Conflict Risk Indicators: Significance and Data Management in the GCRI
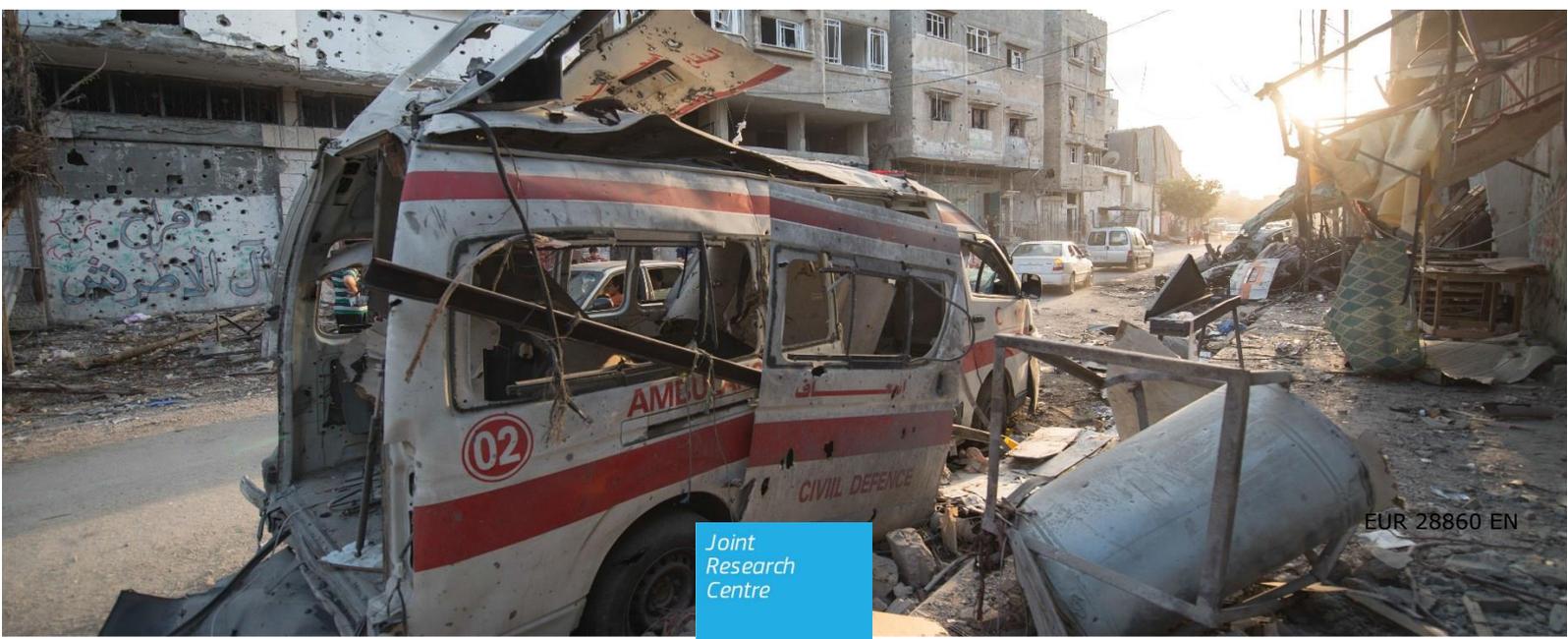
GCRI
Global Conflict Risk Index

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All images © European Union 2017, except: Cover Image, Photo taken during the 72hr ceasefire between Hamas and Israel on 6th of August 2014. Destroyed ambulance in Shuja'iyya in the Gaza Strip, Boris Niehaus (www.1just.de)www.1just.de, 6 August 2014, 17:49:24. Source: https://commons.wikimedia.org/wiki/File:Destroyed_ambulance_in_the_CIty_of_Shijaiyah_in_the_Gaza_Strip.jpg

Conflict Risk Indicators: Significance and Data Management in the GCRI

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Abstract

This technical report presents the composite model of the Global Conflict Risk Index, used to give an insight into the contributing factors of conflict at country level. This release features the data sources, the characteristics of the data, the model computing it and the results, with the objective of improving the documentation on the variables and on the composite model.

A reliable data management system is presented, which combines the data from various sources and imputes missing data. Specific statistical methods (numerical classification, imputation, linear and log rescaling and arithmetic mean) are then used so as to obtain the final index score for each country since 2006, integrated in country profiles.

While the focus is on presenting the current composite model, as well as the optimization effort which took place during the course of 2017, the present report also touches on the potential for improvements with regard to specific aspects of the model input and the running of the model.

This document focuses on the variables included in the GCRI and their influences on the composite model. For details regarding the theoretical framework, please see the previous scientific reports, doi 10.2788/184 and doi 10.2788/705817.

1. Introduction

The Global Conflict Risk Index (GCRI) is an early warning system designed to give policy makers a global risk assessment based on economic, social, environmental, security and political factors.

Previous versions of the GCRI have incrementally developed a statistical regression methodology for defining conflict. The composite model was developed for providing an overview on the factors contributing to conflict. Based on literature review from the conflict science field, five theoretical risk areas were identified (see risk assessment factors above). Within these, a further distinction was made between concepts, which were then represented with individual variables. The variables used are all relatively stable, in that little change is to be expected from year to year. The risk-of-conflict is assessed by the composite model at country level based on these variables. It consists in computing raw data for creating each of the variables, and in compiling all of them into one final score (per country). Country profiles are finally produced, in which the composite model's results are visualized, namely the final score of conflict risk and the background data used to calculate it using the variables.

This report presents the work done between February 2017 and September 2017, which has focused on quality control of the dataset, and on improving the documentation of the composite model. While the work presented here shows great advances in reliability and reproducibility, there is still potential for improvements.

The report is structured to present the three main aspects of the GCRI composite model: the data management, the variables and the model. While the first part gives an overview on the variables and the datasets used, each indicator used for all the variables is described in detail in the second part, including a general description, its relevance with regard to conflict risk, where the data is sourced and how the data is transformed. In the third part, the composite model is described and the results are presented through specific examples.

2. Data Management

This section is meant to provide all the necessary information for the user on the data management.

Table 1 below presents the index structure: 5 risk areas divided in 10 component concepts, which are composed by 24 indicators. Table 2 and Table 3 (p.5 and p.8) gives details about the variables (the raw data and where to download them). The data used are all freely accessible by any user on the Internet. Table 4 (p.10) presents some descriptive statistics: the original range of the data distribution, the thresholds imposed (min and max), the transformation (logistic or of any other type) done before the rescaling and the years covered by each original dataset.

Index	Risk Area	Concept	Indicator
GCRI Index	Political	Regime type	Regime Type
			Lack of Democracy
		Regime performance	Government Effectiveness
			Level of Repression
			Empowerment Rights
	Security	Current conflict situation	Recent Internal Conflict
			Neighbouring with HVC
		History of conflict	Years since HVC
	Social	Social cohesion and diversity	Corruption
			Ethnic Power Change
			Ethnic Compilation

		Transnational Ethnic Bonds
	4	Homicide Rate
	Public security and health	Infant Mortality
Economy	Development and distribution	GDP per capita
		Income Inequality
		Openness
	Provisions and Employment	Food Security
		Unemployment
Geography and Environment	Geographic challenge	Water Stress
		Oil Production
		Structural Constraints
	Demographics	Population Size
		Youth Bulge

Table 1 - The index's structure

Indicator	Source	Name of dataset	Name of original indicator(s)	URL
Regime type	Center for Systemic Peace	Polity IV Annual Time-Series, 1800-2015	PARCOM, EXREC	http://www.systemicpeace.org/inscrdata.html
Lack of democracy	Center for Systemic Peace	Polity IV Annual Time-Series, 1800-2015	POLITY2	http://www.systemicpeace.org/inscrdata.html
Government effectiveness	World Bank	Government Effectiveness: Estimate	GE.EST	http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators
Level of repression	Political Terror Scale Project	PTS Data	Highest of the three indicators in the set (PTS_A, PTS_H, PTS_S)	http://www.politicalterrorscale.org/Data/Download.html
Empowerment rights	CIRI Human Rights Data Project	CIRI Data	NEW_EMPINX	http://www.humanrightsdata.com/p/data-documentation.html
Recent internal conflict	HIIK; UCDP/PRIO	Battle related deaths, One-sided violence, Non-state conflict, Conflict Barometer 2016	Highest casualty estimates	http://ucdp.uu.se/downloads/ http://hiik.de/de/daten/
Neighbours with HVC	HIIK; UCDP/PRIO	Battle related deaths, One-sided violence, Non-state conflict, Conflict Barometer 2016	Highest casualty estimates	
Years since HVC	HIIK; UCDP/PRIO	Armed Conflict Dataset, Conflict Barometer 2016	Conflicts of intensity level 2	
Corruption	World Bank	Control of Corruption: Estimate	CC.EST	http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators
Ethnic Power Change	ETH Zurich	EPR Core Dataset	Recording of dataset, see variable page	http://www.icr.ethz.ch/data/epr

Table 2 - Variable sources (first part)[1]

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[1] All datasets have been accessed on September 15th, 2017.

Ethnic compilation	ETH Zurich	EPR Core Dataset	Recording of dataset, see variable page	http://www.icr.ethz.ch/data/epr
Transnational ethnic bonds	CIDCM Center for International Development &Conflict Management	Marupdate_20042006	GC10	http://www.mar.umd.edu/mar_data.asp
Homicide rate	World Bank	World Development Indicators	Intentional homicides (per 100,000 people)	http://data.worldbank.org/indicator/VC.IHR.PSRC.P5
Infant mortality	World Bank	World Development Indicators	Mortality rate, under-5 (per 1,000 live births)	http://data.worldbank.org/indicator/SH.DYN.MORT

Indicator	Source	Name of dataset	Name of original indicator(s)	URL
GDP per capita	World Bank	World Development Indicators	GDP per capita, PPP (constant 2011 international $)	http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD
Income inequality	Harvard Dataverse Network	The Standardized World Income Inequality Database	Net inequality	https://dataverse.harvard.edu/dataset.xhtml?persistentId=hdl:1902.1/11992
Openness	Word Bank	World Development Indicators	Foreign direct investment, net inflows (BoP, current US$)	http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD
			Foreign direct investment, net inflows (% of GDP)	http://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS
			Exports of goods and services (% of GDP)	http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS
Food security	FAO	Food security indicators	Average dietary energy supply adequacy	http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/
			Domestic food price index	
			Prevalence of undernourishment	
			Domestic food price volatility	
Unemployment	World Bank	World Development Indicators	Unemployment, total (% of total labour force) (modelled ILO estimate)	http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS
Water stress	World Resources Institute	Aqueduct Country and River Basin Rankings (Raw country scores)	tdefm	http://www.wri.org/resources/data-sets/aqueduct-country-and-river-basin-rankings
Oil producer	World Bank	World Development Indicators	Fuel exports (% of merchandise exports)	http://data.worldbank.org/indicator/TX.VAL.FUEL.ZS.UN
Structural constraints	BTI: The Bertelsmann Stiftung	BTI 2016	Structural constrains (Q13.1)	http://www.bti-project.org/en/index/

Population size	UN DESA/ Population Division	Annual population by single age - Both Sexes.	Sum of all ages	http://esa.un.org/unpd/wpp/Download/Standard/Interpolated/
Youth bulge	UN DESA/ Population Division	Annual population by single age - Both Sexes.	Sum of ages 15-24 divided by sum of ages 25+	http://esa.un.org/unpd/wpp/Download/Standard/Interpolated/

Table 3 - Variable sources (second part)[2]

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[2] All datasets have been accessed on September 15th, 2017.

Indicator	Original range	Threshold Min	Threshold Max	Transformation (Before rescaling)	Years covered
Regime type	Parcomp -88 to 5	NA	NA	See variable details.	1800-2015
	Exrec -88 to 8	NA	NA		1800-2015
Lack of democracy	-10 to 10	-	-	None	1800-2015
Government effectiveness	-2.49 to 2.43	-	-	None	1996-2015
Level of repression	1 to 5	-	-	None	1976-2015
Empowerment rights	0 to 14	-	-	None	1981-2011
Recent internal conflict	NA	NA	NA	None	1989-2015 (PRIO), 2016 (HIIIK)
Neighbours with HVC	NA	NA	NA	None	1989-2015 (PRIO), 2016 (HIIIK)
Years since HVC	NA	NA	NA	None	1946-2015 (PRIO), 2016 (HIIK)
Corruption	-2.06 to 2.58	-2	2	None	1996-2015
Ethnic power change	-	-	-	See variable details.	1946-2013
Ethnic compilation	-	-	-	See Table XX	1946-2013
Transnational ethnic bonds	0 to 3	-	-	None	2004-2006
Homicide rate	0 to 139.13	1	50	Log	1995-2014
Infant mortality	1.9 to 332.9	-	-	Log	1989-2015
GDP per capita	246.7 to 137164	-	-	Log	1990-2015
Income inequality	14.06 to 67.21	-	-	None	1960-2015
Openness	Foreign: -29679425810 to 3.065354e+12	100k	15billion	Log	1989-2015
	Foreign 2: -82.89 to 466.6	**1**	15	Log	1989-2015
	Export: 0.005 to 230	3	200	Log	1989-2015
Food security	Nourishment: 5 to 80.8	5	35	None	1990-2014
	Volatility: 0 to 210.4	-	20	None	1990-2014
	Diet: 68 to 165	75	150	None	1990-2014
	Price level: 1 to 11.69	-	10	None	1990-2014
Unemployment	0.1 to 39.3	2	-	None	1991-2014

Water stress	0.58 to 4.43	0.58	4.44	None	NA
Oil producer	0 to 99.97	1	-	Log	1989-2015
Structural constraints	1 to 10	-	-	None	2006-2016
Population size	0 to 1.38 billion	6	12.5	Log	1989-2016
Youth bulge	0.10 to 0.42	0.12	0.39	None	1989-2016

Table 4 - Descriptive statistics

3. Variable definition

The GCRI index is composed of 24 variables, grouped in 10 concepts, which are then grouped in 5 risk areas. While Table 4 (p.10) provides some descriptive statistics, more detailed information is available in the successive paragraphs. The purpose of the present chapter is to describe in detail each variable and to explain the R code used for computing the variables.

As presented in Table 4, data for calculating the Global Conflict Risk Index are extracted from 14 different datasets. While some of the datasets are complete, others contain missing data for specific years and/or specific countries. For each variable, the share of available data is presented, as well as their geographical location. These graphical representations (presented below within the variables' descriptions) aim at providing an understanding on the limitations of some variables and the limitations of some geographical regions when it comes to producing and/or providing data.

In order to overcome the lack of data and be able to compute the model, the missing data are imputed (replacing missing data with substituted values) and identified as *exceptions*. In the imputation system adopted, data is taken from either the closest known historical data (desk research is conducted for finding precise information which would then justify the substituted value), or, if not possible, from regional averages, or from similar countries. In this last case, the characteristics considered to identify a country as "similar" are political, social-economic and/or geographic, according to what is acknowledged as the most adequate one. Thereby, all missing data can be imputed in a relevant way allowing the model to run trouble-free. The imputation is included in the data construction phase, making the data a single and complete dataset ready for statistical analysis.

The 24 variables are used as input for the composite model.

3.1.   Regime Type (REG_U)

Description: The regime type is one of the strongest indicators for the outbreak of political violence. Empirical evidence shows that, with some restrictions, democracies indeed do not resort to war against each other. The idea here is that some "side-effects" of democracy, such as the rule of law, a certain level of socio-economic development, and the inclusion into international trade networks, contribute to a more peaceful way of solving conflicts. The regime type indicator is designed to capture the effect of the democratic U-curve, where anocracies are seen as inherently less stable than autocracies and democracies (Hegre, 2001).

Data source: The dataset used is provided by the Center for Systemic Peace (CSP), which is engaged in researching on the problem of political violence within the structural context of the dynamic global system. The Center continually monitors political behavior in each of the world's major states, that is, all those with current populations greater than 500,000 (167 countries in 2015) and reports on emerging issues and persisting conditions related to the problems of political violence and "state failure." We make use of the Polity IV dataset, which codes democratic and autocratic "patterns of authority", and regime changes in all independent countries. We hereby follow the argumentation of Goldstone et al. (2010) that suggests using the Polity's scale for the openness of executive recruitment (*EXREC*) and the competitiveness of political participation (*PARCOMP*) as it captures variation in the degree and forms of inclusiveness. The data for this indicator can be downloaded at: http://www.systemicpeace.org/inscrdata.html

How it is built: The variable is constructed combining two components of the Polity IV: *PARCOMP* and *EXREC*. *PARCOMP* (The Competitiveness of Participation) refers to the extent to which alternative preferences for policy and leadership can be pursued in the political arena. *EXREC* (Executive Recruitment) is a method for comprehending authority patterns. The table below presents the combination of these two components and the resulting new categorisation, which represents the five different regime types in which countries are classified.

Executive Recruitment	Competitiveness of Political Participation					
	Repressed (0)	Suppressed (1)	Unregulated (2)	Factional (3)	Transitional (4)	Competitive (5)
(1) Ascription						
(2) Ascription + Designation		**0**			**1**	
(3) Designation						
(4) Self-Selection						
(5) Transition from Self-Selection						
(6) Ascription + Election						
(7) Transitional or Restricted Election	**1**		**2**	**3**		**2**
(8) Competitive Election						**4**

Based on POLITY IV scales for Executive Recruitment (EXREC) and Competitiveness of Political Participation (PARCOMP).

0 (White) = **Full Autocracy**   **1** (Light grey) = **Partial Autocracy**   **2** (Dark grey) = **Partial Democracy**

3 (Very dark grey) = **Partial Democracy w/factionalism**   **4** (Black) = **Full Democracy**

Table 5 - Regime type coding rules from Goldstone et al. based on Policy IV scales (2010)

The countries that did not match any of the above mentioned regime types are classified under "*foreign intervention*" (6 and 7) and "*transition*" (8).

Based on this categorization, a new score is associated to each regime type as presented in the Table 6.

Type:	Full democracy	Full autocracy	Partial democracy	Partial autocracy	Transition	Partial democracy w/factionalism	Foreign Intervention
Regime type coding rules (Table 5)	4	0	2	1	8	3	6 and 7
Score:	1	1.07	3.91	3.98	4.49	10	10

Table 6 - Regime type scores

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 95.4%. The remaining 4.6% is imputed.

The distribution of raw data by year shows that, in this variable, we always have a high availability of data.
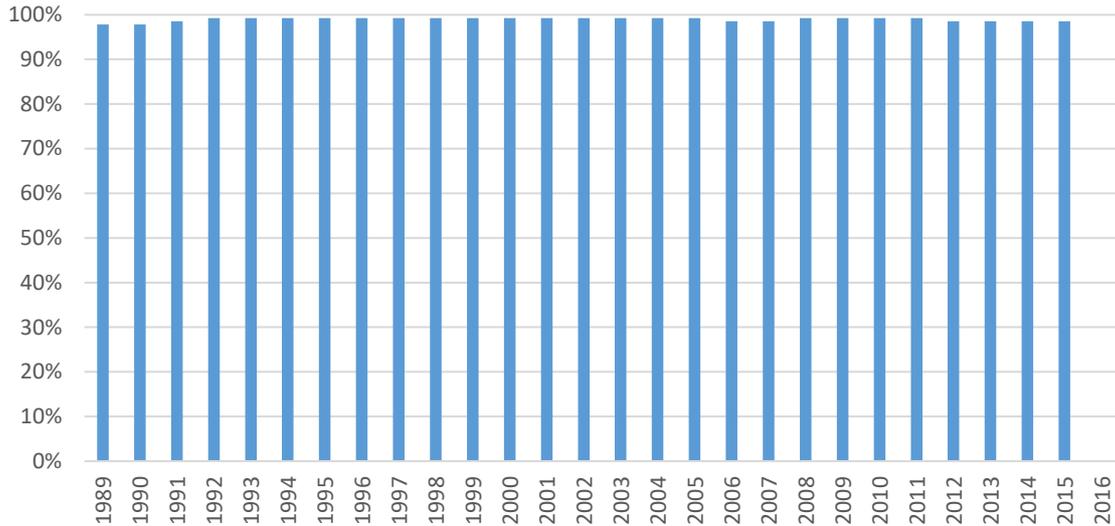
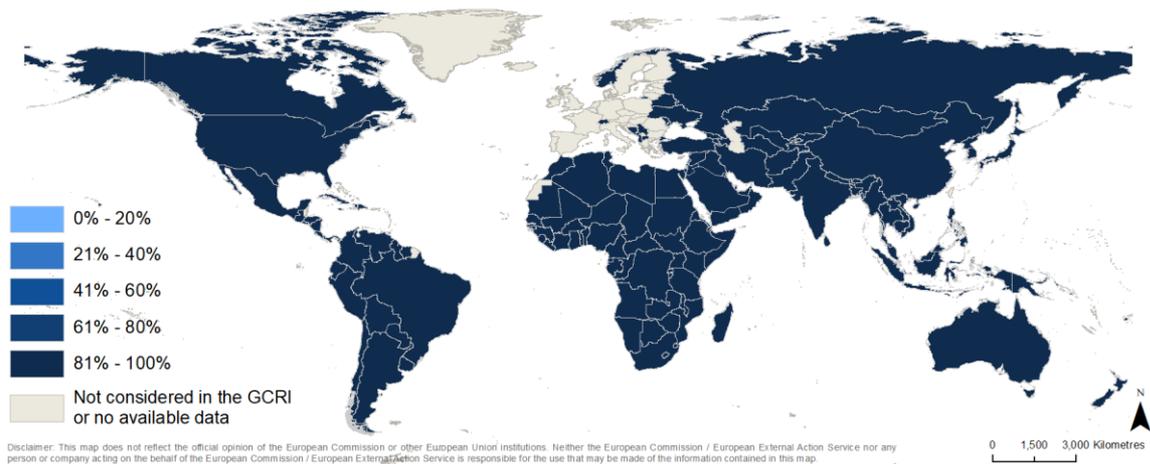*Table 7 - Data availability per year for the variable "Regime Type"*

Figure 1 - Data availability per country for the variable "Regime Type"

Citations: According to Vreeland, anocracies are more susceptible to civil war than either pure democracies or pure dictatorships' (Vreeland, 2008, p. 401). Other studies confirm this claim (Ellingsen, 2000; Collier & Hoeffler, Greed and Grievance in civil wars, 2004; Hegre, Ellingsen, Gates, & Gleditsch, 2001; Russett, Oneal, & Cox, 2000).

Practically, all quantitative studies rely on the Polity dataset, which provides global coverage and open source access and is frequently updated (Collier & Hoeffler 2004; Hegre 2002; Goldstone et al. 2010).

Collier, P. & Hoeffler, A. 2004. Greed and Grievance in civil wars. Oxford Economic Papers 56, pp. 563-596.

Goldstone, J. A. et al. 2010. A Global Model for Forecasting Political Instability. American Journal of Political Science 54, pp. 190-208.

Hegre, H. & Sambanis, N. 2006. Sensitivity Analysis of Empirical Results on Civil War Onset. 4th ed. Journal of Conflict Resolution 50, pp. 508-536.

Vreeland, J. 2008. The Effect of Political Regime on Civil War: Unpacking Anocracy. 3rd ed. Journal of Conflict Resolution 52, pp. 401-425.

3.2.   Lack of Democracy (REG_P2)

Description: It is a measure of the polity regime of a country.

Data source: The dataset used is Polity IV, which is provided by the Center for Systemic Peace (CSP), as in 3.1 (please see above).

The Polity IV dataset codes democratic and autocratic "patterns of authority", and regime changes in all independent countries. More specifically, we are using the variable *POLITY2*. The data for this indicator can be downloaded at: http://www.systemicpeace.org/inscrdata.html

How it is built: This variable is constructed using the *POLITY2* variable, which is a modified version of the *POLITY* variable meant to facilitate its use. The *POLITY* score is computed by subtracting the *AUTOC* score from the *DEMOC* score. The *AUTOC* score corresponds to the level of the institutionalized autocracy, which refers to a sharp restriction or suppression of competitive political participation. Similarly, the *DEMOC* score intends to reflect the level of institutionalized democracy and is defined by the three following elements: presence of institutions and procedures for political alternatives; existence of institutionalized constraints on the exercise of power by the executive; guarantee of civil liberties. Considering that elements of both democracy and autocracy may co-exist in a political regime, the two scores are confronted with each other in order to give a clearer picture on the effects of different regimes. The score resulting from the difference between the two scores (*AUTOC* and *DEMO*) is the *POLITY*, and hence *POLITY2*, scores. It ranges from +10 (strongly democratic) to -10 (strongly autocratic).

The variable is manipulated with an inverse rescaling. The original range -10 to 10 becomes 10 to -10, and is then rescaled from 0 to 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 93.9%. The remaining 6.1% is imputed.

