distributive capacities, as observed in the growing trends of dietary energy supply and household incomes measured as per capita GDP in the post-2002 period. Thus, despite facing three attacks by the FLEC-FAC in Cabinda, the government of Angola was able to maintain, between 2002-2015, the hard-won stability brought by the end of the Civil War. In that sense, the national government of Angola was able to make the transition from a long-term warfare state to a civilian-centered welfare state (Fleury 2013).

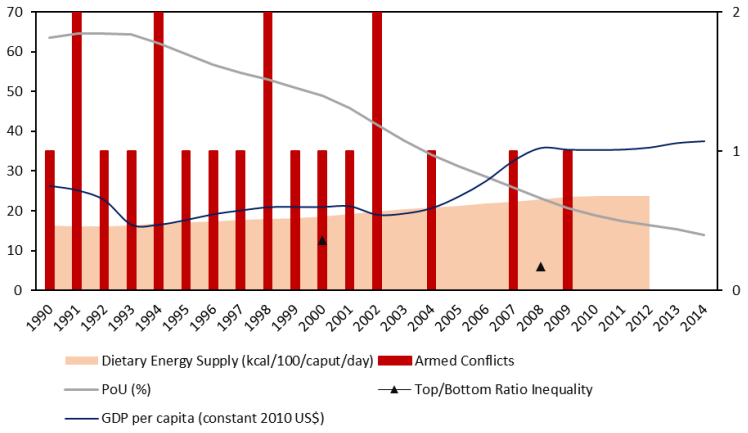

Figure 26. Armed conflicts and Chronic Hunger in the Republic of Angola: 1990-2015. Note: Dietary Energy Supply (kcal/100/caput/day), Prevalence of Undernourishment (PoU), per capita GDP (in constant 2010 US$/100), Top/Bottom Ratio Inequality (income share held by highest 10% divided by income share held by lowest 20%) displayed on the primary vertical axis. Original values of Dietary Energy Supply, and per capita GDP (in constant 2010 US$) were divided by 100 to fit on the common primary vertical axis. Armed Conflicts values displayed on the secondary vertical axis. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data and OECD National Accounts data files, and Uppsala Conflict Data Program.

The Issue of Gender in Angola: an unfinished Post-Civil War agenda

Due to its exceptionally long duration, the Angolan Civil War have intensified pre-existing structural conditions of gender disparity that can be observed during the 1990-2015 period. Although no data is available on PoU levels sorted by gender in Angola during the analyzed period, the cumulative daily challenges faced by women aggravated the consequences of chronic hunger for women. Some of the main issues that affect women health in Angola consist of high prevalence levels of HIV/AIDS, high infection incidence of Malaria, measles, and tuberculosis (Sapalo 2019), low coverage of sanitation infrastructure (FAO Ang 2004), restricted access to innocuous water for hygiene and consumption (Silva 2011), limited access to medicines, and labor discrimination reserving the lowest paid jobs for women (Sapalo 2018; Silva 2011).

It is crucial to consider that although men and women can be exposed to serious risks of infectious disease, the labor market organization in contemporary Angola tend to allocate women's tasks to household areas, where typically the sewage standing water is concentrated. Considering that sewage standing water is an environmental factor that facilitates disease spread and contamination, the combination of labor discrimination with such background public health problems makes women more vulnerable to contracting diseases. In that sense, and considering the bodily organic penury and reduced immunity caused by undernutrition, even in an hypothetical situation where men and women are equally affected by chronic hunger, the comorbidity driven by gender discrimination factors worsens the consequence of hunger for women.

Data on health access in Angola suggests that 80% of the population had no access, or severe restricted access, to medicines (FAO Ang 2004). This is partially a direct result of the widespread destruction of logistic and transport infrastructures caused by the dynamics of the Civil War armed conflicts, limiting physically the spatial mobility of people between rural and urban areas. Thereby,

the interaction of cumulative factors of vulnerability generates a situation where women are more exposed to infectious diseases, with physical restricted access to health services and medicines, with financial constraints to pay for healthcare-related services due to lower paid occupations, and more affected by the lack of adequate sanitation. These conditions exacerbate the hardship of being chronically undernourished for women in Angola. While Angolan women fought side-by-side with men to liberate the country from colonial rule, and subsequently fought for decades to end Civil War, the fight for their rights is not yet over.

CONCLUSION

This section analyzed how armed conflicts, especially in the context of the Angolan Civil War, affected the chronic hunger prevalence levels during the period of 1990-2015. Driven by several players directly involved with the Cold War ideological battles, Angola was the battleground for one of the most prolonged Civil Wars of the 20th century. The inner dynamics of the armed conflicts was influenced by the rich reserves of natural resources, especially of diamonds and oil, that served as an inexhaustible source of warfare funding for regional groups of opposition to the MPLA national government. While UNITA's opposition was stronger in the central and southeast provinces of Angola, rich in diamonds, the FLEC was a significant secessionist opposition group based in the oil-rich Cabinda province. The strategy of mobilizing armed attacks to overthrow the MPLA control of the government took the form of targeting roads, railroads, bridges, agricultural outputs, national troops, the heavy use of terrestrial mines (Furtado 2012), and the sabotage of oil production chains in Cabinda (Figueira 2018). The consequences of the armed conflicts consisted in a severe destruction of infrastructure distribution channels of the national food system, that impeded the central government of accessing Angola's country areas to provide public services and

goods, disconnected the rural food market from urban areas and food imports retailers, while also reducing the local productive capacity of food products. The increase of PoU levels was, therefore, driven by a decrease in food production, food availability, and food access, while also reducing household income due to civilian resources misallocation to warfare (figure 27).

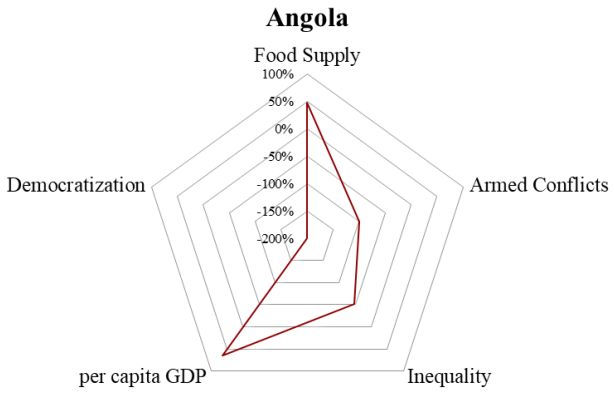

Figure 27. Key determinants of Chronic Hunger in the Republic of Angola. Note: percentage points stand for the variation of each factor between the observed highest and lowest PoU values between 1990 and 2015. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data, Polity IV, and Uppsala Conflict Data Program.

10. Cross-country pattern matching, and Classification of Determinants: Considering On-the-line Model-testing, Off-the-line Model-building, and Equifinality

After analyzing the inner dynamics of armed conflicts and how they affected chronic hunger among the on-the-line SNA countries studied, this section compares the cross-country features observed across the on-the-line cases studied, elucidating their commonalities and differences. In addition, the Republic of Mali will be analytically mobilized as an off-the-line case in which armed conflicts did not lead to higher chronic hunger levels in order to explore and generate new insights for future research and analytical model-building refinement.

According to Lieberman (2005), the exploration of analytical explanations of on-the-line SNA cases serve to test the empirical validity of the large-N explanatory model (section 4). Notedly, a model-test analysis is useful to verify the empirical soundness of the econometric model and hypotheses tests previously developed. A cross-country analysis based on the SNA on-the-line cases will thus be used to explicitly test the LNA results (table 5). Resuming the LNA findings, 6 hypotheses were tested:

Main hypothesis:

Armed Conflict Hypothesis (H1) *Armed conflicts are positively associated to higher levels of Prevalence of Undernourishment.*

Auxiliary hypotheses:

Democracy Hypothesis (H2) *Strong democracies are negatively associated to higher levels of Prevalence of Undernourishment.*

Economic Hypothesis (H3) *Higher income standards are negatively associated to higher levels of Prevalence of Undernourishment.*

Production Hypothesis (H4) *Food production is negatively associated to higher levels of Prevalence of Undernourishment.*

Economic Moderation Hypothesis (H5) *Income standards negatively moderates the impact of armed conflicts on Prevalence of Undernourishment.*

Production Moderation Hypothesis (H6) *Food production negatively moderates the impact of armed conflicts on Prevalence of Undernourishment.*

The panel results revealed that, across Sub-Saharan African countries during the 1990-2015 period, armed conflicts had a significant impact on chronic hunger levels, supporting the main hypothesis (H1). Additionally, the results found that democracy levels (H2) and household income (H3 and H5) were not statistically significant in their association with chronic hunger variation. Finally, the impact of food production on chronic hunger levels (H4) was found to be significant, as well as its impact on decreasing the damage caused by armed conflicts on chronic hunger increase (H6).

In comparison to the LNA findings, the SNA based on the on-the-line cases studied corroborate the LNA hypotheses tests, providing evidence of model-test validity. A radar chart summarizes the average correlation of the multidimensional aspects analyzed across the on-the-line case studies, and presents the off-the-line behavior of the same variables based on data from the Republic of Mali (figure 28). In the chart, it is possible to observe that none of the parameters across on-the-line cases are opposed to the LNA findings. Notedly, it is crucial to emphasize that armed conflicts have substantially decreased between the highest and lowest peaks of chronic hunger rates observed during the period.

Moreover, food supply has increased between the highest and lowest peaks of chronic hunger. The positive association observed between democratization and income (per capita GDP)

follows the hypotheses formulated in the LNA. The fact that such factors were considered to be not statistically significant in the panel results, while behaving in the expected theoretical form across the SNA, suggests only that across the on-the-line cases studied they were particularly relevant, even though such relevance is contextual and might not travel well to other countries of the studied population. Finally, an extra variable was used during the SNA, namely rates of inequality based on the computation of top/bottom ratio of income share held by the highest 10% in respect to income share held by the lowest 20%. The inequality variable was excluded from the LNA model due to data unavailability, and was only observed in a few years datapoints within the SNA. Nevertheless, inequality levels increased between the highest and lowest peaks of chronic hunger, both across on-the-line cases and the Mali Republic, which is also an expected result based on previous studies (McKay and Thorbecke 2017; Wodon 2007).

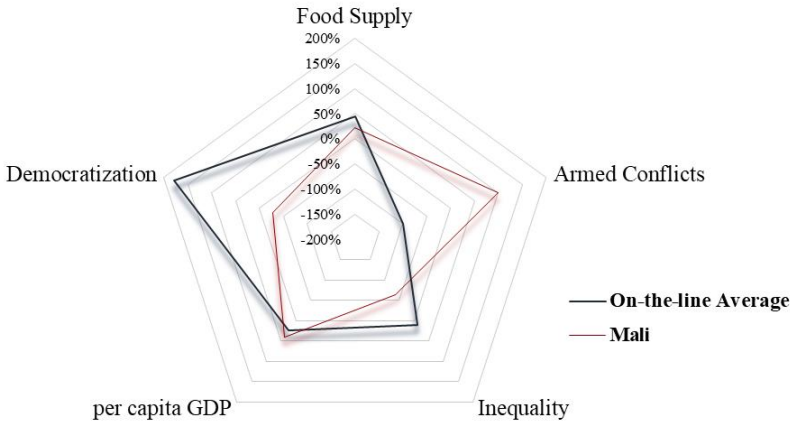

Figure 28. Key determinants of Chronic Hunger among on-the-line cases average and the Republic of Mali. Note: percentage points stand for the variation of each factor between the observed highest and lowest PoU values between 1990 and 2015. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data, Polity IV, and Uppsala Conflict Data Program.

After finding support for the LNA analytical model in the SNA results, it is necessary to highlight the within-case findings across the on-the-line cases. A comparison of those findings is aimed to explain which causal mechanisms linking armed conflicts to chronic hunger increase were common across on-the-line cases, and which mechanisms were singularly contextual and not observed in more than one country. By analyzing the SNA results in a cross-case comparison, potential elements that constitute the main causal mechanisms will thus be revealed. And the recognition of such mechanisms will be relevant original findings for policy making and government decisions, for it reveals which segments of the food system are typically more affected by armed conflicts, leading to observed chronic hunger increase, and which segments should thus be prioritized by governments and international organizations protection in order to reduce the impact of armed conflicts on the prevalence of undernourishment across Sub-Saharan African countries.

