Resiliency and Capacity to Respond:
A Methodology for Determining the Counterbalances to Risk in Uganda

Geo 499 Environmental Change Poverty and Conflict

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Acknowledgements: This paper draws on the World Bank development indicator and conflict databases that were aggregated and meticulously sorted by other students in GEO 499. Methodology was discussed and influenced by Emma Kurz. Statistical methodology was developed through work with and suggestions from Oscar Torres–Reyna of the statistical service lab. Additional Stata help and statistical methodology input came from Nick Ligthart.

Process Overview

My methodology to assess counterbalances to risk in Uganda contains 3 parts:

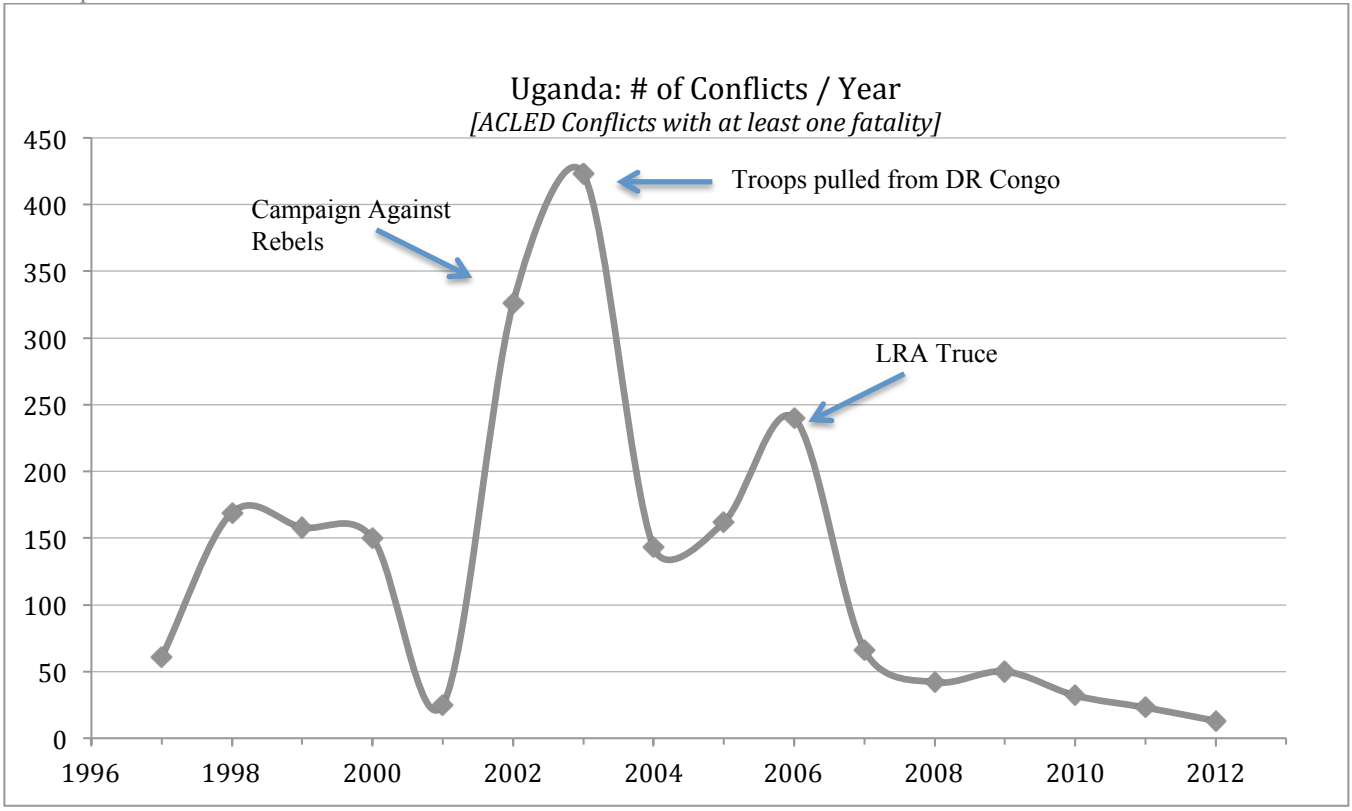
1. Analysis of past ACLED conflicts within social and political context
2. Determination of significant indicators of resiliency and capacity to respond
3. Use of past conflict data to weight and aggregate indicators into a single counterbalance measure.

Analysis of Past Conflicts

Conflicts over time:

Analysis began by mapping past conflicts in the ACLED Database. To filter results, only conflicts resulting in one or more deaths were considered. Context for these conflicts was created through the use of a timeline of events from BBC Africa (Appendix A). Notable Events are included on the time series graph below.

Graph A

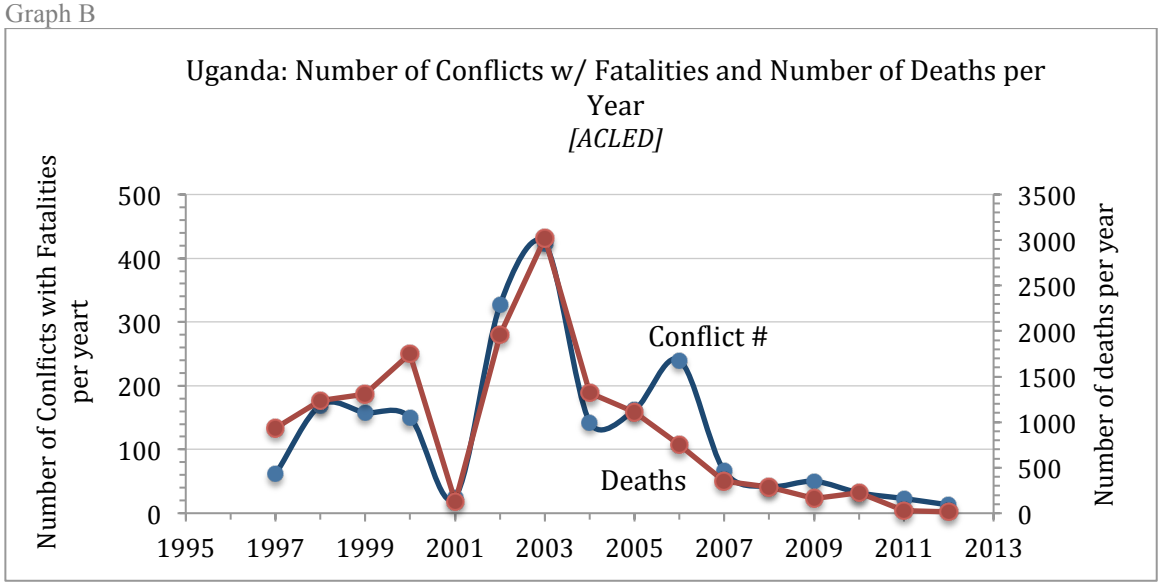


Number of conflicts has a high variation year to year. Many of these sharp changes in conflict numbers coincide with political and military decisions. In 1998 Uganda started intervening in the DR of Congo against its rebel troops, later pulling troops from DR Congo and becoming a state of asylum for displaced citizens of the Congo. Other conflicts and political problems arise in relation to the Lord's Resistance Army (LRA) a rebel group within Uganda, and other extremely violent organizations including Al Shabaab.

Conflicts and Fatalities:

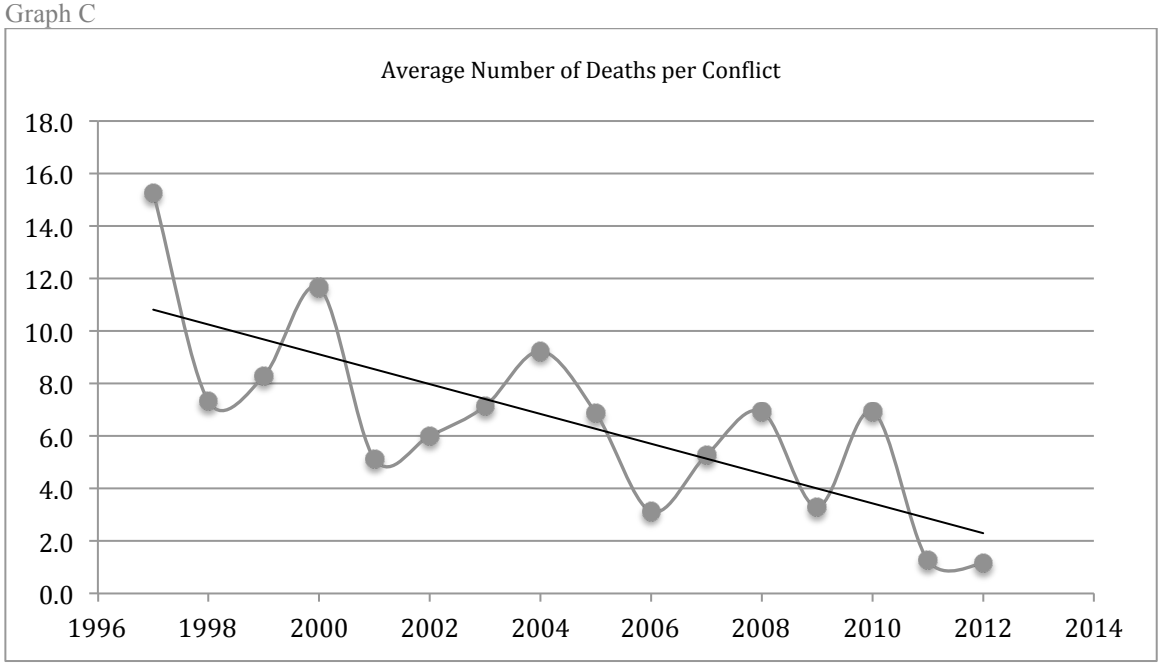
Next I considered the number of conflicts in relation to yearly fatalities. The following graphs address the relationship between yearly conflicts and the number of deaths within each conflict.