The distribution of raw data by year shows that there is always a high coverage of data across time.
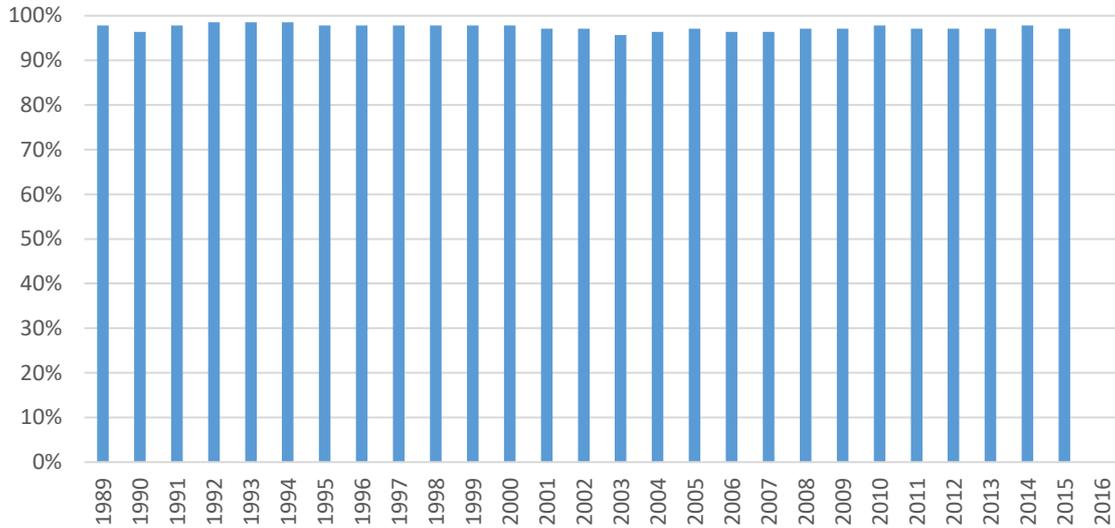

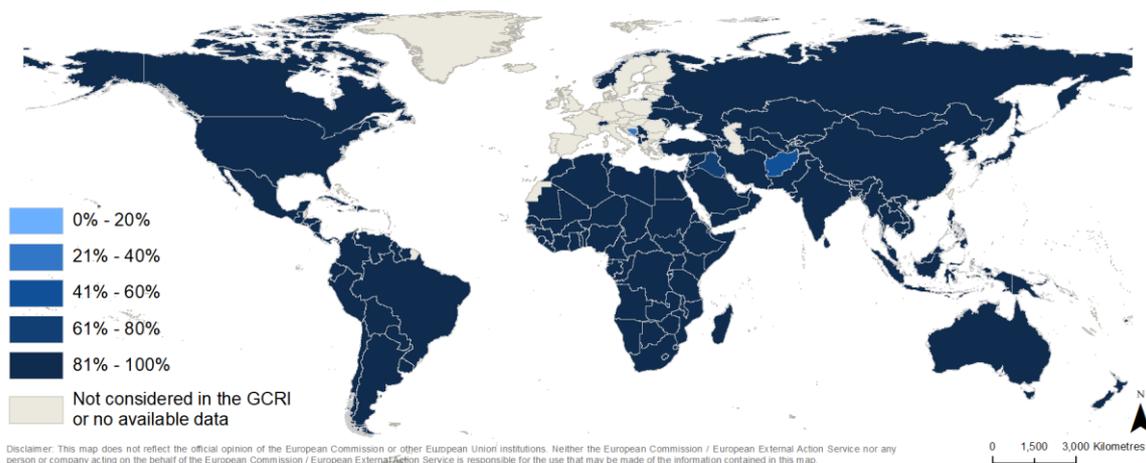*Table 8 - Data availability per year for the variable "Lack of Democracy"*

Figure 2 - Data availability per country for the variable "Lack of Democracy"

Citations: Robert Dahl defines democracy as effective participation, voting equality, knowledge on the issue and its alternatives, control over what issues are placed on the agenda, and all or most adults should be included in the process (Dahl, Robert A. 1998. On Democracy. New Haven: Yale UP, pp. 36-38).

3.3.   Government effectiveness (GOV_EFF)

Description: Government Effectiveness measures the quality of social and political indicators, as it is perceived by citizens. Public and civil service, policy formulation, credibility of the government are the main topics monitored.

Data source: The dataset used is the World Bank's Worldwide Governance Indicators, which are "aggregate and individual governance indicators for 215 countries and territories over the period 1996–2015, for six dimensions of governance."[3] (The data are available for download at: http://data.worldbank.org/data-catalog/worldwide-governance-indicators). In this case we are using the series "Government Effectiveness: Estimate".

How it is built: The variable used presents country's score on the aggregate indicator, in units of a standard normal distribution. The original variable ranges approximately from -2.5 to 2.5.

The variable values are then manipulated with an inverse rescaling in order to be transformed to a 0 to 10 scale.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 62.5%. The remaining 37.5% is imputed.

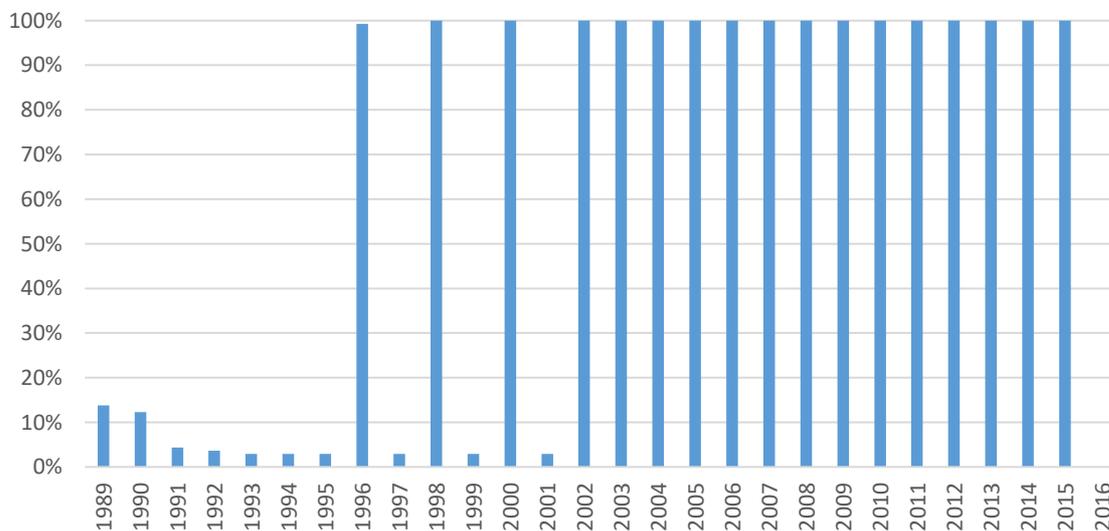The distribution of raw data by year shows that we have complete data only as of 2002.

Table 9 - Data availability per year for the variable "Government Effectiveness"
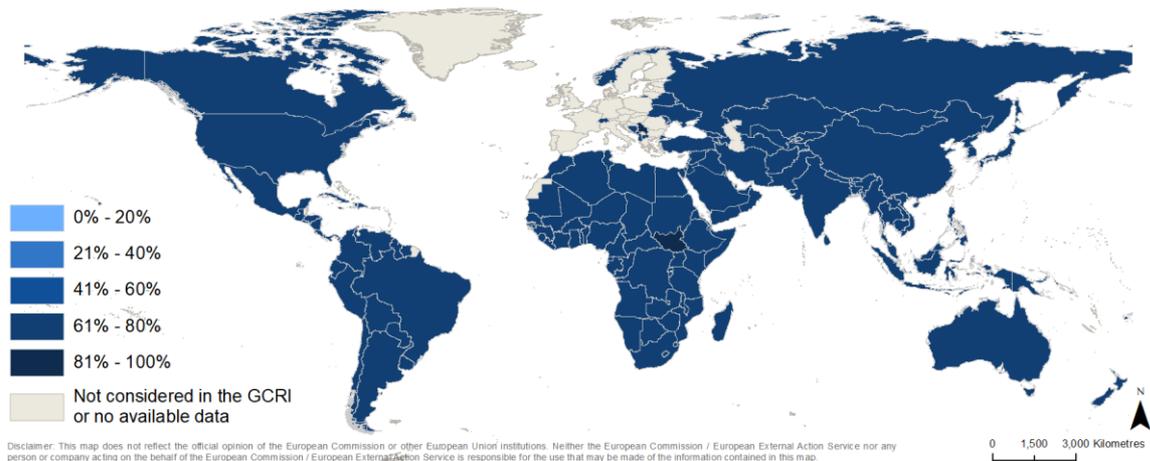
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[3] World Bank Website.

Figure 3 - Data availability per country for the variable "Government Effectiveness"

Citations: Kaufmann. D, Aart, K. & Mastruzzi, M. 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. World Bank Policy Research Working Paper No. 5430.

3.4.   Level of repression (REPRESS)

Description: If a state suppresses oppositional movements, restricts the work of the press or uses force against separatist unrest, it is more likely to encounter full-scale violent conflict. In fact, both Fox and, later, Regan and Norton found repression to be positively correlated with the onset of civil war. Therefore, we assume that the level of repression in a country is on one hand a good predictor for social tensions that might lead to conflict, and on the other it is used to identify a potential climate of state abuse that leads to the aggravation of existing conflict (Fox, 2004) and (Regan and Norton, 2005).

Data source: The dataset used is provided by the Political Terror Scale (PTS). The PTS measures levels of political violence and terror that a country experiences in a particular year based on a 5-level "terror scale". The data used in compiling this index comes from three different sources: the yearly country reports of Amnesty International, the U.S. State Department Country Reports on Human Rights Practices and Human Rights Watch's World Reports. The   data   for   this   indicator   can   be   downloaded   at: http://www.politicalterrorscale.org/Data/Download.html

How it is built: The dataset contains three variables: *PTS_A* from Amnesty International, *PTS_H* from Human Rights Watch and *PTS_S* from US State Department, each coded from

1 to 5. The highest score of the three variables is used as the repression variable and rescaled from 0 to 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 99.2%. The remaining 0.8% is imputed.

The distribution of raw data by year reports that we always have a high availability of data, with the exception of 1991.
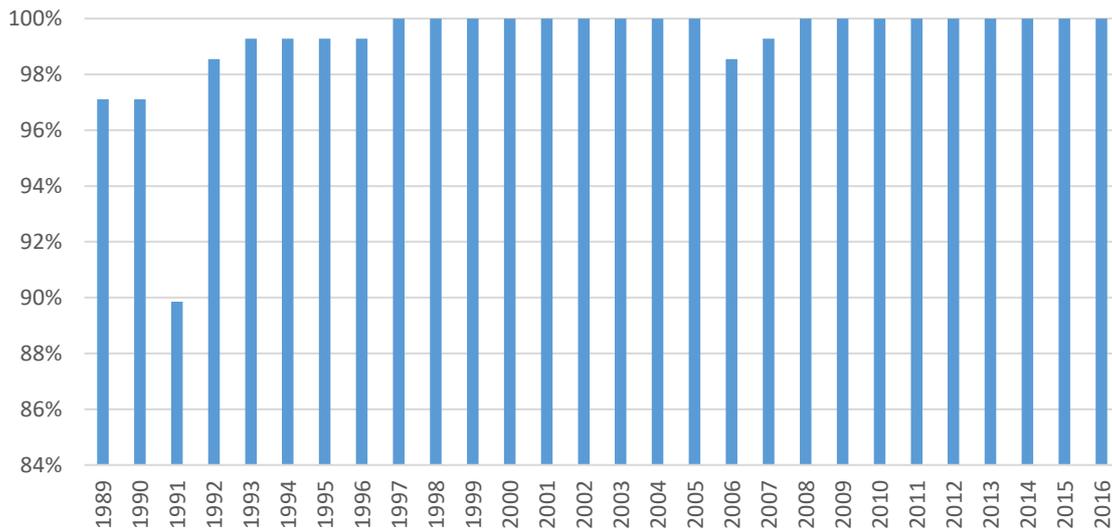

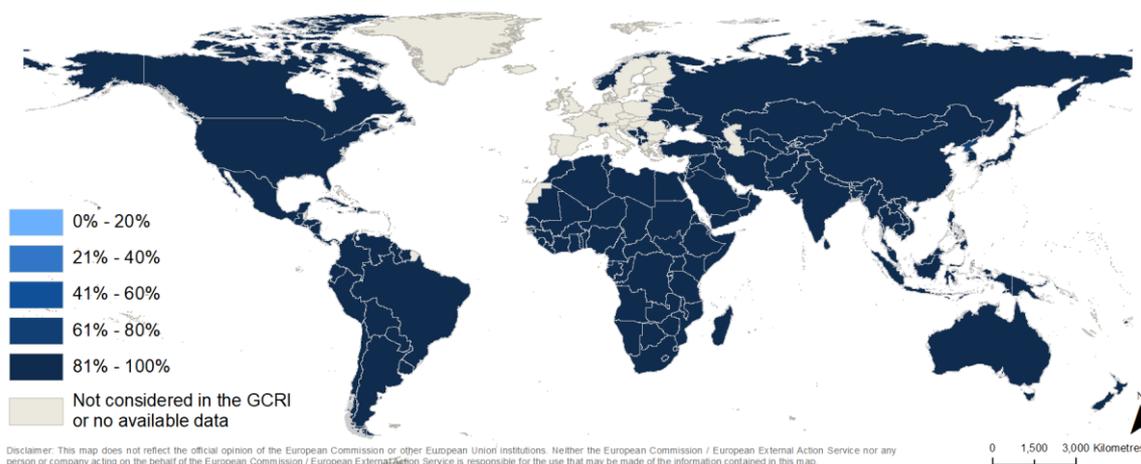*Table 10 - Data availability per year for the variable "Level of Repression"*

Figure 4 - Data availability per country for the variable "Level of Repression"

Citations:

Fox, J. 2004. The rise of religious nationalism and conflict: Ethnic conflict and revolutionary wars, 1945-2001. 6th ed. Journal of Peace Research 41, pp. 715-731.

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Regan, P. M. & Norton, D. 2005. Greed, Grievance and Mobilization in Civil Wars. 3rd ed. Journal of Conflict Resolution 49, pp. 319-336.

3.5. Empowerment rights (EMPOWER)

Description: Every political system claims to provide a certain set of civil rights, as the very legitimacy of a government lies in providing services and granting rights for its citizens. According to Merkel et al. (2003), the rule of law together with a system of checks and balances, as well as the granting of civil rights constitute three of the five pillars of a functioning political system. If one or several of these subsystems show deficiencies, conflicts are much likelier to erupt (Merkel et al., 2003).

Data source: The Empowerment Rights index, provided by the CIRI Human Rights data project, is being used here. The CIRI Human Rights Dataset contains standards-based quantitative information on government. More specifically, the information gathered deals with a wide range of human rights, internationally recognized, for countries of all regime types and from all regions of the world. The data for this indicator can be downloaded at: http://www.humanrightsdata.com/p/data-documentation.html.

How it is built: The Empowerment Rights Index, called *NEW_EMPINX* variable in the dataset, is based on seven indicators: the *Foreign Movement*, *Domestic Movement*, *Freedom of Speech*, *Freedom of* Assembly & Association, *Workers' Rights*, *Electoral Self-Determination*, and *Freedom of Religion*. It ranges from 0 (no government respect for these seven rights) to 14 (full government respect for these seven rights). The original range 0 to 14 becomes 14 to 0, and is then rescaled from 0 to 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 79.94%. The remaining 23.1% is imputed. The distribution of raw data by year reports good availability of information from 1989 to 2011.
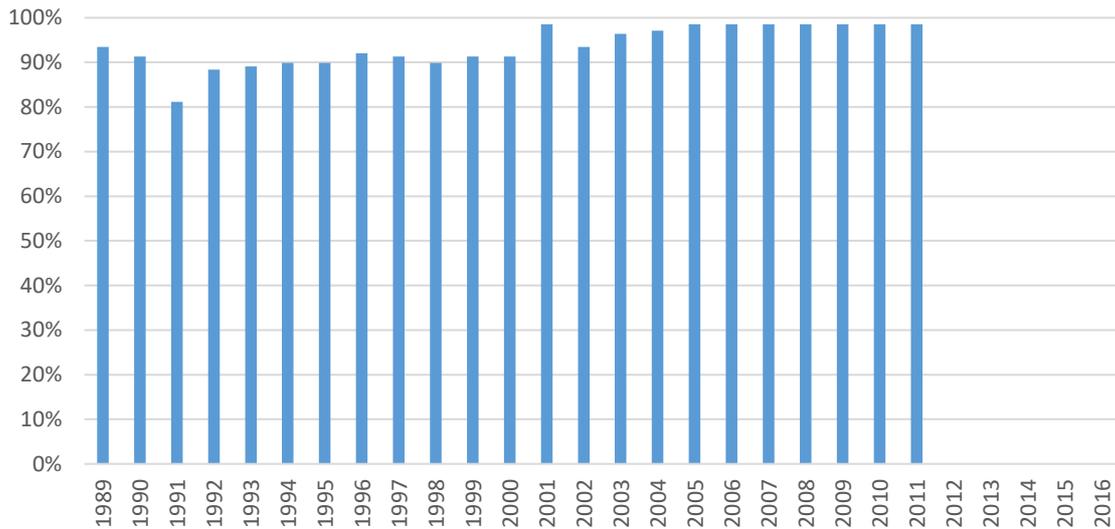
Table 11 - Data availability per year for the variable "Empowerment Rights"
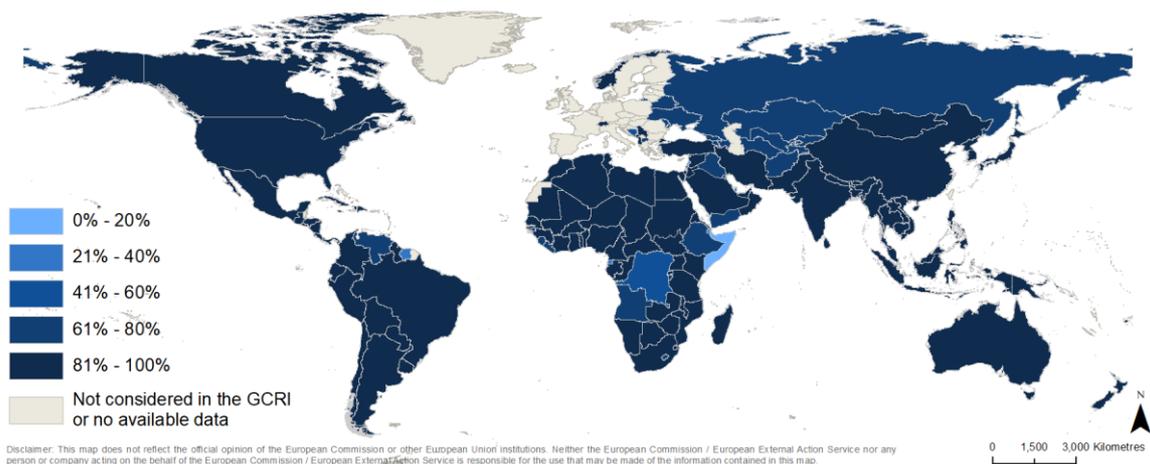

Figure 5 - Data availability per country for the variable "Empowerment Rights"

Citations: Poe, Steven P. Carey, Sabine C. & Vazquez, Tanya C. 2001. How are these pictures Different? A quantitative comparison of the US State Department and Amnesty International human rights reports, 1976-1995. Human Rights Quarterly 23.3, pp. 650-677.

Merkel, W. e. a. 2003. Defekte Demokratie Bd. 1: Theorie. Wiesbaden: VS Verlag für Sozialwissenschaften.

3.6. Recent Internal Conflict (CON_INT)

Description: This variable takes into account all the conflicts that have happened since 1989 and classifies the conflicts based on their types (national or subnational). Moreover, it measures the intensity of the conflict (based on the number of battle-related deaths).

Data source: The three datasets used in the computation of this variable, are provided by UCDP/PRIO Armed Conflict Dataset. This is a joint research project between the Uppsala Conflict Data Program (UCDP) at the Department of Peace and Conflict Research Uppsala University and the Centre for the Study of Civil War at the International Peace Research Institute in Oslo (PRIO). The datasets used are: UCDP Battle-Related Deaths Dataset (BRD), UCDP One-sided Violence (OSV) and UCDP Non-State Conflict datasets (NSC). The first dataset contains information on the number of battle-related deaths in conflicts from 1989 to 2016. The second dataset provides data on intentional attacks on civilians by governments and formally organized armed groups. The third one collects information on armed conflict where none of the parties is the government of a state. The data for this indicator can be downloaded at: http://ucdp.uu.se/downloads/.

How it is built: To create the variable *Recent Internal Conflict*, three databases are used. For each of these three databases, statistical methods are applied. For all three databases we reclassify the data into two categories: National and Subnational. The outputs are three new datasets, which are then bound together in order to obtain the final scores.

Concerning the first dataset called BRD (Battle-Related Deaths Dataset), two variables are used: *Incomp* (a general coding of the conflict issue) and *Typeofconflict*. This last one classifies conflicts in four different categories: *extra-systemic* (1), *interstate* (2), *internal* (3) and *internationalized internal* (4). The *Typeofconflict extra-systemic* (1) and *interstate* (2) are not used by the GCRI. Based on the two variables, we reclassify the conflicts into two categories (national and subnational) as shown in the table below.

		Type of conflict	
		3	4
Incompatibility	1	**Subnational**	**Subnational**
	2	**National**	**National**

A score of intensity is given to both national and subnational conflicts. Based on the existing column *BdHigh* of the BRD dataset, a new column called *Intensity* is created. It

ranges from 0 to 3 according to the following rules: *BdHigh* values<25 deaths = 0; 25-499 deaths = 1; 500-999 deaths = 2, >1000 deaths = 3.

The second dataset used is the OSV (One-sided Violence). We make a subset keeping only the cases when the actors involved are governments. Then we create a new column called *SN* (Subnational) and we apply a value range from 0 to 3 based on the existing *HighFatalityEstimate* column of the OSV dataset, according to the following rules: *HighFatalityEstimate* > 500 = 2, *HighFatalityEstimate* > 1000 = 3.

The third dataset used is NSC (Non-State Conflict datasets). In case conflicts happened in more than one country, then they are attributed to just one country. Following this we create a new column called *SN* (Subnational) and we apply a value range from 0 to 3 based on the existing *HighFatalityEstimate* column of the NSC dataset, according to the following rules: *HighFatalityEstimate* > 500 = 2, *HighFatalityEstimate* > 1000 = 3.

We extract a subset from BRD considering only the subnational conflicts, then we append to it OSV and NSC in order to obtain a list of all the subnational conflicts. This list contains more than one record for each country/year. We apply two different functions to the list. The first function is the max of the SN score, and it is used to calculate the highest SN value for each country/year record. The second function is the sum of the column count. We create this column in order to count the conflicts, therefore each record has a default value of 1. The intensity indicator for subnational conflicts is created combining the *SN* and *Count* column, as shown in the Table 12 below. In this way we obtain the intensity table.

		Count		
		1	2	>2
Intensity	1	**5**	**6**	**7**
	2	**8**	**8.5**	**9**
	3	**10**	**10**	**10**

Table 12 - Subnational Intensity

We create a second subset from BRD, this time considering only the national conflicts. The intensity indicator for national conflicts is created as shown in the Table 13 below.

		GCRI
Intensity	1	**5**
	2	**8**
	3	**10**

Table 13 - National Intensity

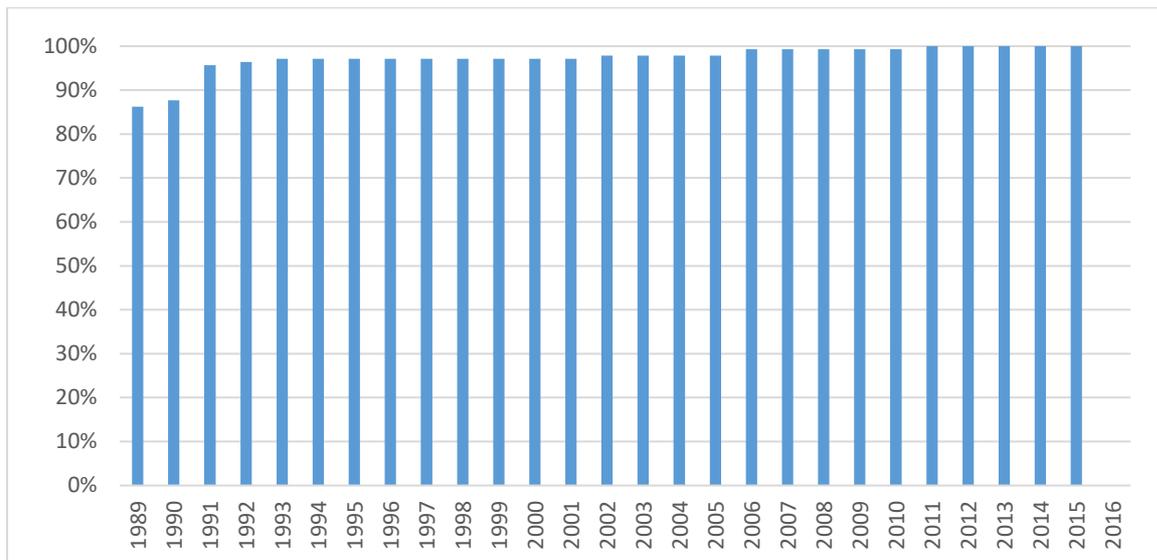**Descriptive Statistics:** No imputation is done.

Table 14 - Data availability per year for the variable "Recent Internal Conflict"
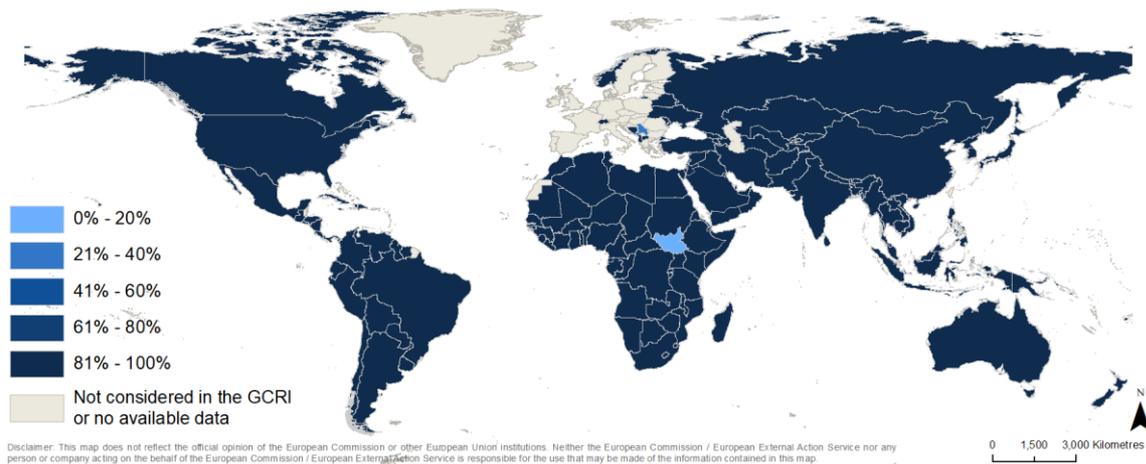

Figure 6 - Data availability per country for the variable "Recent Internal Conflict"

Citations: Sundberg, Ralph, Kristine Eck and Joakim Kreutz, 2012, "Introducing the UCDP NonState Conflict Dataset", Journal of Peace Research, March 2012, 49:351-362

Eck, Kristine and Lisa Hultman, 2007. 'One-sided violence against civilians in war: insights from new fatality data´, Journal of Peace Research 44(2): 233-246.