To begin the SNA cross-country comparison, a summary of key statistics of the countries studied is provided in table 8. A cross-country pattern matching is subsequently developed based on the detailed accounts and specific in-depth conditions of national data gathered and analyzed during each SNA on-the-line case study. Finally, the consideration of the off-the-line Malian case will contribute to advance with the refinement of the current explanatory model. In other words, it will explain how it is exceptionally possible that a country, in Sub-Saharan Africa, and during the same observed period (1990-2015), where armed conflicts took place did not face increased levels of chronic hunger as a consequence of the conflicts.

Table 8. Key Statistics of SNA Countries Studied

	Indicator	*Angola*	*Djibouti*	*Guinea-Bissau*	*Mali*
1990	Prevalence of Undernourishment (PoU) (%)[1]	63.50	74.80	23.10	16.70
2000		48.90	48.90	26.60	12.60
2014		14.00	15.90	20.70	2.50
1990	Population (Total, in millions)[2]	12.17	0.59	1.01	8.47
2000		16.44	0.72	1.24	10.97
2014		26.92	0.91	1.73	16.96
1990	Number of Undernourished (NoU) (in millions)[1]	7.73	0.44	0.23	1.41
2000		8.04	0.35	0.33	1.38
2014		3.77	0.15	0.36	0.42
1990-99	Number of Conflicts (total, per decade)[3]	13	5	2	2
2000-09		7	0	0	4
2010-14		0	0	0	5
1990-99	Number of Conflict related Casualties (total, per decade)[3]	21717	285	704	309
2000-09		6074	35	0	277
2010-14		0	0	0	1246
1990	GDP per capita (constant 2010 US$)[2]	2630.62	1561.00	614.46	481.25
2000		2100.57	1072.62	532.27	553.58
2014		3747.57	1508.29	545.90	705.79

(Table continues on the following page.)

	Indicator	*Angola*	*Djibouti*	*Guinea-Bissau*	*Mali*
1990	Food Production (in millions of US$, international price)[1]	59.99	123.49	87.66	83.53
2000		73.66	91.04	97.54	86.56
2014		129.89	118.59	112.17	118.51
1995	Main Product Imports[4]	Oil extraction machinery	Vegetable products	N/A	Refined Petroleum, Raw Sugar
2000		Excavation machinery	Vegetable products	Petroleum Oils, Rice	Refined Petroleum, Cement
2014		Industrial machinery	Palm Oil, Wheat	Petroleum Oils, Rice	Refined Petroleum, Cotton
1995	Main Product Exports[4]	Oil, Diamonds	Sheep and Goats, Refined Petroleum	Coconuts, Nuts, Cashews, Molluscs	Raw Cotton, Diamonds
2000		Oil, Diamonds	Salt, Refined Petroleum	Coconuts, Nuts, Cashews, Crude Petroleum	Gold, Raw Cotton
2014		Oil, Diamonds	Petroleum coke, Sheep and Goats	Coconuts, Nuts, Cashews	Gold, Raw Cotton
1990	Polity IV (Democracy level from -10 to 10)[5]	-7	-8	-8	-7
2000		-3	2	5	6
2014		-2	3	6	5
1990	Top/Bottom Ratio Inequality[2]*	N/A	5.13	6.14	8.78
2000		12.56	8	3.9	4.77
2014		5.98	6.96	9.33	3.21
1990	Territory (sq. Km, in millions)[2]	1.25	0.02	0.04	1.24
2000		1.25	0.02	0.04	1.24
2014		1.25	0.02	0.04	1.24

(Table continues on the following page.)

	Indicator	*Angola*	*Djibouti*	*Guinea-Bissau*	*Mali*
1990	Education (Primary completion rate, total (% of relevant age group)[6]*	29.20	28.52	6.53	9.49
2000		39.19	26.05	26.90	30.82
2014		46.18	58.94	65.14	53.06
1990	Children Mortality rate under-5 (per 1,000 live births)[7]	130.90	91.40	129.70	130.10
2000		122.90	79.40	105.20	115.50
2014		59.50	56.40	61.60	71.40
1990	Minimum Dietary Energy Requirement (kcal/caput/day)[1]	1660.0	1765.0	1738.0	1683.0
2000		1662.0	1820.0	1746.0	1685.0
2014		1670.0	1851.0	1761.0	1682.0
1990	Average Dietary Energy Requirement (kcal/caput/day)[1]	2059.0	2200.0	2163.0	2092.0
2000		2062.0	2288.0	2182.0	2096.0
2014		2073.0	2345.0	2207.0	2086.0
1990	Dietary Energy Supply (kcal/100/caput/day)[1]	1628.0	1541.0	2315.0	2375.0
2000		1850.0	2010.0	2255.0	2485.0
2014		2380.0	2645.0	2504.0	2844.0
1990	Average Dietary Energy Deficit (kcal/caput/day)[1]**	431.0	659.0	-152.0	-283.0
2000		212.0	278.0	-73.0	-389.0
2014		-307.0	-300.0	-297.0	-758.0

Source: Developed by the author. Data from: [1]Food and Agriculture Organization Statistics (FAOSTAT). [2]World Bank national accounts data, and OECD National Accounts data files. [3]Uppsala Conflict Data Program: Allansson, Marie, Erik Melander & Lotta Themnér (2017) "Organized violence, 1989-2016". *Journal of Peace Research* 54(4); Gleditsch, Nils Petter, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg, and Håvard Strand (2002) "Armed Conflict 1946-2001: A New Dataset". *Journal of Peace Research* 39(5). [4]MIT Atlas of Economic Complexity Database. [5]Polity IV Project on Political Regime Characteristics and Transitions (variable *Polity2*). [6]United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics. [7]Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA Population Division). Note: *Denotes data observation from the closest year available. **Negative values of dietary energy deficit accounts for dietary energy surplus.

Based on the observed features gathered and analyzed during each SNA on-the-line case study, the cross-country pattern matching suggests that among several determinant channels of each food system, linking armed conflicts to the increase of chronic hunger, some of them are common across the cases studied. Furthermore, in all stages of the food system segments - production, distribution, access, and consumption - common channels of disruption were affected by armed conflicts across on-the-line cases despite the specificities and historical context of each country's conflicts dynamics (tables 9 & 10). At the production level of food supply, armed conflicts affected both subsistence agriculture through the disruption of small farmers' activities, and the capacity of governments to fund local producers through the halting of government subsidies. At the distribution level, all countries had food depots obstructed and deranged by conflicts, turning it into unusable facilities of food storage for distribution and commercialization. Regarding food access, individuals faced restrictions mainly through the combination of decreased incomes, which reduced their purchasing power in respect of stable or increased food prices, and public funding diversion of government procurements, social services, and food and nutrition programs towards warfare.

With respect to consumption, all countries revealed a common picture that translated the consequences of the previous interconnected food system segments disruption. That is a decrease of household consumption of food products, and the reduction of available food products to exchange, resell, or utilize as cash crops. The depletion of food products consumption at the household level led to the long-term reduction of physiological utilization by individuals, the phenomenon of chronic hunger itself.

The parallel concomitances across all on-the-line cases potentially represent extremely urgent nodes to be protected in national food systems during armed conflicts. In effect, these general 'clinical symptoms' evince emergency areas for public and international institutions to act in the

protection of civilians with the aim of decreasing the deleterious impacts of conflicts on chronic hunger levels. The empirical evidence seems to suggest that contemporary African governments, and international aid organizations, should closely monitor such segmental nodes of the food system to reduce damage during armed conflicts. Moreover, such empirical evidence gathered from the 1990-2015 period should also be taken into consideration to improve international, regional, national or subnational initiatives within the sustainable goals agenda (SDGs) that aim to eradicate chronic hunger by 2030.

Table 9. Causal Mechanisms of the Countries Studied. Armed conflicts led to increased PoU levels by disrupting:

Feature	*Angola*	*Djibouti*	*Guinea-Bissau*
Production	food import, subsistence agriculture, access to land, labor supply, government subsidies	non-irrigated agriculture, topsoil conditions, nomadic pastoralism, water sources, energy supply, rural labor supply, government subsidies	food import, government subsidies
Distribution	roads, railroads, transportation facilities, Luanda importers, public markets, retailing markets, Zungueiras, street sellers, state warehouses	roads, nomadic routes, transportation facilities, depots, infrastructure, street markets, retailers, rural traders	state's cold stores, depots, state warehouses, public servants
Access	income levels, food prices, direct access to subsistence farming, purchasing power, trade, barter, government procurement, social services, food and nutrition programs	income levels, food prices, government procurement, social services, food and nutrition programs	income levels, food prices, purchasing power, trade, barter, government procurement, social services, food and nutrition programs
Consumption	household consumption, exchange, reselling, cash crops, physiological utilization by individuals	household consumption, exchange, reselling, cash crops, physiological utilization by individuals	household consumption, exchange, reselling, cash crops, physiological utilization by individuals

Source: Developed by the author. In-depth data gathered through SNA case studies.

Table 10. Cross-Country Causal Mechanisms Comparison: Classification of Determinants

Feature	*Angola*	*Djibouti*	*Guinea-Bissau*
Production			
Food import	✓		✓
Subsistence Agriculture**	✓	✓	✓
Access to land	✓		
Labor supply	✓	✓	
Government subsidies**	✓	✓	✓
Topsoil conditions		✓	
Nomadic pastoralism		✓	
Water sources		✓	
Energy supply		✓	
Distribution			
Roads	✓	✓	
Railroads	✓		
Nomadic routes		✓	
Transportation facilities	✓	✓	
Private food importers	✓		
Public markets	✓		✓
Retailing markets	✓	✓	
Street sellers	✓	✓	
State warehouses	✓		✓
Food depots**	✓	✓	✓
Rural traders	✓	✓	
Access			
Income**	✓	✓	✓
Food price**	✓	✓	✓
Subsistence farming	✓		
Purchasing power	✓		✓
Trade	✓		✓
Barter	✓		✓
Government procurement**	✓	✓	✓
Social services**	✓	✓	✓
Food and nutrition programs**	✓	✓	✓
Consumption			
Household consumption**	✓	✓	✓
Exchange**	✓	✓	✓
Reselling**	✓	✓	✓
Cash crops**	✓	✓	✓
Physiological utilization**	✓	✓	✓

Note: **Denotes observed feature across all cases.

In contrast to the on-the-line cases represented by Angola, Djibouti, and Guinea-Bissau, the Republic of Mali exception generates further insights on the causal mechanisms operating behind the association of armed conflicts with chronic hunger increase. The Malian exceptionality, however, is not explained by an extraordinary diverse context and background compared to the on-the-line cases. On the contrary, as observed in table 8 and figure 29, many of the key statistics describing Mali's demographic, economic, social and political variations between 1990-2015 follows the same trends of the on-the-line African countries studied.

Why, then, the Republic of Mali presented no increase of chronic hunger levels during its period of highest numbers of armed conflicts observed during the 1990-2015 period? The answer lies (i) on the specific dynamics of the armed conflicts observed between 2007-2014, accounting for 9 out of the 11 conflicts observed during the entire analyzed period, when chronic hunger levels averaged 3.33% (figure 31), (ii) on the territorial factor that characterizes the demographic distribution of the Malian population across the national territory, and (iii) the relationship between the national economic matrix and the spatial distribution of natural resources in the country.

The armed conflicts in Mali, during the entire 1990-2015 period, occurred in the historically disputed territories of the East, Northeast, and Northern regions (figure 30). More specifically, in the regions of Taoudenit, Kidal, Menaka, Gao, Tombouctou, Mopti, and Segou. The Tuareg's secessionist movement, organized under the Coordination des Mouvements de l'Azawad (CMA) or Mouvement National de Libération de l'Azawad (MNLA), claims the independence of the Azawad region that encompasses the Taoudenit, Kidal, Menaka, Gao, and Tomouctou regions of Mali (Middleton 2015; Galy et al. 2013). The other regions affected by armed conflicts, namely Mopti and Segou, are neighboring regions of the Azawad claimed-territory. The conflict dynamics driven by the Tuareg secessionist claim over the Azawad region, and its confrontation strategy grounded

on local territorial disputes, circumscribed the CMA actions to the least populated regions of Mali, where only 10% of the national population is estimated to inhabit. Given that the remaining 90% of the population inhabit the Southern regions closer to Bamako, the conflict inner dynamics implied that the vast majority of the Malian population was not directly affected by the conflicts.