Graph B



Number of yearly conflicts seems to be strongly associated with deaths per year, a fairly intuitive conclusion. The deviation in 2006 may be explained by a decrease in numbers of deaths per conflict. 2006 is also associated with a change in leadership after multiparty elections

Graph C



Average number of deaths per conflict actually decreases over time, a less intuitive conclusion not readily apparent from the graph above.

Overview of Conflict Analysis:

From the ACLED Data there is a wide variation in conflict numbers and magnitude. Some of this can be put into the context of wars, displacement, political unrest, EVOs and rebel groups. Further, although there is a direct relation between the number of conflicts and deaths, as would be expected, the number of deaths per conflict is decreasing over time. This fluctuation in response to an ever-changing social and political environment will be used to provide a valuable reference for the weighting of individual indicators.

Determination of Significant Indicators

Process overview
Development of an aggregate counterbalance

- Select key factors and data points within each bucket
- Interpolate missing data using linear regression or by adding averages
- Standardize all factors to reduce time, size, and population biases
- Normalize data by z-score to allow for factor combination across units
- Sign correct to so that values for good indicators are positive and for bad indicators are negative. (E.g. high primary school completion rate is good, high pupil teacher ratio is bad)
- Use of Principal Component Analysis to determine the largest contributing factors within buckets.

Weighting Indicators

- Correlate to past conflict to determine factor weights
- Aggregate factors into a single counterbalance indicator.

Assessment Against Conflict

- Display counterbalance values with conflict data

Selection of Factors Within Buckets:

Factors were chosen through assessment of variation, variation and change considering conflict and socio-political context, availability of data (could not use data sets with insufficient data), and judgment on the importance of the factor in relation to its representation of its bucket. When factors were not standardized I ran my own standardization by population size. When necessary I created my own factors from the dataset to better assess what I viewed as important to the bucket. This was done only to find discrepancies between education rates for males and females.

It should be noted as well that two buckets produced little or no data for Uganda. This resulted in no data indicators being available for the social bucket, and only one factor, scientific and technical journal articles, being available for science and technology.

A full list of indicators by bucket can be found in Appendix B. This factor list includes along the left hand side shorthand names for indicators that worked better with STATA. These shorthand names will be used for the appendix Component Analysis.

Standardizations, Normalization and Sign Values:

Standardization: Many indicators selected were already standardized. However, for some indicators (indicated by an "*" in the appendix) were standardized through scaling to overall population.

Normalization: The data set was normalized to Z-Scores using Excel. Z-Score was calculated with the formula[1]:

$$z = \frac{x - \mu}{\sigma}$$

μ is the mean of the population;
σ is the standard deviation of the population.

Notes on Normalization and Z-Scores: The Z-Score measures how 'off target' a value is from the samples average. Z-Scores assume knowledge of population parameters for the average and standard deviations, however, this is often unrealistic for the data we have. Further, Z-Scores assume a normal distribution, i.e. a uni-modal symmetric distribution around the mean. However, it is unlikely that our samples have normal distributions. Further shortcomings of Z-Score normalization come from time bias within our data. That is to say that Z-Score normalization assumes that data from year to year is independent, however, we can logically reason that a past years indicator value will have some effect on the next years value.

Other Normalizations Methods: The other normalization method considered for this analysis was a simple ranking of the indicators. I felt that Z-Scores would be better as they could capture the degree of variation associated with indicators.

Sign Adjustment: Data was then sign adjusted based on assessment of whether or not the indicator could represent something positive or negative for resiliency or capacity to respond in Uganda. Sign Adjustment was done by a simple multiplication of the normalized value by -1.

Grouping of Indicators within Buckets:

Grouping of indicators was done through an exploratory Principal Component Analysis (PCA) and logical combination. PCA results can be found in Appendix C. PCA is a way to break down observations of possibly correlated variables into linearly uncorrelated factors to account for the variation within the observation set. This shows how individual indicators group together to form the variation and factors of the observation set.[2]

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[1] Formula taken from Wikipedia: http://en.wikipedia.org/wiki/Standard_score#cite_note-1

[2] I am not entirely clear on what PCA technically does. This statistical methodology was influenced and described by classmate Nick Ligthart and Oscar from statistical services. Definitions for this paper were taken from Wikipedia: http://en.wikipedia.org/wiki/Principal_component_analysis

Exploratory component analysis was used to see the statistical grouping and relationships between factors within a given bucket. However, I did not rely solely on these results. After assessing PCA results, I looked again to the data to see if the PCA indicated a logical grouping of factors. Logical assessment trumped PCA, that is, PCA was used only to support regrouping.

After regrouping indicators into combined factors within buckets, their Z-Scores were averaged. I am not sure averaging was the right approach, however, I thought it preferable to taking a single indicator to represent the factor, as the culmination of several smaller factors may have impact depending on the scenario. It may have been possible to take a single indicator or to first correlate, weight and then average indicators into factors. However, I felt that averaging would best represent the indicators in their relation to their role as a component factor. Factors are broken down by individual indicator below.

Combined Factor Elements Within Buckets:

AgrFactor1:

agr2	Cereal Exports (FAO, US$ per capita)
agr3	Food imports excluding fish (FAO current US$ per capita)
agr4	Food Exports excluding fish (FAO, current US$ per capita)
agr5	Cereal imports quantity (FAO Tonnes per capita)

AgrFactor2:

agr1	Cereal production (metric per capita)
agr6	Cereal production index (2004-2006 = 100)
agr7	Cereal yield (kg per hectare)

DevFactor1:

dev1	Cereal food aid deliveries (FAO, tonnes)
dev2	Non-cereal food aid deliveries (FAO, tonnes)
dev5	Net ODA received (% of GDP)
dev6	Net ODA received (% of GNI)
dev8	Net ODA received (% of central government expense)

DevFactor2:

dev3	Foreign direct investment, net inflows (% of GDP)
dev4	Net bilateral aid flows from DAC donors, Total (current US$)

EcoFactor1

eco1	Agriculture, value added (% of GDP)
eco2	Manufacturing, value added (% of GDP)
eco3	Industry, value added (% of GDP)
eco4	Services, etc., value added (% of GDP)
eco6	GDP per capita, PPP (current international $)
eco8	Imports of goods and services (% of GDP)
eco9	Trade (% of GDP)
eco10	Agriculture value added per worker (constant 2005 US$)
eco11	Total reserves (% of total external debt)
eco12	Consumer price index (2005 = 100)

EcoFactor2

	eco15	General government final consumption expenditure (% of GDP)
	eco16	Gross national expenditure (% of GDP)
	eco14	External debt, end year (current US$)
EcoFactor3		
	eco5	Inflation, GDP deflator (annual %)
	eco13	Real interest rate (%)
EduFactor1		
	edu1	Adjusted savings: education expenditure (% of GNI)
	edu2	Ratio of female to male primary enrollment (%)
	edu4	Primary completion rate, male (% of relevant age group)
	edu7	Secondary education, pupils (% female)
	edu9	Difference Primary Completion rate Male/ Female
EduFactor2		
	edu3	Primary completion rate, female (% of relevant age group)
EduFactor3		
	edu6	Pupil-teacher ratio, primary
EnvFactor1		
	env1	CO2 emissions (metric tons per capita)
	env3	Adjusted savings: particulate emission damage (% of GNI)
EnvFactor2		
	env2	CO2 emissions (kg per PPP $ of GDP)
GovFactor1		
	gov2	Proportion of seats held by women in national parliaments (%)
	gov6	Political Stability/No Violence (estimate)
	gov7	Regulatory Quality (estimate)
	gov8	Rule of Law (estimate)
GovFactor2		
	gov4	Control of Corruption (estimate)
	gov5	Government Effectiveness (estimate)
GovFactor3		
	gov1	Military expenditure (% of central government expenditure)
	gov3	Health expenditure, public (% of government expenditure)
HltFactor1		
	hlt1	Prevalence of HIV, total (% of population ages 15-49)
	hlt2	Mortality rate, under-5 (per 1,000 live births)
	hlt3	Mortality rate, neonatal (per 1,000 live births)
	hlt4	Immunization, DPT (% of children ages 12-23 months)
	hlt5	Incidence of tuberculosis (per 100,000 people)
	hlt6	Difference in private and public health expenditure
	hlt7	New HIV Infections per capita
	hlt8	Health expenditure, total (% of GDP)
	hlt11	Adolescent fertility rate (births per 1,000 women ages 15-19)
	hlt12	Life expectancy at birth, total (years)

HltFactor2
- hlt9 Prevalence of undernourishment (% of population)
- hlt10 Depth of the food deficit (kilocalories per person per day)

InfFactor1 (*All infrastructure values were found to go together)
- inf1 Mobile and fixed-line telephone subscribers (per 100 people)
- inf2 Gross fixed capital formation (% of GDP)
- inf3 Improved water source (% of population with access)
- inf4 Improved sanitation facilities (% of population with access)

