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A retrospective economic vulnerability index, 1990-2011 Using the 2012 un-cdp definitions

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Abstract

This document is aimed at presenting detailed calculation principles for annual retrospective series of the Economic Vulnerability Index according to the 2012 UN-CDP definitions. It is organized as successive technical sheets explaining EVI retrospective component calculation, reminding definitions followed by the UN-CDP in its 2012 Review of Least Developed Countries, and presenting adjustments that had to be made to obtain retrospective series. Retrospective series cover the 1990-2011 period (starting 1980 for some countries) and 130 developing countries (among which 48 LDCs and 82 non LDCs) and are gathered in the companion database.

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Glossary

EVI: Economic Vulnerability Index

LDCs : Least Developed Countries

UN-CDP : United Nations Committee for Development Policy

UNDESA : United Nations Department of Economic and Social Affairs

1. Introduction

Economic vulnerability can be defined as the likelihood that a country's economic development would be hindered by exogenous unforeseen events, often called external shocks (Guillaumont, 2008; 2009). Since the 1990s, the interest in developing countries' economic vulnerability has been growing. Indeed, the numerous worldwide economic crises in this decade pointed out their vulnerability to international market fluctuations. In 2000, economic vulnerability, measured by the economic vulnerability index (EVI), became an additional criterion for the identification of least developed countries, besides the GDP per capita and an index of human development (Guillaumont 2009ab, chapters 2 and 6; Guillaumont 2009b). Since then, the EVI calculation principles have been revised for the 2006-09 and 2012 Reviews of the United Nations Committee for Development Policy (UN-CDP) to identify Least Developed Countries.

Economic vulnerability has three main determinants: the *size and likelihood of shocks*, the *exposure to these shocks*, and the *resilience* or the capacity for reacting to them (Guillaumont, 2009, chapter 6). While the two former determinants mainly depend on country structural features (geographic localization, human capital, economic diversification, and so on), resilience relies rather on country current economic policy and is not considered in the EVI.

The EVI is hence a synthetic index of the structural vulnerability, independent from the current policy or resilience, composed of the magnitude of shocks and the exposure to shocks. Two main categories of shocks are considered. First, natural *shocks* include natural disasters – such as earthquakes or tsunamis – and climatic shocks – such as droughts, floods, or typhoons. Other domestic shocks such as civil wars, political and social instability are not taken into account since they are not considered as structural or exogenous. Second, the EVI also captures the impacts of *external shocks*, such as international commodity price volatility, or slumps in external demand. Exposure to these shocks is likely to be higher when country size is small, when countries are specialized in primary commodities, and/or are remote from world markets.

The EVI is the arithmetic average of 8 components:

- The **exposure index**, which is a weighted average of population size (25%), remoteness from world markets (25%), exports concentration (12.5%), share of agriculture, forestry and fishery in GDP (12.5%) and the share of population living in low elevated coastal zone (25%).
- The **size and likelihood of shocks**, which is a weighted average of the victims of natural disasters (25%), the instability in the agricultural production (25%), and the instability in exports of goods and services (50%).

The EVI is an index lying between 0 and 100, since its components are also measured on a 0 to 100 scale and the cumulative sum of their weight equals 1. A high score corresponds to a high level of vulnerability.

2. Why a retrospective EVI?

The 2006, 2009 and 2012 triennial reviews of the EVI are available on the United Nations Department of Social and Economic Affairs (UNDESA) website. However these reviews, as well as the former 2000 and 2003 reviews, do not allow intertemporal comparisons because of changes in the method of calculation. This paper presents an updated version of the retrospective EVI previously calculated by the FERDI (Cariolle, 2011), using to the new definitions of the index set in the review 2012 of UN-CDP. This document presents a retrospective EVI calculation method in the form of a technical sheet for each EVI component.

The retrospective calculation follows some general rules:

- Annual EVI is calculated for the longest period for which we have data. We also update UN-CDP results for the most recent years (till 2011).
- Calculations of retrospective EVI closely follow CDP methodology. Some methodological adjustments that were necessary are described in the "special treatment" section.
- Data sources are identical to those used by the CDP in its 2012 review, but these databases have been updated since then.
- Comparisons are made to ensure there are no significant differences between CDP's and our results for last years.

2.1. Normalization

Following the UN-CDP's methodology, EVI components scores are normalized through a *min-max* procedure, to range from 0 to 100 Normalization used time invariant bounds as minimum and maximum value.

Except for the *population size*, variables underlying the calculation of EVI components contribute positively to structural vulnerability. The *min-max* procedure then consists in applying the following formula:

I = [(**Value**-*Min*)/(*Max-Min*)] x 100.

Population size, which is negatively related to vulnerability, is normalized through the following inversed formula:

II = [(*Max*-**Value**)/(*Max-Min*)] x 100

Min and Max value are observed extreme values or arbitrarily set thresholds limits.

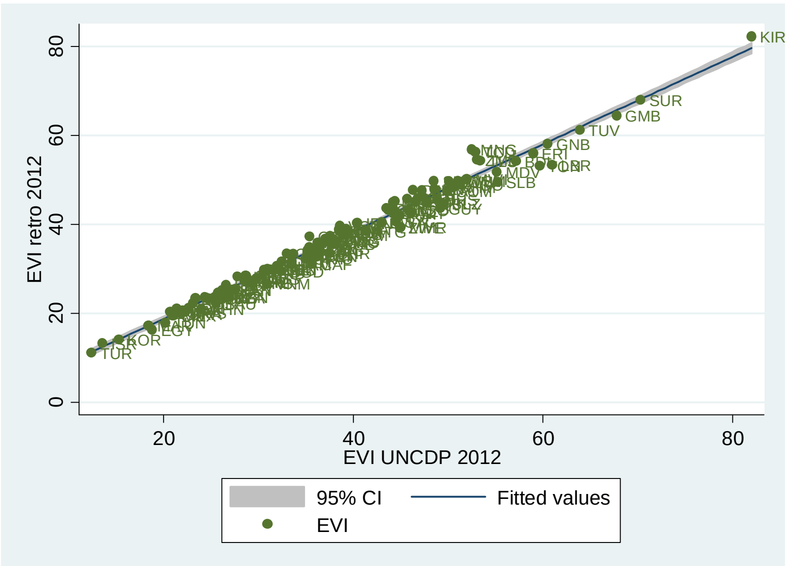
Table 1. Bounds used for normalization (EVI-2012).

Variables/ components	Lower bounds	Upper Bounds
Population (thousands)	150	100 000
Remoteness (index)	10	90
Export concentration (index)	0,10	0,95
Share of agriculture, forestry and fisheries in GDP (%)	1,0	60,0
Share of population living in low elevated coastal areas (%)	0	70
victims of natural disasters (% of population)	0,005	10,0
Agriculture production instability (index)	1,50	20,00
Exports instability (index)	5,00	35,00

2.2. Comparison between UN-CDP EVI 2012 and the retrospective EVI for the year 2010

Graph 1.1 displays the high correlation (Spearman's rank correlation coefficient = 99.1%) between the EVI scores of the UN-CDP 2012 Review and those of our 2012 retrospective EVI.