Allansson, Marie, Erik Melander & Lotta Themnér (2017) Organized violence, 1989-2016. Journal of Peace Research 54(4).

Complementary dataset

The UCDP/PRIO Armed Conflict Dataset is updated until 2015, and for this reason we use a different dataset to cover the 2016. The dataset for 2016 is provided by the Heidelberg Institute for International Conflict Research (HIIK), which is an independent research association affiliated with the Department of Political Science at the University of Heidelberg. The dataset, named Conflict Barometer 2016, is an analysis of global conflicts, whether they are wars, crises, or peace negotiations.

We use two different files: the HIIK dataset and the Inform list, which is a name list with country codes.

We use a max function to identify the max intensity of all the conflicts for each country, then we count how many conflicts with that intensity are associable to each state.

A rescaling is applied according to the following table.

	HIIK Based		PRIO/UCDP Based	
GCRI Intensity	HIIK intensity	Number of conflicts (of highest HIIK intensity)	Casualties	Number of conflicts
0	0		<25	
1	1		-	
2	2	1	-	
3	2	2	-	
4	2	>2	-	
5	3	1	25-499	1
6	3	2	25-499	2
7	3	>2	25-499	>2
8	4	1	500-999	1
8.5	4	2	500-999	2
9	4	>2	500-999	>2

10	5		>=1000	

3.7.   Neighbouring Conflict (CON_NB)

Description: Another factor that strongly correlates with violent conflict is the conflict situation in neighbouring countries. Sambanis stated in 2001: "Living in a bad neighbourhood can triple a country's chance of having an ethnic war" (2001). Hegre and Sambanis (2006) find that the positive impact of neighbouring conflict on the risk of civil war remains robust under many possible specifications, and war in adjacent countries has also been suggested as useful for predicting conflict or generating 'early warning' systems (Hegre & Sambanis, 2006; Esty, Goldstone, Gurr, Harff, & Unger, 1998; Gleditsch, 2007). In addition, there is evidence that conflicts raise the level of repression in neighbouring countries, this in turn leading to national power conflicts (Danneman & Ritter, 2014).

This "spill-over effect" between countries is modelled by the inclusion of a neighbourhood variable. This variable represents the highest conflict intensity that neighbouring countries (of country A) have in both dimensions, national and subnational.

Data source: To construct this variable we combine the output produced with the *Recent internal conflict* variable, with a matrix produced with the R package "cshapes" designed by Nils B.Weidmann. This data package defines which country borders with which other country.

How it is built: Once the matrix *GCRI_NB* is created (it is the matrix that associates each country with all his neighbours for all the years), we create a subset in order to consider only the conflicts between countries and to exclude the internal ones. We merge the previous file with the *recent internal conflict* output. At this point we have three columns: *country A*, *country B*, and the *conflict intensity of B*. We use the max function so that for each year *country A* is associated with just one *country B*, the one that has the highest *conflict intensity* score.

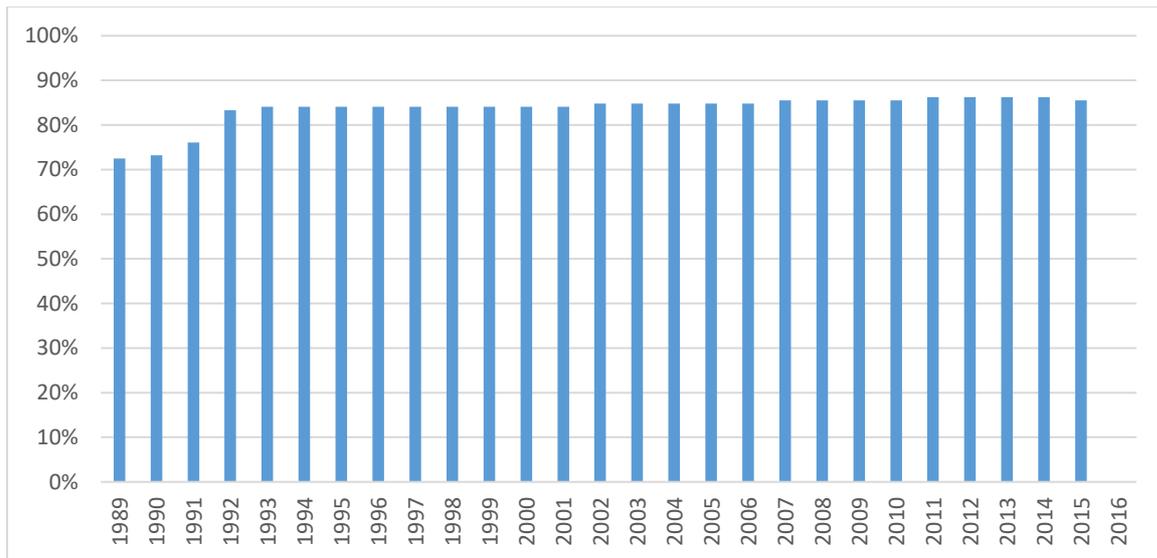**Descriptive Statistics:** No imputation is done.

Table 15 - Data availability per year for the variable "Neighbouring Conflict"
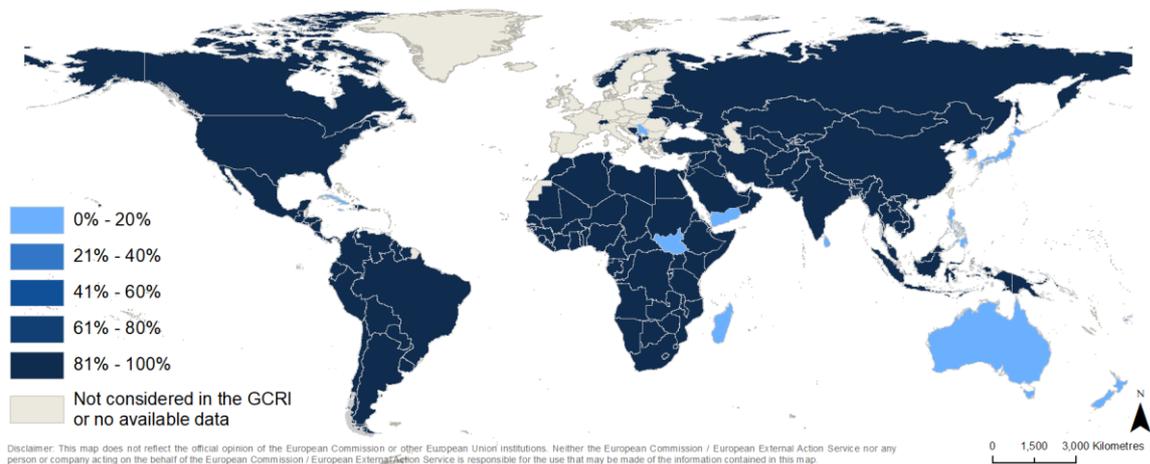

Figure 7 - Data availability per country for the variable "Neighbouring Conflict"

Citations: Sambanis, N., 2001. Do ethnic and non-ethnic civil wars have the same cause? A theoretical and empirical inquiry (Part I). Journal of Conflict Resolution 45 (3), pp. 259-282.

Hegre, H. & Sambanis, N., 2006. Sensitivity Analysis of Empirical Results on Civil War Onset. Journal of Conflict Resolution 50 (4), pp. 508-536.

Esty, D. C. et al., 1998. State failure task force report: Phase II findings, Washington D.C.: Central Intelligence Agency Directorate of Intelligence.

Gleditsch, K. S., 2007. Transnational Dimensions of Civil War. Journal of Peace Research 44 (3), pp. 293-309.

Danneman, N. & Hencken Ritter, E., 2014. Contagious Rebellion and Preemptive Repression. Journal of Conflict Resolution 58 (2), pp. 254-279.

Complementary dataset

As in 3.6, in order to have data also for 2016, it is necessary to use data beyond the UCDP/PRIO Armed Conflict Dataset, which is updated until 2015. Therefore, the dataset for 2016 is provided by the Heidelberg Institute for International Conflict Research (HIIK).

The dataset used to calculate the Neighbouring Conflict values (*CON_NB*) is the 2016 HIIK Conflict Intensity (*HIIK CON_INT*). We first associate all the countries in *HIIK CON_INT* with their neighbours using a matrix of distances. Then we calculate *CON_NB* as the maximum *HIIK CON_INT* of the neighbours.

3.8.   Years Since Highly Violent Conflict (YRS_HVC)

Description: Countries previously engaged in civil war have a high probability of experiencing renewed violence or perpetuating conflict, even outbreak of numerous violent conflicts at the same time. This phenomenon is the so-called "War Trap" (Bueno de Mesquita, 1983) or "Conflict Trap" (Collier, et al., 2003), which is identified as a significant predictor in many quantitative studies. Dixon (2009) lists eleven studies that found the years since the last highly violent conflict to be highly significant in predicting the outbreak of renewed violence.

This variable measures how many years have passed since a major conflict event has taken place. It is an inverted count of years starting from the last high violent conflict in the country and going back till a maximum of 10 years.

Data source: The dataset is provided by UCDP/PRIO Armed Conflict Dataset, as above (see 3.6). The dataset used is Armed Conflict Dataset version 17.1, which collects information on armed conflict where at least one party is the government of a state in the time period 1946-2016. The data for this indicator can be downloaded at: http://ucdp.uu.se/downloads/.

How it is built: We make a subset of the original dataset in order to exclude all those cases where the intensity level is below 2. We reclassify the conflicts into two new columns as presented in the following table:

	Type of conflict		
		3	4
Incompatibility	1	**Subnational (1)**	**Subnational (1)**
	2	**National (1)**	**National (1)**

We keep only the cases that fit in the above table.

We create the new column *unicode*. In this way a unique code, created by associating the year with the location, is assigned to each record. We verify if there are double records, and subsequently we eliminate them. A column called *HVC* is created equal to 1.

We apply the function that calculates the years since the last high violent conflict. We make all the records >10 equal to 10, then an inverse rescaling from 10 to 0 is performed.

Descriptive Statistics: No imputation is done.
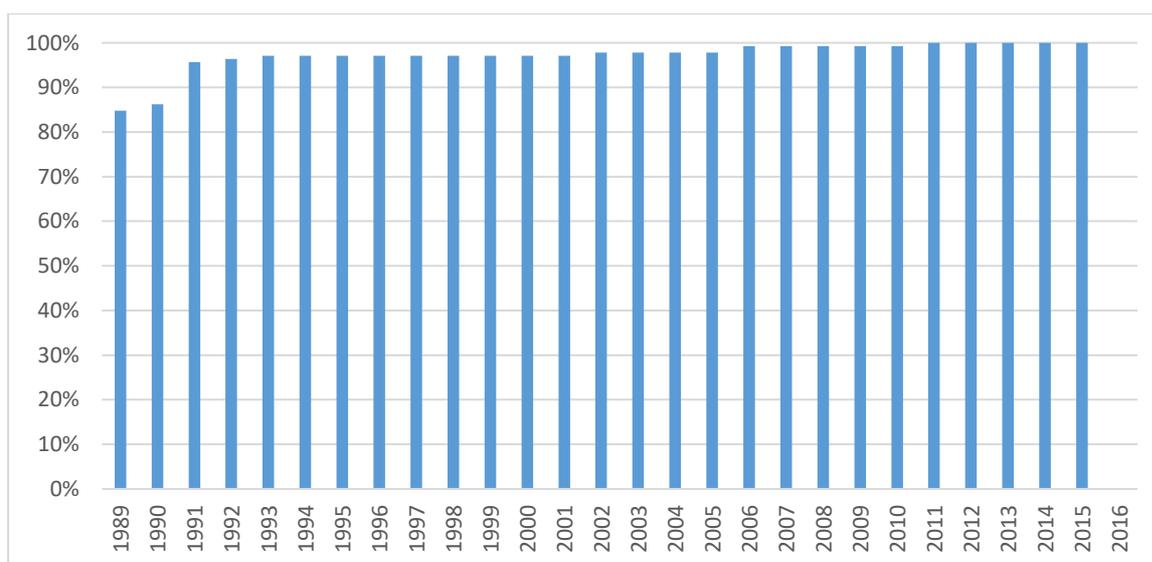
Table 16 - Data availability per year for the variable "Years Since Highly Violent Conflict "
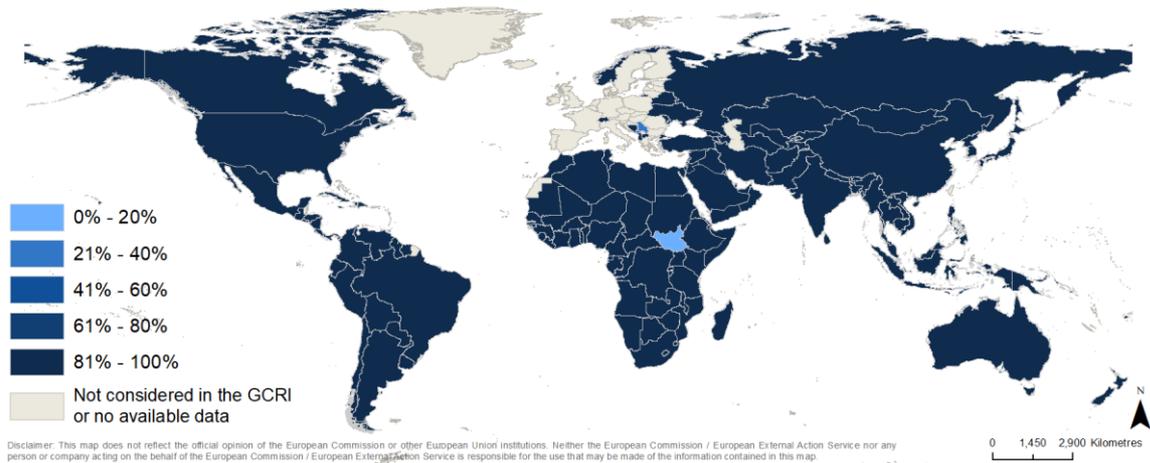
Figure 8 - Data availability per country for the variable "Years Since Highly Violent Conflict"

Citations: Bueno de Mesquita, B., 1983. The War Trap. Yale: Yale University Press.

Collier, P. et al., 2003. Breaking the Conflict Trap. Civil War and Development Policy. A World Bank Policy Research Report. Oxford: Oxford University Press.

Dixon, J., 2009. What causes civil wars? Integrating Quantitative Research Findings. International Studies Review 11, pp. 707-735.

Complementary dataset

As for the previous two variables, it is necessary to use a different dataset to cover the reference year "2016". Data for this year are provided by the Heidelberg Institute for International Conflict Research (HIIK), as in 3.6 and 3.7 (see above).

For this variable we use two different files: the processed 2015 HIIK dataset and the 2016 HIIK Conflict Intensity output. We apply the following rule to obtain values for Years since HVC: if the variable *CON_INT* (from dataset 2016 Conflict Intensity) is >= 8 then Years since HVC is 10. If *CON_INT* is < 8, then we use the value of column *YRS_HVC* from HIIK 2015 dataset minus 1.

3.9.   Corruption (CORRUPT)

Description: Former World Bank President James Wolfensohn has many times called corruption "the single greatest obstacle" to long-term development. In general, corruption has proven to be one of the main challenges that post-conflict and in-transition countries have to face and address as soon as possible. In fact, there had been many cases when concerns about corruption have proven fatal to countries in delicate situations. If

corruption becomes endemic, then it can jeopardise both the political process and the economic development of the state (O'Donnell, 2014).

Corruption measures the citizens' perception of how much public power is used for private gain, and how important is the influence of private interests on the state.

Data source The dataset used is the World Bank's Worldwide Governance Indicators, as in 3.3 (please see above) (The data are available for download at: http://data.worldbank.org/data-catalog/worldwide-governance-indicators). In this case we are using the series "Control of Corruption".

How it is built: The variable used presents country's score on the aggregate indicator, in units of a standard normal distribution. The original variable ranges from -2,5 to 2,5.

Due to outliers, a minimum value of -2 and a maximum value of 2 are enforced. The variable is imputed and rescaled from 0 to 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 62.6%. The remaining 34.4% is imputed.

The distribution of raw data by year shows a complete availability of information from 2002 to 2015, a discontinued availability from 1996 to 2001, and a low availability from 1989 to 1995 (see Table 17).
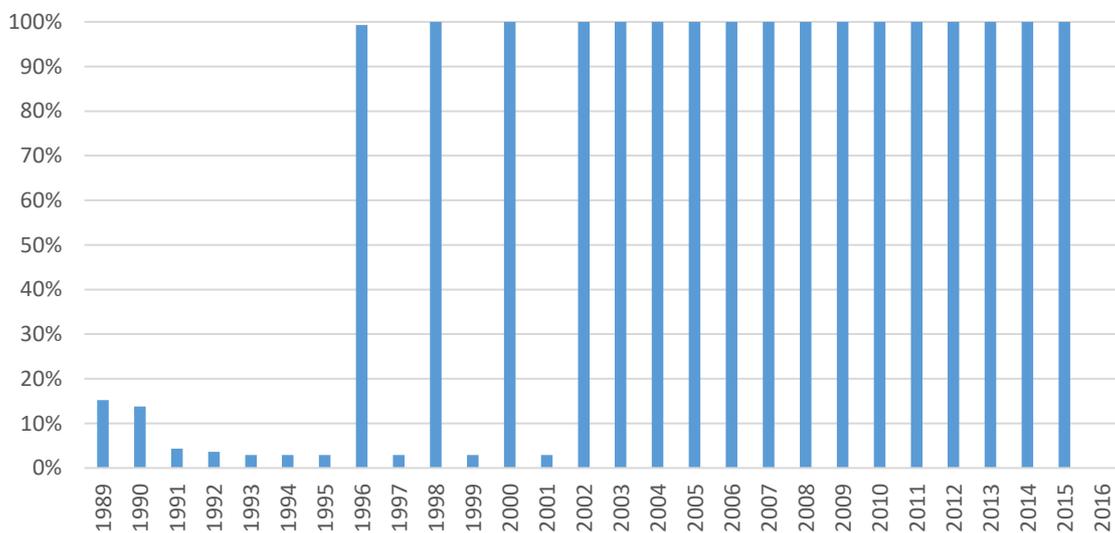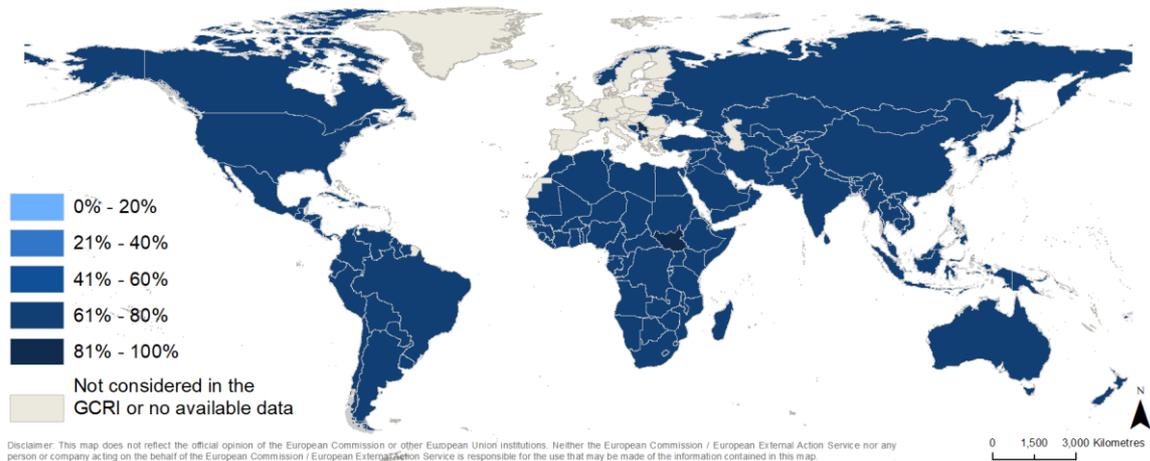

Table 17 - Data availability per year for the variable "Corruption"

31

Figure 9 - Data availability per country for the variable "Corruption"

Citations: Kaufmann. D, Aart, K. & Mastruzzi, M. 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. World Bank Policy Research Working Paper No. 5430.

O'Donnell, M. (2014). Corruption: A Rule of Law Agenda?. In: A. Hurwitz e. a., Civil war and the rule of law : security, development, human rights, Lynne Rienner Publishers, p. 225.

3.10. Ethnic Power Change (ETHNIC_NP)

Description: Some scholars of quantitative conflict literature state that the more homogenous a society is, the lower the risk for significant cleavages and civil war. Furthermore, the connection between ethno-linguistic fractionalisation and chance of civil war is strongest when society is polarized or one group dominates the other (Reynal-Querol, 2002; Collier et al, 2003; Collier/Hoeffler, 2004). A rich body of empirical studies supports the idea that 'ethnicity matters' in violent conflict: 'Ethnic exclusion is as consistently related to conflict as is GDP per capita, one of the most robust explanatory factors in the study of civil wars.' (Wimmer, Cederman, & Min, Ethnic politics and armed conflict. A configurational analysis of a new global dataset, 2009, p. 329). In turn, societies which are split along ethnic lines or due to distribution of wealth tend to show more tension and have a higher probability of experiencing separatist movements or struggles for national power.

Data source: The dataset is provided by the International Conflict Research (ICR) group at ETH Zurich. The group conducts research on international and domestic conflict around

the world. In recent years the group has been investigating the role of ethnic groups in conflict, especially civil war, and their present research focuses on the link between ethnic inequality and conflict. The dataset used is the EPR Core dataset, which records the access to state power by all the ethnic groups of some political significance. It codes to which level the group representative have held state power (from total control of the government to overt political discrimination). The dataset provides data from 1946 till 2013 for all the countries of the world. The data for this indicator can be downloaded at: http://www.icr.ethz.ch/data/epr.

How it is built: The final variable *transition* measures the risk of conflict due to a change in the distribution of state power among ethnic groups. It is scaled from 0 (no or irrelevant power change with no strong ethnical domination) to 10 (power change with domination of one group). The score for the variable *transition* is obtained by comparing seven different variables on power change and power access. Among the seven variables used (listed below), two are given by the EPR Core dataset and five are built by JRC.

Status (EPR Core dataset): it represents the amount of power owned by an ethnic group. Power access is classified in nine categories (*Dominant*, *Monopoly*, *Senior partner*, *Junior partner*, *Powerless*, *Self-exclusion*, *Discriminated, Irrelevant*, *State collapsed*), depending on whether a group controls power alone, shares it with other ethnic groups, or is excluded from it.

Status_lag (created by JRC): Using the variable *Status*, a lag[4] is calculated in order to analyse the change of status in the last year.

Reg_aut (EPR Core dataset): In addition to the previous variables which refer to the national dimension of power, the EPR Core Dataset measures also the access to executive power at the regional level. The variable in question is a separate regional autonomy variable.

Reg_aut_lag (created by JRC): Using the variable *Reg_aut*, a lag is calculated in order to analyse the change of access to executive power at the regional level in the last year.

Reg_aut_trans (created by JRC): It calculates the difference between the variables *Reg_aut* and *Reg_aut_lag* in order to analyse the possible transition in the regional autonomy.

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[4] A lag refers to a difference in time between an observation and a previous observation. (Eurostat Statistics Explained, Glossary. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Lag. Retrieved on 26/07/2017)

Incexc (created by JRC): Using the variable *Status*, the results are categorised into four new categories (*Excluded, Included, Irrelevant, State collapse*). The table below describes the new categorisation:

		INCEXC CLASSES			
		Excluded (EXC)	Included (INC)	Irrelevant (IRR)	State collapsed (COL)
STATUS	Dominant	-	x	-	-
	Monopoly	-	x	-	-
	Senior partner	-	x	-	-
	Junior partner	-	x	-	-
	Powerless	x	-	-	-
	Self-exclusion	x	-	-	-
	Discriminated	x	-	-	-
	Irrelevant	-	-	x	-
	State collapsed	-	-	-	x

Incexc_lag (created by JRC): Using the variable *Incexc,* a lag is calculated in order to analyse the shift, if any, between exclusion and inclusion in the past years.

Specific comparisons are then conducted on the seven former variables. The outcomes of these comparisons are the final scores. Below all the tables used for the comparisons (each including always two variables) and the associated scores are presented.

	INCEXC_LAG	
	INC	EXC
INC	0	-
EXC	-	0

INCEXC (row label on left side)

	STATUS_LAG								
	Dominant	Monopoly	Senior partner	Junior partner	Powerless	Self-exclusion	discriminated	irrelevant	State collapsed
Dominant	0	-	-	-	-	-	-	-	-
Monopoly	-	0	-	-	-	-	-	-	-
Senior partner	-	-	0	-	-	-	-	-	-
Junior partner	-	-	-	0	-	-	-	-	-
Powerless	-	-	-	-	0	0	-	-	-
Self-exclusion	-	-	-	-	6	0	6	6	-
Discriminated	-	-	-	-	-	0	0	-	-
Irrelevant	-	-	-	-	-	-	-	0	-
State collapsed	-	-	-	-	-	-	-	-	0

STATUS (row label on left side)

STATUS_LAG	REG_AUT_TRANS	
		1
	IRRELEVANT	6
	POWERLESS	6
	DISCRIMINATED	6

STATUS	INCEXC		
		INC	EXC
	DOMINANT	-	9
	MONOPOLY	-	9
	IRRELEVANT	0	1
	SENIOR PARTNER	-	7
	JUNIOR PARTNER	-	7
	DISCRIMINATION	3	-
	SELF-EXCLUSION	1	-
	POWERLESS	1	-

If the *Incexc* status is "included" and the regional autonomy scores 1, we assign 1.