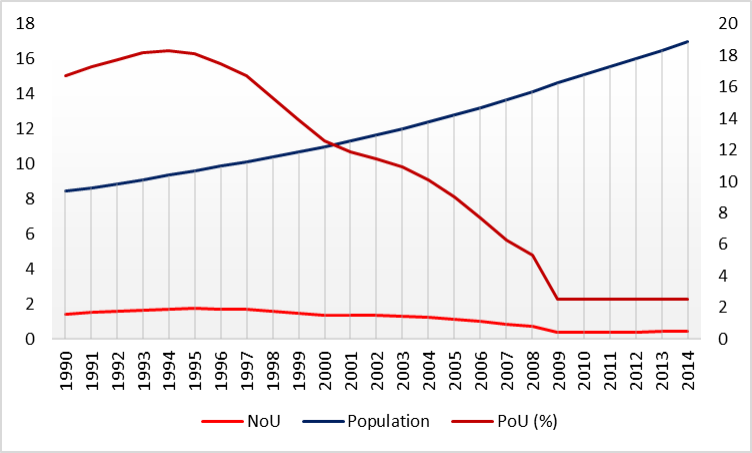

Figure 29. Demography and chronic hunger time-series: The Prevalence of Undernourishment (PoU), Absolute Number of Undernourished people (NoU), and Total Population in the Republic of Mali from 1990-2015. Note: NoU and Total Population values, in millions, displayed on the primary vertical axis. PoU (%) values displayed on the secondary vertical axis. Source: FAOSTAT.

Moreover, regional geopolitics in the Sahel and relevant international actors played an important role on how such conflicts unfolded in Mali. Among those actors, the United States and France were key allies to the national Malian government, and supported the preservation of *status quo* in the region (Giblin and Lacoste 2019). While France acted more directly in Mali's territory, as well as in the entire region of *Françafrique*, the United States was mainly present in the geopolitical disputes of the North Africa-Arabian Peninsula region. Notedly, since the 2001 September 11th attacks, United States military units were deployed to combat terrorist cells in Western Asia, commanding the long-term initiative of 'War on terror' in partnership with France, and the United Kingdom. The war on terror initially aimed to disrupt the al-Qaeda in the Arabian

Peninsula (AQAP) terrorist organization. However, the transnational dimension of terrorism led the AQAP to influence terrorist groups across the Sahel.

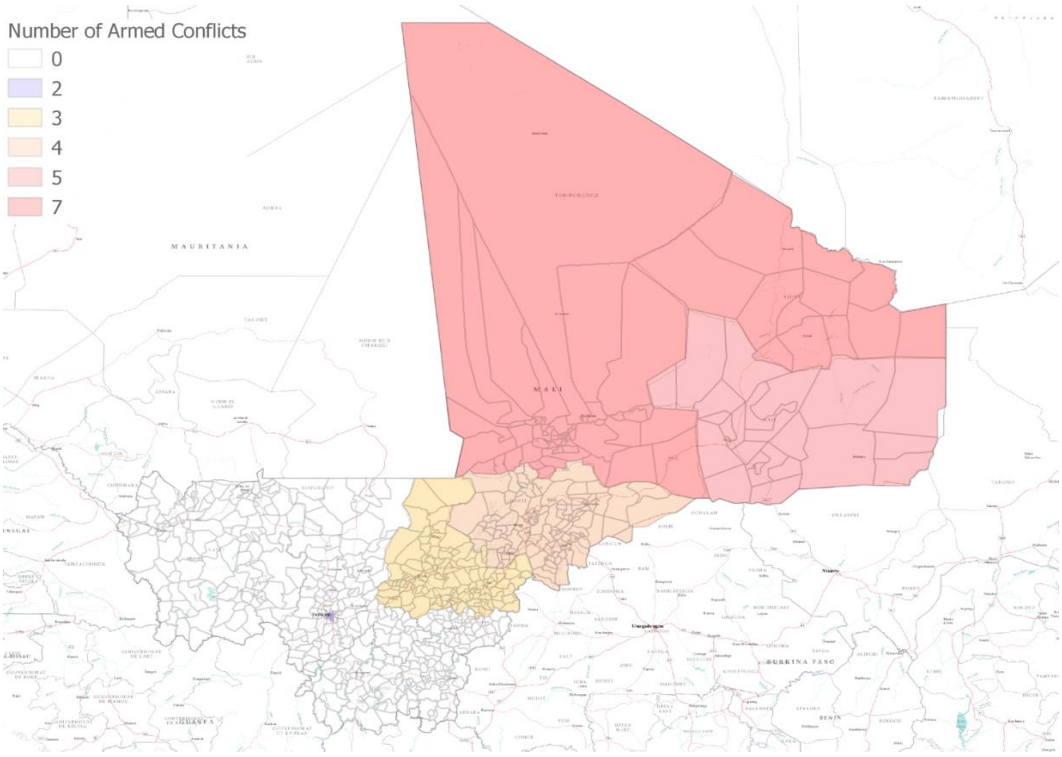

Figure 30. Map of Armed Conflicts in the Republic of Mali between 1990-2015. Source: Developed by the author with data from the Uppsala Conflict Data Program. Note: The attribution of color categories to each region is based on the cumulative number of armed conflicts occurred in the area (ESRI Reference Overlay).

Although most members of the AQAP circumscribe their actions to Yemen's national territory, international wings of terrorist cells spread out to North Africa originating the al-Qaeda in the Islamic Maghreb (AQIM) in 2007, the same year of Mali's first observed armed conflict during the 2000-2015 period. This international dimension of conflicts in the Sahel is crucial to understand the great effort made by Mali's official historical allies to secure political stability in the region. It was in that context that France intervened in January 2013 in Mali to confront the jihadists in Mopti (Giblin and Lacoste 2019; Galy 2013). Thereby, it must be taken into account that differently from the armed conflicts observed in Djibouti, Guinea-Bissau, and Angola, the consequences of armed

conflicts in Mali were of great interest to Western military powers, who intervened to limit almost immediately the disruptive effects or armed conflicts. It is thus plausible that Mali's exceptionality regarding armed conflicts' effects on local PoU is partially due to foreign interventions explicitly aimed at supporting the country in the face of armed conflicts.

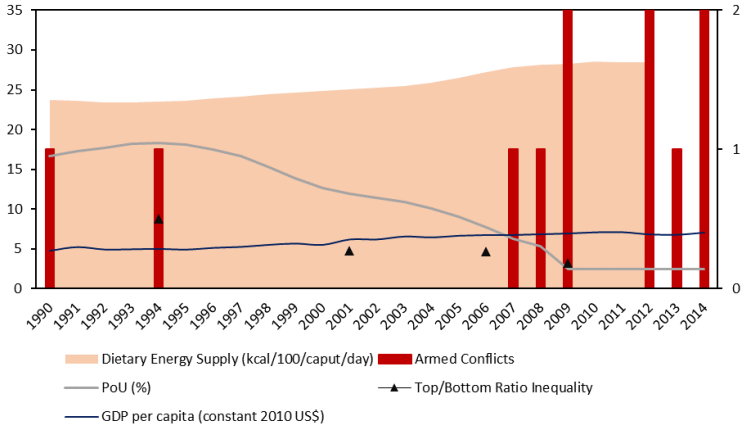

Figure 31. Armed conflicts and Chronic Hunger in the Republic of Mali: 1990-2015. Note: Dietary Energy Supply (kcal/100/caput/day), Prevalence of Undernourishment (PoU), per capita GDP (in constant 2010 US$/100), Top/Bottom Ratio Inequality (income share held by highest 10% divided by income share held by lowest 20%) displayed on the primary vertical axis. Original values of Dietary Energy Supply, and per capita GDP (in constant 2010 US$) were divided by 100 to fit on the common primary vertical axis. Armed Conflicts values displayed on the secondary vertical axis. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data and OECD National Accounts data files, and Uppsala Conflict Data Program.

Furthermore, despite being a region with potentially abundant natural resources such as on-shore oil reserves, the Azawad region is not an actively economic territory explored by the government of Mali (Grégoire et al. 2019; Boukari-Yabara 2014). It means that its economic relevance for Mali's economic matrix and national food system is secondary and marginal, and any disruption of its activities has no significant impact on the overall functioning of the national economy and food system functioning. As such, the remoteness of most of the conflicts in regions

scarcely populated, and economically secondary, did not present elevated risks to Mali's central government or Malian civilians.

The exceptionality of Mali, therefore, demonstrates on the one hand that armed conflicts have lower chances of increasing chronic hunger levels when circumscribed territorially to marginal regions of the country, while on the other hand it also suggests that whenever possible governments and security forces should intent to territorially isolate conflicts, as well as their access to main economic regional channels or local food systems. Compared to its on-the-line counterpart cases, Mali's empirical data reveals a positive association of armed conflicts and chronic hunger decrease, (figure 32). This can only be explained by the fact that, while Mali's undernourishment prevalence levels was decreasing due to independent reasons not-connected to armed conflicts, armed conflicts took place without striking core segments of the national food system. In terms of model building and analytical model refinement for further research, the Malian experience suggests that factors related to demographic territorial concentration, and food system territorialities should be explored.

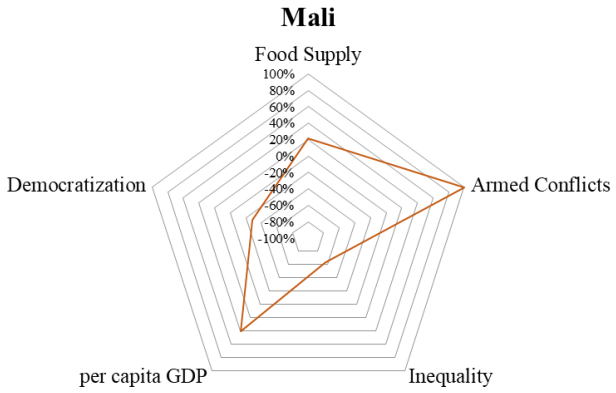

Figure 32. Key determinants of Chronic Hunger in the Republic of Mali. Note: percentage points stand for the variation of each factor between the observed highest and lowest PoU values between 1990 and 2015. Source: Developed by the author with data from FAOSTAT, World Bank national accounts data, Polity IV, and Uppsala Conflict Data Program.

EQUIFINALITY – THE REPUBLIC OF ZAMBIA

The Republic of Zambia has a negative historical record of being constantly listed in the top countries with worst food security conditions in the world (OPHI 2020). As previously specified, this research aimed to analyze the impact of armed conflicts on chronic hunger, not explore extensively the general causes of chronic hunger. That is, it has not argued that armed conflicts are the sole determinant of PoU in contemporary Sub-Saharan Africa. However, considering equifinality is an interesting analytical opportunity to explore some concurrent causal mechanisms that lead to increased levels of PoU, shedding light on why some countries might face themselves with the populational health burden of chronic hunger even without armed conflicts.

Chronic hunger in Zambia has been linked, in the literature, to the socioeconomic conditions generated by a historical scenario of generalized poverty based on British colonization, its mining colonial economy, and low levels of educational training among rural populations to deal with the poor local soil conditions. While traditional communities used to live in an economy characterized by the subsistence cultivation of cereal grains, domestication of sheep and goats, hunter and gathering, and even partially in mining derived activities, the British administration ingeniously started to dominate modern Zambia's territory with chartered companies (Nave 2005b). With this strategy, Cecil Rhode's British South Africa Company (BSAC) took possession of the Zambezi region to explore its mineral deposits by the end of the 19th century, and quickly instituted the so-called hut taxes that suddenly forced indigenous people to work at the mines in order to receive a small salary to pay the taxes. Between the 19th and 20th centuries, in less than 50 years, the British colonial administration instituted a forced labor economy that dramatically altered the social landscape of Zambia's living conditions. At the same time, the mining industry would become the central pillar of the Zambian economy, remaining so until the present.

Some interesting historical contradictions derived from this large-scale economic transformation. As Nave points out, while the mining industry served to impoverish the Zambian population during the colonial era, it has also enabled a certain economic resilience in the post-independence period (2005). In political terms, the first independent Zambian government led by Kenneth Kaunda between the declaration of independence in 1964 until 1989 enjoyed an extraordinary scenario of economic autonomy based on the exports' surpluses of copper. If compared to the economic scenario of Guinea-Bissau after independence, for example, the post-independence Zambian government had the economic means to finance the necessary programs to improve the overall living conditions of its people. In that sense, the composition of exports based on minerals, especially copper, payed off better in Zambia's newly formed independent government than cashew exports in Guinea-Bissau.