Graph 1.1. Correlation between EVI scores of the UN-CDP 2012 Review and corresponding EVI scores (in 2010) of the retrospective 2012 database

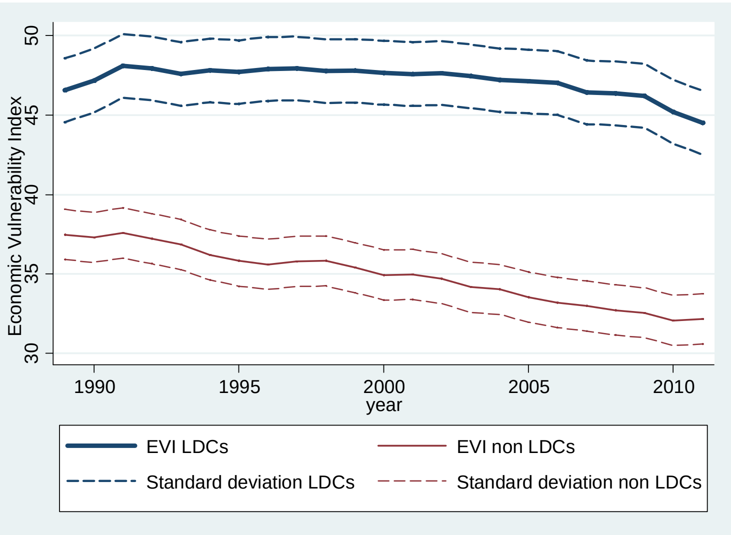


2.3. Average evolution of the retrospective 2012 Economic Vulnerability Index

Graph 1.2 below plots the average evolution of the 2012 retrospective EVI, and its standard deviation, in LDCs and non LDCs, from 1989 to 2011. Missing data lead to the exclusion of four LDCs (Timor-Leste, Lesotho, Eritrea and Ethiopia) and three non-LDCs (Swaziland, Namibia, and Botswana).

Structural economic vulnerability is significantly higher in LDCs than in non LDCs in average over 1989-2011. While continuously declining over the period in non-LDCs, vulnerability remains stable in LDCs over the 1990's and early 2000's, and only started a slight decline since 2003-04.

Graph 1.2. Average evolution of the 2012 retrospective EVI, and its standard deviation, in LDCs and non LDCs, from 1989 to 2011



Notes: average and standard deviation.

3. Size (population)

Small countries are more exposed to shocks. They often have less diversified economies due to the absence of economies of scale in a relatively small domestic market. They are then less resilient to trade shocks. Additionally, small countries are also more exposed to natural shocks. In the UN-CDP's methodology, country size is measured by population: the smaller the population, the more vulnerable are economies.

3.1. Data sources and calculation principles for retrospective series

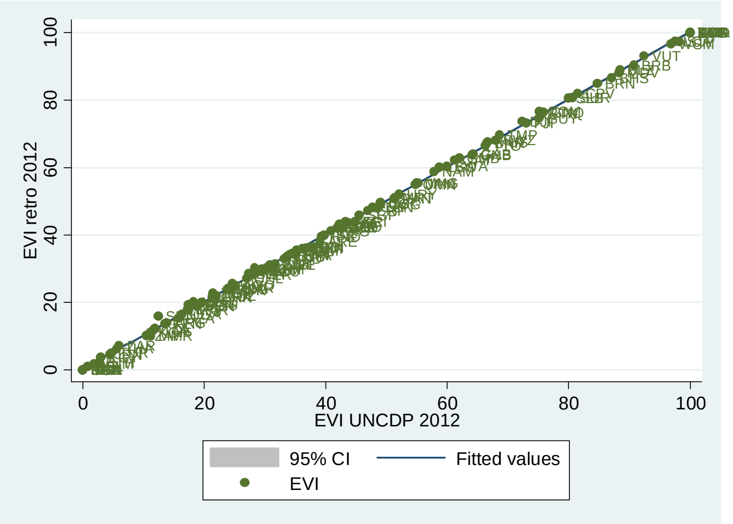
We use annual data for population size that are available for the entire sample from 1975 to 2011 at the Population Division of the UNDESA in its World Population Prospects database, available from http://esa.un.org/unpd/wpp/index.htm and http://data.un.org. For the year 2011, we used the usual "medium fertility" projection.

Population size is expressed in logarithm and normalized using the inversed *min-max* procedure

3.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

Graph 2.1 shows a high correlation (Spearman's rank correlation coefficient=99.96%) between the population index of the UN-CDP 2012 review and our retrospective 2012 database.

Graph 2.1. Correlation between the population index of the UN-CDP 2012 review and the population index of our retrospective 2012 database



4. Bounds used for normalization

Normalization procedure: $Size\ index = \frac{log(Max)-log(Observation)}{log(Max)-log(Min)} \times 100$

Lower bound (millions) = 0.15   Upper bound (millions) = 100

4.1. Differences with previous databases

No difference

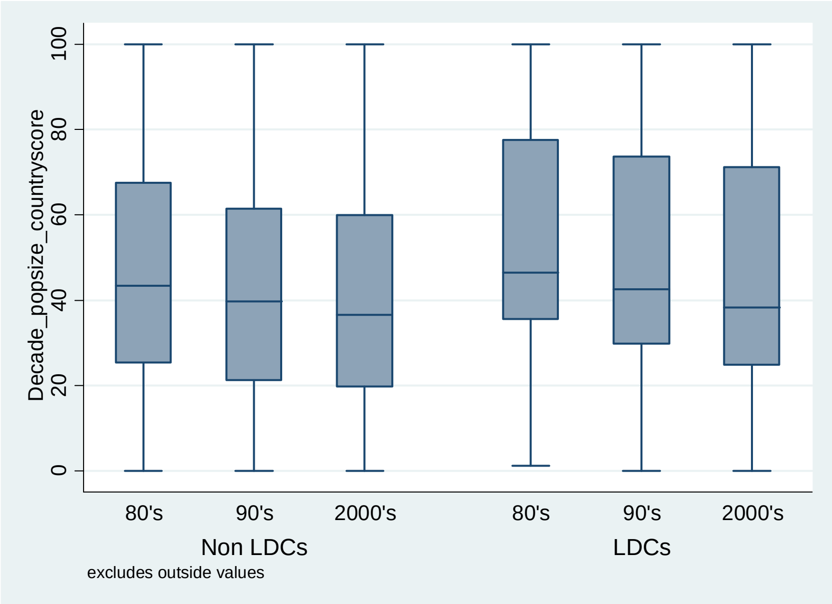
4.2. Special treatments

No special treatment for this index

4.3. Average evolution by decade: LDCs versus non LDCs

According to graph 2.2, the average size of population has increased (the index has decreased) in both LDCs and non LDCs over the last three decades. The average size of population in LDCs is still smaller than in non LDCs.

Graph 2.1. Decadal evolution of the population index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

5. Remoteness from world markets, adjusted for landlockness

5.1. Data sources and calculation principles for retrospective series

For a country, the remoteness component is the trade-weighted minimum average distance to reach 50% of the world markets. We use the same methodology as the UN-CDP in its 2012 Review. For each country and each year, partner countries are ranked by their distances. Then, we calculate the trade-weighted average distance from the nearest countries that gather 50% of the world market:

$$Min \sum_{j \in J} Dij * \frac{X_j}{X} \quad with\ J = \left\{ j\ t.q. \sum_{j \in J} Xj \geq X/2 \right\}.$$

The market share for each country is calculated using 3 year (t-2, t) average trade (import +export) of each country:

- 3-year Avg. Trading Volume = 0.5 * (3-year Avg. Imports + 3-year avg. Exports)
- Market share of country A = Avg. 3-year trading volume of country A/ Avg. 3-year World Volume

The distance is then normalized:

Distance= 100*[ln(D_A) - ln(D_{min})]/[ln(D_{max}) – ln(D_{min})]

Distance is then adjusted for the additional handicap of landlocked countries:

Remoteness = [0,85*Distance + 0,15*L]

With *L* a variable indicating whether the country is landlocked (L=100) or not (L=0).