LbrFactor1
- lbr1 Employment to population ratio, 15+, female (%)
- lbr3 Labor participation rate, female (% of female population ages 15+)
- lbr4 Ratio of female to male labor force participation rate (%)

LbrFactor2
- lbr2 GDP per person employed (annual % growth)

LndFactor1 (*All Land Use was found to go together)
- lnd1 Agricultural land (% of land area)
- lnd2 Arable land (hectares per person)
- lnd3 Arable land (% of land area)
- lnd4 Cereal cropland (% of land area)
- lnd5 Forest area (% of land area)
- lnd6 Terrestrial and marine protected areas (% of total territorial area)

MltFactor1
- mlt2 Military expenditure (% of GDP)
- mlt3 Military expenditure (% of central government expenditure)

MltFactor2
- mlt1 Armed forces personnel (% of total labor force)
- mlt4 Battle-related deaths (number of people)

NrsFactor1 (*nrs 2 and 4 were found repetitive)
- nrs1 Adjusted savings: net forest depletion (% of GNI)
- nrs3 Forest rents (% of GDP)

PopFactor1
- pop1 Population density (people per sq. km of land area)
- pop2 Rural population density (rural population per sq. km of arable land)
- pop3 Population in the largest city (% of urban population)
- pop4 Poverty headcount ratio at $1.25 a day (PPP) (% of population)
- pop6 Employment to population ratio, ages 15-24, total (%)
- pop8 Rural population growth (annual %)
- pop10 Economically Active population in agriculture (% of total)
- pop11 Agricultural Population (% of total)

PopFactor2
- pop5 GINI index
- pop7 Population growth (annual %)
- pop9 Urban population growth (annual %)

SctFactor1 (*only one indicator available)
- SCT1 Scientific and technical journal articles

Updated time series values under averaged factor grouping can be found at Appendix D.

Weighting indicators

Correlation of Factors:

After reconfiguring indicators into factors within buckets, the new factors were correlated against past conflict data to determine weighting. Correlation analysis was done in STATA using the simple "Correlate" function. The full correlation of factors can be found in Appendix D. Below is only correlation to conflict.

	conflict
conflict	1
agrfactor1	-0.4615
agrfactor2	-0.2735
devfactor1	0.298
devfactor2	-0.3026
ecofactor1	-0.3158
ecofactor2	0.7863
ecofactor3	-0.4783
edufactor1	0.5245
edufactor2	0.1487
edufactor3	-0.1316
envfactor1	0.6754
envfactor2	0.3811
govfactor1	-0.5027
govfactor2	0.4153
govfactor3	-0.3318
hltfactor1	-0.2865
hltfactor2	0.666
inffactor1	-0.3783
lbrfactor1	0.3598
lbrfactor2	0.2878
lndfactor1	-0.1101
mltfactor1	0.3731
mltfactor2	-0.5809
nrsfactor1	-0.0371
popfactor1	0.4993
popfactor2	-0.1878
sctfactor1	-0.4186

Correlation Formula[3]:

$$\rho_{X,Y} = \operatorname{corr}(X,Y) = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y},$$

Where E is expected value, Cov is covariance and corr represents the correlation coefficient.

[3] Correlation Formula taken from Wikipedia: http://en.wikipedia.org/wiki/Correlation

Weighting methodology

Weighting was done as follows:

- Give more significance to higher correlations by using the square of the correlation value as the absolute weight
- Negatively correlated values (conflicts decrease when they increase) will be sign adjusted to become a positive multiplier
- Positively correlated Values (conflicts increase when they increase) will be sign adjusted to become a negative multiplier

Factor Weights:

Factor	Weight
agrfactor1	0.21298225
agrfactor2	0.07480225
devfactor1	-0.088804
devfactor2	0.09156676
ecofactor1	0.09972964
ecofactor2	-0.6182677
ecofactor3	0.22877089
edufactor1	-0.2751003
edufactor2	-0.0221117
edufactor3	0.01731856
envfactor1	-0.4561652
envfactor2	-0.1452372
govfactor1	0.25270729
govfactor2	-0.1724741
govfactor3	0.11009124
hltfactor1	0.08208225
hltfactor2	-0.443556
inffactor1	0.14311089
lbrfactor1	-0.129456
lbrfactor2	-0.0828288
lndfactor1	0.01212201
mltfactor1	-0.1392036
mltfactor2	0.33744481
nrsfactor1	0.00137641
popfactor1	-0.2493005
popfactor2	0.03526884
sctfactor1	0.17522596

Creating an Overall Counterbalance Measure:

After determining the weights, they were applied to yearly factor values to produce the table values shown in appendix F. The sum of weighted factors was was then used to produce a cumulative counterbalance measure.

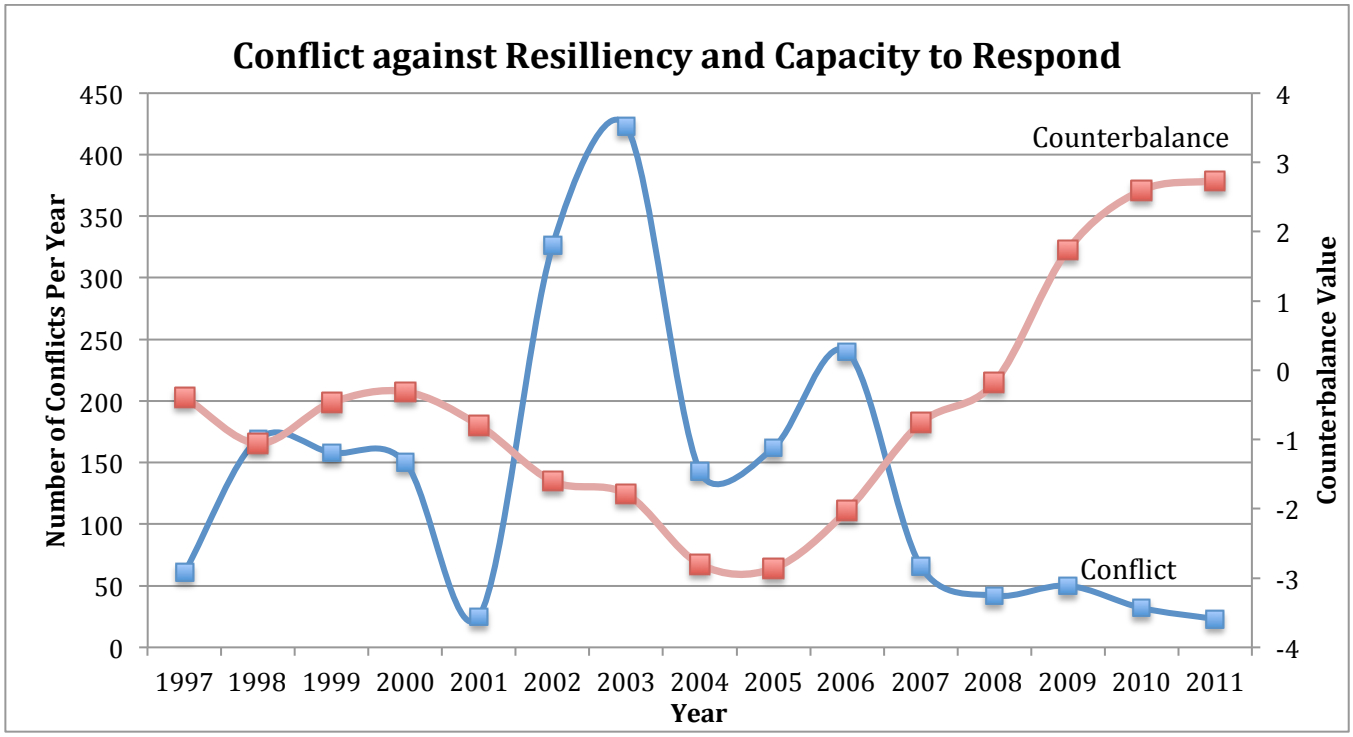
Counterbalance Values:

1997	1998	1999	2000	2001	2002	2003	2004
-0.3878802	-1.0568698	-0.4662711	-0.3113743	-0.7948284	-1.603173	-1.7868323	-2.7986327

2005	2006	2007	2008	2009	2010	2011
-2.8605335	-2.0257257	-0.7619834	-0.1809545	1.73554477	2.5932092	2.73576897

Conclusion:

Counterbalance Value Against Conflict In Uganda:



The counterbalance measure decreases prior to increased conflict and increases prior to decreased conflict. This indicates it may be an accurate association of WDI indicators, bucket factors, and conflict in Uganda.

Assessment of Methodology:

Overall the counterbalance indicator seems to associate well with past conflict data. However, the methodology made several assumptions for data selection, determination of key indicators, normalization, and weighting. Time bias within datasets could further distort the counterbalance measure. For examples, we could see the increase in counterbalance values coming primarily from technological advancement, which may not actually affect resiliency and capacity to respond, but just happens to go along with the decreased conflict from 2005-2011.

Another weakness of this measure is that the correlation weighting means that it will by definition work well against past conflict in Uganda. To better assess the accuracy of this methodology I would like to see this system and weighting applied in conjunction with other countries conflicts over time. I would also like to keep the same weighting while projecting onto conflict data in the coming years.

As a final note, I think the methodology could greatly benefit from the analysis of someone with a better understanding of statistical methods and biases. The short time spent with statistical services and learning from more able classmates showed me that there are other tools or methods that could be used to group and weight these data.