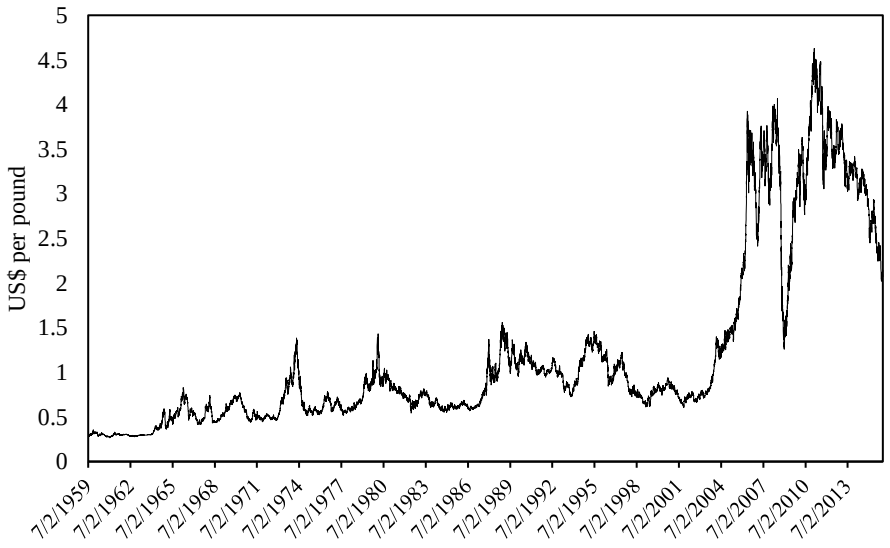

Figure 33. Historical series of international copper prices (in US$ per pound). Source: Macrotrends.

The reliance on solely one main export primary product, however, has also brought political and economic instability to the country. As figure 33 illustrates, although copper prices have valued

over the last several decades, its variation from one year to another has not been even. The combination of the unpredictable variation of copper prices with an economy reliant on food import to supply most of the national demand for food consumption caused occasional shocks of food shortage. In addition, even though copper exports compose the biggest part of Zambia's national GDP, an estimated >80% of the Zambian population are employed in subsistence agriculture cultivating maize, sorghum, rice, peanuts, sunflower seeds, tobacco, cotton, sugarcane, cassava, livestock, and poultry, while also relying on food imports to be fed (Nave 2005). The direct consequence of this economic institutional arrangement is that the highest salaries associated to the mining industry are available to the smaller fraction of the national workforce. The spatial distribution of chronic hunger in the Zambian territory reflects this reality. In a recent study (OPHI 2020), it was demonstrated that the region with the second lowest prevalence of undernourishment is the Copperbelt region, only behind Lusaka, Zambia's capital which concentrates most of the administrative functions and public jobs with more stable incomes. The PoU series for the 1990-2015 period in Zambia reveals that this has been an enduring situation during the whole period (figure 34).

Considering this socioeconomic background, authors have highlighted the lack of food distribution channels such as road networks to connect consumers to food supply, limited maize supply due to constraining soil conditions and low productivity outputs, the high costs of transporting food products across national regions, and the unstable source of welfare financing based on copper's variation export surplus based on international prices (Nayak 2020). Furthermore, the professional qualification of rural laborers is still rudimentary, and good practices are not well communicated to most of the rural workforce, especially to women who not only work in agriculture

but are traditionally entrusted with the responsibility of taking care, and feeding the children (Musenge et al. 2019).

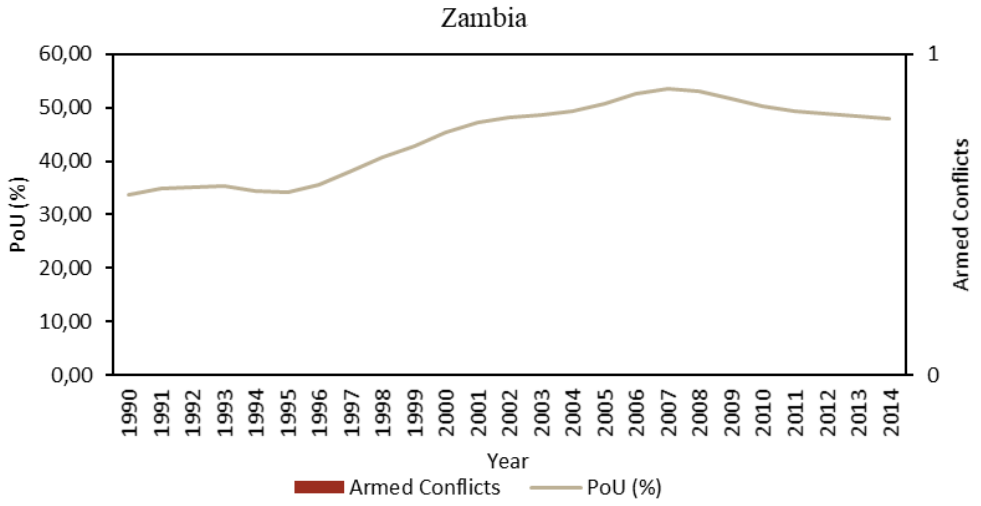

Figure 34. Armed conflicts and Chronic Hunger in the Republic of Zambia: 1990-2015. Note: Prevalence of Undernourishment (PoU) displayed on the primary vertical axis. Armed Conflicts values displayed on the secondary vertical axis. Source: Developed by the author with data from FAOSTAT, and Uppsala Conflict Data Program.

As a consequence of this historical dysfunctional economic arrangement, Zambia's lack of economic diversification in its production matrix suggests that the natural resource curse is continuing the work of the colonial administration curse. Therefore, it is relevant to consider that even though Zambia did not face armed conflicts during the 1990-2015 period, several of the common challenges faced by post-independent African economies such as Guinea-Bissau and Angola, seem to be an alternative causal mechanism to generate sustained elevated levels of chronic hunger. Policy implications to generate hunger eradication strategies in Sub-Saharan Africa should thus take into consideration the economic characteristics of low-complex economies in order to realistically build long-term development programs that rely on stable sources of financing.

11. Conclusion: Armed Conflicts and Chronic Hunger in Contemporary Sub-Saharan Africa

At the turn of the millennium, an estimated 904.872 million people suffered from chronic undernourishment across the world. In Sub-Saharan Africa, 183.610 million Africans were living under this dire condition. The global adoption of the Millennium Development Goals (MDGs) in the year 2000 sparked some hope that the international development agenda would set chronic hunger eradication as its top priority. Indeed, the 1st goal of the MDG established the global commitment to halve the prevalence of undernourishment across all countries until 2015, setting as a comparative baseline hunger levels observed in 1990. Although many countries were able to achieve this goal, many others did not have the same success, occasionally reaching worse levels in 2015 than those previously observed in 1990. Sub-Saharan African countries were no exception, seeing some countries in the region achieving extremely positive results while others achieved extremely high levels of chronic undernourishment during the period. Among many obstacles faced by African countries to eradicate hunger, a long term challenge related to the historically recent decolonization processes appeared to be of crucial importance for many of them: the presence of armed conflicts between national governments and groups that defy the authority or legitimacy of such governments. This doctoral dissertation aimed to analyze the impact of armed conflicts on the prevalence of undernourishment across Sub-Saharan African countries during the 1990-2015 MDG period.

Based on a nested analysis as a mixed-method strategy for comparative research (Lieberman 2005), longitudinal data followed by in-depth case studies were mobilized as an empirical comparative research strategy for the causal analysis of the impact of armed conflicts on chronic hunger prevalence across 39 sub-Saharan African countries during the MDG period. Panel data models' estimations were used as large-N analyses (LNA) to test hypotheses on the regular effects

of armed conflicts on chronic hunger, and results supported the hypothesis that armed conflicts are associated with the increase of chronic hunger in the region. Subsequently, small-N analyses (SNA) based on the case studies of the Republic of Djibouti, Republic of Guinea-Bissau, Republic of Angola, and the Republic of Mali were used to explore and trace the causal mechanisms through which armed conflicts affect the prevalence of chronic hunger in the contemporary Sub-Saharan African region.

MAIN ARGUMENT

This dissertation has argued that armed conflicts increase chronic hunger prevalence across Sub-Saharan African countries, adding a long-term perspective to the existing literature that analyzes the impact of armed conflicts in famines. Production, distribution, access, and consumption constitute the four structural segments of national food systems, and all are affected in different ways by armed conflicts.

Across Sub-Saharan African countries affected by armed conflicts during the 1990-2015 period, all on-the-line SNA countries studied (Angola, Djibouti, Guinea-Bissau) presented crucial commonalities in terms of causal mechanisms that link armed conflicts to chronic hunger increase. At the production level of food supply, armed conflicts affected both subsistence agriculture through the disruption of small farmers' activities, and the capacity of governments to fund local producers through the halting of government subsidies. At the distribution level, all countries had food depots obstructed and deranged by conflicts, turning it into unusable facilities of food storage for distribution and commercialization. Regarding food access, individuals faced restrictions mainly through the combination of decreased incomes, which reduced their purchasing power in respect of

stable or increased food prices, and public funding diversion of government procurements, social services, and food and nutrition programs towards warfare. With respect to consumption, all countries revealed a common picture that translated the consequences of the previous interconnected food system segments disruption. That is a decrease of household consumption of food products, and the reduction of available food products to exchange, resell, or utilize as cash crops. The depletion of food products consumption at the household level led to the long-term reduction of physiological utilization by individuals, the phenomenon of chronic hunger itself.

Although data on observed prevalence of undernourishment levels is not available by gender for the MDG period, there are empirical evidence that gender matters. The impossibility of comparing the distribution of undernourishment among men and women does not make it impossible to evaluate the different consequences of chronic hunger in the lives of men and women. In that sense, empirical evidence demonstrate that women face cumulative burdens in Sub-Saharan African countries, and that the combination of such pre-existing burdens with the health effects caused by being chronically undernourished make women more vulnerable to multidimensional deprivations, aggravating the consequences hunger when compared to their male counterparts.

CONTRIBUTION

Understanding the impact of armed conflicts on chronic hunger from a comprehensive comparative perspective across sub-Saharan African nations will help governments, stakeholders and specialized agencies to utilize evidence on how to prevent hunger, decrease the impact of armed conflicts on chronic hunger, combat extreme poverty, and promote sustainable development in the region.

By engaging in the discussion raised by previous LNA, case studies and technical monitoring reports, related to acute famines and chronic hunger crises, this research developed an original contribution in the field of comparative politics, development administration and international political economy, in the form of a comprehensive comparative picture of the effects of armed conflicts on chronic hunger trends in sub-Saharan Africa.

Panel results with robust specifications demonstrated that income and democracy levels had no systematic significant impact to explain chronic hunger variation across Sub-Saharan African countries during the MDG period. On the other hand, food production was found to be crucial both to decrease chronic hunger levels and to diminish the impact of armed conflicts on the increase of chronic hunger. Such findings suggest that to protect civilians from chronic hunger in Sub-Saharan Africa it will take more than an income-centered approach to development, and more than formal democratic institutional building, potentially involving more proactive public actions in the form of social services, and various forms of social assistance programs. Furthermore, by highlighting potential segments of the food system chain which stakeholders should focus their actions to decrease the impact of armed conflicts on the risk of increasing chronic hunger this research generates a practical contribution to the field of public administration.

With the analyses of the effects of armed conflicts in chronic hunger trends this research intended to advance the comprehension of the role of armed conflicts in chronic hunger prevalence variation in contemporary sub-Saharan Africa. It contributed to highlight and understand the mechanisms behind how armed conflicts were obstacles in the way to eradicate chronic hunger in the period of the Millennium Development Goals agenda (1990-2015), across contemporary sub-Saharan Africa. This contribution can be of paramount importance during the current move toward

the implementation of the Sustainable Development Agenda (SDG), which replaces the MDGs with a new agenda of combatting global hunger for the 2015-2030 period.

IMPLICATIONS FOR SUB-SAHARAN AFRICAN COUNTRIES AND FURTHER RESEARCH

Governments, regional organizations, and corporate leaders of Sub-Saharan Africa must unite to promote an agenda of institutional stabilization and political representativeness that eliminates or diminish the risks of generating new armed conflicts in the region. In addition, it is necessary to establish a wide social contract with the aim of promoting shared prosperity that takes the form of material public policies of welfare. As demonstrated in this research, warfare tends to divert funds from civilian-targeted public welfare initiatives. By the same token, the lack of welfare initiatives tend to aggravate the consequences of armed conflicts, including the impact on chronic hunger increase. This is especially true to countries with post-colonial economic matrices that were planned and formed in accordance to past colonial economic matrices: they strongly rely on governments and public action to alleviate hunger and poverty since their market institutions and private initiatives, turned to primary economic sectors, are not immune to several fluctuations risks, making civilians extremely vulnerable to market disruptions.