In some cases, no comparisons are performed. If status is *STATE COLLAPSED*, then it is coded as 10. If *STATUS* is *IRRELEVANT*, then we have 0 (zero). If *status_lag* is *STATE COLLAPSED*, then we have 0 (zero).

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 8.54% (see Table 18). The remaining 91.5% is coded with 0 under the assumption that nothing happened where no data is present.
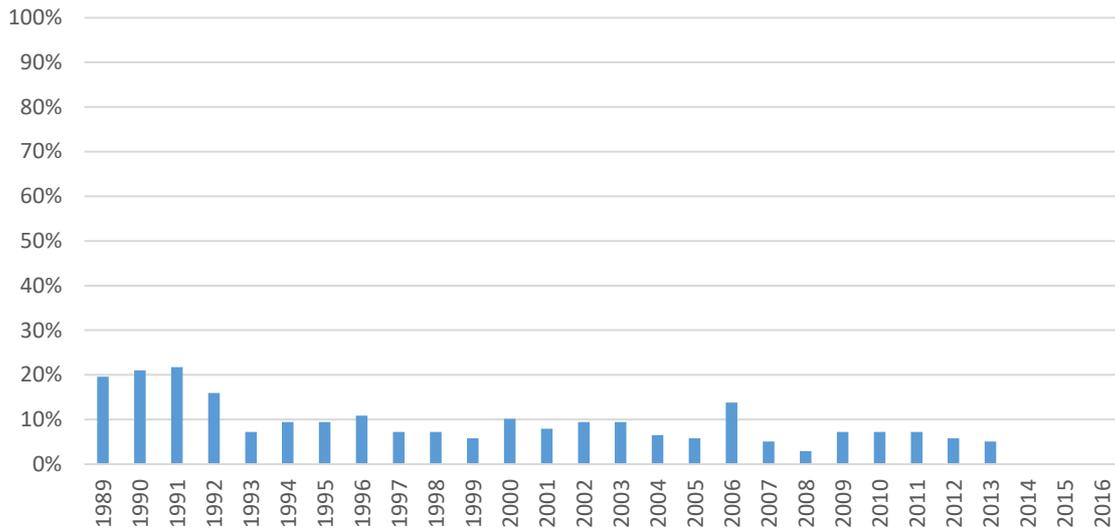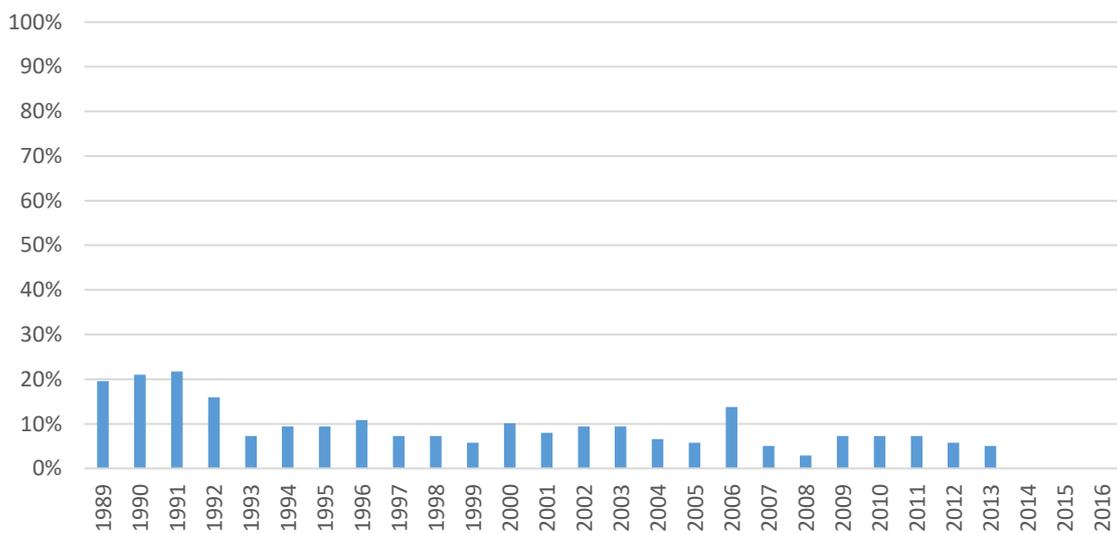
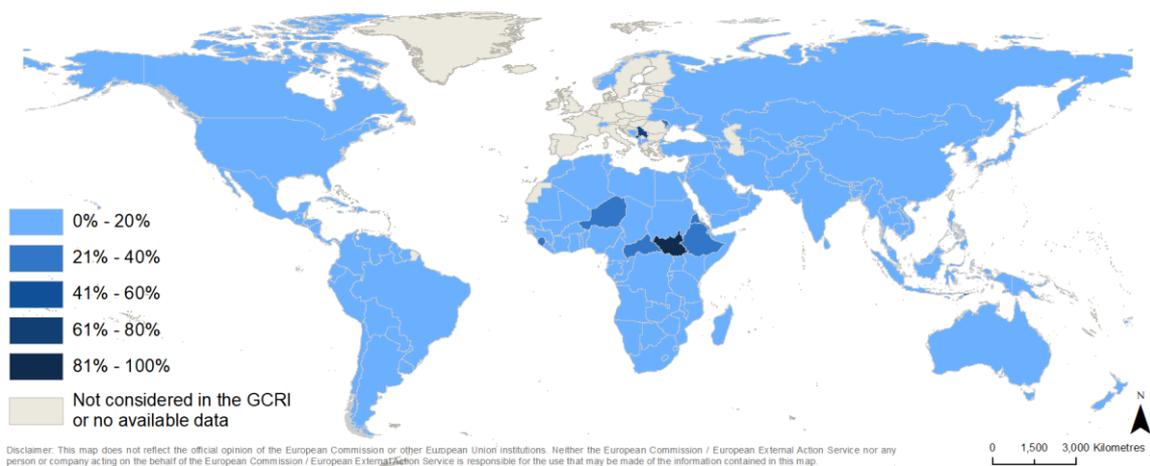*Table 18 - Data availability per year for the variable "Ethnic Power Change"*
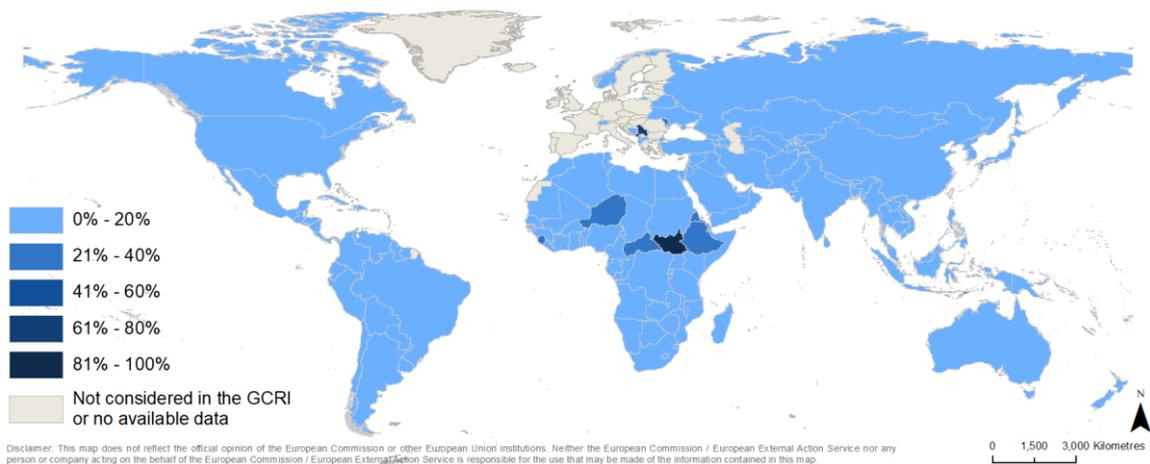
Figure 10 - Data availability per country for the variable "Ethnic Power Change"

Citations: Vogt, M., Bormann, N.-C., Rüegger, S., Cederman, L.-E., Hunziker, P., & Girardin, L. 2015. Integrating Data on Ethnicity, Geography, and Conflict: The Ethnic Power Relations Dataset Family. 7th ed. Journal of Conflict Resolution 59, 1327-1342.

Collier, P. et al., 2003. Breaking the Conflict Trap. Civil War and Development Policy. A World Bank Policy Research Report. Oxford: Oxford University Press.

Collier, P. & Hoeffler, A., 2004. Greed and Grievance in civil wars. Oxford Economic Papers 56, pp. 563-596.

Wimmer, A., Cederman, L.-E. & Min, B., 2009. Ethnic Polictics and Armed Conflict: A Configurational Analysis of a New Global Data Set. American Sociological Review, pp. 316-337.

Reynal-Querol, M., 2002. Ethnicity, Political Systems, and Civil Wars, Sage Publications: Journal of Conflict Resolution, Vol. 46, pp. 29-54.

3.11. Ethnic Compilation (ETHNIC_SN)

Description: If a country presents a very unbalanced distribution of power among ethnic groups, then the political situation of that country is most likely not stable. The aim of ethnic compilation is to measures how dangerous the unbalance of power between ethnic groups can be.

Data source: This dataset is provided by the International Conflict Research (ICR) group at ETH Zurich, as in 3.10 (please see above).

How it is built: The variable used is *status* which represents the amount of power owned by an ethnic group. Power access is classified in nine categories *(Dominant*, *Monopoly, Senior partner, Junior partner, Powerless, Self-exclusion, Discriminated, Irrelevant, State collapsed*), depending on whether a group controls power alone, shares it with other ethnic groups, or is excluded from it. We create a numerical classification of the variable as shown in the table below.

STATUS	SCORE
State collapse	10
Self-exclusion	9
Regional autonomy	7
Discriminated	5
Junior/Senior partner	5
Dominant/Monopoly	1
Powerless/Irrelevant	1

Table 19 - Ethnic compilation score

After this, each country-year is coded using the highest score of all ethnic groups present in that year.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 8.54% (see Table 20). The remaining 91.5% is coded with 0 under the assumption that nothing happened where no data is present.

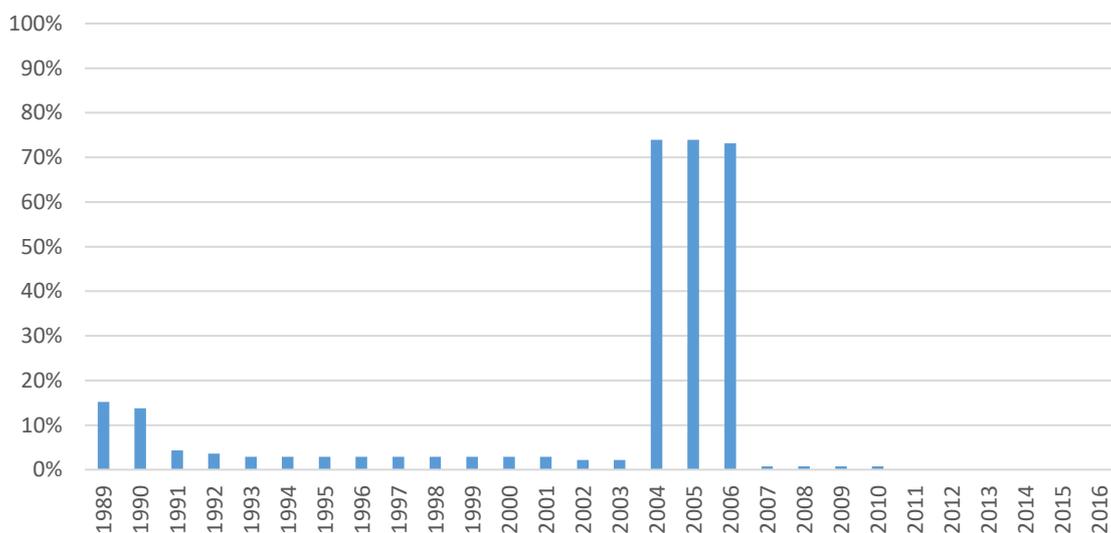*Table 20 - Data availability per year for the variable "Ethnic Compilation"*

Figure 11 - Data availability per country for the variable "Ethnic Compilation"

Citations: Vogt, M., Bormann, N.-C., Rüegger, S., Cederman, L.-E., Hunziker, P., & Girardin, L. 2015. Integrating Data on Ethnicity, Geography, and Conflict: The Ethnic Power Relations Dataset Family. 7th ed. Journal of Conflict Resolution 59, 1327-1342.

3.12. Transnational Ethnic Bonds (DISPER)

Description: The Center for International Development and Conflict Management (CIDCM) project defines a "minority at risk" as "an ethno-political group that collectively suffers, or benefits from, systematic discriminatory treatment". It "collectively mobilizes in defence or promotion of its self-defined interests. (…) Members share some distinguishing cultural features, such as common language religion and customs". Unfortunately, there are many cases where this type of minorities is split by country borders, and when that happens a country's conflict risk is significantly higher. If minorities are connected to their peers by transnational ethnic bonds, as is the case in many Sub-Saharan African countries, literature confirms those countries with shared ethnic ties are much more likely to intervene in on-going conflicts (Buhaug & Gleditsch, Contagion or Confusion? Why Conflicts Cluster in Space, 2008; Nome, 2005).

Data source: The dataset used is the Minorities at Risk (MAR) project. It is a "university-based research project that monitors and analyses the status and conflicts of politically-active communal groups in all countries with a current population of at least 500,000." (MAR project website http://www.mar.umd.edu/). Since 1988, the CIDCM at the University of Maryland has hosted the project. The CIDCM is an interdisciplinary research center that has the aim of preventing conflict. The CIDCM's research interests focus on the interplay between conflict and development. The data for this indicator can be downloaded at: http://www.mar.umd.edu/mar_data.asp.

How it is built: The original variable used is *GC10* which represents the transnational dispersion. It ranks from 0 to 3. A value of transnational dispersion is produced for every year and this value is the max of all the ethnic groups of a country. The variable is rescaled from 0 to 10.

Value	Meaning
0	The group has no close kindred across an international border

1	The group has close kindred across a border which does not adjoin its regional base
2	The group has close kindred in one country which adjoins its regional base
3	The group has close kindred in more than one country which adjoins its regional base

Source: Minority at Risk Project (Available at: http://www.mar.umd.edu/data/mar_codebook_Feb09.pdf)

Descriptive Statistics: Missing data are imputed taking the closest available value. The value 0 is assigned to the remaining missing data.

The average percentage of available raw data is 10.40%. The remaining 89.6% is imputed.

The data availability declared by the provider, released in February 2006 for the years 2004-2006 is confirmed in our analyses. The distribution of raw data by year shows that the highest availability is in the period 2004 – 2006 (see Table 21).

Table 21 - Data availability per year for the variable "Transnational Ethnic Bonds"
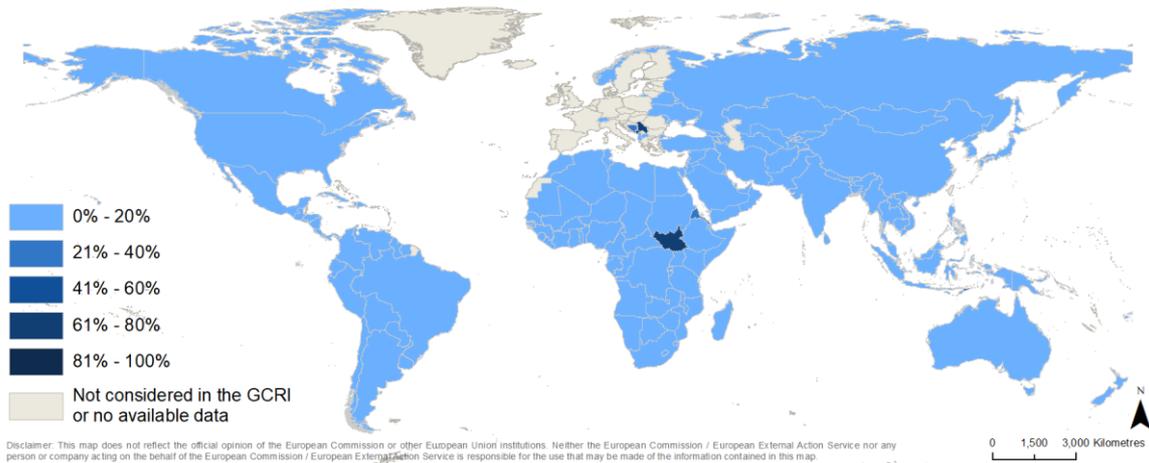
Figure 12 - Data availability per country for the variable "Transnational Ethnic Bonds"

Citations:

Buhaug, H. & Gleditsch, K.-S., 2008. Contagion or Confusion? Why Conflicts Cluster in Space. 2nd ed. International Studies Quarterly 52, pp. 215-233.

Nome, M.-A., 2005. Transnational Ethnic Dimensions of Third-Party Interverntions in Civil Conflicts, Oslo: University of Oslo.

3.13.   Homicide Rate (HOMIC)

Description: Many studies have confirmed that the cost of violence on societies is high. Violence destroys human and physical capital as well as social and political institutions. Moreover, it can lead to disruptions in consumption, investment, trade and production. For example, in 2015, homicide was the second cause of expenditure related to violence, and it accounted for 14.4 per cent of total expenditure of the year (IEP, 2015)

International homicides include unlawful homicides caused by domestic disputes, interpersonal violence, violent conflicts over land resources, inter-gang violence, predatory violence and killing by armed groups. However, killings during armed conflict are usually excluded (World Bank Metadata).

Data source: The dataset used is provided by the World Bank's Worldwide Development Indicators databank, as in 3.3 (please see above) (The data are available for download at: http://databank.worldbank.org/data/home.aspx). In this case, we are looking at the series "Intentional homicides".

How it is built: The original variable used is *value* which counts the numbers of homicides per 100,000 people. Two thresholds are imposed: the first equal to 1 for the values <1,

the second equal to 50 for the values >50. Then a log is applied to the distribution in order to expand the low values and to shrink the high ones[5]. Two rescaling procedures are performed the first with a min of 0 and a max of 30, the second with a min of 0 and a max of 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 37.7%, this implies that the remaining 62.3% is imputed.

The distribution of raw data by year shows that the availability is low for most of the years, except for 2008, 2009, 2010, 2012.
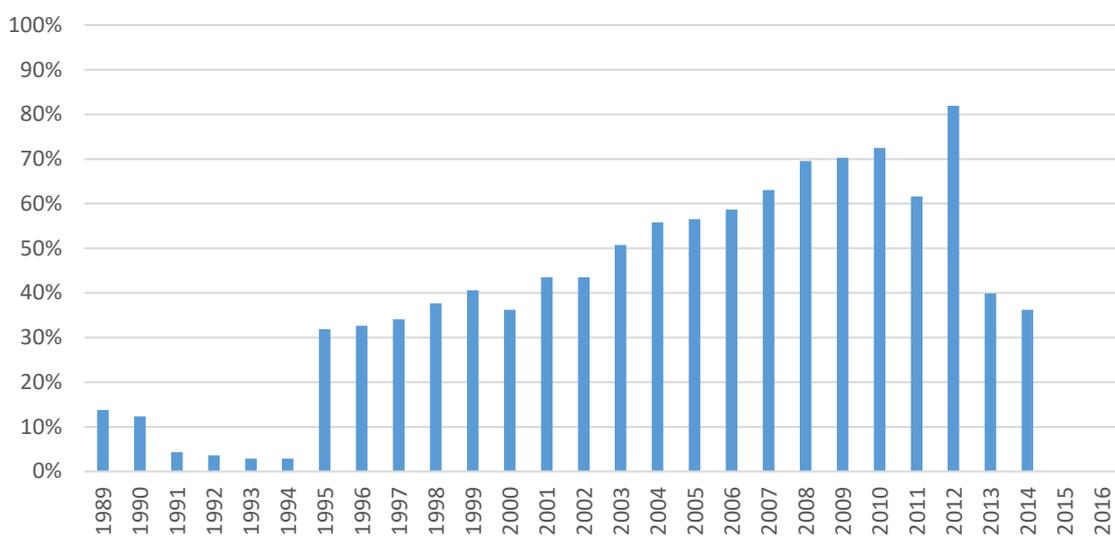
Table 22 - Data availability per year for the variable "Homicide Rate"

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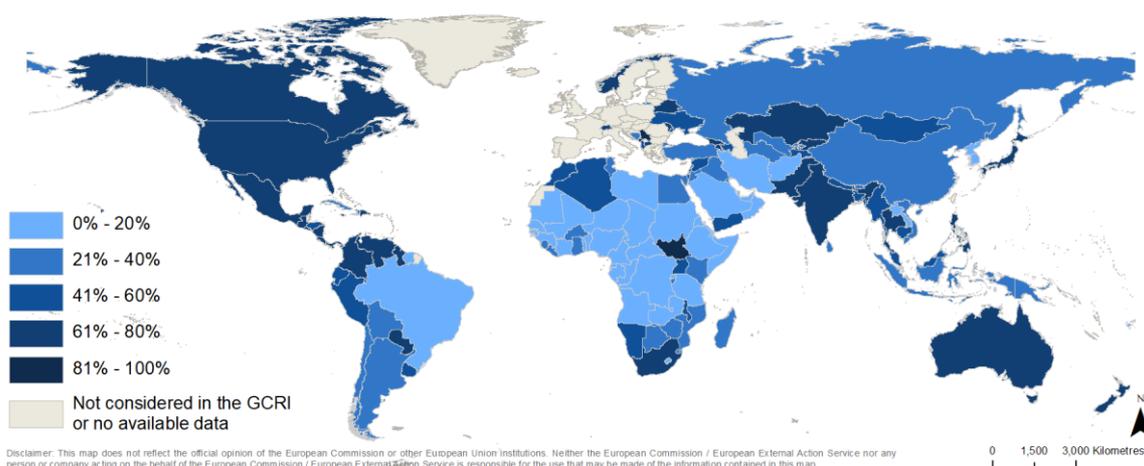
[5] A log is the exponent that indicates the power to which a base number is raised to produce a given number (available at https://www.merriam-webster.com/dictionary/logarithm).

Citations: IEP, 2015, Global Peace Index: measuring peace, its causes and its economic value.

3.14. Infant Mortality (MORT)

Description: Two of the most frequently used indicators to evaluate the socioeconomic progress or failure of a country are the life expectancy at birth and the survival to a certain age. Both indicators provide a clear picture of how good the health system is, while the under-five mortality captures also the effect of gender discrimination. Malnutrition and medical services have a significant impact to this age group, and when female mortality is higher, girls are likely to have less access to resources than boys (World Bank Metadata).

Data source: The dataset used is provided by the World Bank's Worldwide Development Indicators databank, as in 3.3 (please see above) (The data are available for download at: http://databank.worldbank.org/data/home.aspx). In this case we are using the series "Mortality rate, under-5 (per 1000 live births)".

How it is built: The original variable used is *SH.DYN.MORT* which is the "under-five" mortality rate. It measures the probability per 1,000 inhabitants that a newborn baby will die before reaching the age of five, if subject to age-specific mortality rates of the specified year. A log is firstly applied to the distribution and two rescaling procedures are then performed: the first one with a minimum value of 0 and a maximum value of 130; and the second one with a minimum value of 0 and a maximal value of 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 96.4%. The remaining 3.6% is imputed.

The distribution of raw data by year shows a very high availability of data.
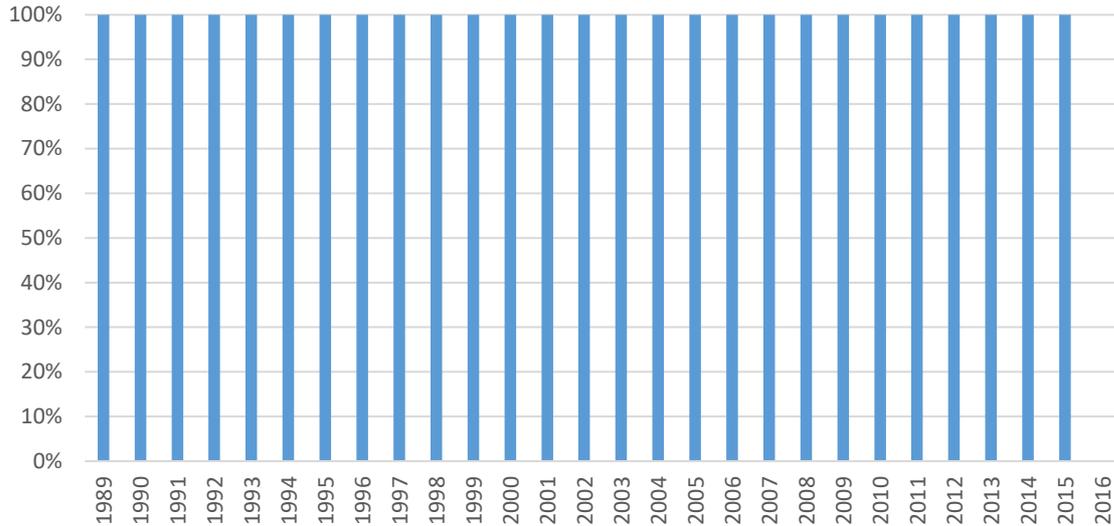
Table 23 - Data availability per year for the variable "Infant Mortality"
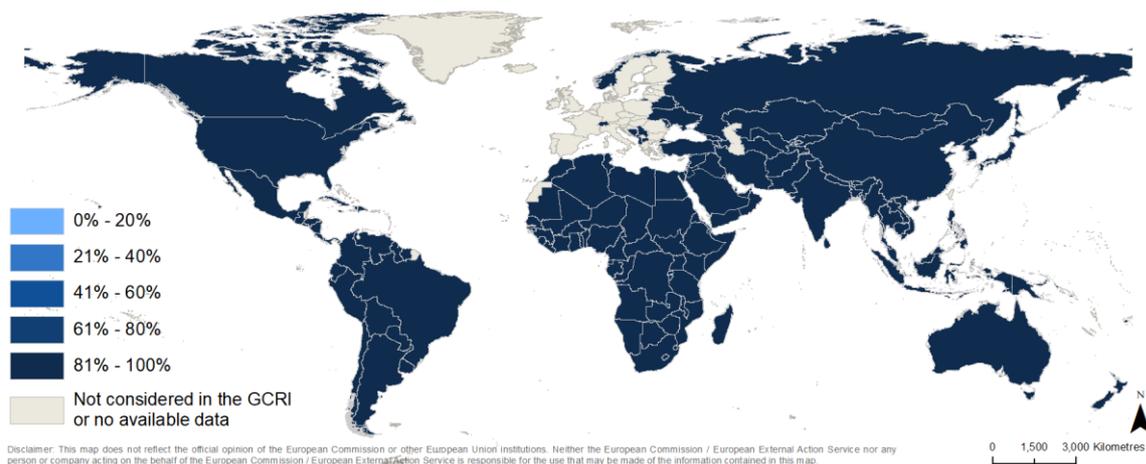
Figure 14 - Data availability per country for the variable "Infant Mortality"

3.15.   GDP Per capita (GDP)

Description: Based on capitalist political theory, peace happens when countries are similar enough that it is not cost-efficient to fight about the difference. Moreover, peace is driven by two characteristics of mature capitalist economies. First, since there is no more impetus to territorial expansion the new expansion frontier is the financial capital, where factors are not conquered. Second the rise of global capital markets creates a new way of competing for states that might otherwise be forced to fight. According to Gartzke, together, these elements explain the absence of war among states in the developed countries (Gartzke, 2007).