Appendix A – Uganda Timeline

(BBC Arica: http://www.bbc.co.uk/news/world-africa-14112446 (accessed 10/28/2013)

1993 - Museveni restores the traditional kings, including the king of Buganda, but without political power.
1995 - New constitution legalises political parties but maintains the ban on political activity.
1996 - Museveni returned to office in Uganda's first direct presidential election.
1997 - Ugandan troops help depose Mobutu Sese Seko of Zaire, who is replaced by Laurent Kabila.
1998 - Ugandan troops intervene in the Democratic Republic of Congo on the side of rebels seeking to overthrow Kabila.
2000 - Ugandans vote to reject multi-party politics in favour of continuing Museveni's "no-party" system.
2001 January - East African Community (EAC) inaugurated in Arusha, Tanzania, laying groundwork for common East African passport, flag, economic and monetary integration. Members are Tanzania, Uganda and Kenya.
2001 March - Uganda classifies Rwanda, its former ally in the civil war in DR Congo, as a hostile nation because of fighting in 2000 between the two countries' armies in DR Congo.
Museveni wins another term in office, beating his rival Kizza Besigye by 69% to 28%.
Campaign against rebels
2002 March - Sudan, Uganda sign agreement aimed at containing Ugandan rebel group the Lord's Resistance Army (LRA), active along common border.
2002 October - Army evacuates more than 400,000 civilians caught up in fight against cult-like LRA which continues its brutal attacks on villages.
2002 December - Peace deal signed with Uganda National Rescue Front (UNRF) rebels after more than five years of negotiations.
2003 May - Uganda pulls out last of its troops from eastern DR Congo. Tens of thousands of DR Congo civilians seek asylum in Uganda.
2004 February - LRA rebels slaughter more than 200 people at a camp for displaced people in the north.
2004 December - Government and LRA rebels hold their first face-to-face talks, but there is no breakthrough in ending the insurgency.
2005 April - Uganda rejects accusations made by DR Congo at the International Court in The Hague. DR Congo says Uganda invaded its territory in 1999, killing citizens and looting.
2005 July - Parliament approves a constitutional amendment which scraps presidential term limits.
Voters in a referendum overwhelmingly back a return to multi-party politics.
Lord's Resistance Army leader Joseph Kony
2005 October - International Criminal Court issues arrest warrants for five LRA commanders, including leader Joseph Kony.
2005 November - Main opposition leader Kizza Besigye is imprisoned shortly after returning from exile after a trial in a military court on various charges including treason and illegal possession of firearms. Supporters say the trial was politically motivated, and take to the streets. Mr Besigye is released on bail in January 2006, just ahead of presidential elections.
2005 December - International Court in The Hague rules that Uganda must compensate DR Congo for rights abuses and the plundering of resources in the five years leading to 2003.
2006 February - President Museveni wins multi-party elections, taking 59% of the vote against the 37% share of his rival, Kizza Besigye. EU observers highlight intimidation of Mr Besigye and official media bias as problems.
2006 August - The government and the LRA sign a truce aimed at ending their long-running conflict. Subsequent peace talks are marred by regular walk-outs.
2006 November - Government rejects a United Nations report accusing the army of using indiscriminate and excessive force in its campaign to disarm tribal warriors in the lawless northeastern region of Karamoja.
Somalia role
2007 March - Ugandan peacekeepers deploy in Somalia as part of an African Union mission to help stabilise the country.
The UN World Food Programme says it will have to halve food handouts to more than 1 million people displaced by war in the north.
2007 April - Protests over a rain forest explode into racial violence in Kampala, forcing police to protect Asian businesses and a Hindu temple. An Asian man and two other people are killed.
2007 July - Lord's Resistance Army says lack of funds for foreign travel and to reach commanders in remote hideouts will delay peace talks.

2007 August - Uganda and DRCongo agree to try defuse a border dispute.
2007 September - State of emergency imposed after severe floods cause widespread devastation.
2008 February - Government and the Lord's Resistance Army sign what is meant to be a permanent ceasefire at talks in Juba, Sudan.
2008 November - The leader of the Lord's Resistance Army, Joseph Kony, again fails to turn up for the signing of a peace agreement. Ugandan, South Sudanese and DR Congo armies launch offensive against LRA bases.
2009 January - Lord's Resistance Army appeals for ceasefire in face of continuing offensive by regional countries.
The UK oil explorer Heritage Oil says it has made a major oil find in Uganda.
2009 March - Ugandan army begins to withdraw from DR Congo, where it had pursued Lord's Resistance Army rebels.
2009 October - Somali Islamists threaten to target Uganda and Burundi after action by African peacekeepers in Somalia kills several civilians.
2009 December - Parliament votes to ban female circumcision. Anyone convicted of the practice will face 10 years in jail or a life sentence if a victim dies.
2010 January - President Museveni distances himself from the anti-homosexuality Bill, saying the ruling party MP who proposed the bill did so as an individual. The European Union and United States had condemned the bill.
The Ugandan army says it killed Bok Abudema, a senior commander of the Lord's Resistance Army armed group, in the Central African Republic.
2010 February - Heritage Oil sells its assets in Uganda to the UK firm Tullow Oil after Italian energy company Eni dropped out of the bidding.
2010 June - Public prosecutor opens corruption investigation against Vice-President Gilbert Bukenya, Foreign Minister Sam Kutesa and several other ministers and officials over the alleged theft of $25m.
2010 June-August - Operation Rwenzori against ADF-NALU rebels striving for an Islamic state in Uganda prompts 90,000 to flee in North Kivu province of neighbouring DR Congo.

Blasts

2010 July - Two bomb attacks on people watching World Cup final at a restaurant and a rugby club in Kampala kill at least 74 people. The Somali Islamist group Al-Shabab says it was behind the blasts.
2010 August - National Resistance Movement primary elections for parliamentary and local candidates suspended amid irregularities, violence.
Opposition leader Kizza Besigye
2010 October - UN report into killing of Hutus in DR Congo between 1993 and 2003 says they may constitute "crimes of genocide". It implicates Rwanda, Uganda, Burundi, Zimbabwe and Angola.
2010 October - Constitutional Court quashes treason charges against opposition leader Kizza Besigye.
2011 February - Museveni wins his fourth presidential election. Challenger Kizza Besigye alleges vote-rigging and dismisses the result as a sham.
2011 April - Kizza Besigye arrested several times over "walk-to-work" protests against rising prices.
2011 July - US deploys special forces personnel to help Uganda combat LRA rebels.
2011 September - Court orders release of LRA commander Thomas Kwoyelo, saying he should be given the amnesty on offer from the government.
2012 May - Ugandan Army captures senior LRA commander Caesar Achellam in a clash in the Central African Republic, one of the nearby states in which the remaining band of LRA troops operates. Uganda says this is a major breakthrough, billing Achellam as a top LRA strategist.
Tens of thousands of refugees cross into Uganda, fleeing fighting in DR Congo.
2012 July - UN accuses Uganda of sending troops into DR Congo to fight alongside the M23 rebel movement, a charge Uganda denies.
2012 November - Uganda announces its intention to withdraw from UN-backed international peacekeeping missions in response to UN accusations that Uganda is arming Congolese rebels.
Britain and other European countries halt aid channelled through the Ugandan government amid a scandal involving the alleged theft of donor funds.
2013 February - Eleven countries, including Uganda, sign a UN-mediated agreement pledging not to interfere in DR Congo.
2013 March - Uganda is grouped among the worst offenders in the illegal ivory trade at a meeting of CITES, the body regulating wildlife trade.
2013 May - Government temporarily shuts two newspapers after they published a letter suggesting President Museveni was grooming his son for power.

Appendix B – Chosen Indicators by Bucket

The 3 Letter Value on the left indicates indicator abbreviation as used in Stata Analysis

Agriculture

AGR1 - *Cereal production (metric per capita)
AGR2 - *Cereal Exports (FAO, US$ per capita)
AGR3 - *Food imports excluding fish (FAO current US$ per capita)
AGR4 - *Food Exports excluding fish (FAO, current US$ per capita)
AGR5 - *Cereal imports quantity (FAO Tonnes per capita)
AGR6 - Cereal production index (2004-2006 = 100)
AGR7 - Cereal yield (kg per hectare)

Development AID

DEV1 - Cereal food aid deliveries (FAO, tonnes)
DEV2 - Non-cereal food aid deliveries (FAO, tonnes)
DEV3 - Foreign direct investment, net inflows (% of GDP)
DEV4 - Net bilateral aid flows from DAC donors, Total (current US$)
DEV5 - Net ODA received (% of GDP)
DEV6 - Net ODA received (% of GNI)
DEV7 - Net ODA received per capita (current US$)
DEV8 - Net ODA received (% of central government expense)

Economics

ECO1 - Agriculture, value added (% of GDP)
ECO2 - Manufacturing, value added (% of GDP)
ECO3 - Industry, value added (% of GDP)
ECO4 - Services, etc., value added (% of GDP)
ECO5 - Inflation, GDP deflator (annual %)
ECO6 - GDP per capita, PPP (current international $)
ECO7 - High-technology exports (% of manufactured exports)
ECO8 - Imports of goods and services (% of GDP)
ECO9 - Trade (% of GDP)
ECO10 - Agriculture value added per worker (constant 2005 US$)
ECO11 - Total reserves (% of total external debt)
ECO12 - Consumer price index (2005 = 100)
ECO13 - Real interest rate (%)
ECO14 - External debt, end year (current US$)
ECO15 - General government consumption expenditure (% of GDP)
ECO16 - Gross national expenditure (% of GDP)