Import and export data for each country in 1970-2011 are retrieved from UN Statistics National Accounts Main Aggregates Database. http://unstats.un.org/unsd/snaama

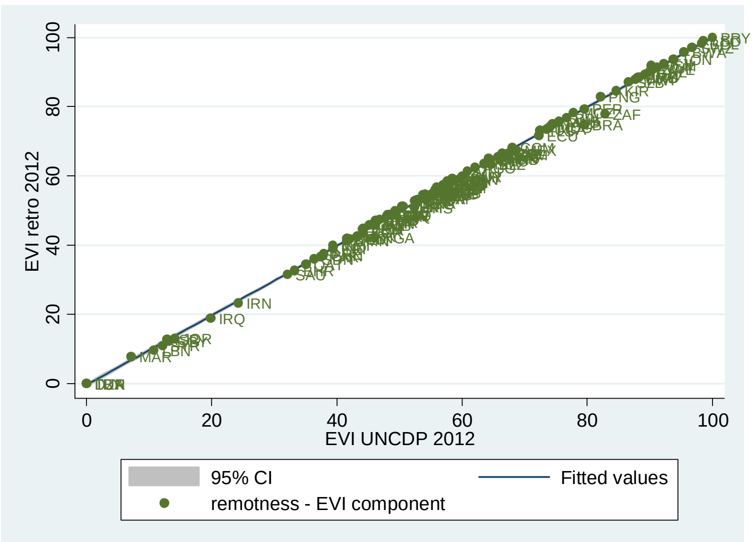
Distance data is calculated based on CEPII methodology: Bilateral Physical distance is calculated as distance between capital cities.

Remoteness indicator is available from 1972 to 2011 for the whole sample.

5.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

Graph 3.1 displays the almost-perfect correlation (Spearman's rank correlation coefficient=99.87%) between both index.

Graph 3.1. Correlation between the remoteness index of the UN-CDP 2012 review and the remoteness index of our retrospective 2012 database



5.3. Bounds used for normalization

Lower bound = 10 Upper bound = 90

5.4. Differences with previous databases

The 2012 retrospective series – based on the UN-CDP 2012 review definitions – differ from the 2009 retrospective series – based on the 2006-09 review definitions – in that it uses data on exports and imports of goods and services; while the 2009 retrospective series use data on exports of goods and services (not imports).

The retrospective EVI 2009 was based on the minimum distance to reach 33% of the world market, while the retrospective EVI 2012, following CDP definitions, calculates the minimum distance to reach 50% of the world market.

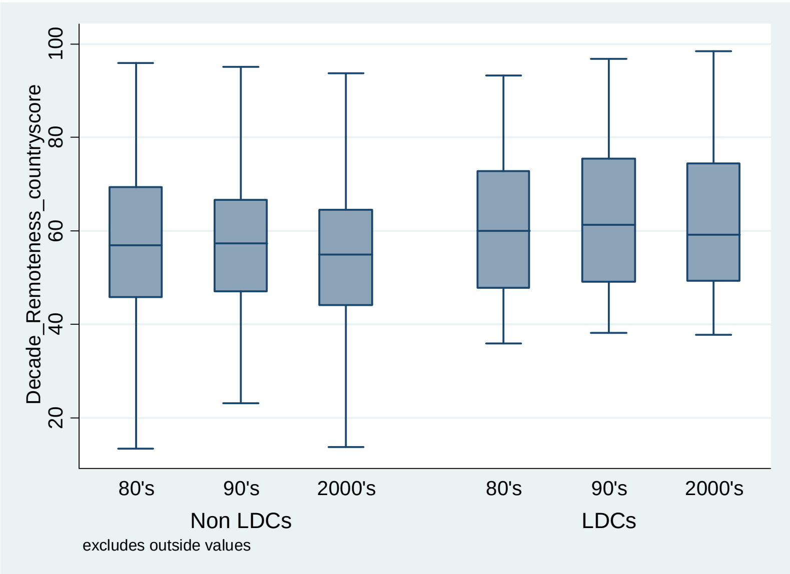
5.5. Special treatments

No special treatments for this indicator.

5.6. Average evolution by decade: LDCs versus non LDCs

Graph 3.2 shows that LDCs are slightly remoter from world markets than non LDCs. This indicator remained stable over the three decades for both LDCs and non LDCS.

Graph 3.2. Decadal evolution of the remoteness index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

6. Merchandise export concentration index

6.1. Data sources and calculation principles for retrospective series

The export concentration index is derived from the Herfindhal index applied to exports of merchandises (excluding services) as categorized by the three-digit level of the Standard International Trade Classification (SITC). This index is lying between 0 and 1, a high level of concentration being associated with a score close to 1. A country exporting only one product would score 1 according to this index. The derived Herfindhal Index formula is the following:

$$H_j = \frac{\sqrt{\sum_{i=1}^{n}\left(\frac{x_i}{X_j}\right)^2} - \sqrt{1/n}}{1-\sqrt{1/n}}$$

Where X_j *is* the total exports of country *j*, x_i is the value of exports of product i, and *n* the number of products at the three-digit SITC level. The index is based on a 3-year (the current and the 2 previous years) moving average of Hj. The index is then normalized using the min-max procedure with the bounds specified below.

We use annual data of the index drawn from UNCTAD and from our own calculation.

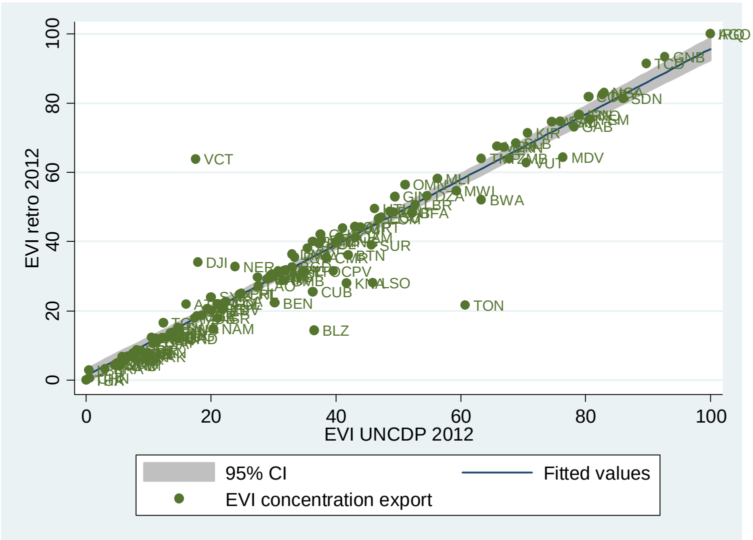
The Hj index annual data are available from 1995 until 2011 at the UNCTAD website http://unctadstat.unctad.org/.

Before 1995, data have been calculated by CERDI and FERDI with trade data from COMTRADE.

6.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

Graph 4.1 below displays a high correlation between both indexes. The Spearman's rank correlation coefficient=95.66%. For some countries like Tonga, Djibouti, Belize or Saint Vincent and the Grenadines, the explanation of the difference between estimates is the update in the raw database of Hj from UNCTAD.

Graph 4.1. Correlation between the export concentration index of the UN-CDP 2012 review and the export concentration index of our retrospective 2012 database



6.3.Bounds used for normalization

Lower bound: 0.1 Upper bound: 0.95

6.4. Differences with previous versions

Following the UN-CDP practice at this time, the 2009 retrospective EVI was based on annual data while the retrospective EVI 2012 version is based on a 3-year rolling average of the data.

We applied 3 different methods to fill missing data (data prior 1995). Some of the methods that were applied for the retrospective EVI 2009 have been ruled out as unreliable. This implies that this component is less documented in the retrospective 2012 than in the 2009 database. Data for Maldives, Kiribati, Guinea, Zimbabwe, Timor-Leste, China, Mongolia, North Korea and Bhutan, are available since 1982 only (from 1975 in the 2009 version.

6.5. Special treatment

Three methods have been applied to fill missing data.