Stakeholders should closely monitor the risk of eventual combinations of impoverishment of certain populations with armed conflicts, for it increases the risk of utilizing non-conventional methods of warfare, including food and water terrorism in food scarce regions. The good news is that stakeholders can be crucial even in times of economic hardship through a better distribution of food access or food products, as demonstrated by the exemplary case of Djibouti. As such, countries

and regional organizations can play an important role in the advancement of the SDG agenda despite the existence of many obstacles to achieve it.

POLICY IMPLICATIONS

The policy implications can be summarized as follows:

- ✓ National, sub-national, and regional organizations must promote institutional stability through the strengthening of political representativeness to decrease the risk of new armed conflicts;
- ✓ Promote nation-wide social contracts, with the aim of promoting shared prosperity, should take the form of material public policies of welfare, including measures such as in-kind food provision, income distribution, productive assets such as credit and land entitlement, among others;
- ✓ Prioritize civilian welfare spending over long-term military spending;
- ✓ Diversify production as a strategy to diversify risks, actively promoting national programs of economic diversification to reduce economic dependency from global markets and protect consumers from volatile international prices;
- ✓ Establish country-focused long-term development agendas, gathering support from various political actors towards the achievement of common goals;
- ✓ Promote gender-based public policies to empower women leadership in businesses, civil society, and political groups as a general development acceleration strategy.

FURTHER STUDIES

Further studies could explore both the role of each common feature highlighted in the cross-country comparison pertaining to the food system segments that connect armed conflicts to chronic hunger levels, and the territorial factors found in Mali's outlier behavior. Moreover, future publications should develop an original typology of cases following the different causal mechanisms at play among on-the-line cases.

Finally, collecting and providing gender sensitive measurement data at the national and subnational levels on chronic hunger and overall food security conditions will be essential to the development and adoption of the adequate measures required to eradicate hunger in Sub-Saharan Africa until 2030. Countries should therefore invest in and promote transparent and independent local statistical offices. Data is the first step for policy makers to get acquainted with the real living conditions of the people, and a necessary condition to build effective development policies.

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Datasets:

- African Elections Database (AED)
- Center for Systemic Peace, Polity IV Scale
- Food and Agriculture Organization Statistics (FAOSTAT, 2017)
- Ibrahim Index of African Governance
- International Labour Organization, Labour Market database
- International Monetary Fund, International Financial Statistics and data files, and Balance of Payments databases
- MIT Atlas of Economic Complexity Database
- OECD National Accounts data files
- Uppsala Conflict Data Program
- World Bank Database
- UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA Population Division)
- UNICEF Childinfo
- United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics
- UNCTAD Statistics

Appendix 1. Literature Review Summary.

Authors	Dependent Variable	Explanatory Variable	Year
Langan, Mark.	Poverty	International constraints	2017
McKay, Andy. Thorbecke, Erik.	Poverty Reduction, Economic Growth	Democratic accountability, End of debt crisis, Technology, New public and private leaders, Social protection, Institutions, Inequality	2017
Nissanke, Machiko. Ndulo, Muna.	Poverty Reduction	Structural reforms	2017
Osberg, Lars.	Tanzania's development	Industrialization	2017
Rodrik, Dani.	Global Inequality, National Inequality	Labor market barriers	2017
Rodrik, Dani.	Economic growth	Structural change	2016
Estache, Antonio. Wodon, Quentin.	Poverty	Infrastructure	2014
McMillan, Margaret. Rodrik, Dani. Verduzco-Gallo, Íñigo.	Growth	Structural change	2014
Stein, Alexander J.	Malnutrition, Undernourishment	Biofortification programs	2014
Coffey, Diane. Deaton, Angus. Drèze, Jean. Spears, Dean. Tarozzi, Alessandro.	Stunting among Indian children	Disease Environment, Hunger	2013
Verwinp, Philip. Muñoz-Mora, Juan Carlos.	Food Security, Nutrition	Civil War	2013
Frankel, Jeffrey A.	Economic Development	Natural Resources	2012
Rodrik, Dani.	Economic Growth	Policies	2012
Sharma, Jayeeta.	Food Markets	Global Food Corporations, European and American Empires of the past	2012
Abdulai, Awudu. Kuhlgatz, Christian.	Food Security	Health Care, Sanitation, and Water Access, Transportation and Communication Infrastructure, Financial Sector in Rural and Peri-Urban Regions, Public Investment in the Agricultural Sector, Public Safety Nets for Food Access, Agricultural Market Liberalization, State Engagement in Storage and Trade, Price and Trade Regulation Policies	2011
Coyne, Christopher J. Mathers, Rachel L.	Political regimes, Democracy, Autocracy	Inter-state War, Civil War, Post-War occupation	2011
Andreasson, Stefan.	Development	Development strategies	2010
Bonds, Matthew H. Keenan, Donald C. Rohani, Pejman. Sachs, Jeffrey D.	Health, Income	Income, Health	2010

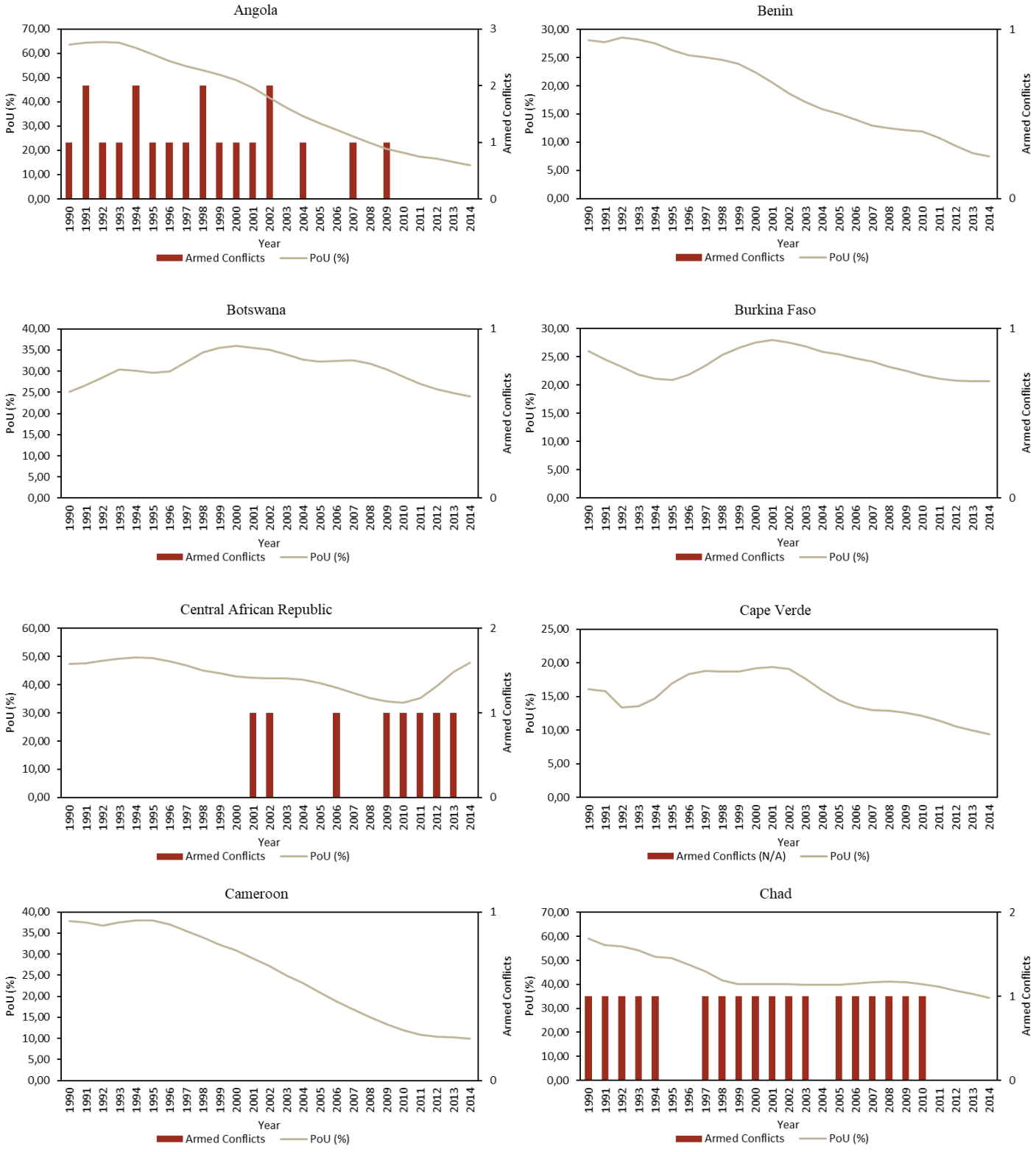
Avendaño, Rolando. Reisen, Helmut. Santiso, Javier.	Institutional stability	Commodity Booms	2008
Crawford, Gordon. Hartmann, Christof.	Poverty reduction	Democratic decentralization, Incomplete decentralization, Autocratic decentralization	2008
Flint, Adrian.	Africa's poverty alleviation	Cotonou Agreement, European aid	2008
Hausmann, Ricardo. Rodrik, Dani. Sabel, Charles F.	Industrial Policy Implementation	Industrial Policy in the Small, Industrial Policy in the large	2008
Kempe Ronald Hope, Sr.	Social and Economic Development	Democratic Governance factors, Ibrahim Index factors, World Bank institutional factors	2008
Moreno-Dodson, Blanca. Wodon, Quentin.	Economic growth, Poverty reduction	Public spending, taxation, borrowing, debt sustainability	2008
Ndulu, Benno J. O'Connell, Stephen A. Bates, Robert H. Collier, Paul. Soludo, Chukwuma C.	Economic growth	Geography, Institutions, Democracy	2008
Rodrik, Dani.	Economic Development	Industrial Policy	2008
Christiaensen, Luc. Demery, Lionel.	Poverty Reduction	Agriculture	2007
Hausmann, Ricardo. Hwang, Jason. Rodrik, Dani.	Economic Growth	Income level of a country's export index, Production specialization (mix of goods that a country produces)	2007
Wodon, Quentin.	Well-being and Poverty	Economic growth, Inequality	2007
Case, Anne. Deaton, Angus.	Health	Wealth	2006
Conroy, Anne C. Blackie, Malcolm J. Whiteside, Alan. Malewezi, Justin C. Sachs, Jeffrey D.	Poverty, AIDS, Hunger in Malawi	National Policies, International aid, Debt	2006
Kalyvas, Stathis N.	Institutional stability, Social stability	Civil War	2006
Rodrik, Dani.	Economic Growth and Unemployment	Manufacturing sector, De-Industrialization	2006
Marysse, Stefaan. Reyntjens, Filip.	Development	Globalization, International intervention	2005
McCord, Gordon. Sachs, Jeffrey D. Woo, Wing Thye.	African poverty	International Institutions, Washington Consensus	2005
Banerjee, Abhijit. Deaton, Angus. Duflo, Esther.	Health	Delivery of Health Care	2004
Case, Anne. Deaton, Angus.	Self-reported health status (SRHS) over life	Sex, Age, Income, Role of work	2004
Einarsdóttir, Jónína.	Mother's love	Poverty, Child Mortality	2004
Nsouli, Saleh M.	NEPAD and MDG goals	Mutual support between African countries and International Funds	2004