Education

EDU1 - Adjusted savings: education expenditure (% of GNI)
EDU2 - Ratio of female to male primary enrollment (%)
EDU3 - Primary completion rate, female (% of relevant age group)
EDU4 - Primary completion rate, male (% of relevant age group)
EDU5 - Primary completion rate, total (% of relevant age group)
EDU6 - Pupil-teacher ratio, primary
EDU7 - Secondary education, pupils (% female)
EDU8 - School enrollment, tertiary (% gross)
EDU9 - **Difference Primary Completion rate Male/ Female

Environment

ENV1 - CO2 emissions (metric tons per capita)
ENV2 - CO2 emissions (kg per PPP $ of GDP)
ENV3 - Adjusted savings: particulate emission damage (% of GNI)

Governance

GOV1 - Military expenditure (% of central government expenditure)
GOV2 - Proportion of seats held by women in national parliaments (%)
GOV3 - Health expenditure, public (% of government expenditure)
GOV4 - Control of Corruption (estimate)
GOV5 - Government Effectiveness (estimate)
GOV6 - Political Stability/No Violence (estimate)
GOV7 - Regulatory Quality (estimate)
GOV8 - Rule of Law (estimate)

Health

HLT1 - Prevalence of HIV, total (% of population ages 15-49)
HLT2 - Mortality rate, under-5 (per 1,000 live births)
HLT3 - Mortality rate, neonatal (per 1,000 live births)
HLT4 - Immunization, DPT (% of children ages 12-23 months)
HLT5 - Incidence of tuberculosis (per 100,000 people)
HLT6 - Difference in private and public health expenditure
HLT7 - New HIV Infections per capita
HLT8 - Health expenditure, total (% of GDP)
HLT9 - Prevalence of undernourishment (% of population)
HLT10 - Depth of the food deficit (kilocalories per person per day)
HLT11 - Adolescent fertility rate (births per 1,000 women ages 15-19)
HLT12 - Life expectancy at birth, total (years)

Infrastructure

INF1 - Mobile and fixed-line telephone subscribers (per 100 people)
INF2 - Gross fixed capital formation (% of GDP)
INF3 - Improved water source (% of population with access)
INF4 - Improved sanitation facilities (% of population with access)

Labor

LBR1 - Employment to population ratio, 15+, female (%)
LBR2 - GDP per person employed (annual % growth)
LBR3 - Labor participation rate, female (% of female population ages 15+)
LBR4 - Ratio of female to male labor force participation rate (%)

Land Use

LND1 - Agricultural land (% of land area)
LND2 - Arable land (hectares per person)
LND3 - Arable land (% of land area)
LND4 - Cereal cropland (% of land area)
LND5 - Forest area (% of land area)
LND6 - Terrestrial and marine protected areas (% of territorial area)

Military

MLT1 - Armed forces personnel (% of total labor force)
MLT2 - Military expenditure (% of GDP)
MLT3 - Military expenditure (% of central government expenditure)
MLT4 - Battle-related deaths (number of people)

Natural Resources

NRS1 - Adjusted savings: net forest depletion (% of GNI)
NRS2 - Adjusted savings: natural resources depletion (% of GNI)
NRS3 - Forest rents (% of GDP)
NRS4 - Total natural resources rents (% of GDP)
NRS5 - Ores and metals exports (% of merchandise exports)

Population

POP1 - Population density (people per sq. km of land area)
POP2 - Rural population density (rural popul per sq. km of arable land)
POP3 - Population in the largest city (% of urban population)
POP4 - Poverty headcount ratio at $1.25 a day (PPP) (% of pop)
POP5 - GINI index
POP6 - Employment to population ratio, ages 15-24, total (%)
POP7 - Population growth (annual %)
POP8 - Rural population growth (annual %)
POP9 - Urban population growth (annual %)
POP10 - *Economically Active population in agriculture (% of total)
POP11 - *Agricultural Population (% of total)

Science and Tech

SCT1 - Scientific and technical journal articles

* Indicates an indicator I created through Standardization
** Indicates a created indicator

Appendix C – Principal Component Analysis

Agriculture:

Factor	Variance	Difference	Proportion	Cumulative
Factor1	**3.19337**	**0.45268**	**0.4562**	**0.4562**
Factor2	**2.74069**	.	**0.3915**	**0.8477**

LR test: independent vs. saturated: chi2(**21**) = **138.16** Prob>chi2 = **0.0000**

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
agr1	**0.0063**	**0.9461**	**0.1049**
agr2	**0.6997**	**0.4371**	**0.3194**
agr3	**0.8794**	**0.3490**	**0.1049**
agr4	**0.8148**	**0.4486**	**0.1349**
agr5	**0.8628**	**-0.1207**	**0.2410**
agr6	**0.6256**	**0.7083**	**0.1068**
agr7	**0.3614**	**0.9029**	**0.0540**

Factor rotation matrix

	Factor1	Factor2
Factor1	**0.7536**	
Factor2	**0.6573**	**-0.7536**

Development

Factor analysis/correlation — Number of obs = **17**
Method: principal-component factors — Retained factors = **2**
Rotation: orthogonal varimax (Kaiser off) — Number of params = **15**

Factor	Variance	Difference	Proportion	Cumulative
Factor1	**3.63581**	**0.50585**	**0.4545**	**0.4545**
Factor2	**3.12996**	.	**0.3912**	**0.8457**

LR test: independent vs. saturated: chi2(**28**) = **170.65** Prob>chi2 = **0.0000**

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
dev1	**0.6870**	**0.5961**	**0.1726**
dev2	**0.8366**	**0.2838**	**0.2195**
dev3	**0.2348**	**0.9073**	**0.1217**
dev4	**-0.0296**	**0.9764**	**0.0457**
dev5	**0.9297**	**-0.0642**	**0.1315**
dev6	**0.9142**	**0.2090**	**0.1206**
dev7	**0.2254**	**0.9167**	**0.1089**
dev8	**0.8106**	**0.1713**	**0.3136**

Factor rotation matrix

	Factor1	Factor2
Factor1	**0.7713**	**0.6365**
Factor2	**-0.6365**	**0.7713**

Economics:

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 3
Rotation: orthogonal varimax (Kaiser off) — Number of params = 45

Factor	Variance	Difference	Proportion	Cumulative
Factor1	6.82907	3.17139	0.4268	0.4268
Factor2	3.65769	0.99241	0.2286	0.6554
Factor3	2.66528	.	0.1666	0.8220

LR test: independent vs. saturated: chi2(120) = . Prob>chi2 = .

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Uniqueness
eco1	-0.8003	-0.5445	0.0931	0.0543
eco2	-0.0043	-0.4918	0.5600	0.4445
eco3	0.8671	0.3948	0.0192	0.0920
eco4	0.7087	0.6255	-0.1706	0.0774
eco5	0.1204	-0.1485	-0.9304	0.0977
eco6	0.9824	-0.0410	-0.0782	0.0270
eco7	0.3111	0.4299	0.5981	0.3608
eco8	0.9658	-0.1421	-0.0225	0.0465
eco9	0.9403	-0.2625	-0.0687	0.0422
eco10	-0.0649	0.9169	0.1272	0.1389
eco11	0.8118	-0.0252	-0.0396	0.3388
eco12	0.9395	-0.1484	-0.0460	0.0931
eco13	-0.1593	0.1040	0.9335	0.0923
eco14	-0.6167	0.5067	0.2316	0.3093
eco15	-0.2792	0.8641	0.2432	0.1163
eco16	0.1076	0.6300	0.2732	0.5168

Factor rotation matrix

	Factor1	Factor2	Factor3
Factor1	0.9878	0.0245	-0.1539
Factor2	0.0474	0.8936	0.4464
Factor3	0.1485	-0.4482	0.8815

Education

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 3
Rotation: orthogonal varimax (Kaiser off) — Number of params = 24

Factor	Variance	Difference	Proportion	Cumulative
Factor1	5.20171	3.59468	0.5780	0.5780
Factor2	1.60703	0.31347	0.1786	0.7565
Factor3	1.29356	.	0.1437	0.9003

LR test: independent vs. saturated: chi2(36) = 802.11 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Uniqueness
edu1	0.7742	-0.0085	0.4096	0.2328
edu2	0.9108	0.3158	0.2301	0.0179
edu3	0.1418	0.9752	-0.0202	0.0285
edu4	-0.9486	0.1278	0.2142	0.0379
edu5	-0.8325	0.5021	0.1924	0.0178
edu6	0.0851	0.0026	-0.8995	0.1837
edu7	0.8349	0.3735	0.3322	0.0530
edu8	0.7835	0.2915	-0.1702	0.2723
edu9	-0.9174	-0.2516	0.2027	0.0539

Factor rotation matrix

	Factor1	Factor2	Factor3
Factor1	0.9846	0.1738	0.0187
Factor2	-0.1588	0.8449	0.5109
Factor3	-0.0730	0.5060	-0.8594

Environmental

Factor	Variance	Difference	Proportion	Cumulative
Factor1	1.81016	0.78279	0.6034	0.6034
Factor2	1.02737	.	0.3425	0.9458