GDP is calculated as the sum of the gross value produced by all the actors resident in a country, plus taxes on good, minus subsidies not included in the value of the products. GDP is converted to international dollars using purchasing power parity rates. Therefore, an international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States.

Data source: The dataset used is provided by the World Bank's Worldwide Development Indicators databank, as in 3.3 (please see above) (The data are available for download at: http://databank.worldbank.org/data/home.aspx). In this case we are using the series "GDP per capita, PPP (constant 2011 international $)".

How it is built: The original variable used is "*value*". Then a log is applied to the distribution, and a linear inverse rescaling is performed from 0 to 10

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 89.5%. The remaining 10.5% is imputed.

The distribution of raw data by year shows that the availability is very high for all the years except for 1989.
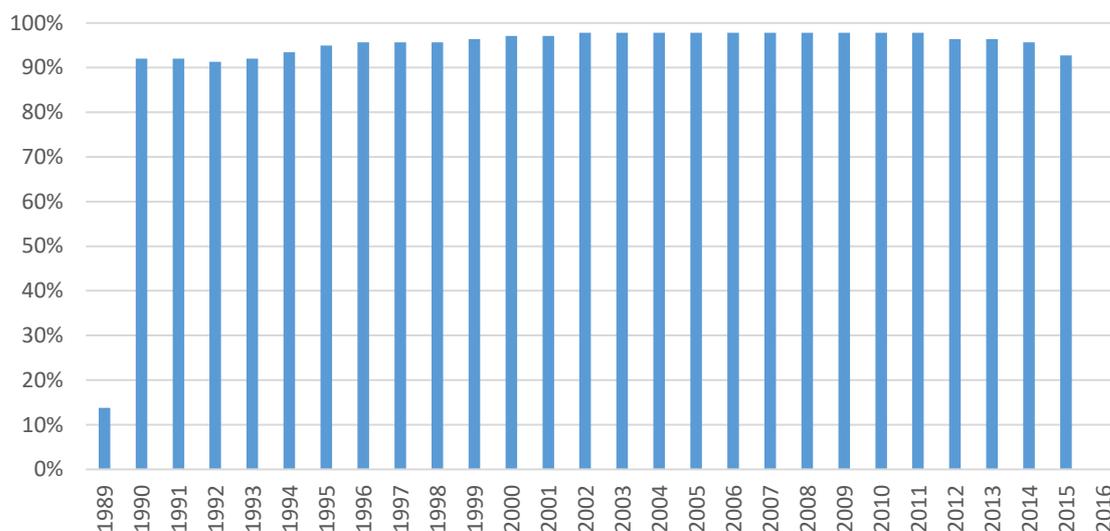
Table 24 - Data availability per year for the variable "GDP per capita"
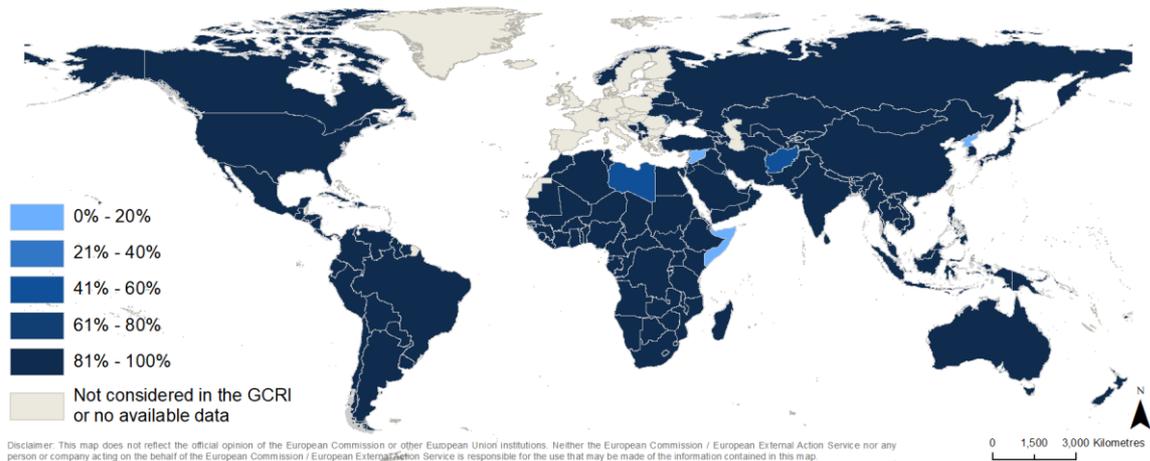
Figure 15 - Data availability per country for the variable "GDP per capita"

Citations: GDP per capita is consistently linked with conflict in literature (Hegre & Sambanis, 2006). A low level of income makes it easier to recruit solders to rebel organisations, as making a living from normal work becomes harder (Collier & Hoeffler, 2004).

Collier, P. & Hoeffler, A., 2004. Greed and Grievance in civil wars. Oxford Economic Papers 56, pp. 563-596.

Hegre, H. & Sambanis, N., 2006. Sensitivity Analysis of Empirical Results on Civil War Onset. 4th ed. Journal of Conflict Resolution 50, pp. 508-536.

Gartzke, E. 2007. The Capitalist Peace, American Journal of Political Science, Vol. 51, No. 1, pp. 166–19.

3.16.   Income Inequality (INEQ_SWIID)

Description: Distribution issues manifest in a variety of economic indicators, for example indicators on income inequality. Because inequality in various terms contributes to social tension, these indicators play a central role in studies on the economic causes of violence (see e.g. Collier and Hoeffler, 2004). However, cross-national research on the causes and consequences of income inequality has been hindered by the limitations of existing inequality datasets: greater coverage across countries and over time is available from these sources only at the cost of significantly reduced comparability across observations.

Data source: The dataset used is the Standardized World Income Inequality Database (SWIID). It is provided by Harvard Dataverse, an open source web application which allows sharing research data. The SWIID provides comparable Gini indices of gross and

net income inequality for 176 countries from 1960 to 2015. The data for this indicator can be downloaded at:

https://dataverse.harvard.edu/dataset.xhtml?persistentId=hdl:1902.1/11992.

How it is built: The variable used is the Gini index of net income. A mean of all the Gini indicators is firstly calculated and a linear rescaling is then performed from 0 (minimal income inequality) to 10 (maximal income inequality)

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 55.2%, this implies that the remaining 44.8% is imputed.

The distribution of raw data by year shows a significant and progressive decrease of data availability starting from 2006.
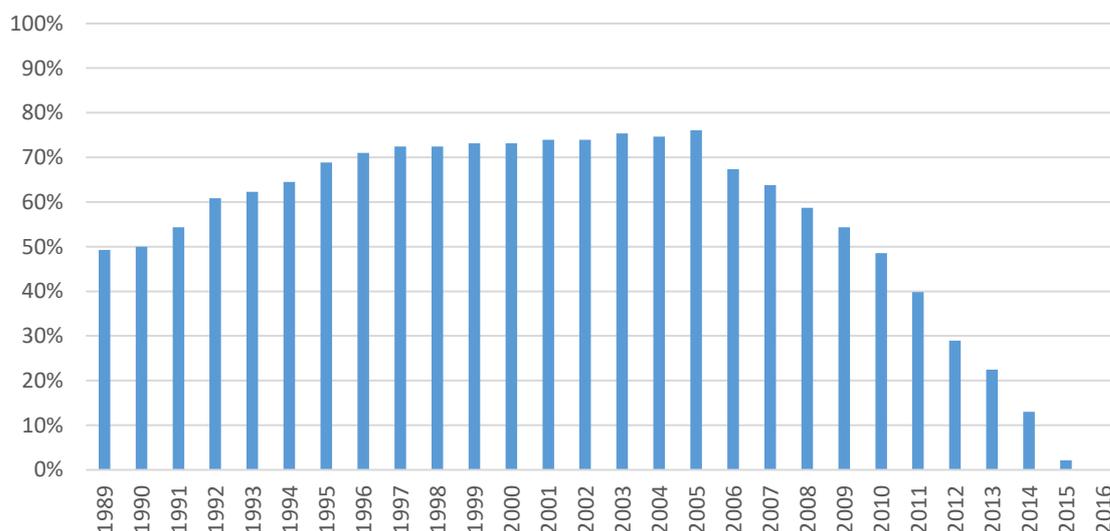
Table 25 - Data availability per year for the variable "Income Inequality"
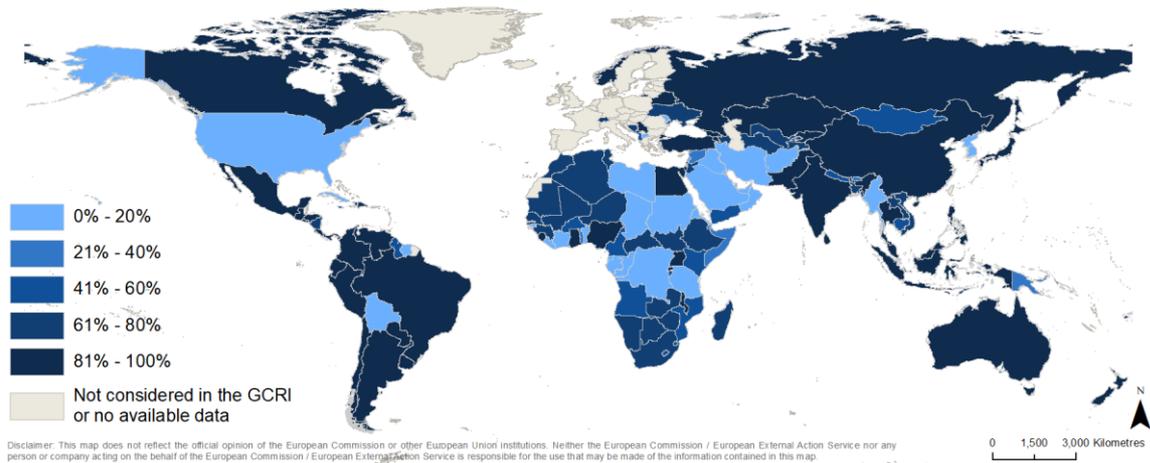
Figure 16 - Data availability per country for the variable "Income Inequality"

Citations: Solt, Frederick. 2016. The Standardized World Income Inequality Database. Social Science Quarterly 97. SWIID Version 5.1.

Collier, P. & Hoeffler, A., 2004. Greed and Grievance in civil wars. Oxford Economic Papers 56, pp. 563-596.

3.17. Openness (ECON_ISO)

Description: According to Martin, Thoenig and Mayer, trade can have two different effects on the risk of civil conflicts: it may act as a deterrent, as well as an insurance. The first case happens when economical gains are put in danger by wars. The second takes place when the internal trade is destroyed and the international one can somehow substitute it. Therefore, the authors found proof that "trade openness may deter the most severe civil wars (those that destroy the largest amount of trade) but may increase the risk of lower-scale conflicts" (Martin et al. 2008, p. 541).

We determine a country economic openness by using the following three indicators: FDI net inflow (BoP, current US $), FDI net inflow as a percentage of the GDP, and Exports of goods and services (as percentage of the GDP). The first indicator refers to direct investment equity flows; it is the sum of equity capital, reinvestment of earnings, and other capital. The second is the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. The third represents the value of all goods and other market services provided to the rest of the world (World Bank Metadata).

Data source: The dataset used is provided by the World Bank's Worldwide Development Indicators databank, as in 3.3 (please see above) (The data are available for download at: http://databank.worldbank.org/data/home.aspx). In this case we are looking at the series: Foreign direct investment, net inflows (BoP, current US$), Foreign direct investment, net inflows (% of GDP), and Exports of goods and services (% of GDP).

How it is built: We bind together the three initial components FDI net inflow (*Foreign*), FDI net inflow as a percentage of the GDP (*Foreign2*), and Exports of goods and services (*Export)* and impose then thresholds:

For *Foreign*: the first threshold equal to 100.000 for the values <100.000, the second equal to 15.000.000.000 for the values >15.000.000.000.

For *Foreign2*: the first threshold equal to 1 for the values <1, the second equal to 15 for the values >15.

For *Export*: the first threshold equal to 3 for the values <3, the second equal to 200 for the values >200.

A log is applied to all the values and a linear inverse rescaling is performed from 0 to 10. An index is constructed by firstly calculating the mean value of *Foreign* and *Foreign2,* and secondly the mean value of the previous result and *Export*.

Descriptive Statistics: Missing data are imputed taking the closest available value.

This variable is composed using three sources *(Foreign, Foreign2, Export)*.
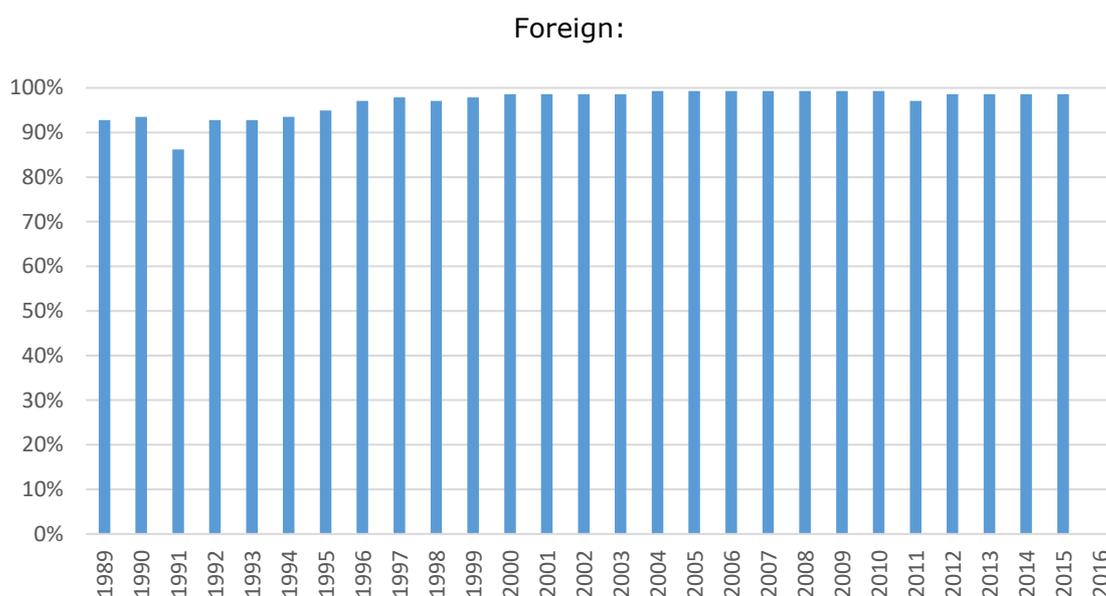
Foreign:

Table 26 - Data availability per year for the variable "Foreign"
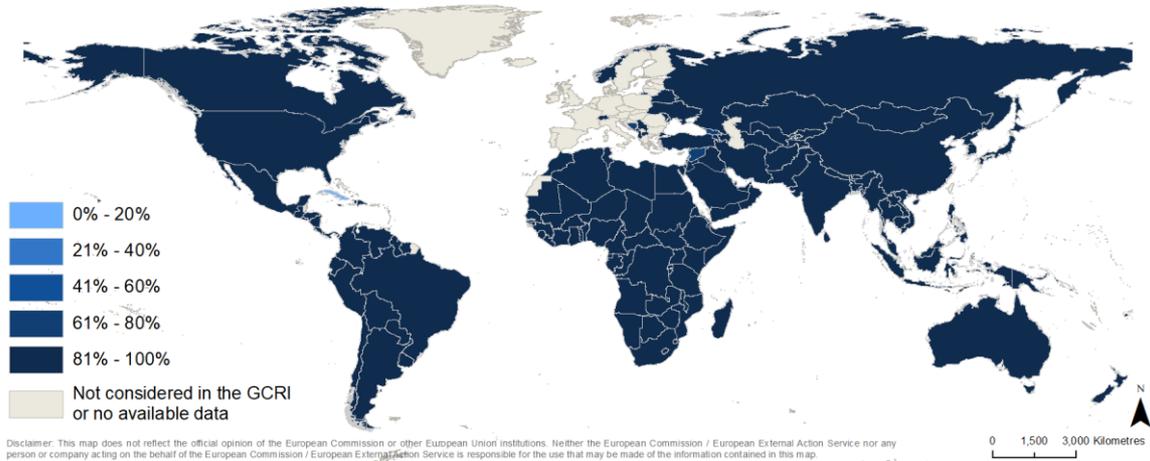
Figure 17 - Data availability per country for the variable "Foreign"

The average percentage of available raw data is 93.45%. The remaining 6.5% is imputed. The distribution of raw data by year shows a complete availability of information in the period 1989 – 2015.
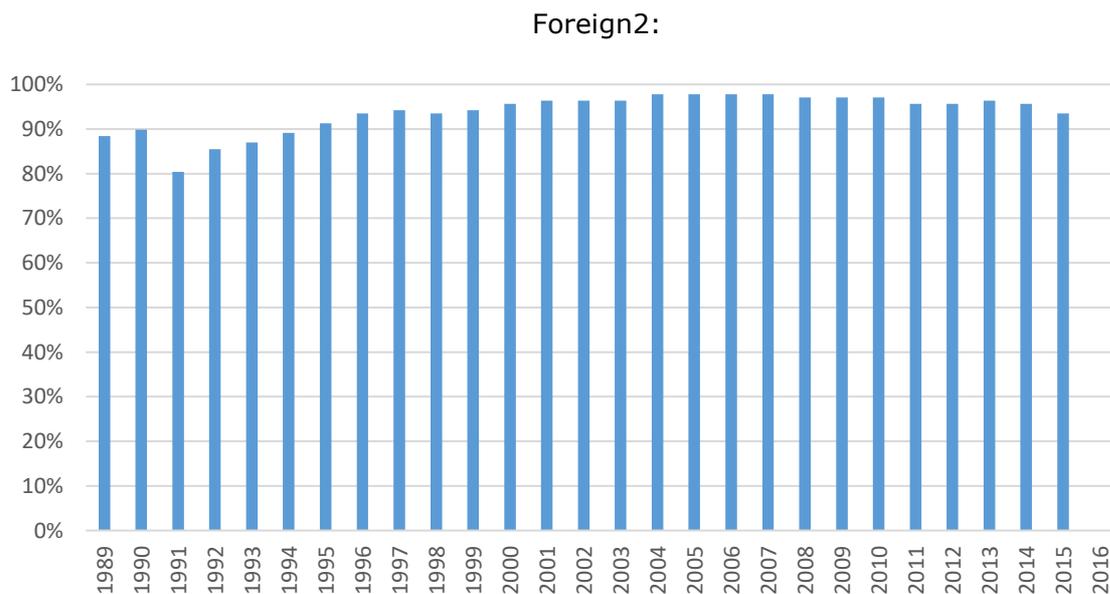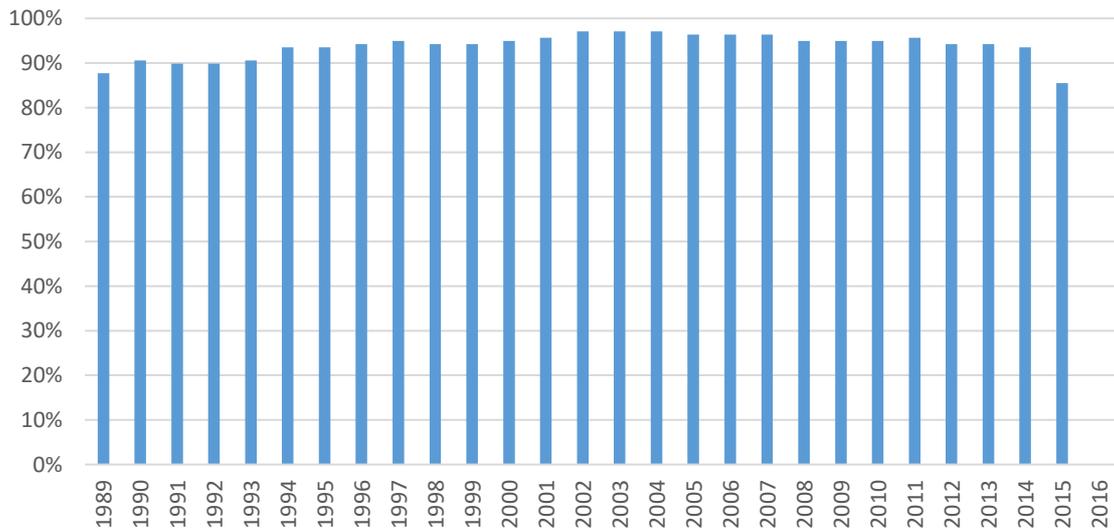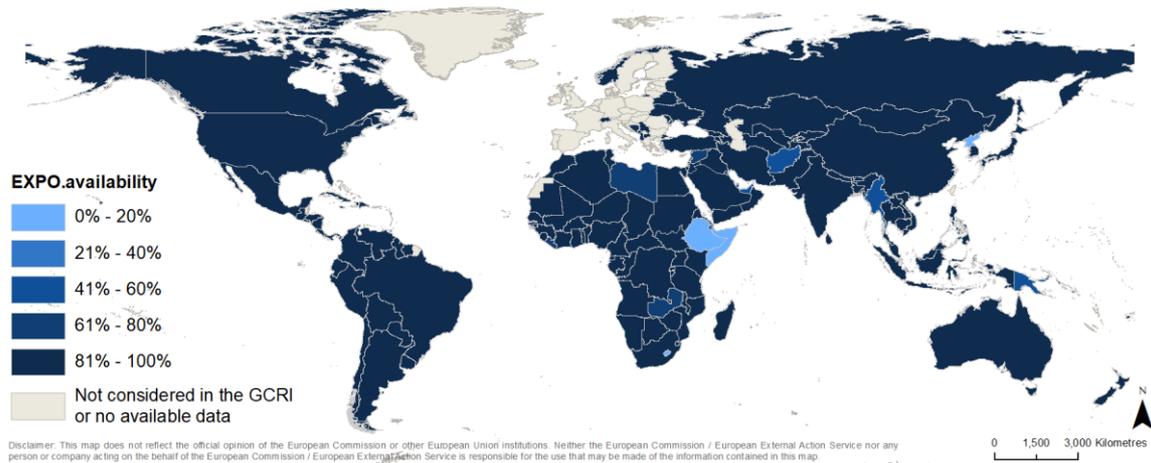
Foreign2:

Table 27 - Data availability per year for the variable "Foreign2"
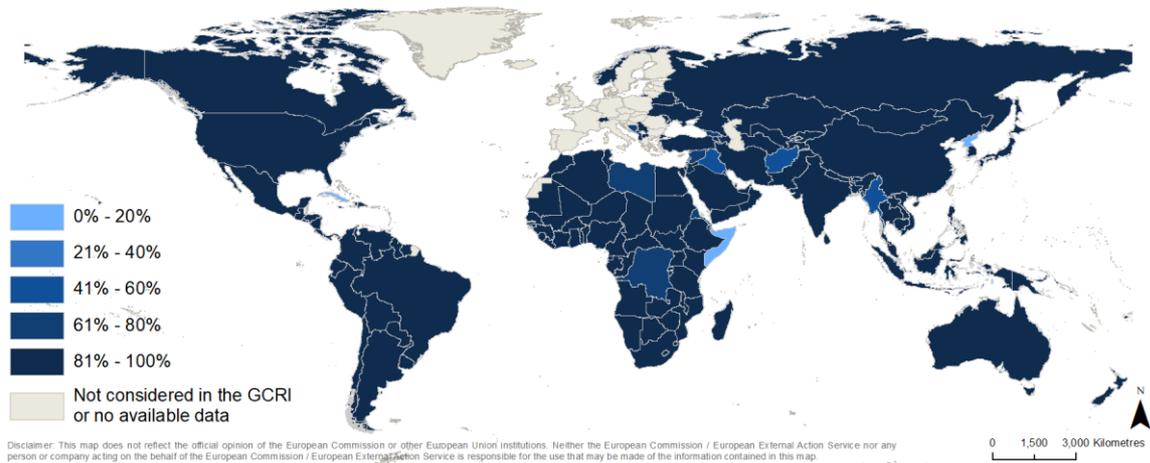
Figure 18 - Data availability per country for the variable "Foreign2"

The average percentage of available raw data is 90.40%. The remaining 9.6% is imputed. The distribution of raw data by year shows a quite complete availability of information in the period 1989 – 2015.