Method 1: moving average of the closest past and future available data :

Concent_1= $(\text{concentration}_{t\text{-}k} + \text{concentration}_{t+k})/2$

k is set according to the availability of previous and future data. For instance, in 1971, interpolated data is the average of 1970 and 1972. In 1977, it is the average of 1976 and 1978; in 1978, data is the average of 1976 and 1980; and in 1979, we averaged data from 1978 and 1980.

This method is applied for nearly the whole sample in 1971, 1973, 1975, 1977, 1978, and 1979.

When missing data is dispersed, two additional methods have been applied:

Method 2: Data is reported from previous (t-k) or later (t+k) available data:

Concent_2 = $\text{Concentration}_{t-/+k}$

Method 3 : Data is interpolated by adding to the last observation the change between this last observation (t-p) and the next one (t+q), weighted by the ratio of the number of years passed since the last observation over the total number of years between the last and the next observations:

Concent_3=$\text{concentration}_{t-p} + [(p+1)/(p+q+1)] \times (\text{concentration}_{t+q} - \text{concentration}_{t-p})$

For instance, these methods have been applied for Ethiopia for the period 1980 to 1992, South Africa from 1980 to 1994 and for Yemen from 1980 to 1989.

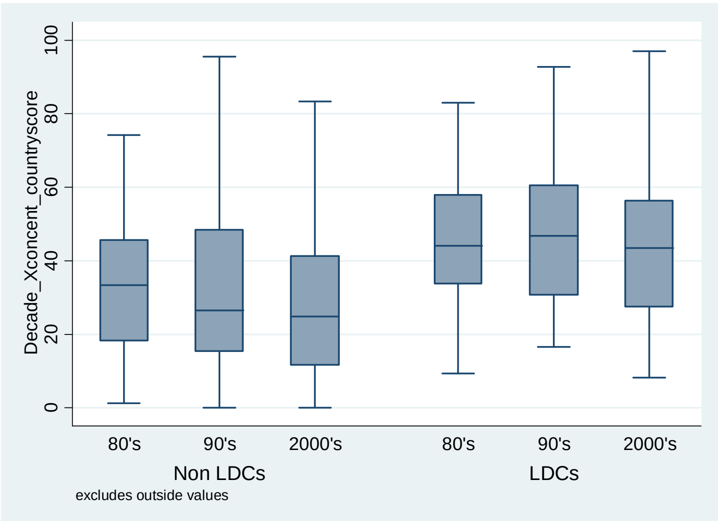
6.6. Average change by decade: LDCs versus non LDCs

Graph 4.2 below displays the average evolution of LDCs and non LDCs. The figure shows that:

- Export concentration (and vulnerability) in LDC's is higher than in non LDC's.

- Export concentration in LDC's is stable over the three decades while non-LDC's export concentration decreases since the 1980s.

Graph 4.2. Decadal evolution of the export concentration index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

7. Share of agriculture, forestry and fisheries in gdp

7.1. Data sources and calculation principles for retrospective series

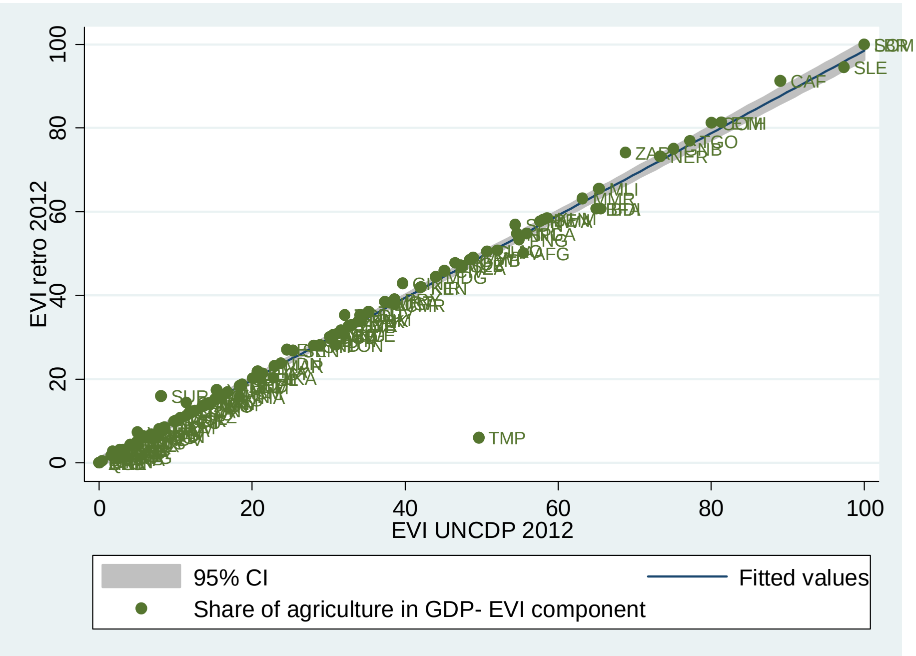
In its review 2012, the CDP uses a 3-year average of the agriculture index (2008-2010). Following this calculation, the retrospective index is based on 3-year rolling average over [t; t – 2]. Raw data being available from 1970, the index is therefore documented from 1972 until 2011 for a large sample of country. The *min-max* procedure is applied with the bounds specified below.

Raw data are those used for UN-CDP EVI 2012 review and has been retrieved from the United Nations National Accounts Main Aggregates Database:(http://unstats.un.org/unsd/snaama/.

7.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

Graph 5.1 shows a high correlation between both indexes (Spearman's rank correlation coefficient = 98%). For Timor Leste (TMP label), the only explanation of the huge difference between the two estimates is an update in the UNSTATS raw database.

Graph 5.1. Correlation between the share of agriculture index of the UN-CDP 2012 review and the share of agriculture index of the retrospective 2012 database



7.3. Bounds used for normalization

Lower bound = 1%   Upper bound = 60%

7.4. Differences with the previous version

In the 2009 retrospective EVI, we used annual data while in this 2012 version we use a 3-year rolling averages of the variable.

7.5. Special Treatments

For Yemen, values from 1975 to 1988 are averages of the two Yemen's values.

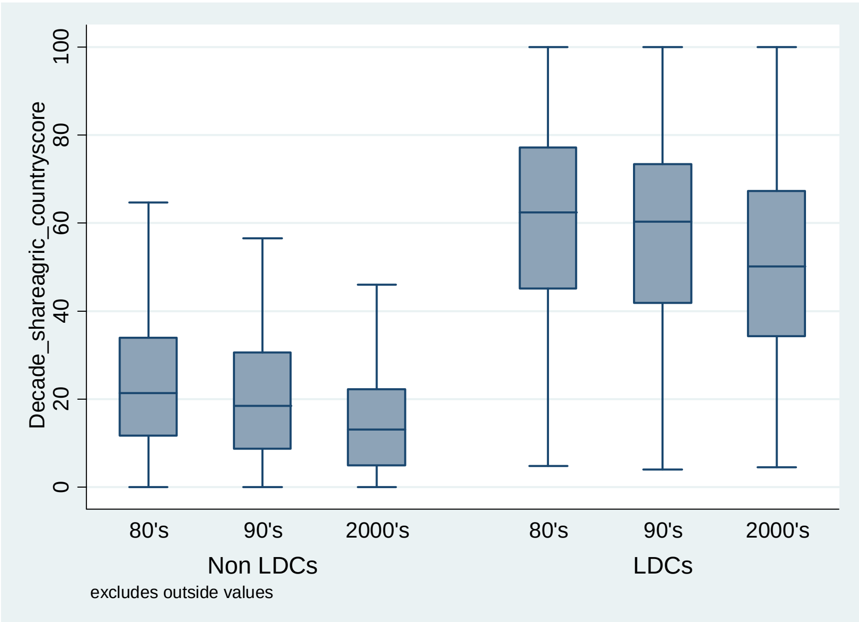
For Sudan from 1970 to 2009, we used data of former Sudan.