LR test: independent vs. saturated: chi2(3) = 18.19 Prob>chi2 = 0.0004

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
env1	0.9473	0.1509	0.0798
env2	0.0210	0.9973	0.0050
env3	-0.9551	0.1002	0.0776

Factor rotation matrix

	Factor1	Factor2
Factor1	0.9963	0.0861
Factor2	-0.0861	0.9963

Governance

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 3
Rotation: orthogonal varimax (Kaiser off) — Number of params = 21

Factor	Variance	Difference	Proportion	Cumulative
Factor1	3.20435	1.43882	0.4005	0.4005
Factor2	1.76552	0.27096	0.2207	0.6212
Factor3	1.49456	.	0.1868	0.8081

LR test: independent vs. saturated: chi2(28) = 78.60 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Uniqueness
gov1	0.0221	0.0434	0.8717	0.2377
gov2	0.9490	0.1495	0.1059	0.0659
gov3	0.3060	-0.2039	0.6422	0.4523
gov4	-0.1873	-0.8393	-0.2812	0.1815
gov5	0.0104	0.8647	-0.3255	0.1462
gov6	0.6717	0.4372	0.3140	0.2591
gov7	-0.9192	-0.1838	0.0830	0.1144
gov8	0.9372	-0.1505	0.1431	0.0785

Factor rotation matrix

	Factor1	Factor2	Factor3
Factor1	0.9176	0.2851	0.2770
Factor2	0.1236	-0.8669	0.4829
Factor3	-0.3778	0.4088	0.8307

Health

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 2
Rotation: orthogonal varimax (Kaiser off) — Number of params = 23

Factor	Variance	Difference	Proportion	Cumulative
Factor1	8.65541	5.97985	0.7213	0.7213
Factor2	2.67556	.	0.2230	0.9442

LR test: independent vs. saturated: chi2(66) = 673.05 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
hlt1	0.8137	0.5331	0.0537
hlt2	0.9765	-0.2106	0.0020
hlt3	0.9562	-0.2896	0.0019
hlt4	0.8122	-0.5292	0.0603
hlt5	0.9924	-0.1036	0.0043
hlt6	0.9274	-0.0572	0.1367
hlt7	0.8457	-0.1096	0.2727
hlt8	0.9750	-0.0082	0.0493
hlt9	-0.2549	0.9605	0.0124
hlt10	-0.0832	0.9610	0.0696
hlt11	0.9715	-0.2281	0.0042
hlt12	0.9692	-0.2425	0.0018

Factor rotation matrix

	Factor1	Factor2
Factor1	0.9726	-0.2326
Factor2	0.2326	0.9726

Infrastructure

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 1
Rotation: orthogonal varimax (Kaiser off) — Number of params = 4

Factor	Variance	Difference	Proportion	Cumulative
Factor1	3.71158	.	0.9279	0.9279

LR test: independent vs. saturated: chi2(6) = 179.59 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Uniqueness
inf1	0.9022	0.1860
inf2	0.9712	0.0568
inf3	0.9894	0.0210
inf4	0.9876	0.0246

Factor rotation matrix

	Factor1
Factor1	1.0000

Labor

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 1
Rotation: orthogonal varimax (Kaiser off) — Number of params = 4

Factor	Variance	Difference	Proportion	Cumulative
Factor1	2.95482	.	0.7387	0.7387

LR test: independent vs. saturated: chi2(6) = 82.45 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Uniqueness
lbr1	0.9845	0.0308
lbr2	0.2357	0.9444
lbr3	0.9810	0.0377
lbr4	0.9838	0.0322

Factor rotation matrix

	Factor1
Factor1	1.0000

Land Use

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 1
Rotation: orthogonal varimax (Kaiser off) — Number of params = 6

Factor	Variance	Difference	Proportion	Cumulative
Factor1	5.56836	.	0.9281	0.9281

LR test: independent vs. saturated: chi2(15) = 322.94 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Uniqueness
lnd1	0.9949	0.0102
lnd2	-0.9357	0.1244
lnd3	0.9912	0.0176
lnd4	0.9708	0.0575
lnd5	-0.9963	0.0075
lnd6	0.8863	0.2144

Factor rotation matrix

	Factor1
Factor1	1.0000

Military

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 2
Rotation: orthogonal varimax (Kaiser off) — Number of params = 6

Factor	Variance	Difference	Proportion	Cumulative
Factor1	1.67629	0.08954	0.4191	0.4191
Factor2	1.58675	.	0.3967	0.8158

LR test: independent vs. saturated: chi2(6) = 16.34 Prob>chi2 = 0.0120

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
mlt1	-0.2806	0.8279	0.2358
mlt2	0.8599	-0.2764	0.1842
mlt3	0.9259	0.0364	0.1413
mlt4	0.0287	0.9075	0.1757

Factor rotation matrix

	Factor1	Factor2
Factor1	0.7445	-0.6676
Factor2	0.6676	0.7445

Natural Resources

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 1
Rotation: orthogonal varimax (Kaiser off) — Number of params = 3

Factor	Variance	Difference	Proportion	Cumulative
Factor1	2.11884	.	0.7063	0.7063

LR test: independent vs. saturated: chi2(3) = 55.44 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Uniqueness
nrs1	0.9685	0.0619
nrs3	-0.9770	0.0454
nrs5	0.4756	0.7738

Factor rotation matrix

	Factor1
Factor1	1.0000

Population

Factor analysis/correlation — Number of obs = 17
Method: principal-component factors — Retained factors = 2
Rotation: orthogonal varimax (Kaiser off) — Number of params = 21

Factor	Variance	Difference	Proportion	Cumulative
Factor1	5.98289	1.69739	0.5439	0.5439
Factor2	4.28550	.	0.3896	0.9335

LR test: independent vs. saturated: chi2(55) = 608.54 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
pop1	-0.8027	0.5901	0.0075
pop2	-0.6825	0.5900	0.1861
pop3	0.8629	-0.4769	0.0280
pop4	-0.8423	0.4381	0.0985
pop5	0.0943	-0.9584	0.0725
pop6	0.9196	-0.3530	0.0296
pop7	-0.2935	0.8945	0.1137
pop8	0.9716	0.1095	0.0439
pop9	-0.6693	0.6488	0.1311
pop10	0.6960	-0.7074	0.0152
pop11	0.7754	-0.6270	0.0055

Factor rotation matrix

	Factor1	Factor2
Factor1	0.7833	-0.6217
Factor2	0.6217	0.7833

Appendix D – New Factor Values

	AGRFactor1	agrfactor2	DevFactor1	DevFactor2	EcoFactor1	EcoFactor2	EcoFactor3	EduFactor1	EduFactor2	EduFactor3
1995	-0.2470512	0.04048287	0.09461661	-0.9122188	-0.9704707	-0.7329056	-0.0351704	-0.697288	-0.550839	2.321191
1996	-0.4349775	-1.6667875	-0.5702418	-1.1239288	-0.6220606	-0.1500231	-0.025946	-0.6216806	-0.550839	1.95705008
1997	-0.5259754	-1.6556682	-0.2638381	-0.7565625	-0.5552151	-0.5083296	0.04422464	-0.5918612	-0.550839	-1.3181452
1998	-0.5518852	-0.2667259	-0.6363674	-0.7064035	-0.5275651	-0.0180697	0.00282001	-0.3340357	-0.550839	-1.1806383
1999	-0.7737593	-0.0460352	-0.6216481	-1.0274014	-0.1418543	0.14206552	0.08125453	-0.0026188	-0.550839	-0.9995721
2000	-1.0797051	-0.4459032	0.12422966	-0.6320701	-0.4651039	0.34656861	0.12247713	0.26653607	-0.550839	-1.3187416
2001	-1.2221616	-0.0070993	-0.1749175	-0.8904908	-0.2600449	0.68349791	0.11217809	0.34439505	-0.550839	-0.5514459
2002	-0.8657258	-0.0175088	-0.6393739	-0.6789859	-0.0089111	1.34574477	-0.0340042	0.47626183	1.27340841	-0.3114502
2003	-0.7202843	0.19262469	0.60817938	-0.3322079	-0.0284893	1.17980658	-0.1068608	0.45560075	1.24587431	-0.2612123
2004	0.0969812	-0.6792918	1.00040951	0.03470025	-0.1756308	0.30345072	0.0241412	0.49510593	-0.1270892	0.08473907
2005	0.37779251	-0.1911659	0.69909212	0.16506115	0.01974614	0.5606262	-0.0179266	0.27779623	-0.3186834	0.1161145
2006	0.5839667	-0.2978589	1.37232601	1.42278885	0.38251328	0.9301701	-0.1109031	0.17327542	-0.9792669	0.2408396
2007	0.70899775	-0.2739444	0.99239804	1.52694225	0.48858502	-0.3568693	-0.0980603	0.01788211	-1.6398504	0.16324749
2008	0.87819114	1.01374174	0.07036834	1.21861515	0.58056046	-1.5486558	-0.020948	0.13201718	1.39727946	0.10886662
2009	1.02504732	1.39387087	-0.0619479	1.11854664	0.7846459	-0.74476	0.0345153	-0.0824022	1.90587206	0.20570579
2010	1.37527443	1.31713684	-0.8583116	0.42434575	0.70450819	-0.8464287	-0.0340432	-0.1114457	1.16095591	0.31164048
2011	1.37527443	1.59013216	-1.1349734	1.14926965	0.79478673	-0.5858886	0.06225178	-0.1975384	-0.0626271	0.43181105