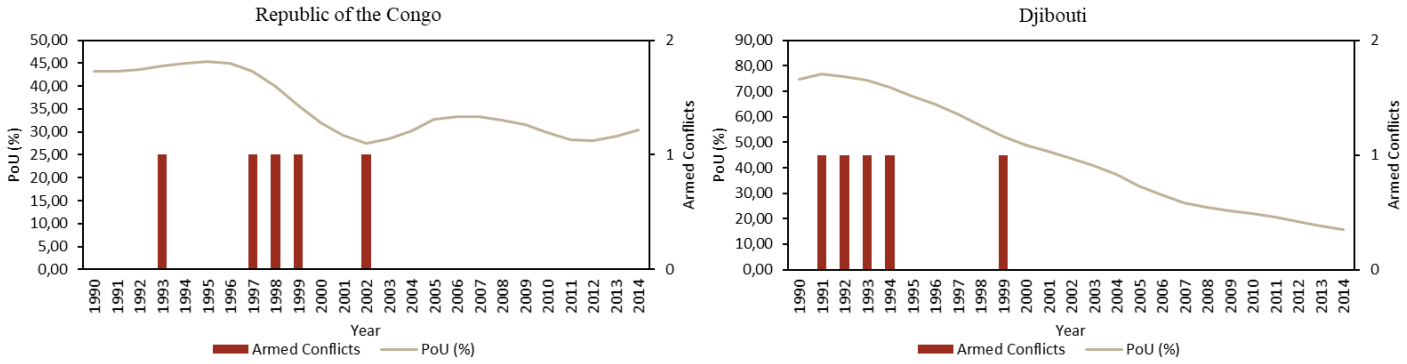
Sachs, Jeffrey D. McArthur, John W. Schmidt-Traub, Guido. Kruk, Margaret. Bahadur, Chandrika. Faye, Michael. McCord, Gordon.	Poverty trap	Economic growth, Governance	2004
Söderbaum, Fredrik.	Southern Africa Regionalism	Multidimensional Aspects	2004
Davidson, Ogunlade. Halsnæs, Kirsten. Huq, Saleemul. Kok, Marcel. Metz, Bert. Sokona, Youba. Verhagen, Jan.	Economic development, Social development	Climate change	2003
Deaton, Angus. Laroque, Guy.	Long-run behavior of the prices of primary commodity produced by poor countries	Unlimited supplies of labor	2003
Moss, Todd J.	Stock Markets consolidation	Political and Economic factors	2003
Alwang, Jeffrey. Mills, Bradford F. Taruvinga, Nelson.	Well-being decline	Returns on Assets, Investment in human and physical assets, Structural Reform	2002
Case, Anne. Deaton, Angus.	Differences between genders	Income, consumption, health, poverty, education	2002
Christiaensen, Luc. Demery, Lionel. Paternostro, Stefano.	Poverty	Growth, Distribution	2002
Dunn, Kevin. Shaw, Timothy.	Africa role in International Relations	History of IR	2001
Kanbur, Ravi.	Disagreements on economic policy and distribution	Assumptions on Aggregation, Time Horizon, Market Structure	2001
Oyejide, T. Ademola.	Sustainable Human Development (SHD)	Trade Policy, Economic Growth led by Trade Policy	1999
Sen, Amartya.	Well-being	Capability to function	1999
Bloom, David E. Sachs, Jeffrey D. Collier, Paul. Udry, Christopher.	Economic Growth	Geography, Demography, Public Health	1998
Deaton, Angus. Paxson, Christina H.	Self-reported health status (SRHS) that ranges from 1 (excellent) to 5 (poor)	Household income	1998
Kumar, Krishna.	Household Food Production, Institutional stability	Ethnic Conflicts, Civil War	1997
Sen, Amartya.	Inequality definition	Desert theory, Meritocracy, Marxist distribution, Neo-classical price-based	1997
World Bank	Poverty reduction in SSA	World Bank actions	1997
Sachs, Jeffrey D. Warner, Andrew M.	Economic growth	Natural Resources	1995

Davarajan, Shatayanan. Rodrik, Dani.	Benefits of fixed exchange rates	Costs	1991
Drèze, Jean. Sen, Amartya.	Chronic undernourishment, Famines	Institution building, legal reforms, asset redistribution, provisioning in kind, entitlements, endowment and exchange, extended entitlements, capability and living standards, cooperative conflicts, social security, epidemiological protection, health care, basic education, sanitation, free media, public action	1989
Browning, Martin. Deaton, Angus. Irish, Margareth.	Life-cycle household consumption behavior	Family labor supply and wages	1985
Sen, Amartya.	Poverty, Famines	Property regimes, Entitlements, Trade-based entitlements, Production-based entitlements, Own-labor entitlements, Inheritance entitlements	1981

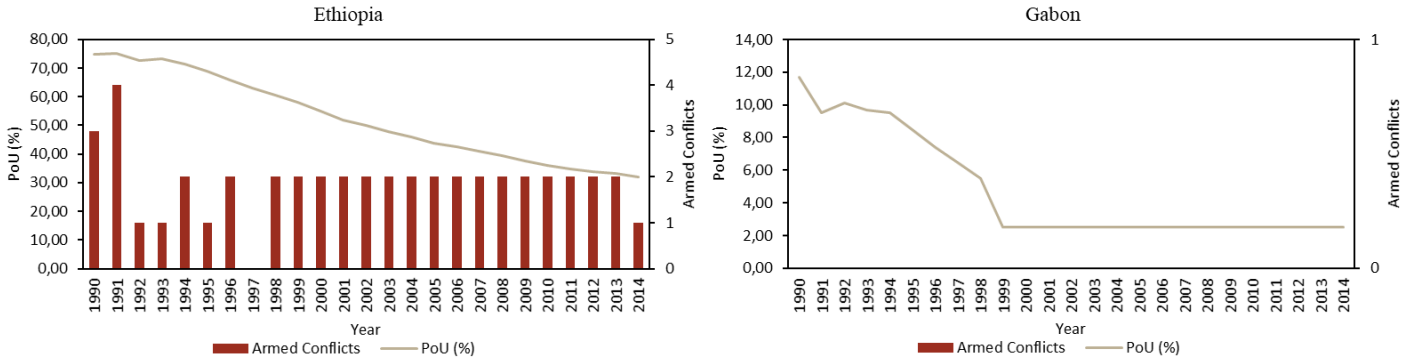
Source: Developed by the author.

Appendix 2. Charts of PoU (%) and Armed Conflicts variation across sub-Saharan African countries from 1990 to 2015, by country.

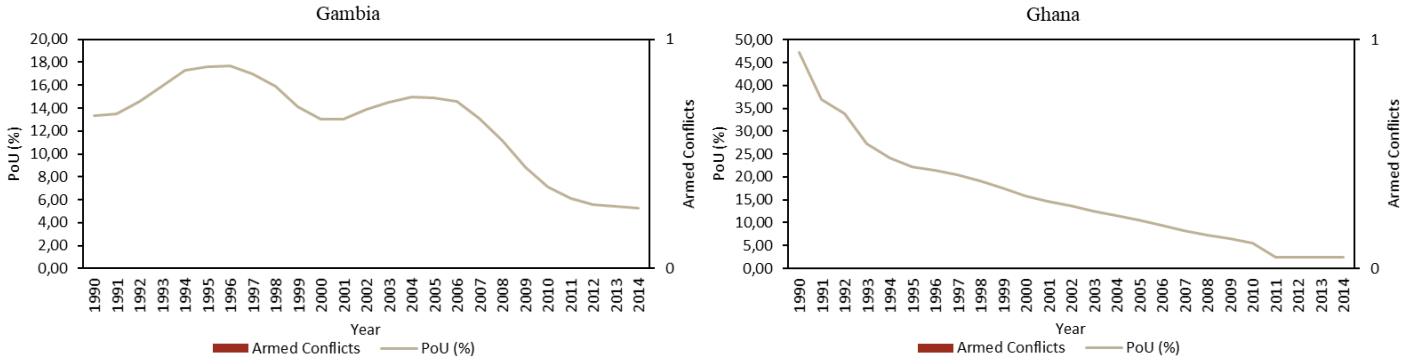



Republic of the Congo
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

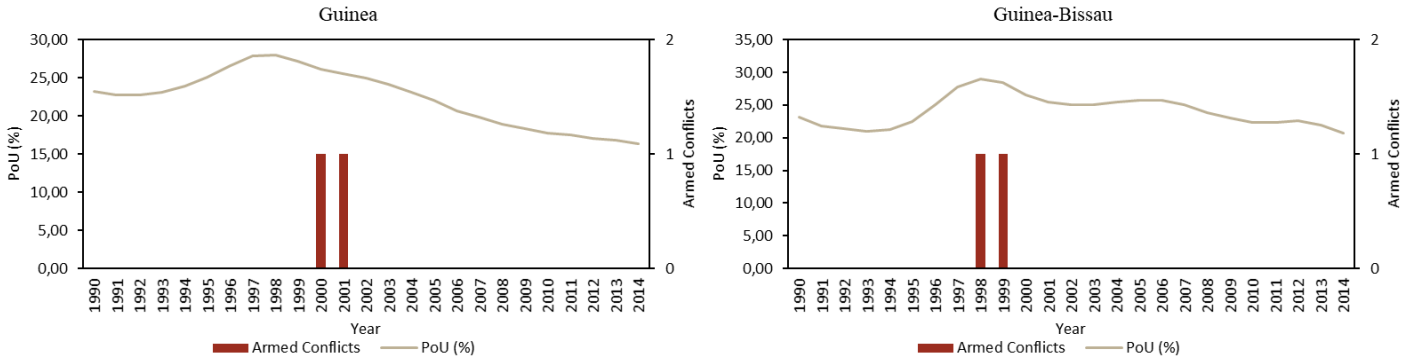
Djibouti
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


Ethiopia
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

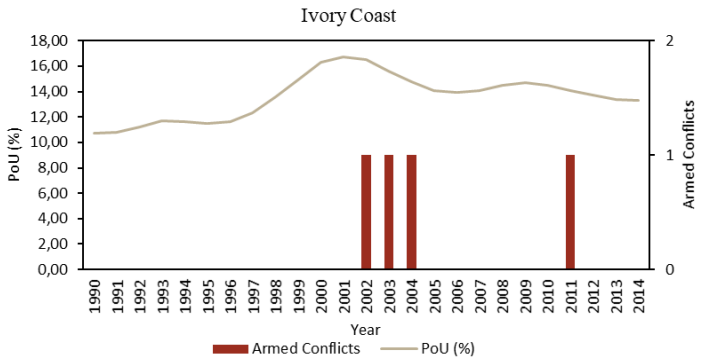
Gabon
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

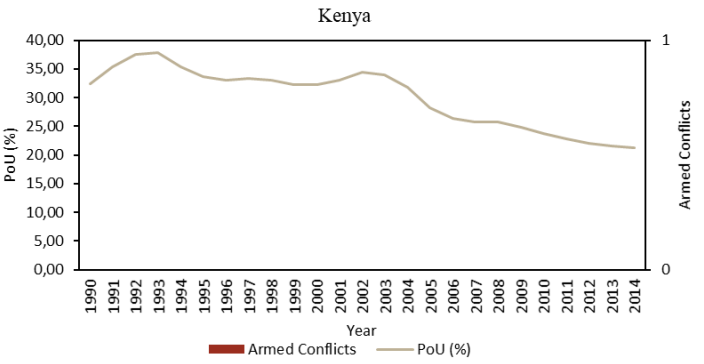

Gambia
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

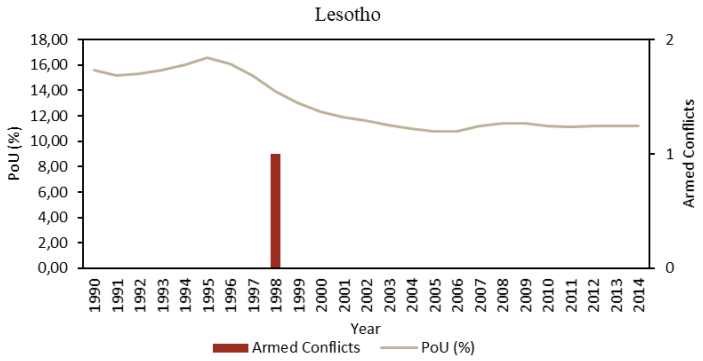
Ghana
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

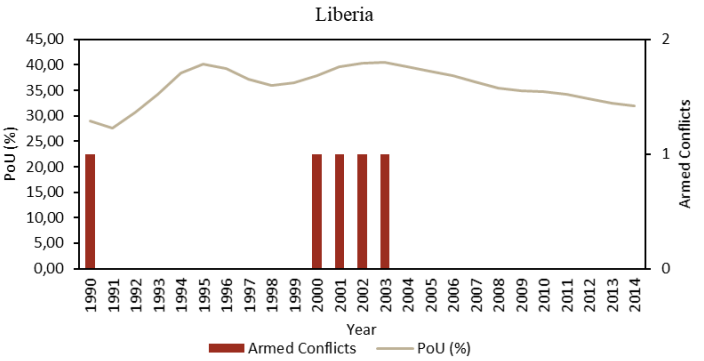

Guinea
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

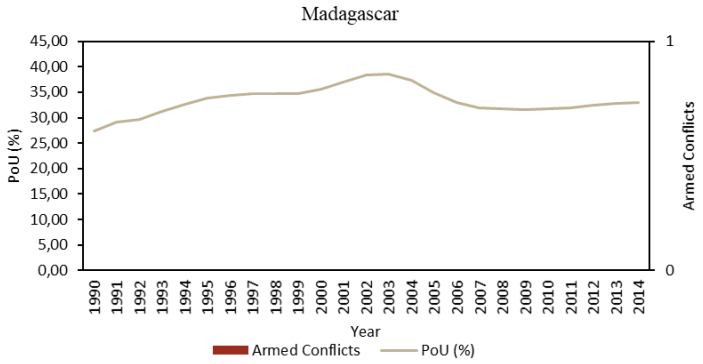
Guinea-Bissau
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