For Ethiopia and Eritrea from 1970 and 1989, we use data of former Ethiopia.

7.6. Average evolution by decade: LDCs versus non LDCs

According to graph 5.2., LDCs have a much higher share of agriculture than non LDCs. The share of agriculture has decreased over the last three decades for both category of country.

Graph 5.2. Decadal evolution of the share of agriculture index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

8. Share of the population living in low elevated coastal zone

8.1. Data sources and calculation principles for retrospective series

In its 2012 review, the UN-CDP used data retrieved from the CIESIN-GRUMP Version 1 database, "Low Elevation Coastal Zone (LECZ) Urban-Rural Estimates" in 2000. Since then, the version 3

(CIESIN-PLACE III dataset) of this database is available and provides estimations for years 1990, 2000, and 2010. Because data are consistent between version 2 (PLACE II) and version 3 (PLACE III), we retrieved data from the latter.

As we need series covering the period 1975-2010, we extrapolate data by assuming a linear trend in the series:

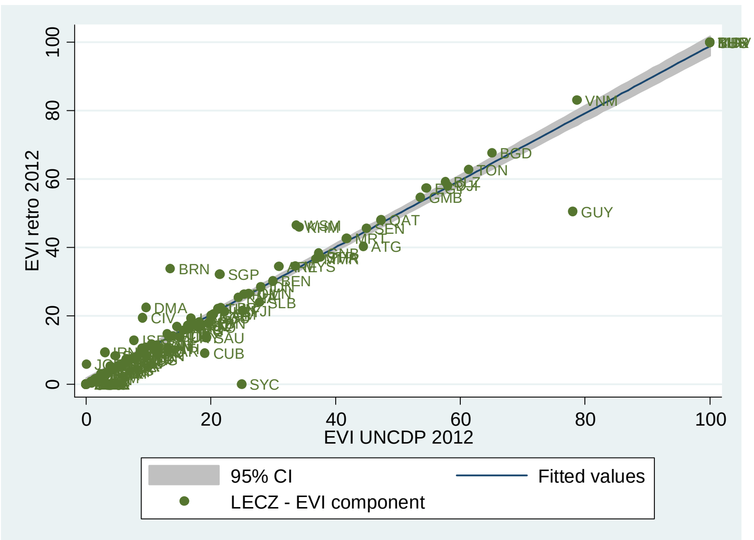
- **for years prior to 1990**, we extrapolate data using the annual average change between 1990 and 2010: $\textit{Annual average change}_{1990\text{-}2010} = (LECZ_{2010} - LECZ_{1990})/21$
- **for years between 1990 and 2000**, we interpolate data using the annual average change between 1990 and 2000: $\textit{Annual average change}_{1990\text{-}2000} = (LECZ_{2000} - LECZ_{1990})/11$
- **for years between 2000 and 2011**, we interpolate data using the annual average change between 2000 and 2010: $\textit{Annual average change}_{2000\text{-}2010} = (LECZ_{2010} - LECZ_{2000})/11$

8.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

Graph 6.1 below displays a 97.0% correlation between LECZ scores of the UN-CDP 2012 review and 2010 scores of our retrospective database.

The difference in LECZ scores between the two database (e.g. Guyana) are explained by updates between the CIESIN-V1, and the 2000's estimate used by the UN-CDP – and CIESIN-V3 (PLACE III) from which we use the 2010's estimate.

Graph 6.1. Correlation between the LECZ index of the UN-CDP 2012 review and the LECZ index of the retrospective 2012 database



8.3. Bounds used for the max-min procedure

Lower bound = 0;   Upper bound = 70.

8.4. Differences with previous databases

Because this component of the EVI has been introduced in the UN-CDP 2012 review, it does not appear in the previous retrospective database.

8.5. Special Treatments

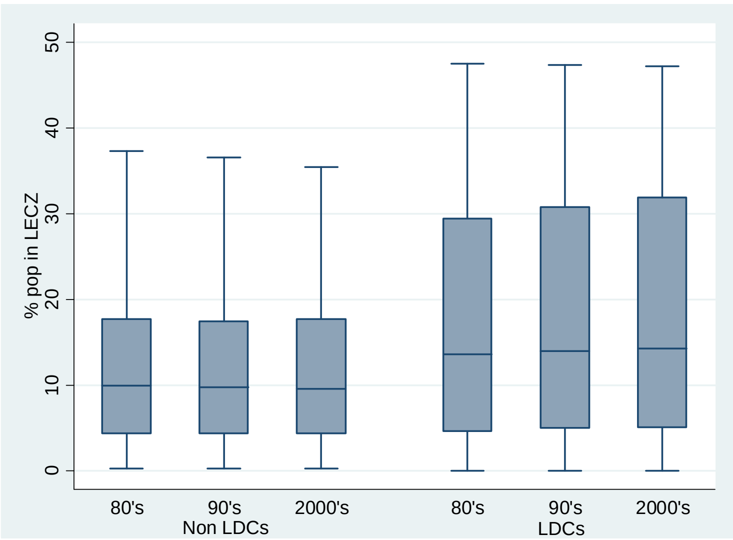
Maldives, Tuvalu and Kiribati, have an erroneous zero value in the PLACE III database, that we replaced by data from the PLACE II database.

Because the PLACE III database includes non-coastal low elevated zones, Ethiopia, which is landlocked, has a positive value, that we replace by 0.

8.6. Average change by decade: LDCs versus non LDCs

Graph 6.2 below display sample distribution of LECZ scores for LDCs and non-LDCs, by decade. Because many LDCs are landlocked, we excluded them from both categories in order to make suitable comparisons. Graph 6.2 shows that in average this index is higher in LDCs than in non LDCs, but its displays greater discrepancies within the LDC category (higher standard deviation). This index remains stable over the three decades in both LDCs and non LDCs.

Graph 6.2. Decadal evolution of the LECZ index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

9. Export instability

9.1. Data sources and calculation principles for retrospective series

Raw data used for this indicator are the exports of goods and services in current USD, retrieved from the **United Nations Statistics Division's National Account Main Aggregates Database** (http://unstats.un.org/unsd/snaama/Introduction.asp). We downloaded this database in the first quarter of 2013 and obtained data for the period 1970-2010. We also used data covering 1960-69, which has been provided to the FERDI by the UNDESA at the time of the calculation of the 2009 retrospective EVI.

Following the UN-CDP, export data are then deflated by the import unit value index for developing and emerging countries, retrieved from the IMF International Financial statistics (http://www.imf.org/external/data.htm).

The UN-CDP computes the reference value around which export deviations are computed as a mixed trend (with both deterministic and stochastic components) estimated over 1991-2010, using data transformed in logarithm: $Log\, Y_t = \alpha + \beta \cdot \log Y_{t-1} + \gamma \cdot T + \varepsilon_t$

With Y_t our export variable, and t a time trend. Estimates of Y_t are then rescaled using an exponential transformation. The residuals ε_t, the difference between observed and estimated export values, are used to compute the instability indicator, according to the following formula:

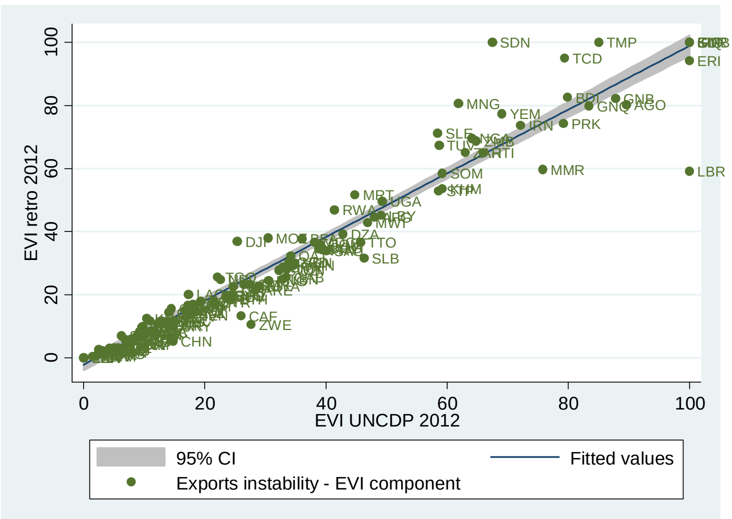
$$Instabilit\,y_t = 100 \times \sqrt{\frac{\sum_{t-k}^{t} \varepsilon_t^2 / Y_t}{(k+1)}}$$

Because the UN-CDP computes this indicator over 20 years (1991-2010), we compute each year this indicator over [t; t-k] with k = 19.