EnvFactor1	EnvFactor2	GovFactor1	GovFactor2	GovFactor3	HltFactor1	HltFactor2	InfFactor1	lbrFactor1	lbrFactor2	LndFactor1
-0.6832302	0.05815732	-0.458671	0.0582227	-0.0567752	-1.332725	-0.3096009	-1.3213387	1.50810011	2.20664688	-0.1606961
-0.15574	-0.1537781	-0.458671	0.0582227	-0.0567752	-1.2820923	-0.7019634	-1.1751837	1.20296598	1.07482196	-0.2558548
0.00339644	0.63390625	-0.1977525	-0.0253421	-0.0567752	-1.177456	-0.7437623	-1.0776685	1.11052607	-0.6838349	-0.3655946
0.13354868	-1.4145875	0.06316595	-0.1089069	-0.0567752	-1.0514261	-0.2291035	-1.0659268	0.96889948	-1.4876643	-0.4284571
0.11811042	-0.3762651	-0.2838075	0.06290743	0.81819924	-0.7947403	0.46431464	-0.6473845	0.68269058	0.6397345	-0.548542
0.09550594	-1.0527123	-0.6265673	0.23472172	-0.7267424	-0.5900643	0.88381221	-0.5573786	0.64800676	-0.8244587	-0.4249591
0.15126826	-0.6934582	-0.3785641	-0.0650155	-0.517629	-0.3993309	1.07504267	-0.4642416	0.59890732	-0.9649418	-0.420344
0.2685736	0.72886427	-0.4213037	-0.3647526	-0.5605224	-0.2173866	1.22190451	-0.2702766	0.50234962	0.64775077	0.01004312
0.37127373	1.85132169	-0.3144265	0.66616251	-0.3383467	0.00769771	1.33044488	-0.078477	0.18593202	-0.4065541	0.17561494
0.49566661	2.09082646	-0.1329893	0.90980449	-0.2514617	0.3086151	1.1637799	-0.0222216	-0.1169992	-0.3542822	0.19821762
0.33552225	-0.1232632	-0.4361394	-0.3683874	0.3105424	0.44406602	0.76023103	0.28917345	-0.5430619	-0.555246	0.11824439
0.11235964	-0.4510426	0.38678417	0.50779969	-0.0365933	0.71148127	0.20248837	0.30628826	-0.7539337	1.58583061	0.19090152
-0.1701113	-1.6048705	0.61091148	0.58930017	-0.633451	0.78866932	-0.281181	0.61383216	-1.027465	0.33847073	0.24255727
-0.1173015	0.3600751	0.6658012	-0.1860681	-0.2334921	0.86977584	-0.62789	0.99905399	-1.09432	0.53271198	0.33668045
-0.1846043	0.66976901	0.58381599	-0.9381807	0.58480201	1.10955161	-0.9388472	1.23902161	-1.2477815	-0.1189173	0.40270927
-0.3871192	-0.2614713	0.58620144	-0.5193387	1.0868525	1.23851765	-1.3510129	1.43616617	-1.2788649	-0.8150341	0.50051558
-0.3871192	-0.2614713	0.81221204	-0.5111495	0.72494333	1.36684713	-1.9186571	1.79656179	-1.3459517	-0.8150341	0.42896349

MltFactor1	MltFactor2	NrsFactor1	PopFactor1	PopFactor2	SCTfactor1
-0.2237944	-0.573732	0.00175391	0.21421658	0.06722717	-1.4568667
-0.2509911	-1.6282331	0.06629395	0.16822364	-0.2691319	-1.2245383
-0.2089138	-0.6516491	0.10426598	0.12499034	-0.4531675	-1.1981373
-0.4624428	-0.2937325	0.19389847	0.13071687	-0.4901759	-0.8707655
-0.7581693	0.34853989	0.12621649	0.26674545	-0.9610756	-0.6806787
0.00747987	-0.1537747	-0.0064414	0.30492438	-0.715441	-0.5117126
0.84760179	-0.0981567	-0.0635133	0.16094554	-0.0151346	-0.3691474
0.86381034	-0.7799346	0.02059441	0.21455339	-0.0927612	-0.6357971
0.7206148	-0.8504397	-0.1380983	0.13947203	0.02990011	-0.245063
0.39742079	-1.2140689	-0.0009534	0.11018243	0.05186589	0.612968
0.27984881	-0.0001185	-0.035527	0.08366389	0.00659945	-0.0919374
0.64071757	0.68158562	-0.0191283	-0.1990115	0.65606098	0.4440019
0.88312318	0.89326393	-0.0111962	-0.3234972	0.59363474	1.78781038
0.50781293	0.9658255	-0.133477	-0.4011382	0.54397896	0.77137371
0.71498696	1.04828796	-0.0151461	-0.2899311	0.34234432	1.22283
-2.247129	1.11968615	-0.0089136	-0.3351892	0.3214914	1.22283
-1.7119766	1.18665076	-0.0806285	-0.3698673	0.38378468	1.22283

Appendix E – Factor Correlation matrices

	conflict	agrfac~1	agrfac~2	devfac~1	devfac~2	ecofac~1	ecofac~2	ecofac~3	edufac~1	edufac~2	edufac~3	envfac~1
conflict	1.0000											
agrfactor1	-0.4615	1.0000										
agrfactor2	-0.2735	0.6382	1.0000									
devfactor1	0.2980	0.0276	-0.4063	1.0000								
devfactor2	-0.3026	0.8741	0.5041	0.3522	1.0000							
ecofactor1	-0.3158	0.8815	0.8219	-0.0335	0.8521	1.0000						
ecofactor2	0.7863	-0.6346	-0.4325	0.3161	-0.4537	-0.4742	1.0000					
ecofactor3	-0.4783	-0.3525	-0.0347	-0.5001	-0.4970	-0.3620	-0.1623	1.0000				
edufactor1	0.5245	-0.2817	-0.0009	0.4626	-0.0752	-0.0450	0.6232	-0.1648	1.0000			
edufactor2	0.1487	0.2290	0.6092	-0.3142	0.0791	0.4024	-0.1922	-0.1059	0.1755	1.0000		
edufactor3	-0.1316	0.8073	0.6269	0.2576	0.8082	0.8660	-0.1853	-0.5041	0.2657	0.3118	1.0000	
envfactor1	0.6754	-0.6612	-0.6186	0.4796	-0.5268	-0.6713	0.7511	-0.0657	0.6240	-0.1231	-0.2961	1.0000
envfactor2	0.3811	-0.0152	-0.0100	0.1686	-0.0856	0.0090	0.1636	-0.1505	0.3657	0.5861	0.2199	0.4297
govfactor1	-0.5027	0.8835	0.6441	-0.0935	0.8450	0.8424	-0.7049	-0.3265	-0.4222	0.1714	0.6525	-0.7827
govfactor2	0.4153	-0.3342	-0.5955	0.6851	-0.0758	-0.3884	0.4116	-0.3018	0.3929	-0.5020	-0.1354	0.5500
govfactor3	-0.3318	0.5585	0.5405	-0.4665	0.1776	0.4728	-0.4189	0.0993	-0.4559	0.2591	0.3001	-0.4932
hltfactor1	-0.2865	0.8925	0.7470	0.1432	0.8725	0.9449	-0.3814	-0.3782	0.1213	0.3439	0.9471	-0.5196
hltfactor2	0.6660	-0.7506	-0.5309	0.4595	-0.5387	-0.6096	0.8173	-0.0260	0.7833	-0.1264	-0.3013	0.9088
inffactor1	-0.3783	0.8987	0.8398	-0.0677	0.8142	0.9607	-0.4998	-0.2466	-0.0122	0.4101	0.8743	-0.6541
lbrfactor1	0.3598	-0.9347	-0.7313	-0.1470	-0.9130	-0.9545	0.4857	0.3815	-0.0081	-0.2909	-0.9102	0.5854
lbrfactor2	0.2878	0.1599	-0.0073	0.4257	0.4073	0.3443	0.1575	-0.4741	0.2899	0.0105	0.3312	0.0685
lndfactor1	-0.1101	0.8611	0.6467	0.1769	0.8187	0.8714	-0.3353	-0.5465	0.1182	0.4788	0.9266	-0.4006
mltfactor1	0.3731	-0.3657	-0.3688	0.6605	0.0342	-0.2028	0.4265	-0.2521	0.5329	-0.0259	-0.0109	0.5635
mltfactor2	-0.5809	0.7484	0.7070	-0.1921	0.7125	0.8104	-0.6357	-0.0754	-0.3726	0.0718	0.5054	-0.8579
nrsfactor1	-0.0371	-0.3282	-0.4751	-0.2988	-0.4826	-0.5292	0.0225	0.2463	-0.5280	-0.3846	-0.6336	0.0884
popfactor1	0.4993	-0.9260	-0.6646	-0.0148	-0.9092	-0.9030	0.6772	0.3852	0.2942	-0.2281	-0.7618	0.7566
popfactor2	-0.1878	0.7534	0.4833	0.3596	0.8816	0.7961	-0.2556	-0.6002	0.1268	0.2088	0.8873	-0.3747
sctfactor1	-0.4186	0.8562	0.6336	0.1981	0.8803	0.8818	-0.4864	-0.3380	0.0241	0.1500	0.8454	-0.5761