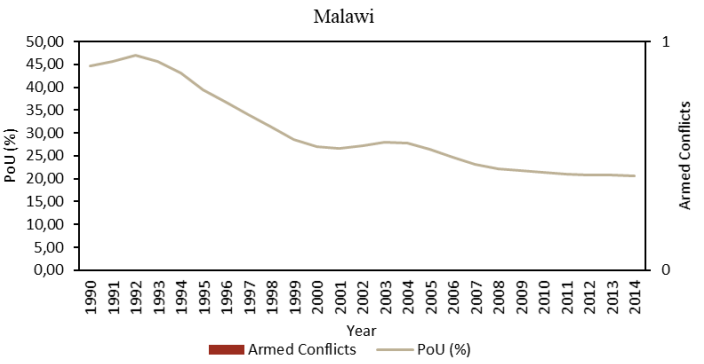

Ivory Coast
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

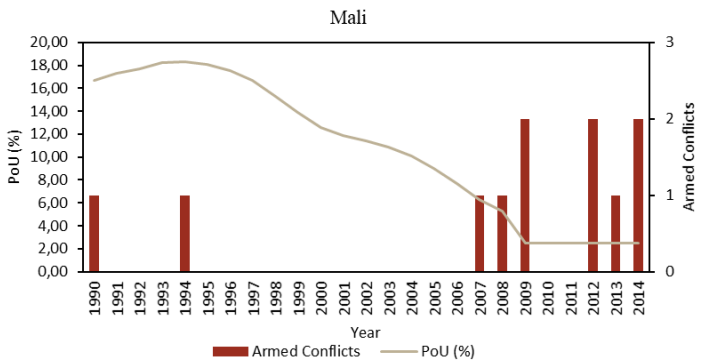

Kenya
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

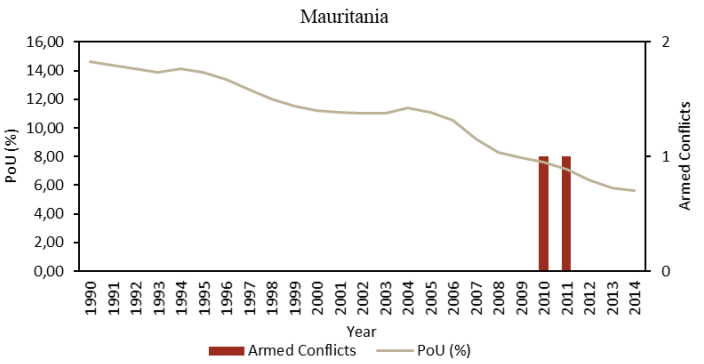

Lesotho
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

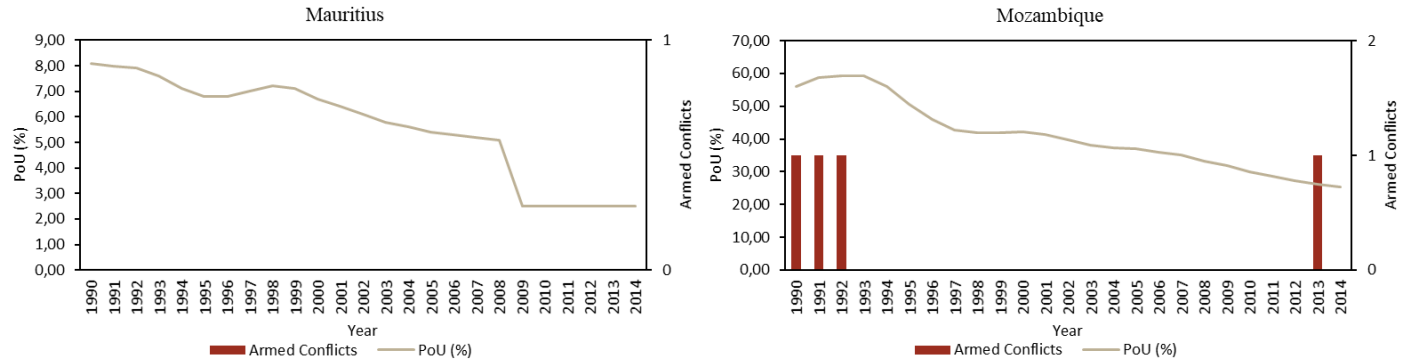

Liberia
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


Madagascar
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

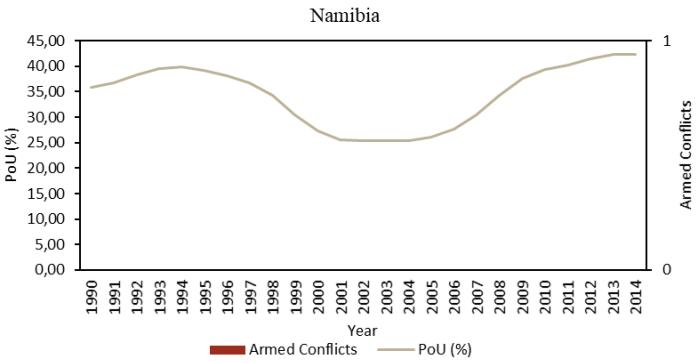

Malawi
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

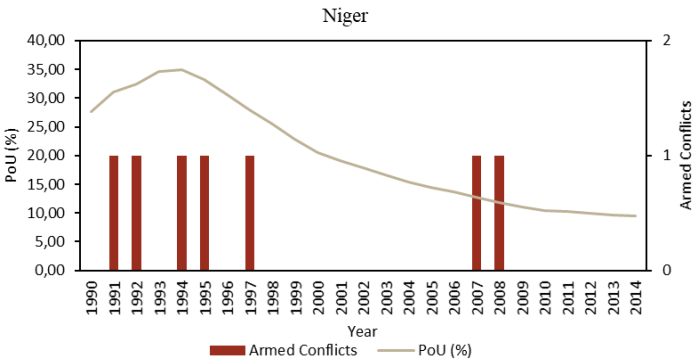

Mali
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

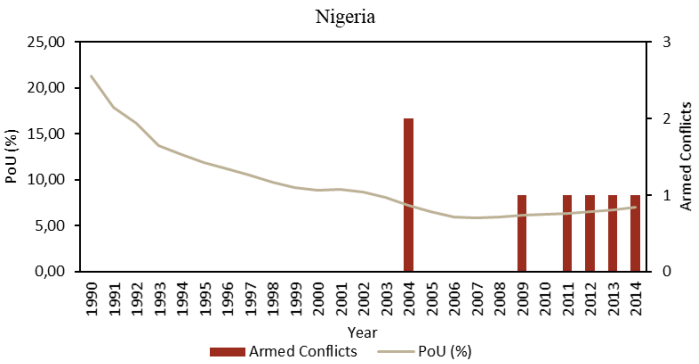

Mauritania
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

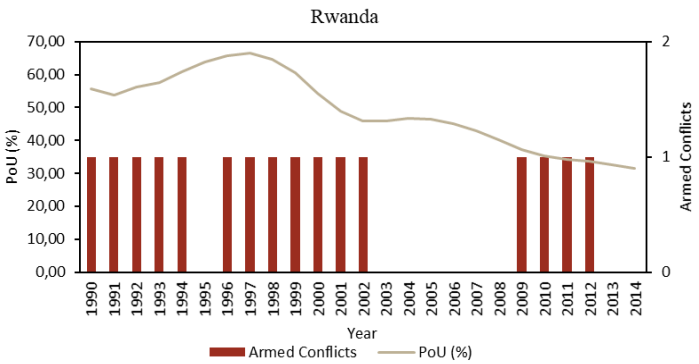

Mauritius
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

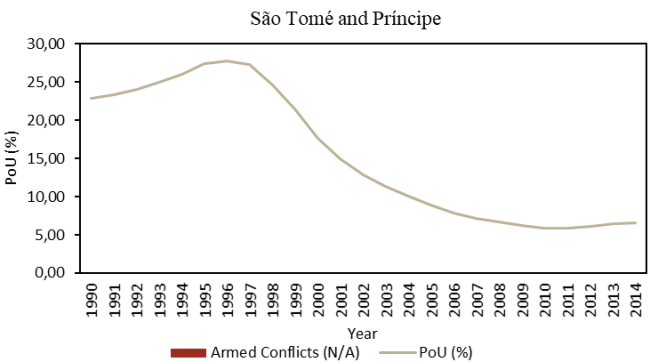
Mozambique
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

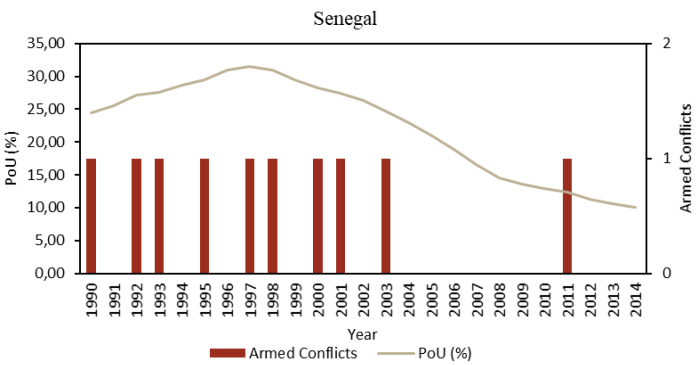

Namibia
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

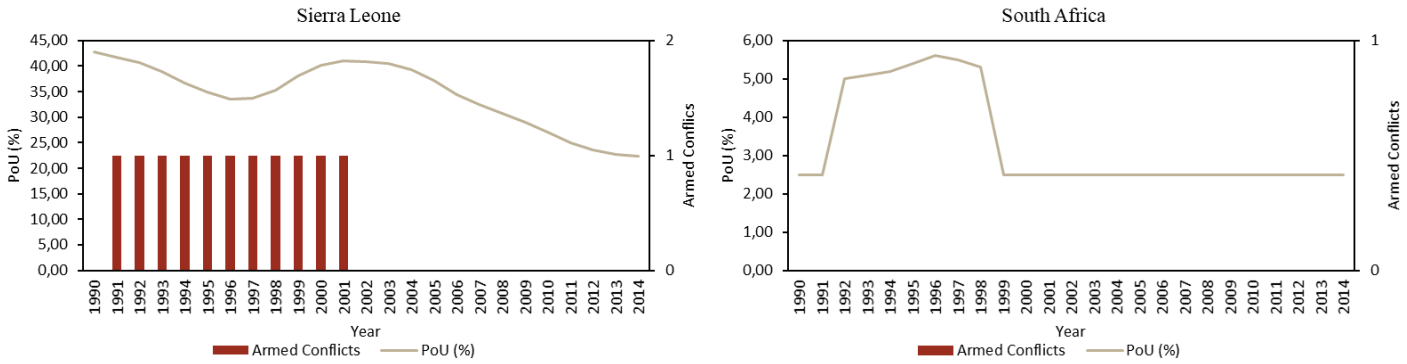

Niger
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


Nigeria
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

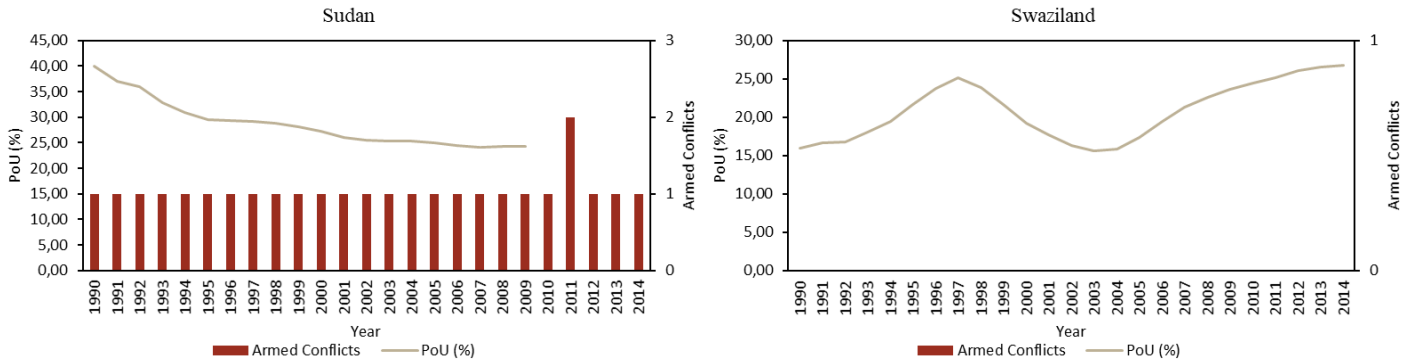

Rwanda
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


São Tomé and Príncipe
PoU (%)
Armed Conflicts
Year
Armed Conflicts (N/A)
PoU (%)