9.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

The graph 7.1 below displays a 97.5% correlation between export instability scores of the UN-CDP 2012 review and 2010 scores of our retrospective database.

Graph 7.1. Correlation between the export instability index of the UN-CDP 2012 review and the export instability index of the retrospective 2012 database



The difference in instability scores between the two estimates (e.g. Liberia) are explained by updates that have been made to UN-stats since the UN-CDP 2012 review. For Liberia, the UN-CDP reports an indicator equal to 89.5% before the max-min transformation, while our retrospective database reports an indicator equal to 27%.

9.3. Bounds used for the max-min procedure

Bounds used for the max-min transformation are those used by the UNDESA:

Lower bound = 5 Upper bound = 35

9.4. Differences with previous databases

The main difference concerns the period considered for trend estimation and indicator computation.

In the 2009 review, the CDP considered a 28-year period, covering 1980-2007. In the 2009 retrospective database, we reduce this period to 15 years (similar to the one considered for the computation of the agricultural instability indicator).

Here we follow the period considered in the UN-CDP 2012 review, so that differences between estimates cannot be attributable to difference in the computation period.

9.5. Special treatments

Data prior to 1970 is retrieved from an older version of the IMF database, covering 1960-2008. When we identify large gaps between the year 1969 (from the former database) and 1970 (from the new database), we consider the data as missing before 1970. This rule has been applied to: Bangladesh, Benin, Cambodia, Cuba, Dominican Republic, El Salvador, Equatorial Guinea, Laos, Liberia, Libya, Malawi, Malaysia, Maldives, Mongolia, Mozambique, Nigeria, Oman, Qatar, Seychelles, South Africa Sri Lanka, Soudan, Syria, Sao Tome and Principe, Timor-Leste, Tonga, Turkey, Tuvalu, and United Arab Emirates.

Data from 1970 to 2007 for Sudan are data from Former Sudan.

Data is missing from 1970 to 1990 for Ethiopia and Eritrea. To fill missing data, we applied the following rule:

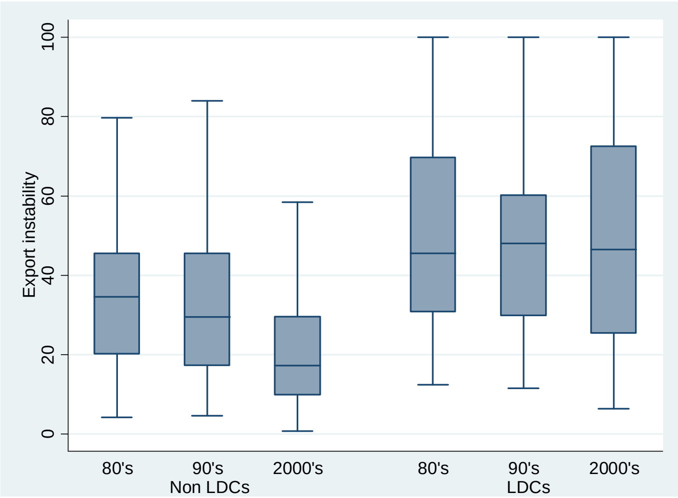
- because data of Ethiopia and Eritrea overlap data of Former Ethiopia from 1990 to 1993, we computed the ratio for Ethiopia and Eritrea separately $\frac{Average_{90-93}(Exports\ Ethiopia\ or\ Eritrea)}{Average_{90-93}(Former\ Ethiopia)}$
- and we extrapolated data for Ethiopia and Eritrea prior to 1990 by multiplying export raw data of former Ethiopia by this ratio .

9.6. Average evolution by decade: LDCs versus non LDCs

According to graph 7.2, LDCs experienced a greater instability in their exports than non LDCs, over the three decades. We can observed that, in average, the instability in export earnings has been strictly decreasing since the 80's in non-LDCs, while it has been stable over the three decades in LDCs.

It is worth noting that averages of the decade 1980 have to be considered with caution because of less than half of the sample is covered during the 80's.

Graph 7.2. Decadal evolution of the export instability index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

10. Instability in agricultural production

10.1. Data sources and calculation principles for retrospective series

Following the UN-CDP, we use the Net agricultural production index retrieved from the FAO (http://faostat.fao.org/site/612/default.aspx#ancor). This database is updated on a timely basis.

This index follows the same calculation principles as for the export instability index. The UN-CDP computes the reference value a as a mixed trend (with both deterministic and stochastic components) estimated over 1990-2009, using data transformed in logarithm: $Log\ Y_t = \alpha + \beta \cdot \log Y_{t-1} + \gamma \cdot T + \varepsilon_t$

With Y_t our agricultural production variable, and t a time trend. Estimates of Y_t are then rescaled using an exponential transformation. Because the UN-CDP estimates this trend over 20 years (1990-2009), we estimate it each year over (t; t-k) with k = 19.

The residuals ε_t, i.e. the difference between observed and estimated export values, are used to compute the instability indicator, according to the following formula:

$$Instability_t = 100 \times \sqrt{\frac{\sum_{t-k}^{t} \varepsilon_t^2 / Y_t}{(k+1)}}$$

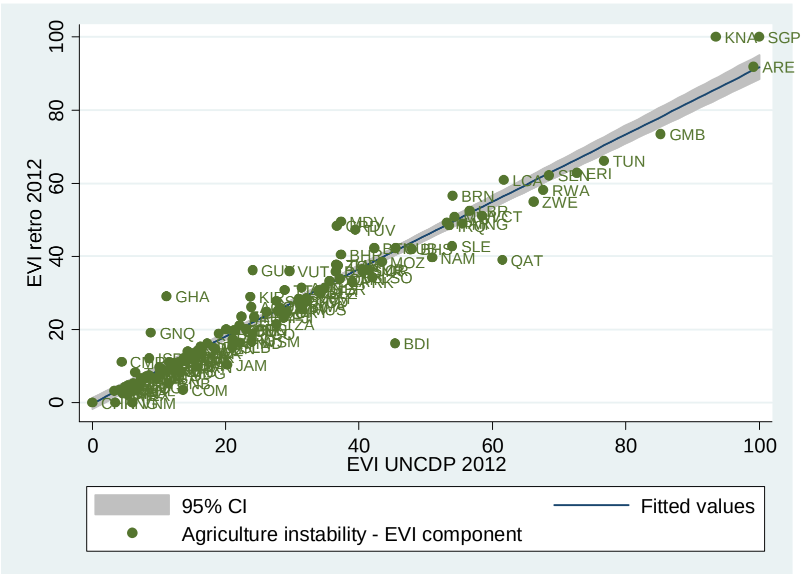
Because the UN-CDP computes this indicator over 20 years (1990-2009), we compute each year this indicator over [t; t-k] with k = 19.

10.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

The graph 8.1 below displays a 97.3% correlation between agricultural instability scores of the UN-CDP 2012 review and 2009 scores of our retrospective database.