	envfac~2	govfac~1	govfac~2	govfac~3	hltfac~1	hltfac~2	inffac~1	lbrfac~1	lbrfac~2	lndfac~1	mltfac~1	mltfac~2
envfactor2	1.0000											
govfactor1	-0.1622	1.0000										
govfactor2	0.1604	-0.2793	1.0000									
govfactor3	0.0150	0.4243	-0.5556	1.0000								
hltfactor1	0.0913	0.7583	-0.2498	0.3736	1.0000							
hltfactor2	0.2634	-0.8254	0.5507	-0.6151	-0.4843	1.0000						
inffactor1	0.0564	0.7913	-0.3971	0.4802	0.9720	-0.6150	1.0000					
lbrfactor1	-0.0019	-0.8142	0.2750	-0.4119	-0.9849	0.5624	-0.9650	1.0000				
lbrfactor2	0.1082	0.1876	0.2224	-0.0741	0.2499	0.1441	0.1477	-0.2649	1.0000			
lndfactor1	0.3165	0.7119	-0.1832	0.3068	0.9389	-0.4378	0.8996	-0.9112	0.2273	1.0000		
mltfactor1	0.2055	-0.3099	0.3631	-0.7454	-0.1544	0.6278	-0.3022	0.1739	0.3944	-0.1017	1.0000	
mltfactor2	-0.4883	0.8005	-0.4860	0.5257	0.6838	-0.7470	0.7518	-0.7639	0.2149	0.4830	-0.3678	1.0000
nrsfactor1	-0.3341	-0.2317	-0.0502	0.1535	-0.6396	-0.0427	-0.6028	0.5716	-0.1637	-0.6177	-0.2413	-0.2303
popfactor1	0.1172	-0.9611	0.3021	-0.3694	-0.8604	0.7650	-0.8739	0.9075	-0.2149	-0.8131	0.2230	-0.8165
popfactor2	0.0846	0.7339	-0.0472	0.0321	0.8564	-0.3608	0.7679	-0.8410	0.3408	0.8600	0.1634	0.5165
sctfactor1	-0.0530	0.8141	-0.0915	0.2661	0.9220	-0.5095	0.8883	-0.9333	0.2046	0.8413	-0.1169	0.6944

Appendix F – Weighted Counterbalance

Weighted	AGRFactor1	agrfactor2	DevFactor1	DevFactor2	EcoFactor1	EcoFactor2	EcoFactor3	EduFactor1	EduFactor2	EduFactor3
1997	-0.0526175	0.00302821	-0.0084023	-0.0835289	-0.0967847	0.45313187	-0.008046	0.19182411	0.01217998	0.04019969
1998	-0.0926425	-0.1246795	0.05063976	-0.1029145	-0.0620379	0.09275443	-0.0059357	0.17102448	0.01217998	0.03389329
1999	-0.1120234	-0.1238477	0.02342988	-0.069276	-0.0553714	0.31428375	0.01011731	0.16282115	0.01217998	-0.0228284
2000	-0.1175417	-0.0199517	0.05651197	-0.0646831	-0.0526139	0.01117191	0.00064514	0.0918933	0.01217998	-0.020447
2001	-0.164797	-0.0034435	0.05520484	-0.0940758	-0.0141471	-0.0878345	0.01858867	0.00072043	0.01217998	-0.0173111
2002	-0.229958	-0.0333546	-0.0110321	-0.0578766	-0.0463846	-0.2142722	0.0280192	-0.0733241	0.01217998	-0.0228387
2003	-0.2602987	-0.000531	0.01553337	-0.0815394	-0.0259342	-0.4225847	0.02566308	-0.0947432	0.01217998	-0.0095502
2004	-0.1843842	-0.0013097	0.05677896	-0.0621725	-0.0008887	-0.8320305	-0.0077792	-0.1310197	-0.0281572	-0.0053939
2005	-0.1534078	0.01440876	-0.0540088	-0.0304192	-0.0028412	-0.7294363	-0.0244466	-0.1253359	-0.0275484	-0.0045238
2006	0.02065527	-0.0508126	-0.0888404	0.00317739	-0.0175156	-0.1876138	0.0055228	-0.1362038	0.00281016	0.00146756
2007	0.0804631	-0.0142996	-0.0620822	0.01511411	0.00196928	-0.3466171	-0.0041011	-0.0764218	0.00704663	0.00201094
2008	0.12437454	-0.0222805	-0.121868	0.13028016	0.03814791	-0.5750941	-0.0253714	-0.0476681	0.02165325	0.004171
2009	0.15100394	-0.0204917	-0.0881289	0.13981715	0.04872641	0.22064079	-0.0224333	-0.0049194	0.03625986	0.00282721
2010	0.18703912	0.07583016	-0.006249	0.11158464	0.05789909	0.95748382	-0.0047923	-0.036318	-0.0308962	0.00188541
2011	0.21831688	0.10426468	0.00550122	0.10242169	0.07825245	0.46046103	0.0078961	0.02266888	-0.0421421	0.00356253

EnvFactor1	EnvFactor2	GovFactor1	GovFactor2	GovFactor3	HltFactor1	HltFactor2	InfFactor1	IbrFactor1	IbrFactor2	LndFactor1
0.31166583	-0.0084466	-0.1159095	-0.0100419	-0.0062505	-0.1093931	0.13732532	-0.189098	-0.1952327	-0.182774	-0.001948
0.07104315	0.02233431	-0.1159095	-0.0100419	-0.0062505	-0.105237	0.31136006	-0.1681816	-0.1557312	-0.0890263	-0.0031015
-0.0015493	-0.0920668	-0.0499735	0.00437085	-0.0062505	-0.0966482	0.32990025	-0.1542261	-0.1437643	0.05664125	-0.0044317
-0.0609203	0.20545074	0.0159625	0.01878361	-0.0062505	-0.0863034	0.10162023	-0.1525457	-0.1254299	0.12322151	-0.0051938
-0.0538779	0.05464769	-0.0717202	-0.0108499	0.09007657	-0.0652341	-0.2059495	-0.0926478	-0.0883784	-0.0529885	-0.0066494
-0.0435665	0.152893	-0.1583381	-0.0404834	-0.080008	-0.0484338	-0.3920202	-0.079767	-0.0838884	0.06828896	-0.0051514
-0.0690033	0.10071593	-0.0956659	0.01121348	-0.0569864	-0.032778	-0.4768416	-0.066438	-0.0775322	0.07992501	-0.0050954
-0.1225139	-0.1058582	-0.1064665	0.06291038	-0.0617086	-0.0178436	-0.5419831	-0.0386795	-0.0650322	-0.0536524	0.00012174
-0.1693621	-0.2688808	-0.0794579	-0.1148958	-0.037249	0.00063185	-0.5901268	-0.0112309	-0.02407	0.03367441	0.00212881
-0.2261058	-0.3036658	-0.0336074	-0.1569177	-0.0276837	0.02533182	-0.5162016	-0.0031802	0.01514625	0.02934478	0.0024028
-0.1530536	0.01790241	-0.1102156	0.06353728	0.034188	0.03644994	-0.337205	0.04138387	0.07030264	0.04599038	0.00143336
-0.0512546	0.06550817	0.09774318	-0.0875823	-0.0040286	0.05839998	-0.0898149	0.04383319	0.09760128	-0.1313525	0.00231411
0.07759885	0.23308692	0.15438178	-0.101639	-0.0697374	0.06473575	0.1247195	0.08784607	0.13301155	-0.0280351	0.00294028
0.05350884	-0.0522963	0.16825282	0.03209192	-0.0257054	0.07139316	0.27850439	0.14297551	0.14166634	-0.0441239	0.00408124
0.08421005	-0.0972754	0.14753456	0.16181186	0.06438158	0.09107449	0.41643132	0.17731748	0.16153285	0.00984978	0.00488165

MltFactor1	MltFactor2	NrsFactor1	PopFactor1	PopFactor2	SCTfactor1
0.03115299	-0.1936029	2.4141E-06	-0.0534043	0.00237102	-0.2552809
0.03493887	-0.5494388	9.1248E-05	-0.0419382	-0.009492	-0.2145709
0.02908156	-0.2198956	0.00014351	-0.0311602	-0.0159827	-0.2099448
0.06437371	-0.0991185	0.00026688	-0.0325878	-0.0172879	-0.1525807
0.1055399	0.11761298	0.00017373	-0.0664998	-0.033896	-0.1192726
-0.0010412	-0.0518905	-8.866E-06	-0.0760178	-0.0252328	-0.0896653
-0.1179892	-0.0331225	-8.742E-05	-0.0401238	-0.0005338	-0.0646842
-0.1202455	-0.2631849	2.8346E-05	-0.0534883	-0.0032716	-0.1114081
-0.1003122	-0.2869765	-0.0001901	-0.0347704	0.00105454	-0.0429414
-0.0553224	-0.4096813	-1.312E-06	-0.0274685	0.00182925	0.10740791
-0.038956	-3.997E-05	-4.89E-05	-0.0208574	0.00023276	-0.0161098
-0.0891902	0.22999753	-2.633E-05	0.04961366	0.02313851	0.07780066
-0.1229339	0.30142728	-1.541E-05	0.08064802	0.02093681	0.31327079
-0.0706894	0.3259128	-0.0001837	0.10000396	0.01918551	0.1351647
-0.0995288	0.35373933	-2.085E-05	0.07227996	0.01207409	0.21427156