Export:

Table 28 - Data availability per year for the variable "Export"

Figure 19 - Data availability per country for the variable "Export"

The average percentage of available raw data is 90.42%. The remaining 9.6% is imputed. The distribution of raw data by year shows a quite complete availability of information in the period 1989 – 2015.

Citations: Martin, P., Thoenig, M., & Mayer, T. 2008. Civil Wars and International Trade, Journal of the European Economic Association, pp.541–550.

3.18.   Food Security (FOOD)

Description: The final report of the 1996 World Food Summit states that food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy" (Patel 2013, and Rome Declaration: available at: http://www.fao.org/docrep/003/w3548e/w3548e00.htm).

According to many studies, past and present conflicts have erupted also because of lack of food; in fact outbreaks of riots, or worse, often have a very basic motivation behind, food insecurity. Conflicts often are about controlling the factors of food production, primarily land and water. Groups fight over farmable land and water sources to produce high value commodities like coffee or cotton. Moreover more variable climates, greater price volatility, and a growing population tend to increase the risk of civil unrest or worse, conflict.

Data source: The dataset used is provided by FAO (Food and Agriculture Organization) and is called Food Security Indicators (FSI). FAO is a specialized agency of the United Nations, whose goal is to defeat hunger. In September 2011, an initial set of indicators,

aiming to capture various aspects of food insecurity, were presented. From then on many of these indicators are produced and published elsewhere by FAO and other international organizations. However, they are combined in a single database (FSI) with the aim of building a wide food security information system. The data for this indicator can be downloaded at: http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/.

How it is built: The FSI dataset is an excel file made of many sheets; we use four of them: *v_1.1 (Diet), v_2.5 (Price Level), v_2.6 (Nourishment) and v_3.5 (Volatility)*. The first indicator expresses the Dietary Energy Supply (DES) as a percentage of the Average Dietary Energy Requirement (ADER). The second is the domestic food price level index, an indicator of the relative price of food in a country. The third represents the prevalence of undernourishment and expresses the probability that a randomly selected individual from the population consumes an amount of calories that is insufficient to cover her/his energy requirement for an active and healthy life. Finally, the fourth indicator is the domestic food price volatility index that measures the variability in the relative price of food in a country. Threshold are then imposed on the different indicators:

Diet: two thresholds are imposed. The first equals to 75 for the values <75, the second equals to 150 for the values >150.

Price Level: one threshold equal to 10 for the values >10 is imposed.

Nourishment: two thresholds are imposed. The first one equals to 5 for the values <5, the second equals to 35 for the values >35.

Volatility: one threshold equal to 20 for the values >20 is imposed.

The four variables are imputed separately, then an index is created. Firstly, all variables are bound all together. An imputation using the mean is then performed to fill all those cases when no previous data were available. A linear rescaling is performed, which is inverted for the diet indicator. Finally, a weighted average of the price level and the price volatility is performed, which is again averaged with the other two variables.

Descriptive Statistics: Missing data are imputed taking the closest available value.

Diet**:**
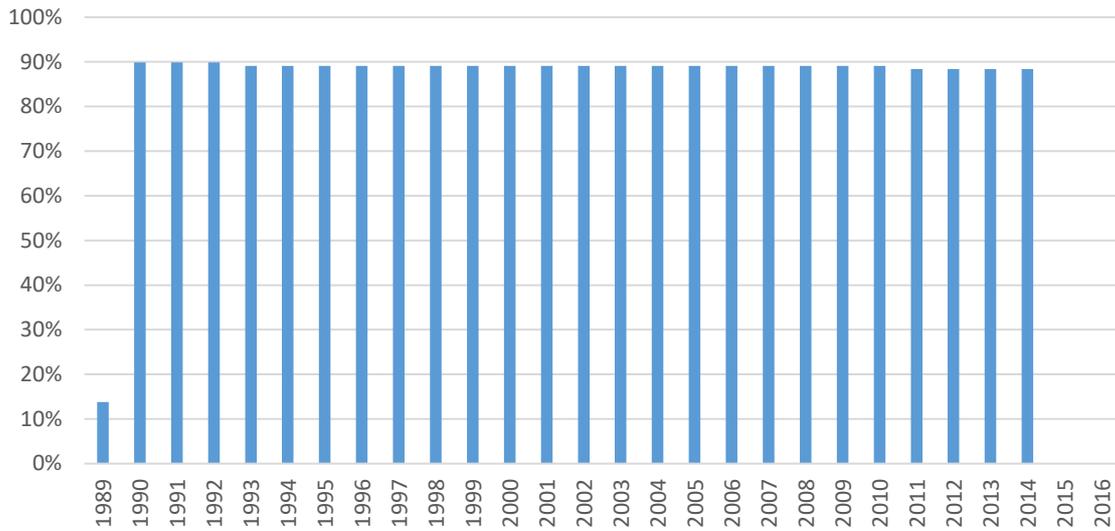

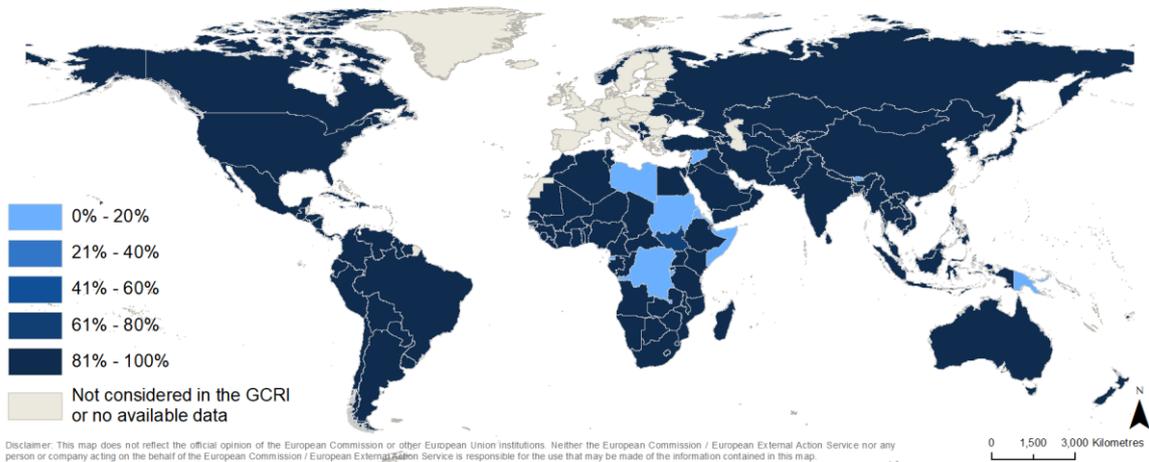*Table 29 - Data availability per year for the variable "Diet"*

Figure 20 - Data availability per country for the variable "Diet"

The average percentage of available raw data is 80%, this implies that the remaining 20% is imputed.

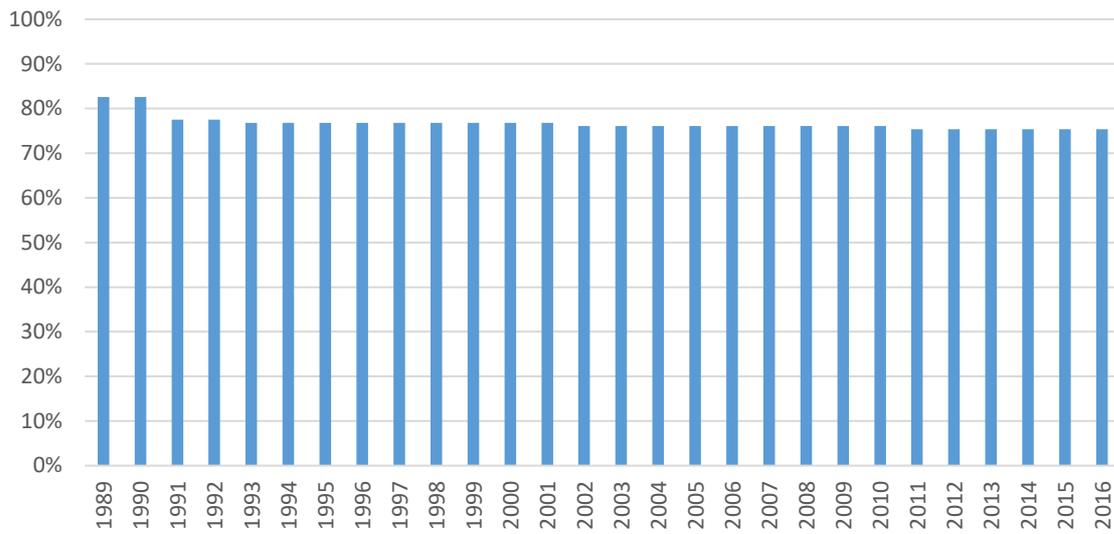The data availability has remained constant since 1990.

Price Level:

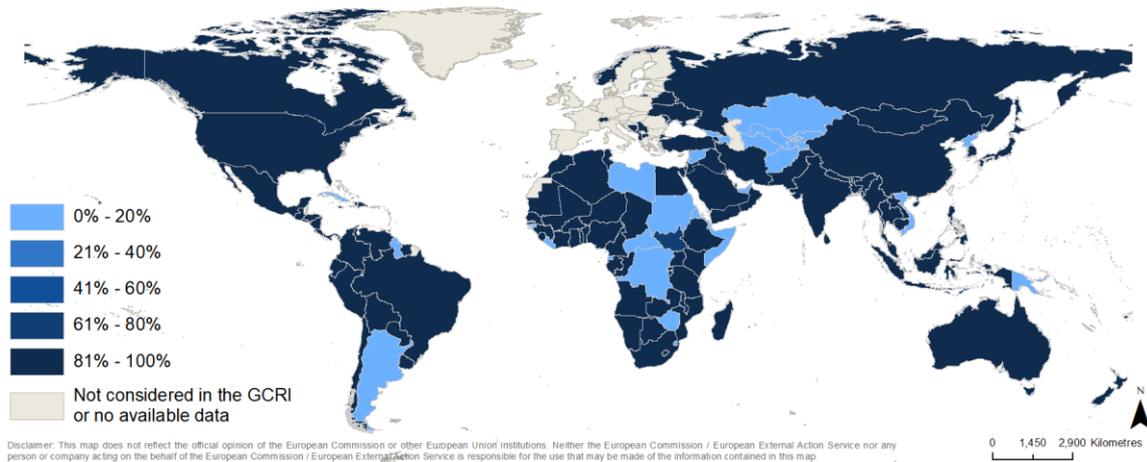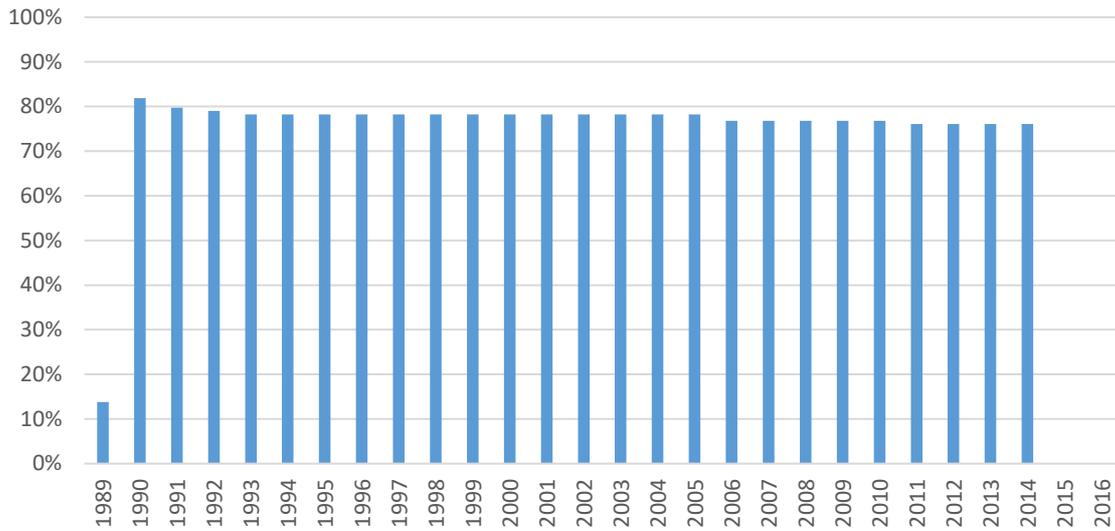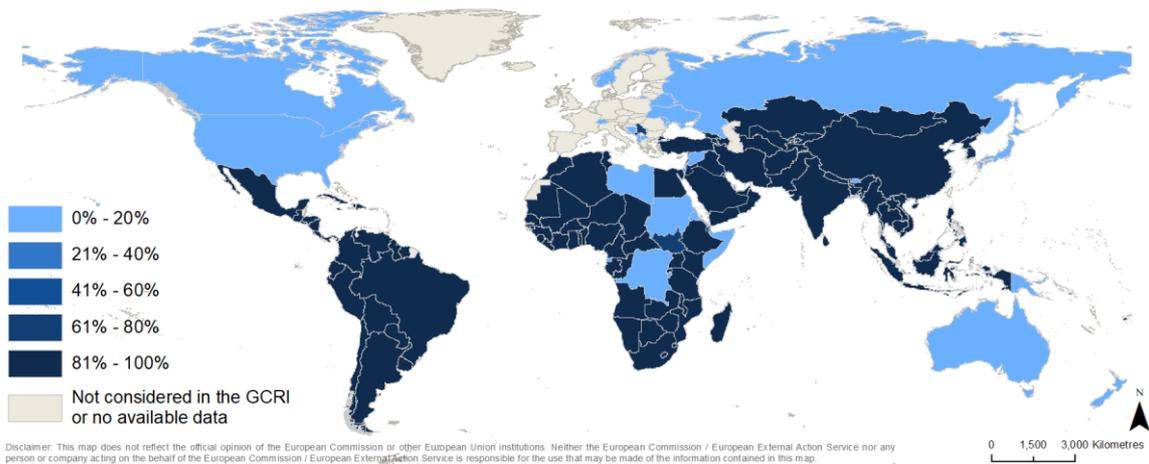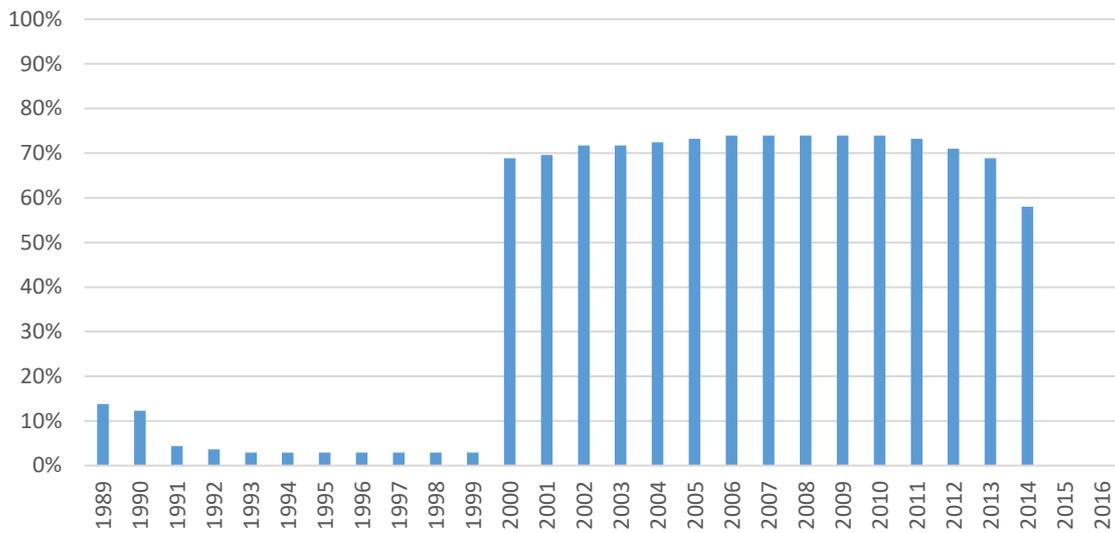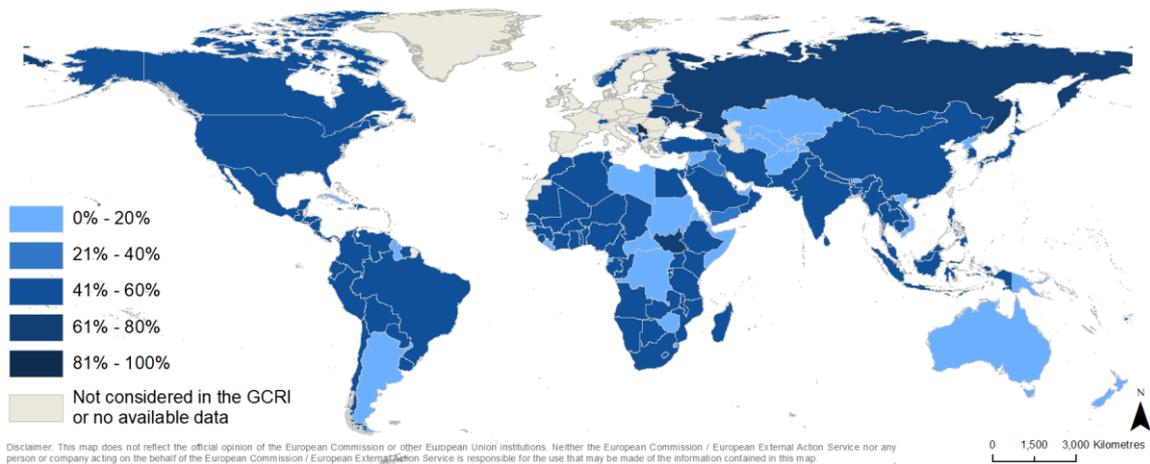*Table 30 - Data availability per year for the variable "Price Level"*

Figure 21 - Data availability per country for the variable "Price Level"

The average percentage of available raw data is 76%. The remaining 24% is imputed.

The data availability has remained constant during the years.

Nourishment:

Table 31 - Data availability per year for the variable "Nourishment"

Figure 22 - Data availability per country for the variable "Nourishment"

The average percentage of available raw data is 70%**.** The remaining 30% is imputed.

The data availability has remained constant since 1990.

Volatility:

Table 32 - Data availability per year for the variable "Volatility"

Figure 23 - Data availability per country for the variable "Volatility"

The average percentage of available raw data is 40.1%. The remaining 59.9% is imputed.

The data availability is very poor until 2000. from 2001 until 2014 it improves sensibly.

Citations: FAO, UN. 2003. Trade Reforms and Food Security: Conceptualizing the Linkages*.*

Patel, P. 2013. Food sovereignty is next big idea. Financial Times.

FAO, UN. 1996. Rome Declaration on Food Security and World Food Summit Plan of Action.

Bora, S., Ceccacci, I., Delgado, C., & Townsend. R. 2010. Food security and Conflict, World Bank: World Development Report 2011.

3.19. Unemployment (UNEMP)

Description: Unemployment is a key measure to monitor whether a country is implementing policies for an inclusive economic growth and for full employment. What has been noted is that low unemployment rates can disguise substantial poverty in a country, while high unemployment rates can occur in countries highly economically developed. This happens because if workers can rely on unemployment benefits and on a safety net, then they can wait for suitable jobs. While in poor countries with no state support, citizens accept jobs even if underpaid or unsafe.

Unemployed are those individuals without work, but that have been searching for a job in a recent past period, and that are currently available for work. Persons who, although are not looking for work, have an arrangement for a future job are also considered unemployed. A certain unemployment level is unavoidable, also just because workers change jobs and generally they are jobless in between. (World Bank Metadata).

Unemployment is considered a possible cause of recruiting members of insurgent groups, gangs or even extremist cells, in fact, according to economic theories, unemployed people have a low opportunity cost of engaging in violence and therefore low recruitment costs.

Data source: The dataset used is provided by the World Bank's Worldwide Development Indicators databank, as in 3.3 (please see above) (The data are available for download at: http://databank.worldbank.org/data/home.aspx). In this case we are looking at the series: Unemployment, total (% of total labour force).

How it is built: The variable used is *value*. A threshold equal to 2 has been imposed for the values <2, then a linear rescaling is performed from 0 to 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 85.9%. The remaining 14.1% is imputed.

The distribution of raw data by year reports a very good data coverage since 1991, while for the most part data for years 1989 and 1990, had to be imputed.
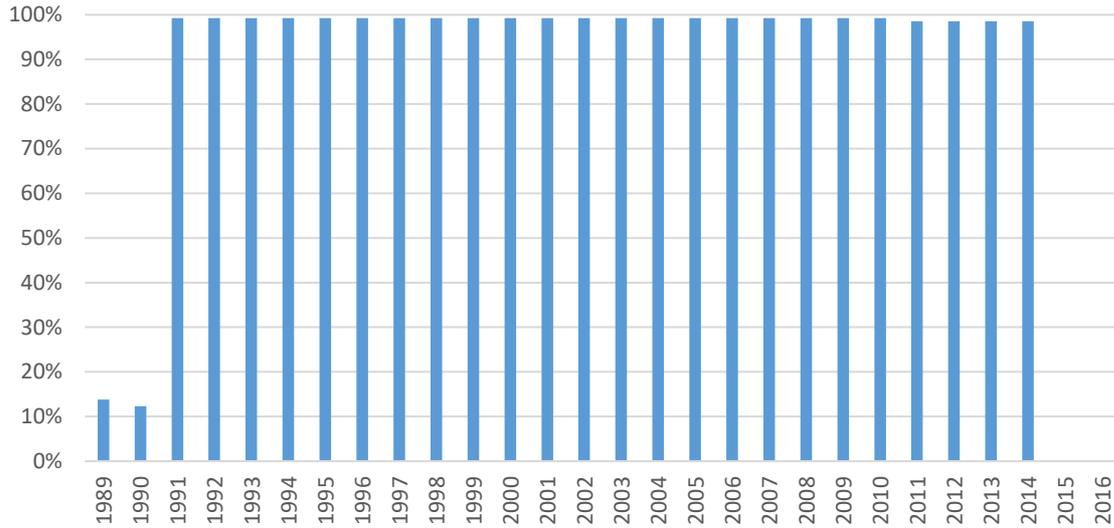
Table 33 - Data availability per year for the variable "Unemployment"
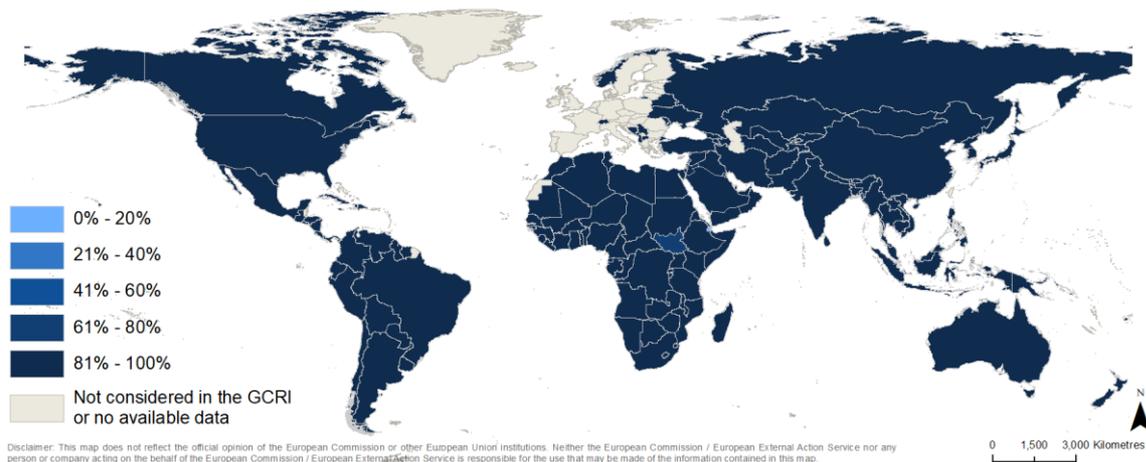

Figure 24 - Data availability per country for the variable "Unemployment"

3.20. Water Stress (WATER)

Description: Geographical factors that are inherent to the country's specificity have to be taken into account by quantitative studies. For example, the shortage of water or the abundance of certain resources have been factors widely researched and found significant to explain countries' behaviour. In fact, in a theoretical view, the shortage of certain resources may cause incentives to secede.

Data source: The dataset used is called Aqueduct Country and River Basin Rankings. This dataset shows countries and river basins' average exposure to five water risk indicators: baseline water stress, inter-annual variability, seasonal variability, flood occurrence and

drought severity. The World Resources Institute, which is the dataset provider, has the objective of providing scientific analysis about global environment and development challenges. The data for this indicator can be downloaded at http://www.wri.org/resources/data-sets/aqueduct-country-and-river-basin-rankings.

How it is built: The variable used is the *tdefm*, which is not a time series but a judgement of the country based on time series data. As an indicator of overall water risk, it refers to all the sectors (agricultural, domestic, and industrial) for which it has been derived as the mean value. In fact, one value is given to all countries and is used for the entire period. The variable is linearly rescaled from 0 to 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 91.3%. The remaining 8.7% is imputed.