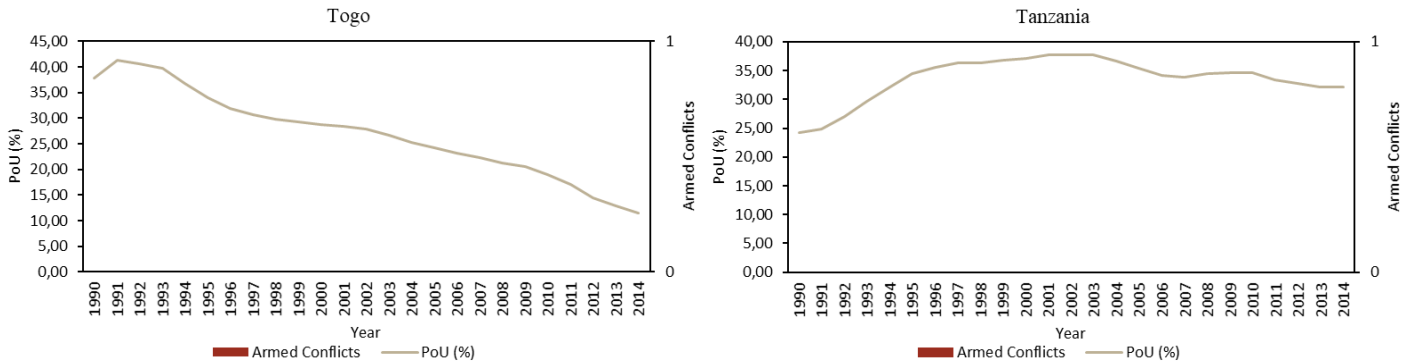

Senegal
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


Sierra Leone
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

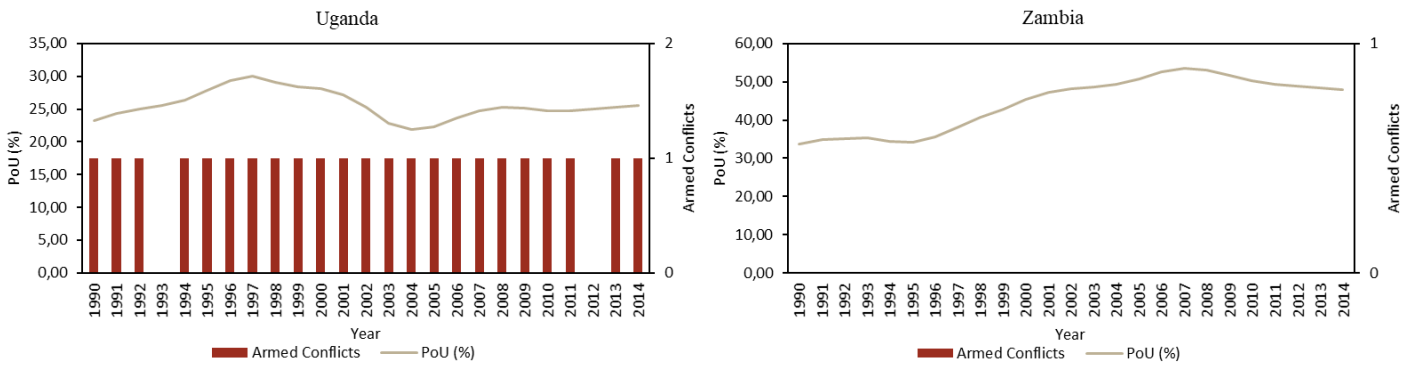
South Africa
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


Sudan
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

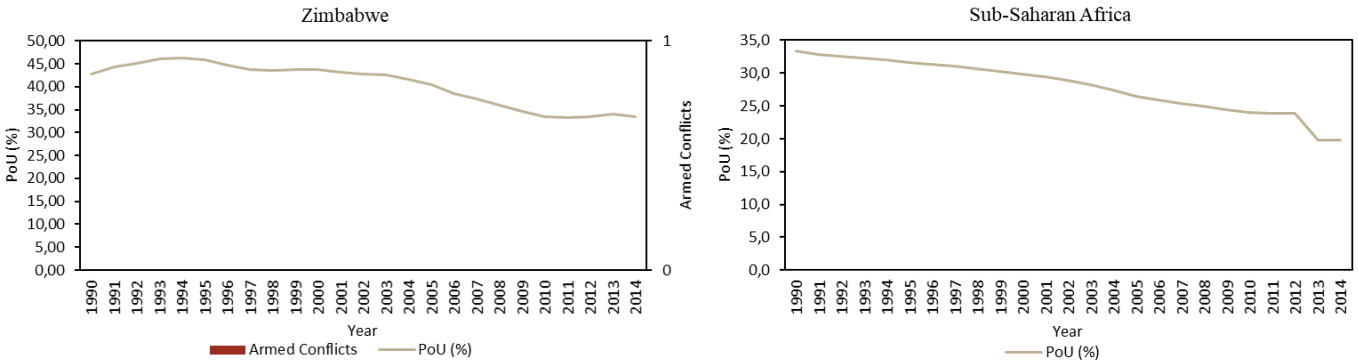
Swaziland
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


Togo
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

Tanzania
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)


Uganda
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)

Zambia
PoU (%)
Armed Conflicts
Year
Armed Conflicts
PoU (%)



Source: Developed by the author. Results of PoU (%) based on data from the Food and Agriculture Organization Statistics (FAOSTAT 2017), and Number of Armed Conflicts based on data from the Uppsala Conflict Data Program. Note: N/A accounts for not available data.

Appendix 3. Income standards measured by GDP per capita growth (average annual %) across sub-Saharan African countries from 1990 to 2015.

Country Name	1990-2000	2000-2015	1990-2015	Country Name	1990-2000	2000-2015	1990-2015
Angola	-1,79	3,89	1,64	Madagascar	-1,16	-0,08	-0,60
Benin	1,70	1,29	1,41	Malawi	1,80	1,40	1,68
Botswana	2,68	2,57	2,71	Mali	0,96	1,59	1,50
Burkina Faso	1,98	2,44	2,38	Mauritania	-0,50	1,57	0,89
Burundi	-3,10	-0,19	-1,32	Mauritius	4,36	3,90	3,94
Cape Verde	7,92	3,58	5,09	Mozambique	3,88	4,35	4,36
Cameroon	-1,88	1,21	-0,11	Namibia	0,45	3,19	2,10
Central African Republic	-1,48	-1,35	-1,28	Niger	-1,87	0,84	-0,08
Chad	-1,43	4,61	2,41	Nigeria	0,32	4,77	2,97
Comoros	-0,41	0,22	-0,35	Rwanda	1,07	5,19	3,55
Congo, Dem. Rep.	-8,47	1,66	-2,21	Sao Tome and Principe	n/a	2,63	2,63
Congo, Rep.	-1,34	1,66	0,28	Senegal	0,01	1,22	0,73
Cote d'Ivoire	-1,10	0,42	-0,04	Seychelles	3,07	2,20	2,63
Djibouti	-3,66	2,33	0,11	Sierra Leone	-2,44	3,02	0,68
Equatorial Guinea	28,12	7,99	16,30	Somalia	-2,80	n/a	-2,80
Eritrea	5,63	-1,25	1,88	South Africa	-0,38	1,73	0,80
Ethiopia	-0,33	6,12	3,51	South Sudan	n/a	-7,64	-7,64
Gabon	-0,52	-0,56	-0,40	Sudan	1,81	4,28	3,27
Gambia	0,23	0,32	0,20	U. Republic of Tanzania	0,40	3,45	2,21
Ghana	1,54	3,63	2,84	Togo	-0,44	0,14	0,04
Guinea	0,04	0,34	0,20	Uganda	3,15	2,94	3,15
Guinea-Bissau	-0,43	0,54	0,01	Zambia	-1,17	3,55	1,65
Kenya	-0,91	1,69	0,73	Zimbabwe	0,42	-1,71	-0,71
Lesotho	2,75	3,01	2,90	Sub-Saharan Africa	-0,60	2,26	1,10
Liberia	-0,43	1,40	-0,16				

Source: Developed by the author. Note: Results based on the World Bank national accounts data, and OECD National Accounts data files.

Appendix 4. Pooled Average and Minimum Dietary Energy Requirement (kcal/caput/day) across sub-Saharan African countries from 1990 to 2015.

Country Name	ADER	MDER	ADES	-Def	Country Name	ADER	MDER	ADES	-Def
Angola	2061,87	1662,22	1963,17	-98,70	Madagascar	2095,35	1683,09	2046,30	-49,04
Benin	2147,57	1722,13	2381,57	234,00	Malawi	2100,09	1687,83	2155,30	55,22
Botswana	2294,17	1817,43	2176,91	-117,26	Mali	2093,78	1684,65	2557,78	464,00
Burkina Faso	2172,00	1745,74	2453,65	281,65	Mauritania	2186,30	1748,09	2659,87	473,57
Burundi	n/a	n/a	n/a	n/a	Mauritius	2383,65	1864,22	2955,83	572,17
Cameroon	2195,30	1760,96	2254,39	59,09	Mozambique	2109,57	1695,43	2025,43	-84,13
Cape Verde	2268,52	1802,74	2491,57	223,04	Namibia	2262,09	1801,74	2129,17	-132,91
Central African Republic	2184,17	1741,13	1999,13	-185,04	Niger	2083,13	1680,61	2317,57	234,43
Chad	2133,35	1719,87	1971,87	-161,48	Nigeria	2152,83	1724,39	2615,78	462,96
Comoros	n/a	n/a	n/a	n/a	Rwanda	2117,04	1694,57	1913,09	-203,96
Congo	2196,52	1757,26	2108,48	-88,04	Sao Tome and Principe	2195,61	1757,70	2429,74	234,13
Côte d'Ivoire	2123,30	1698,35	2674,83	551,52	Senegal	2211,39	1772,00	2243,83	32,43
Democratic Republic of the Congo	n/a	n/a	n/a	n/a	Seychelles	n/a	n/a	n/a	n/a
Djibouti	2286,48	1818,00	2064,87	-221,61	Sierra Leone	2147,04	1719,17	2146,48	-0,57
Equatorial Guinea	n/a	n/a	n/a	n/a	Somalia	n/a	n/a	n/a	n/a
Eritrea	n/a	n/a	n/a	n/a	South Africa	2376,17	1877,65	2905,17	529,00
Ethiopia	2147,87	1725,74	1828,78	-319,09	South Sudan	n/a	n/a	n/a	n/a
Somalia	n/a	n/a	n/a	n/a	Sudan	2166,90	1738,60	2219,80	52,90
Gabon	2222,13	1772,30	2659,39	437,26	Swaziland	2207,96	1763,70	2294,65	86,70
Gambia	2188,87	1758,57	2540,74	351,87	Togo	2143,83	1713,83	2203,00	59,17
Ghana	2205,26	1757,43	2604,17	398,91	Uganda	2077,43	1676,91	2265,48	188,04
Guinea	2177,91	1745,00	2432,43	254,52	United Republic of Tanzania	2102,35	1690,78	2100,26	-2,09
Guinea-Bissau	2182,74	1747,00	2290,13	107,39	Zambia	2093,04	1680,17	1927,39	-165,65
Kenya	2141,57	1716,74	2075,96	-65,61	Zimbabwe	2229,61	1776,17	2050,65	-178,96
Lesotho	2172,13	1725,87	2484,39	312,26	Sub-Saharan Africa	2154,00	1726,52	2266,70	112,70
Liberia	2136,13	1711,39	2152,96	16,83					

Source: Developed by the author. Note: Results based on the average computation of the FAOSTAT (2017) data for the 1990-2015 Pooled Average Dietary Energy Requirement (ADER), data for the 1990-2015 Pooled Minimum Dietary Energy Requirement (MDER), and data for the 1990-2015 Pooled Average Dietary Energy Supply (ADES). In addition, the deficit between the Average Dietary Energy Requirement (ADER) and the Average Dietary Energy Supply was computed to calculate the Average Dietary Energy Deficit (-Def) by country (kcal/caput/day). N/A accounts for not available data.

1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 RENEWABLE ENERGY
8 GOOD JOBS AND ECONOMIC GROWTH
9 INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
THE GLOBAL GOALS
For Sustainable Development