The difference in instability scores between the two databases (e.g. Qatar) are explained by updates to FAO-stats since the UN-CDP 2012 review. For Burundi, the UN-CDP used a value of 9.9% before the max-min transformation, while we used an instability score of only 4.5%. This difference is exacerbated by the max-min transformation.

Graph 8.1. Correlation between the agricultural instability index of the UN-CDP 2012 review and the agricultural instability index of the retrospective 2012 database



10.3. Bounds used for the max-min procedure

Bounds used for the max-min transformation are those used by the UNDESA:

Lower bound= 1.5   Upper bound = 20

10.4. Differences with previous databases

The main difference concerns the period considered for trend estimation and indicator computation.

In the 2009 review, the CDP considered a 16-year period, covering 1990-2005. In the 2009 retrospective database, we reduce this period to 15 years (similar to that considered for the export instability indicator).

Here we follow the period considered in the UN-CDP 2012 review.

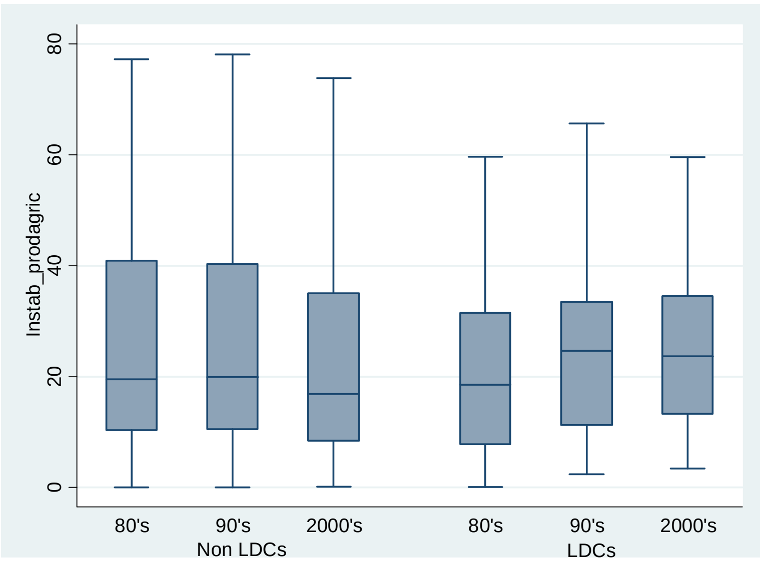
10.5. Special treatments

We use Former Sudan's data for1970 to 2007 for Sudan.

10.6. Average evolution by decade: LDCs versus non LDCs

According to graph 7.2, LDCs experienced a slightly greater instability in their agricultural production than non LDCs, over the three decades. However, we observe that agricultural instability has decreased in non-LDCs over the last three decades, but increased over the last three decades in LDCs.

Graph 8.2. Decadal evolution of the agricultural instability index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

11. Victims of natural disasters

11.1. Data sources and calculation principles for retrospective series

The indicator measures the share of the population victims of natural disasters. Victims of natural disasters are defined as people killed or affected (i.e., people requiring immediate food, water, shelter, sanitation or medical assistance). It covers weather and climate-related disasters (such as floods, landslides, storms, droughts and extreme temperatures) as well as geo-physical disasters (such as earthquakes or volcanoes). The indicator reflects vulnerability to natural shocks, in particular the human impact of natural disasters associated with these shocks.

Following UN-CDP methodology, we first calculated the annual total number of people killed or affected by natural disaster. We then divided it by total population of the country. We then calculated for each year an average of victims on a rolling period of 20 years. For example for 1986, we calculate an average on 1967-1986 period.

$$Victimes_t = \ln\left(\frac{\sum_{s=t-19}^{t}\left(\frac{victimes_s}{population_s}\times 100\right)}{20}\right)$$

The normalization procedure use log-transformed values.

In its review 2012 of EVI, the UN-CDP used data from WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED Emergency) in its Disasters Data Base (EM-DAT), http://www.emdat.be/.

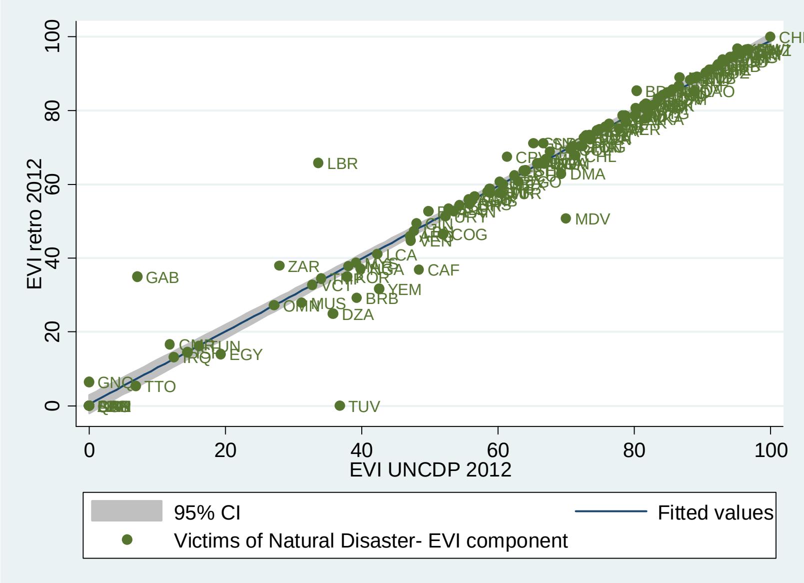
This database is updated on a timely basis and according to EMDAT website these updates may imply major modifications in the historical data. Using this database, it should be also kept in mind that the further we go on the past, the lesser the events are listed.

Data on population is drawn from the Population Division of the UNDESA in its World Population Prospects database, available from http://esa.un.org/unpd/wpp/index.htm.

11.2. Comparison between estimates of the UN-CDP EVI 2012 and our retrospective EVI for the year 2010

Graph 9.1 below displays the high correlation between both indexes. The Spearman's rank correlation coefficient equals 98.68%. Again, the only explanation of difference in estimates is an update in EMDAT raw database.

Graph 9.1. Correlation between the victim index of the UN-CDP 2012 review and the victim index of the retrospective 2012 database



11.3. Bounds used for normalization

Normalization formula:

$$\text{Victim index} = \frac{\log(\text{observed value}) - \log(\min value)}{\log(\max value) - \log(\min value)} \times 100$$

Lower bound = ln (0,005) ; Upper bound = ln(10) (% of total population)

11.4. Differences with previous versions

This new index of victims of natural disaster replaces the index of “homeless due to natural disaster” which was used by UN-CDP in its reviews 2006 and 2009.

In the retrospective EVI 2009, the calculation method was also different. In the previous retrospective of EVI 2009 we computed, for each year, the cumulative annual mean share of homelessness in the population. First, we computed the cumulated yearly-averaged number of homeless for each year. For instance, in 1979, we added up the number of homeless people from 1970 to 1979 and divided it by the number of years since 1970, i.e. 10 years. In 1980, we added up the number of homeless people from 1970 to 1980 and divided it by the number of years since 1970, i.e. 11 years, and so on. We then computed each year the ratio between the yearly-averaged number of homeless and the national population. This annual mean share of homeless in the population was then expressed in logarithm and normalized through the *min-max* procedure

Thus, the construction of an annual retrospective homeless 2009 component consisted in applying the following formula:

$$Homeless_{1970+k} = \log\left(100 \times \left(\frac{\sum_{1970}^{1970+k} homeless \Big/ k+1}{population_{1970+k}}\right)\right)$$