The distribution of raw data by year shows that we have a high availability of data for the whole time series.
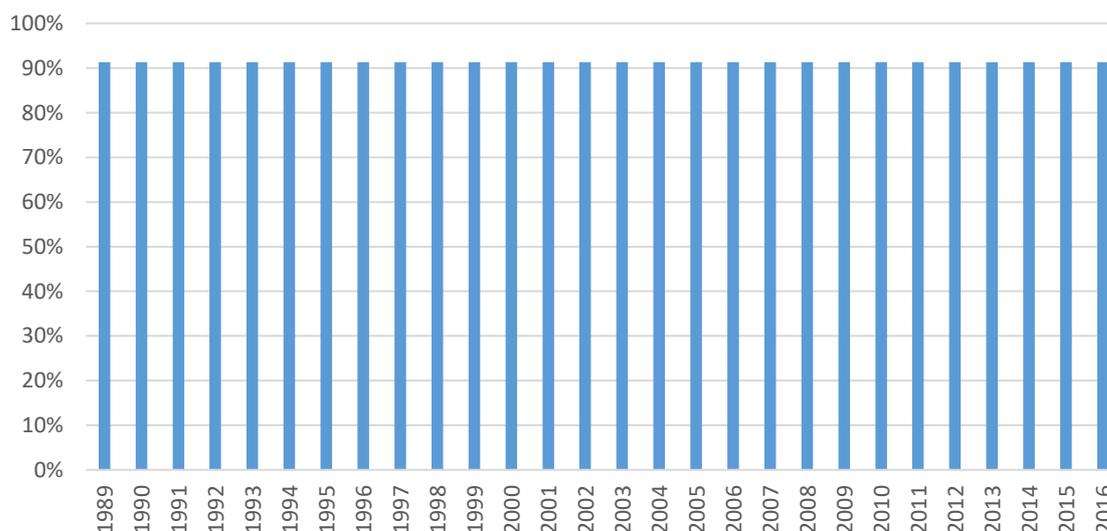
Table 34 - Data availability per year for the variable "Water Stress"
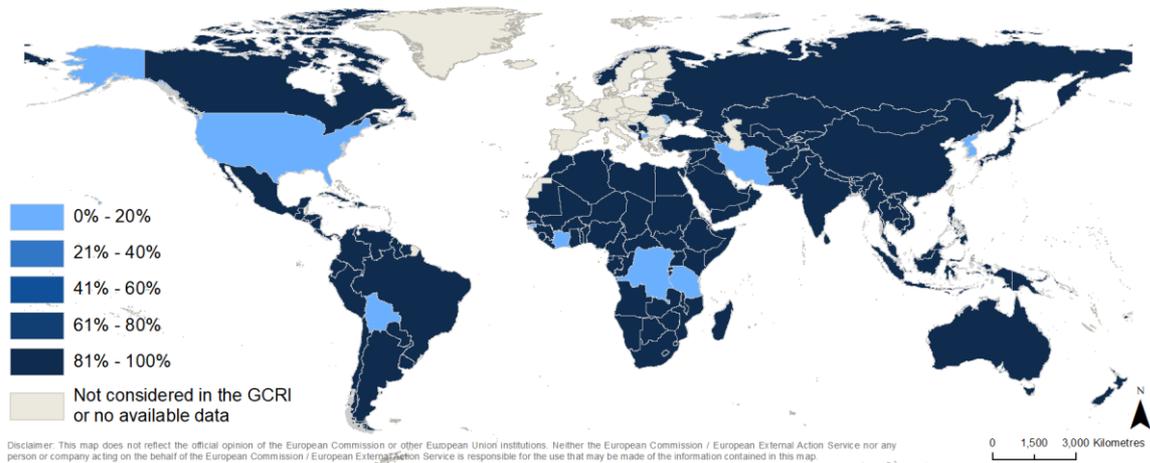
Figure 25 - Data availability per country for the variable "Water Stress"

Citations: Gassert, F., Reig, P., Luo, T., & Maddocks, A. 2013. Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators. Working paper. Washington, DC: World Resources Institute.

3.21.   Oil Producer (FUEL_EXP)

Description: Several studies show that oil producers have a higher risk of conflict than other countries, whereas the correlations for other resources and conflict are oftentimes insignificant (Dixon, 2009). Indeed, based on a compilation of several quantitative studies, Dixon shows a high degree of consensus on the increased vulnerability of oil exporters to civil wars (2009).

Data source: The dataset used is provided by the World Bank's Worldwide Development Indicators databank, as in 3.3 (please see above) (The data are available for download at: http://databank.worldbank.org/data/home.aspx). The World Bank measures fuels exports for each country, where fuels comprise the commodities in SITC (Standard International Trade Classification) section 3. We are looking at the series "Fuel exports (% of merchandise exports)" in the databank "World Development Indicators".

How it is built: The variable used is *value* which represents the fuel exports as percentage of merchandise exports. A threshold equal to 1 is imposed for values <1. A log is then applied to the distribution, which is linearly rescaled from 0 to 10.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 66.9%. The remaining 33.1% is imputed. The data availability increased from 1992 to 2001, then it has remained quite stable.
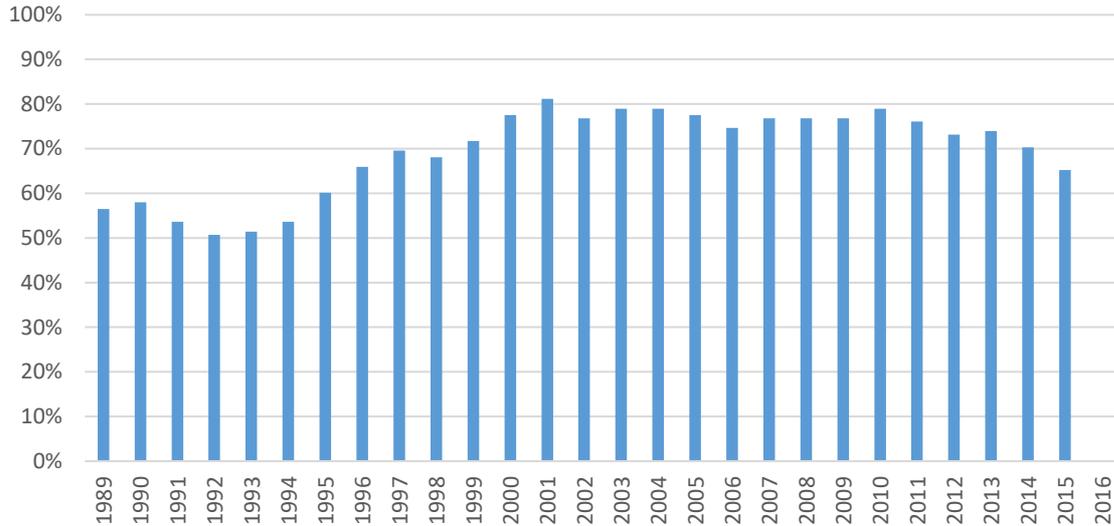
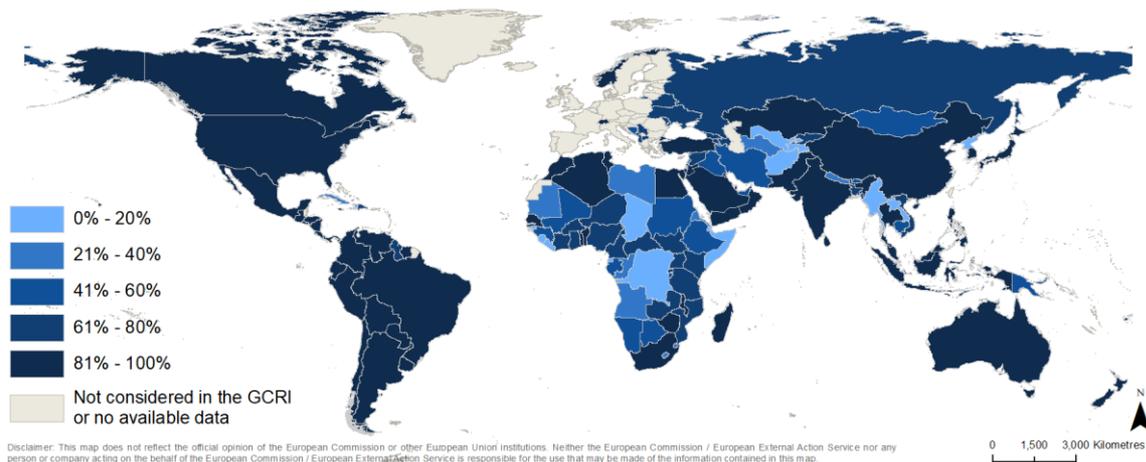*Table 35 - Data availability per year for the variable "Oil Producer"*

Figure 26 - Data availability per country for the variable "Oil Producer"

Citations: Dixon, J. 2009. What causes civil wars? Integrating Quantitative Research Findings. International Studies Review 11, pp. 707-735.

3.22.   Structural Constraints (STRUCT)

Description: Are countries in transition able to moderate and de-escalate conflict? According to Hauke Hartmann[6] this is still one of the main difficulties that transition countries have to face. They still lack for the most part the ability to prevent conflict, and "this has always made it more difficult for them to steer transformation processes (…).

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[6] Senior Project Manager at BTI

The countries that take a moderate, balanced approach to dealing with forces that polarize and create conflict are located in regions that are not particularly prone to conflict. In other words, the regions where good conflict management is missing—in the Sahel, North Africa and the Middle East—those are the regions that need it more than ever.

Data source: The dataset used is BTI 2016, provided by the Bertelsmann Stiftung's Transformation Index (BTI). It is a cross-national comparative index that has been built in order to measure "the quality of governance during processes of transition" (Bertelsmann Stiftung website. Available at: http://www.bti-project.org/en/index/). It analyses three aspects of the democratization process: the quality of democracy, the openness of the economy and the political management. The research is conducted on 129 countries, focusing especially on the developing ones. The BTI dataset is the result of an international analytical collaboration of almost 300 experts from around the world, plus the contribution of local reporters from many countries (http://www.bti-project.org/en/about/).

How it is built: The variable used is *Q13.1 | Structural constraints*. There are six different excel sheets that are bind together. The Bertelsmann Stiftung provides data every 2 years. No rescaling is necessary.

Descriptive Statistics: Missing data are imputed taking the closest available value.

The average percentage of available raw data is 18.8%. The remaining 81.2% is imputed.

The BTI releases the data every two years and this is clearly visible in the below graph starting from 2006. For the previous years the datasets are composed mostly by data not relevant to our analysis. Moreover, missing data might also be caused by the fact that the BTI excludes countries "that might be considered long-consolidated democratic systems and in which economic development can be regarded as well-advanced. In the absence of a clearly defined "threshold of consolidation," the Transformation Index therefore excludes all countries that were members of the Organisation for Economic Cooperation and Development (OECD) by the year 1989"[7].

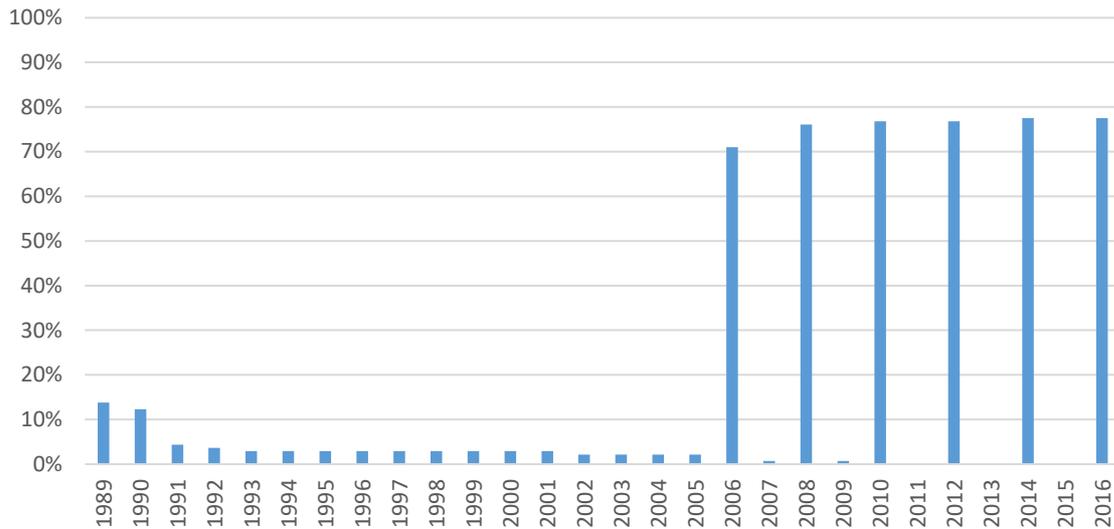[7] (https://www.bti-project.org/en/index/methodology/).

Table 36 - Data availability per year for the variable "Structural Constrains"
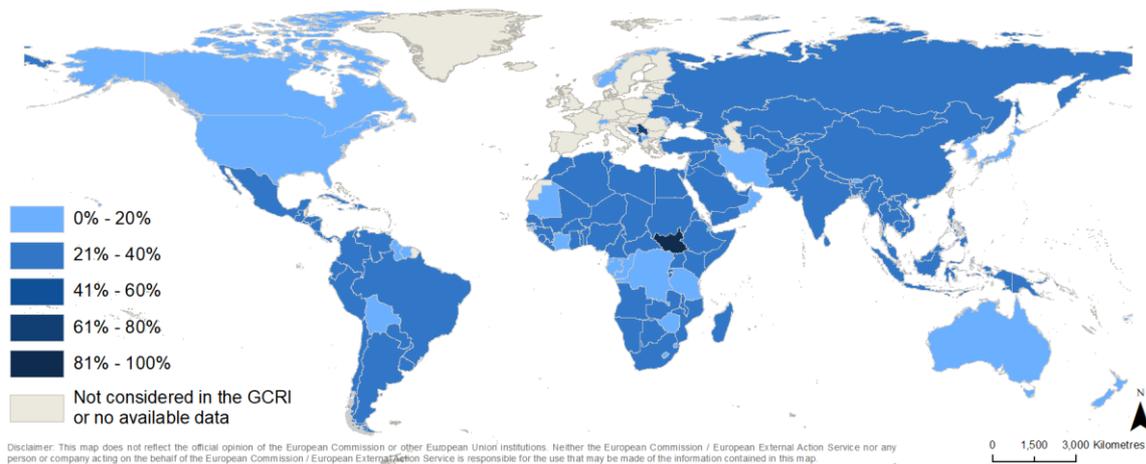
Figure 27 - Data availability per country for the variable "Structural Constrains"

Citations: https://blog.bti-project.org/2014/02/19/conflict-management-is-at-a-low-point/

3.23.   **Population Size (POP)**

Description: Population size has been an important control variable in quantitative studies for years, as it tends to correlate with the number of shared borders and the country size: "The most robust empirical finding in country-level studies of civil war is that large countries have more civil wars than small countries" (Raleigh & Hegre, 2009, p. 224; Collier & Hoeffler, 2004; Fearon & Laitin, 2003; Hegre & Sambanis, 2006)

Data source: The dataset used is called "Annual Population by Age-both Sexes" and is the twenty-fifth round of official United Nations population estimates and projections that have been prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. The UN Population Division assists the Department of Economic and Social Affairs in discharging its functions as member of the Global Migration Group. The data for this indicator can be downloaded at: http://esa.un.org/unpd/wpp/Download/Standard/Interpolated/.

How it is built: We sum the population, which is divided by age, in order to know the total population of a country for a specific year. A log is firstly applied to the distribution. Then, a threshold equal to 6 is imposed for values <6, and a threshold equal to 12.5 is imposed for values <12.5. Finally, the values are rescaled from 0 to 10.

Descriptive Statistics: No missing data. The average percentage of available raw data is 100%.
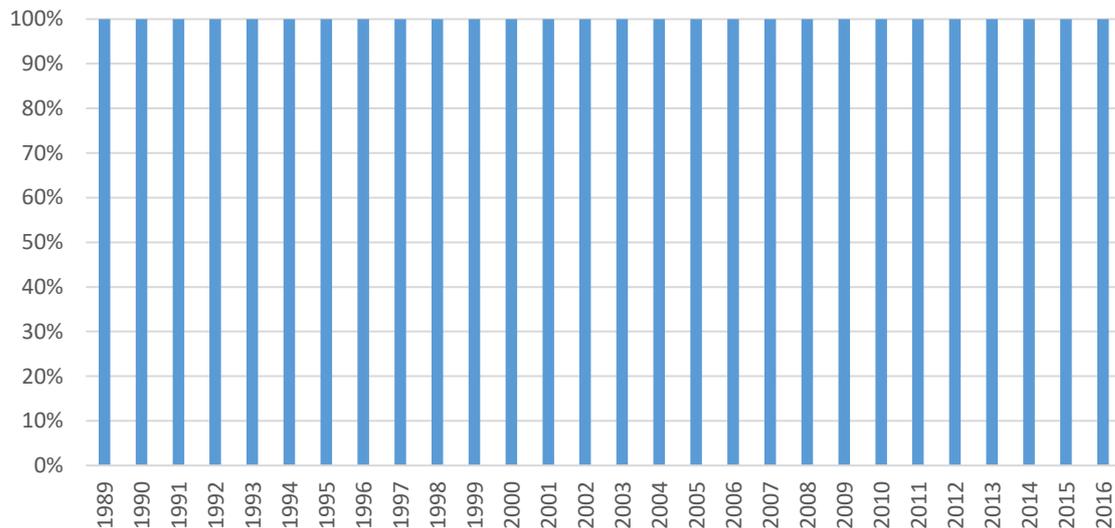
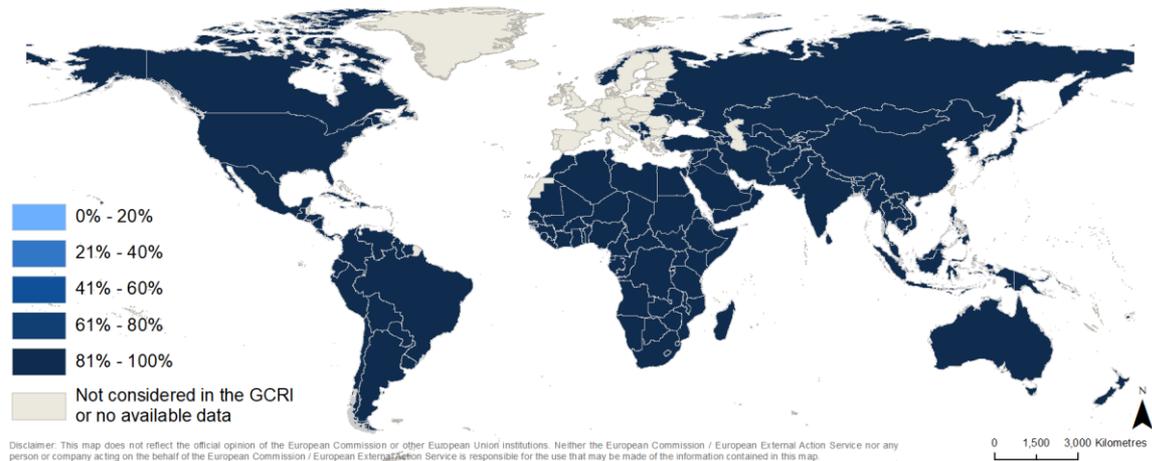*Table 37 - Data availability per year for the variable "Population Size"*

Figure 28 - Data availability per country for the variable "Population Size"

Citations: Collier, P. & Hoeffler, A. 2004. Greed and Grievance in civil wars. Oxford Economic Papers 56, pp. 563-596.

Fearon, J. & Laitin, D. 2003. Ethnicity, Insurgency, and Civil War. American Political Science Review 91, pp. 75-90.

Hegre, H. & Sambanis, N. 2006. Sensitivity Analysis of Empirical Results on Civil War Onset. 4th ed. Journal of Conflict Resolution 50, pp. 508-536.

3.24. Youth Bulge (YOUTHBBOTH)

Description: Another demographic aspect, found to correlate with conflict, is youth bulges (Gurr et al. 1970). The large amount of young people compared to the rest of the population is theorized to provide easier recruitment opportunities to rebel groups. Mesquida and Wiener (1996) found that large youth cohorts, measured as the ratio between 15–29 years old males and males of 30 years and above, were associated with higher intensity levels (manifested in the number of conflict-related deaths) in intrastate and interstate conflicts. "An emerging consensus is that youth bulges appear to matter for low-intensity conflict, but not for high-intensity civil war" (Hegre et al, 2013).

Data source: The dataset used is called "Annual Population by Age-both Sexes" and is the twenty-fifth round of official United Nations population estimates and projections that have been prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. The UN Population Division assists the Department of Economic and Social Affairs in discharging its functions as member of the Global Migration Group. The data for this indicator can be downloaded at: http://esa.un.org/unpd/wpp/Download/Standard/Interpolated/.

How it is built: We create a new variable called *YOUTHBBOTH*, which is the number of inhabitants between age 15 and 24 divided by the number of inhabitants older than 25. Two thresholds are imposed: one equal to 0.12 for values <0.12 and another one equal to 0.39 for values >0.39. The values are then linearly rescaled from 0 to 10.

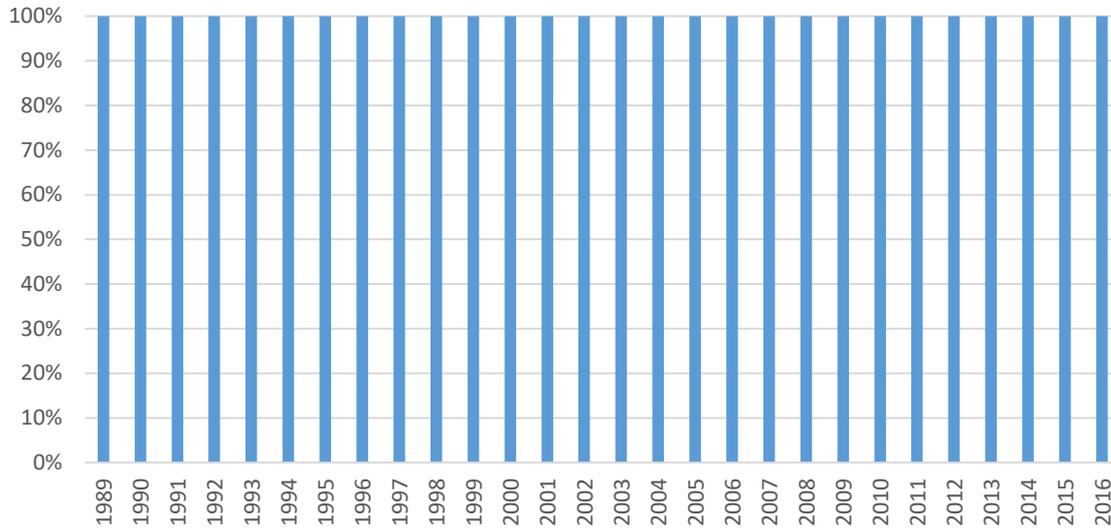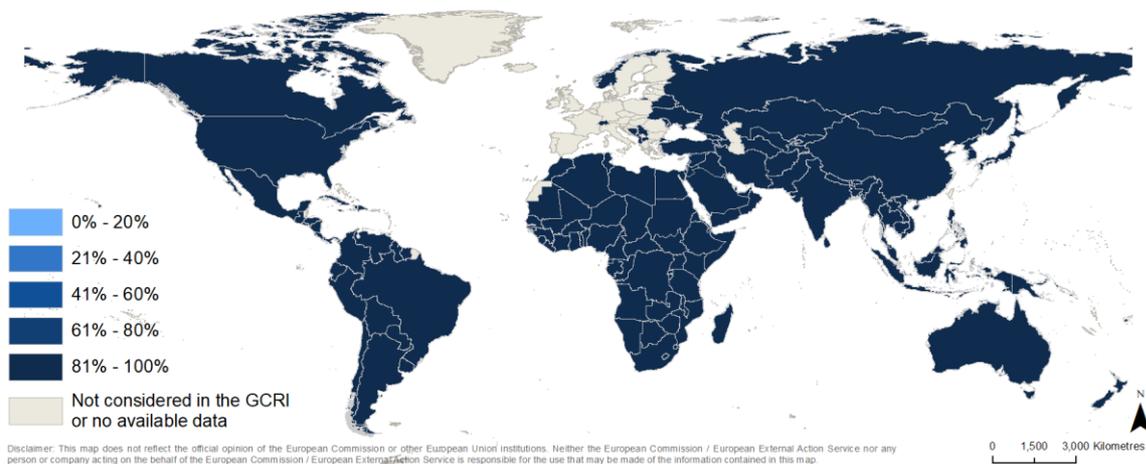**Descriptive Statistics:** The average percentage of available raw data is 100%.

Table 38 - Data availability per year for the variable "Youth Bulge"

Figure 29 - Data availability per country for the variable "Youth Bulge"

Citations: Gurr, T. R., 1970. Why Men Rebel. Princeton: Princeton University Press.

Mesquida, C.G. and Wiener, N.I. 1996, Human Collective Aggression: A Behavioral Ecology Perspective, Ethology and Sociobiology 17, pp. 247–262.

Hegre, Håvard & Karlsen, Joakim & Nygård, Håvard & Strand, Håvard & Urdal, Henrik, 2013, Predicting Armed Conflict, 2010–2050. International Studies Quarterly. 57

Correlation between the variables and conflict intensity

	CON_INT	CON_NB	YRS_HVC	CORRUPT	DISPER	ECON_ISO	EMPOWER	ETHNIC_SN	ETHNIC_NP	FOOD	FUEL_EXP	GDP_CAP	GOV_EFF	HOMIC	INEQ_SWIID	MORT	POP	REG_P2	REG_U	REPRESS	STRUCT	UNEMP	WATER	YOUTHBBOTH
CON_INT	1.00																							
CON_NB	0.25	1.00																						
YRS_HVC	0.67	0.16	1.00																					
CORRUPT	0.29	0.34	0.22	1.00																				
DISPER	0.32	0.37	0.20	0.25	1.00																			
ECON_ISO	0.11	0.11	0.10	0.24	-0.07	1.00																		
EMPOWER	0.20	0.32	0.12	0.39	0.16	0.09	1.00																	
ETHNIC_SN	0.24	0.09	0.16	0.11	0.21	0.03	0.16	1.00																
ETHNIC_NP	0.16	0.12	0.18	0.19	0.04	0.07	0.03	0.12	1.00															
FOOD	0.24	0.25	0.24	0.56	0.10	0.31	0.13	0.05	0.24	1.00														
FUEL_EXP	0.05	0.07	0.06	0.08	0.03	-0.12	0.32	0.05	0.04	-0.23	1.00													
GDP_CAP	0.25	0.32	0.20	0.61	0.14	0.31	0.10	0.09	0.26	0.78	-0.36	1.00												
GOV_EFF	0.26	0.30	0.22	0.90	0.16	0.32	0.39	0.11	0.23	0.63	0.00	0.69	1.00											
HOMIC	0.09	0.09	0.09	0.35	0.19	0.08	-0.23	-0.16	0.15	0.25	-0.11	0.26	0.33	1.00										
INEQ_SWIID	-0.05	-0.03	-0.06	0.10	-0.08	0.08	-0.12	-0.09	-0.05	0.19	-0.07	0.10	0.12	0.40	1.00									
MORT	0.27	0.38	0.20	0.64	0.11	0.35	0.18	0.11	0.28	0.78	-0.13	0.81	0.69	0.33	0.23	1.00								
POP	0.35	0.25	0.23	0.08	0.39	-0.07	0.16	0.04	0.00	-0.05	0.15	0.04	-0.05	-0.05	-0.12	-0.03	1.00							
REG_P2	0.07	0.25	0.07	0.32	0.00	0.18	0.78	0.07	0.04	0.18	0.31	0.14	0.38	-0.22	-0.04	0.29	-0.07	1.00						
REG_U	0.21	0.04	0.16	0.27	0.22	-0.02	-0.12	0.11	0.04	0.15	-0.20	0.22	0.24	0.22	0.05	0.14	0.00	-0.26	1.00					
REPRESS	0.62	0.34	0.51	0.56	0.35	0.12	0.42	0.17	0.16	0.32	0.11	0.37	0.51	0.19	0.08	0.36	0.41	0.26	0.22	1.00				
STRUCT	0.31	0.37	0.23	0.72	0.23	0.28	0.32	0.13	0.25	0.72	-0.12	0.77	0.77	0.30	0.15	0.78	0.05	0.31	0.22	0.48	1.00			
UNEMP	0.02	0.02	0.06	0.08	0.05	-0.02	-0.04	0.03	-0.05	-0.09	0.06	-0.03	0.09	0.27	0.06	0.02	-0.14	-0.07	0.10	0.05	0.01	1.00		
WATER	0.01	-0.04	0.02	0.02	-0.18	0.01	0.24	0.00	-0.07	-0.07	0.06	-0.11	0.01	-0.16	-0.05	-0.05	-0.06	0.23	-0.03	0.05	-0.05	0.16	1.00	
YOUTHBBOTH	0.19	0.31	0.14	0.54	0.08	0.32	0.19	0.04	0.19	0.66	-0.14	0.67	0.59	0.32	0.30	0.82	-0.07	0.28	0.15	0.33	0.69	0.08	0.15	1.00

Table 39 - Correlation matrix

Table 39 shows the correlation between all the variables. We observe that there seem to be eleven cases where the variables are highly correlated, being the coefficient of correlation[8] (r) bigger than 0.7 (but still smaller than 0.9). Higher correlation is indicated by a darker red colour. For instance, in the table above, we see that the coefficient of correlation between the mortality rate index (*MORT*) and the GDP per capita index (*GDP_CAP*) is 0.81.

---

[8] *r in* statistics, the Pearson correlation coefficient is a measure of the linear correlation between two variables *X* and *Y*. It has a value between +1 and −1, where 1 is total positive linear correlation, 0 is no linear correlation, and −1 is total negative linear correlation. (https://en.wikipedia.org/wiki/Pearson_correlation_coefficient)

The correlation matrix is strictly symmetric (for instance, the correlation between *MORT* and *GDP_CAP* is identical to the correlation between *GDP_CAP* and *MORT*), hence only the lower-left part of the correlation matrix is shown here.

4. Composite Model

Based on economic, social, environmental and political data, the composite model gives an insight into the contributing factors of conflict. It combines the 24 variables presented in the previous chapter and provides a final score per country for each year. The present chapter describes how the model works and what the outputs are.

4.1. Model description

The method used for combining the variables is a simple grouped mean method, its calculation being much simpler and intuitively understood than other existing methods.

More specifically, the method reduces the number of variables in three steps: firstly from 24 (variables) to 10 (concepts); secondly from 10 (concepts) to 5 (risk areas), and from 5 (risk areas) to 1 (final score), using the arithmetic mean of the theoretically defined groups (see Figure 30, p.72). One exception is applied for the concept "Social cohesion and diversity", in which the maximum value between the variables "Ethnic Power Change" and "Ethnic Compilation" is firstly selected and then averaged with the two other variables of this concept, namely "Corruption" and "Transnational ethnic bonds".
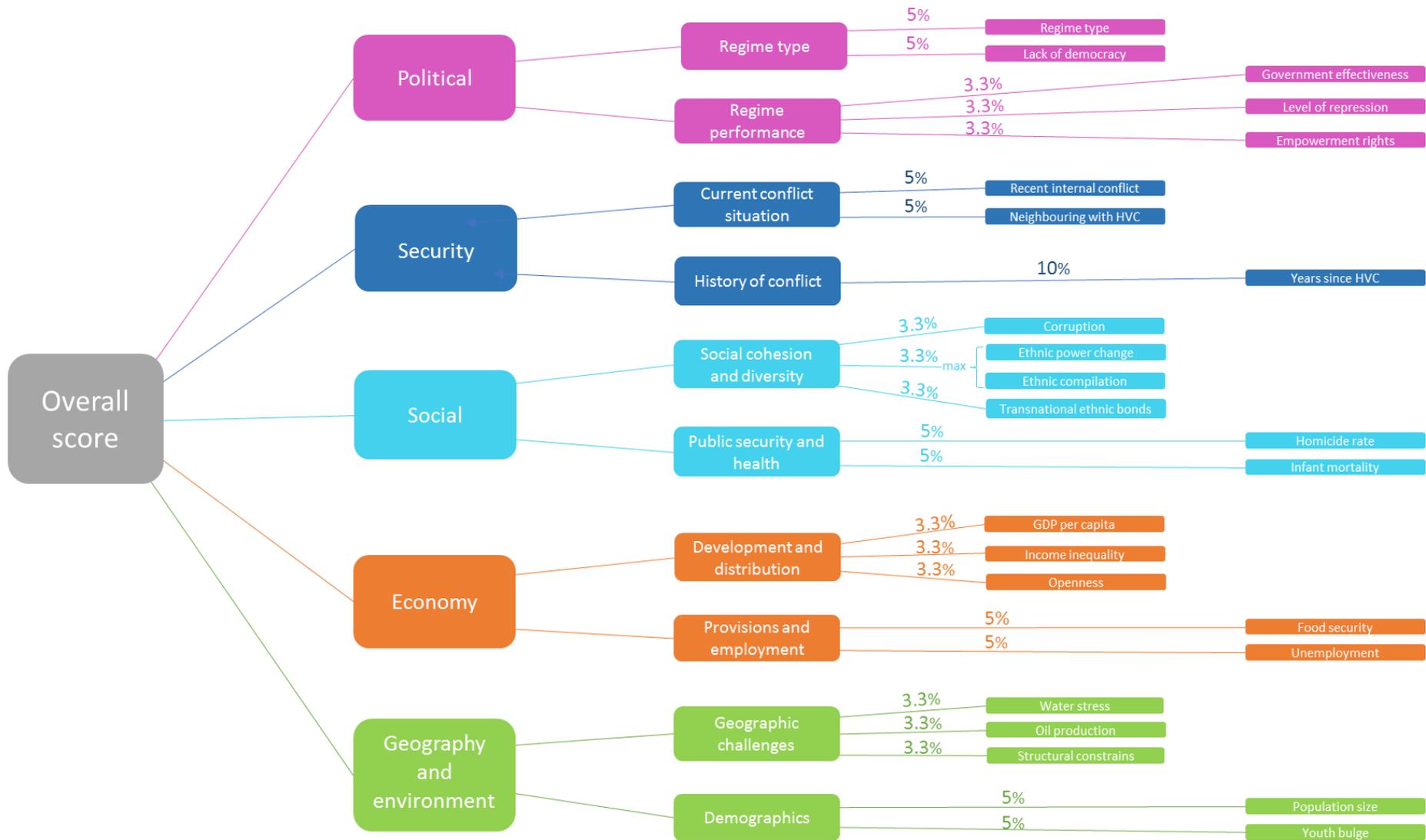
Figure 30 - Influence of each variable in each concept on the overall score

The "concepts" being composed of a different number of variables, the final weights of those indicators differs thus from one to another. For instance, as shown on the figure above, the concept "Social cohesion and diversity" is composed of four variables whereas the concept "History of conflict" has only one variable. Therefore, the influences of the variables vary greatly from one concept to another. Table 40 presents the differences in the relative weights of each variable on the final score.

Dependent variables
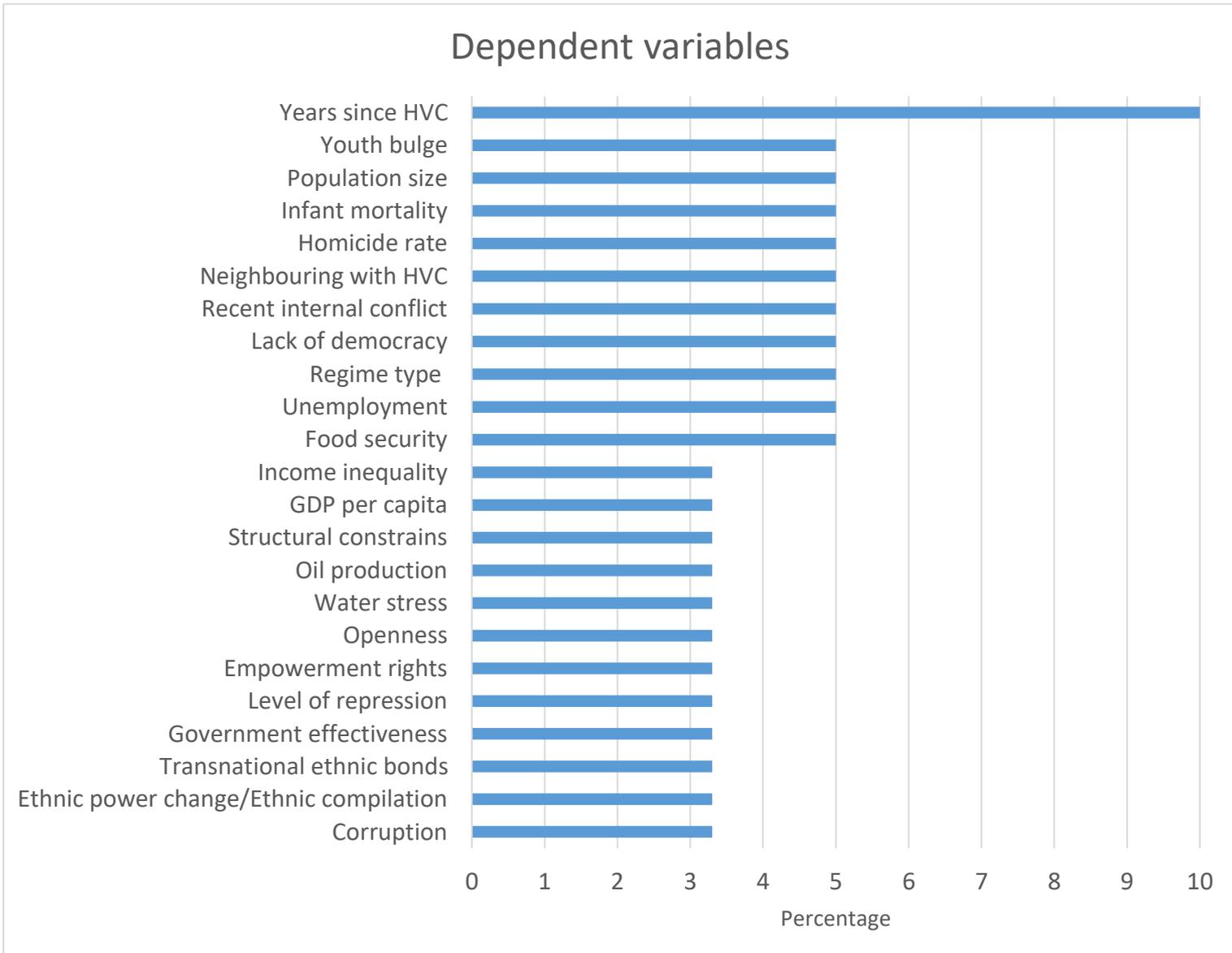
Table 40 - Relative weight of each variable

4.2. Model results

The outcome of the model is a final score per country for each year. Figure 31 shows a screenshot of the excel sheet in which all scores are listed.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Country	ISO3A	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
2	Afghanistan	AFG	7.43	7.80	7.95	7.93	7.93	7.91	7.86	7.98	7.38	7.38	7.35
3	Angola	AGO	6.18	6.52	5.91	6.30	5.42	5.58	5.73	5.74	5.65	5.80	5.88
4	Albania	ALB	3.47	3.44	3.32	3.27	3.35	3.44	3.55	3.47	3.21	3.58	3.69
5	United Arab Emirates	ARE	3.03	3.07	3.13	3.15	3.12	3.06	2.99	3.01	2.90	3.38	3.40
6	Argentina	ARG	3.39	3.24	3.26	3.64	3.19	3.47	3.13	3.09	3.21	3.48	3.50
7	Armenia	ARM	4.02	4.22	4.27	4.01	4.04	4.19	4.14	3.90	3.89	4.44	4.39
8	Australia	AUS	1.89	1.85	1.92	1.92	1.96	1.83	1.84	1.85	1.93	1.98	1.95
9	Azerbaijan	AZE	4.62	4.76	5.15	4.90	4.89	4.83	5.04	4.76	4.82	5.08	5.04
10	Burundi	BDI	5.76	5.87	5.65	5.32	5.09	4.88	5.03	4.84	4.69	6.36	6.25
11	Benin	BEN	4.16	4.00	4.22	4.28	4.29	4.25	4.16	4.12	4.20	4.21	4.23
12	Burkina Faso	BFA	3.90	4.14	4.15	4.13	3.80	4.08	4.03	4.44	4.27	4.43	4.33
13	Bangladesh	BGD	5.49	5.23	5.18	4.89	4.85	4.90	4.87	5.29	5.07	5.45	5.50
14	Bahrain	BHR	3.39	3.41	3.28	3.38	3.37	3.70	3.35	3.32	3.31	3.64	3.68
15	Bosnia and Herzegovina	BIH	4.01	3.99	3.97	4.05	3.98	3.98	3.95	3.91	3.90	4.39	4.03
16	Belarus	BLR	4.42	4.33	4.21	4.37	4.36	4.29	4.27	4.23	4.27	4.30	4.26
17	Bolivia, Plurinational Sta	BOL	4.84	5.08	5.02	4.86	4.80	4.75	4.51	4.47	4.65	5.10	5.15
18	Brazil	BRA	4.44	4.27	4.30	4.49	4.18	4.46	4.02	4.00	4.04	5.27	5.60
19	Bhutan	BTN	4.31	4.21	4.30	4.24	3.80	3.72	3.97	3.87	3.78	3.68	3.91
20	Botswana	BWA	3.83	3.84	4.15	3.84	3.68	3.59	3.67	3.56	3.58	3.82	3.82
21	Central African Republic	CAF	5.72	5.55	5.30	5.58	5.63	5.60	5.68	6.33	6.29	7.33	7.12
22	Canada	CAN	2.04	2.11	2.17	2.13	2.09	2.10	2.08	2.06	2.06	2.28	2.34
23	Switzerland	CHE	1.78	1.78	1.87	1.83	1.76	1.77	1.76	1.85	1.70	1.68	1.89
24	Chile	CHL	2.50	2.68	2.74	2.73	2.61	2.36	2.31	2.30	2.30	2.84	2.91
25	China	CHN	4.65	4.68	5.05	5.12	4.69	4.66	4.63	4.59	4.53	5.74	5.62
26	Cote d'Ivoire	CIV	4.97	4.88	4.95	4.93	4.93	5.50	5.22	5.18	4.98	5.92	5.67
27	Cameroon	CMR	5.49	5.09	5.25	5.03	5.34	4.97	5.28	5.27	5.34	6.83	6.72
28	Congo, the Democratic R	COD	6.67	6.49	6.50	6.52	6.04	6.29	6.33	7.37	7.28	7.48	7.47
29	Congo	COG	5.06	5.15	4.93	5.10	4.69	4.66	4.93	4.98	5.00	5.31	5.27
30	Colombia	COL	6.13	5.97	5.95	5.84	5.78	5.60	5.14	5.01	4.90	6.24	6.31
31	Comoros	COM	4.00	4.20	4.17	3.98	3.98	3.97	3.97	3.91	3.89	3.88	3.93
32	Costa Rica	CRI	2.62	2.53	2.69	2.74	2.59	2.68	2.65	2.63	2.62	2.90	2.89
33	Cuba	CUB	3.27	3.24	3.23	3.22	3.26	3.29	3.25	3.25	3.21	3.30	3.28
34	Djibouti	DJI	5.21	5.16	4.97	5.22	5.27	5.14	5.17	4.83	4.64	5.13	4.97

Figure 31 - Examples of countries' scores for the last 10 years

In order to summarize these results in a comprehensive way, country profiles are automatically generated based on the outcomes of the model, namely the variables, the score of each concept and the final score. An example of a country profile is shown in the figure below.

Country A

Composite score

7.4

Risk area	Concept		Indicator	Score	Raw data	Updated
Political **5.8**	Regime type	3.3	Regime Type	1.1	Anocracy	2015
			Lack of democracy	5.5		2015
	Regime performance	8.3	Government Effectiveness	7.7		2015
			Level of Repression	10.0		2015
			Empowerment Rights	7.1		2011
Security **10.0**	Current conflict situation	10.0	Recent Internal conflict	10.0	Intensity previous year	2016
			Neighbors with HVC	10.0	Highest intensity neighbours	2016
	History of conflict	10.0	Years since HVC	10.0	10 = ongoing; reduced by 1 for each peaceful year	2016
Social **7.3**	Social cohesion and diversity	8.5	Corruption	8.4		2015
			Ethnic Power Change	0.0		2015*
			Ethnic compilation	7.0		2015*
			Transnational Ethnic Bonds	10.0		2009*
	Public security and health	6.2	Homicide Rate	4.8	6.6 per 100,000 people	2014
			Infant Mortality	7.5	91.1 per 1,000 live births	2015
Economy **6.0**	Development and distribution	6.1	GDP per capita	6.8	1808 PPP USD 2011	2015
			Income inequality	3.1		2016*
			Openness	8.4		2015
	Provisions and employment	5.8	Food security	6.5		2016*
			Unemployment	5.1	9.1 %	2014
Geography – Environment **7.7**	Geographic challenge	7.4	Water Stress	8.1		2013*
			Oil Production	4.2	6.8 % of merch. exports	2015
			Structural constraints	10.0		2016
	Demographics	8.0	Population size	6.8	33.4 million	2016
			Youth bulge	9.2	0.38 Less than 24 years	2016

GCRI composite score history

(bar chart: 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016)

DISCLAIMER

The Global Conflict Risk Index is a quantitative conflict risk assessment based on open source data and a statistical regression method developed by the European For further information about the model, please visit http://conflictrisk.jrc.ec.europa.eu

Figure 32 – Example of a country profile

5. Conclusion

The latest version (2017) of the GCRI composite model has been greatly improved by clearer documentation and improved traceability. The GCRI code has also been improved with more transparency.

While there is still much room for improvement, the present data management provides reliable data and the use of R scripts limits the possibility for human errors, while development errors, if they happen, can easily be reported and effectively corrected.

The GCRI composite indicator is a tool that gives an easily interpretable presentation of the variables. While it presents in a simple way how high the risk of conflict is at country level, it also provides a great overview on the sector(s) that have the strongest influence(s).

Further work should focus on improving specific aspects of the model. While the imputation method used for the data is now (2017) uniform among the indicators, one improvement could be to implement specialized methods for the variables depending on their nature. There are also still some variables with very little data that rely on these imputations, which introduces a considerable amount of noise. Having reliable data is crucial in uncovering actual causal mechanisms and not random patterns in noisy data. Effort should therefore also be put into finding improved data for the variables with the most serious availability problems. This not only adds more input information, but also improves the accuracy of imputed data.

6. References

Allansson, Marie, Erik Melander & Lotta Themnér (2017) Organized violence, 1989-2016. Journal of Peace Research 54(4).

Bora, S., Ceccacci, I., Delgado, C., & Townsend. R. 2010. Food security and Conflict, World Bank: World Development Report 2011.

Bueno de Mesquita, B., 1983. The War Trap. Yale: Yale University Press.

Buhaug, H. & Gleditsch, K.-S., 2008. Contagion or Confusion? Why Conflicts Cluster in Space. 2nd ed. International Studies Quarterly 52, pp. 215-233.

Collier, P. et al., 2003. Breaking the Conflict Trap. Civil War and Development Policy. A World Bank Policy Research Report. Oxford: Oxford University Press.

Collier, P. & Hoeffler, A. 2004. Greed and Grievance in civil wars. Oxford Economic Papers 56, pp. 563-596.

Dahl, Robert A. 1998. On Democracy. New Haven: Yale UP, pp. 36-38)

Danneman, N. & Hencken Ritter, E., 2014. Contagious Rebellion and Preemptive Repression. Journal of Conflict Resolution 58 (2), pp. 254-279.

Dixon, J. 2009. What causes civil wars? Integrating Quantitative Research Findings. International Studies Review 11, pp. 707-735.

Eck, Kristine and Lisa Hultman, 2007. 'One-sided violence against civilians in war: insights from new fatality data´, Journal of Peace Research 44(2): 233-246.

Esty, D. C. et al., 1998. State failure task force report: Phase II findings, Washington D.C.: Central Intelligence Agency Directorate of Intelligence.

FAO, UN. 1996. Rome Declaration on Food Security and World Food Summit Plan of Action .

FAO, UN. 2003. Trade Reforms and Food Security: Conceptualizing the Linkages.

Fearon, J. & Laitin, D. 2003. Ethnicity, Insurgency, and Civil War. American Political Science Review 91, pp. 75-90.

Fox, J. 2004. The rise of religious nationalism and conflict: Ethnic conflict and revolutionary wars, 1945-2001. 6th ed. Journal of Peace Research 41, pp. 715-731.

Gartzke, E. 2007. The Capitalist Peace, American Journal of Political Science, Vol. 51, No. 1, pp. 166–19.

Gassert, F., Reig, P., Luo, T., & Maddocks, A. 2013. Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators. Working paper. Washington, DC: World Resources Institute.

Gleditsch, K. S., 2007. Transnational Dimensions of Civil War. Journal of Peace Research 44 (3), pp. 293-309.

Goldstone, J. A. et al. 2010. A Global Model for Forecasting Political Instability. American Journal of Political Science 54, pp. 190-208.

Gurr, T. R., 1970. Why Men Rebel. Princeton: Princeton University Press.

Hegre, H. & Sambanis, N. 2006. Sensitivity Analysis of Empirical Results on Civil War Onset. 4th ed. Journal of Conflict Resolution 50, pp. 508-536.

Hegre, Håvard & Karlsen, Joakim & Nygård, Håvard & Strand, Håvard & Urdal, Henrik, 2013, Predicting Armed Conflict, 2010–2050. International Studies Quarterly. 57

https://blog.bti-project.org/2014/02/19/conflict-management-is-at-a-low-point/

IEP, 2015, Global Peace Index: measuring peace, its causes and its economic value.

Kaufmann. D, Aart, K. & Mastruzzi, M. 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. World Bank Policy Research Working Paper No. 5430

Martin, P., Thoenig, M., & Mayer, T. 2008. Civil Wars and International Trade, Journal of the European Economic Association, pp.541–550.

Merkel, W. e. a. 2003. Defekte Demokratie Bd. 1: Theorie. Wiesbaden: VS Verlag für Sozialwissenschaften

Mesquida, C.G. and Wiener, N.I. 1996, Human Collective Aggression: A Behavioral Ecology Perspective, Ethology and Sociobiology 17, pp. 247–262.

Nome, M.-A., 2005. Transnational Ethnic Dimensions of Third-Party Interverntions in Civil Conflicts, Oslo: University of Oslo.

O'Donnell, M. (2014). Corruption: A Rule of Law Agenda?. In: A. Hurwitz e. a., Civil war and the rule of law : security, development, human rights, Lynne Rienner Publishers, p. 225.

Patel, P. 2013. Food sovereignty is next big idea. Financial Times.

Poe, Steven P. Carey, Sabine C. & Vazquez, Tanya C. 2001. How are these pictures Different? A quantitative comparison of the US State Department and Amnesty International human rights reports, 1976-1995. Human Rights Quarterly 23.3, pp. 650-677.

Regan, P. M. & Norton, D. 2005. Greed, Grievance and Mobilization in Civil Wars. 3rd ed. Journal of Conflict Resolution 49, pp. 319-336.

Reynal-Querol, M.. 2002. Ethnicity, Political Systems, and Civil Wars, Sage Publications: Journal of Conflict Resolution, Vol. 46, pp. 29-54.

Sambanis, N., 2001. Do ethnic and non-ethnic civil wars have the same cause? A theoretical and empirical inquiry (Part I). Journal of Conflict Resolution 45 (3), pp. 259-282.

Solt, Frederick. 2016. The Standardized World Income Inequality Database. Social Science Quarterly 97. SWIID Version 5.1.

Sundberg, Ralph, Kristine Eck and Joakim Kreutz, 2012, "Introducing the UCDP NonState Conflict Dataset", Journal of Peace Research, March 2012, 49:351-362

Vogt, M., Bormann, N.-C., Rüegger, S., Cederman, L.-E., Hunziker, P., & Girardin, L. 2015. Integrating Data on Ethnicity, Geography, and Conflict: The Ethnic Power Relations Dataset Family. 7th ed. Journal of Conflict Resolution 59, 1327-1342.

Vreeland, J. 2008. The Effect of Political Regime on Civil War: Unpacking Anocracy. 3rd ed. Journal of Conflict Resolution 52, pp. 401-425.

Wimmer, A., Cederman, L.-E. & Min, B., 2009. Ethnic Polictics and Armed Conflict: A Configurational Analysis of a New Global Data Set. American Sociological Review, pp. 316-337.

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