11.5. Special treatments

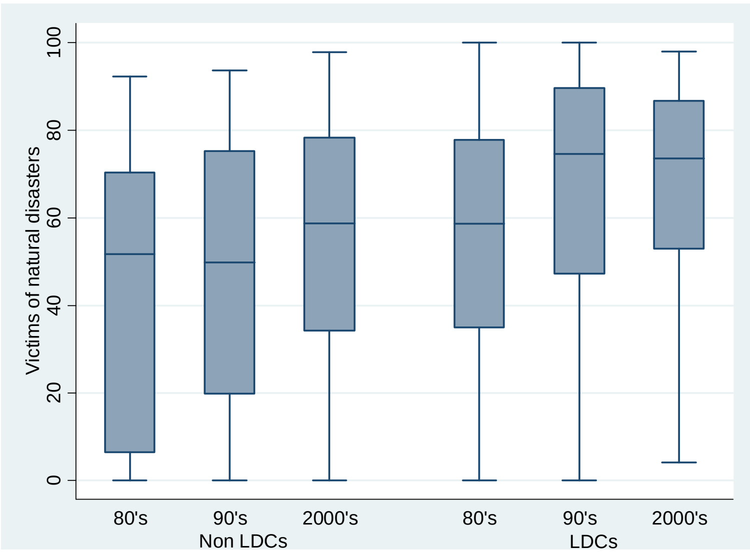
Data for Qatar and United Arab Emirates (UAE) are not available. We impute a zero score to these territories as this is the score showed by both Brunei (a similar small coastal State) and neighboring Saudi Arabia over 1975-2010.

Raw data being missing in 2011 for the whole sample, we copied values from 2010.

11.6. Average evolution by decade: LDCs versus non LDCs

Graph 9.2 below shows that LDC's has been more affected by natural disaster than non LDC's. This figure also highlights an increase in the number of victims of natural disaster in both country categories (which can be due to an improvement in disaster data coverage).

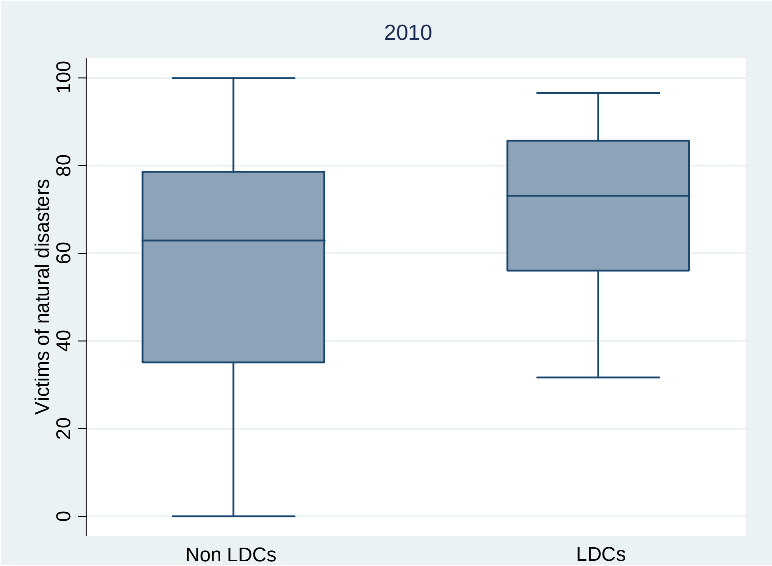
Graph 9.2. Decadal evolution of the victim index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent decadal country scores

However the index in 2010 display in graph 9.3 still confirms that LDC's are more affected by natural disaster than non LDC's.

Graph 9.3. 2010 scores of the retrospective victim index in LDCs and non LDCs



Notes: median, 25%/75%percentile, lower/upper adjacent 2010 country scores

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Guillaumont, P. (2008), « An Economic Vulnerability Index : Its design and Use for International Development Policy », Research Paper No. 2008/99, UNU WIDER.

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Annex: the evolution of structural economic vulnerability according to 2012 definitions in ldcs and other relevant country categories

Table A. Evolution of structural economic vulnerability in LDCs.

LDCs	1980	1990	2000	2010
Afghanistan	36,42	34,68	35,97	37,89
Angola	n.a.	41,25	51,17	49,30
Bangladesh	n.a.	43,84	34,46	31,99
Benin	n.a.	48,25	44,90	34,02
Bhutan	n.a.	35,38	42,82	42,59
Burkina Faso	39,70	40,78	44,33	37,37
Burundi	49,01	42,53	51,63	54,17
Cambodia	n.a.	50,28	64,72	50,17
Central African Republic	36,32	31,66	32,70	31,16
Chad	37,43	35,79	40,15	56,31
Comoros	n.a.	53,89	55,64	48,29
Democratic Republic of the Congo	43,36	32,08	39,67	37,34
Djibouti	n.a.	57,44	57,40	49,96
Equatorial Guinea	n.a.	56,39	51,49	43,59
Eritrea	n.a.	n.a.	n.a.	56,14
Ethiopia	n.a.	n.a.	n.a.	31,63
Gambia	n.a.	58,09	49,94	66,54
Guinea	n.a.	26,56	26,45	28,43
Guinea-Bissau	n.a.	53,32	61,59	59,62
Haiti	n.a.	32,96	43,19	46,66
Kiribati	n.a.	82,79	84,78	82,31
Lao People's Democratic Republic	n.a.	57,38	53,86	36,76
Lesotho	n.a.	n.a.	44,30	43,19
Liberia	n.a.	47,63	63,99	54,18
Madagascar	n.a.	35,90	30,61	36,75
Malawi	n.a.	40,88	52,04	50,17
Mali	n.a.	41,36	34,04	35,73
Mauritania	n.a.	53,87	36,81	46,56
Mozambique	n.a.	48,64	47,33	45,87
Myanmar	n.a.	40,02	37,74	40,81
Nepal	n.a.	36,88	33,32	28,25
Niger	54,91	47,09	42,84	38,32
Rwanda	56,22	53,86	49,33	47,67
Samoa	n.a.	57,27	57,68	51,52
Sao Tome and Principe	n.a.	62,03	56,55	43,97
Senegal	n.a.	49,88	39,23	36,09
Sierra Leone	n.a.	36,18	49,54	50,35
Solomon Islands	n.a.	59,40	54,18	50,45
Somalia	n.a.	57,17	61,29	49,99
Sudan	n.a.	39,30	52,05	52,84
Timor-Leste	n.a.	n.a.	n.a.	54,56

Togo	n.a.	42,29	38,99	35,54
Tuvalu	n.a.	79,95	70,92	61,25
Uganda	n.a.	57,48	47,86	35,88
United Republic of Tanzania	n.a.	32,34	29,68	28,04
Vanuatu	n.a.	57,45	55,30	46,15
Yemen	n.a.	32,94	47,32	38,99
Zambia	42,81	50,37	45,25	54,50

Table B. Evolution (mean, median, and standard deviation) of structural economic vulnerability in LDCs and other country categories.

	1980	1990	2000	2010
LEAST DEVELOPED COUNTRIES				
average	44,02	47,17	47,67	45,21
median	42,81	47,36	47,33	46,01
std dev	7,69	12,16	11,68	10,81
N (non missing)	9	44	45	48
Sample held constant				
average	..	47,17	47,74	45,10
median	..	47,36	47,60	46,01
std dev	..	12,16	11,80	10,89
N		44	44	44
OTHER DEVELOPING COUNTRIES				
average	33,27	37,30	34,93	32,07
median	32,87	36,89	34,73	30,69
std dev	7,38	10,61	10,54	10,70
N (non missing)	25	79	82	82
Sample held constant				
average	..	37,30	34,69	31,76
median	..	36,89	34,45	30,29
std dev	..	10,61	10,49	10,77
N		79	79	79
OTHER FORMER OR PRESENT LOW INCOME COUNTRIES				
average	31,73	36,32	36,80	32,96
median	31,60	31,71	36,94	30,77
std dev	7,20	10,20	9,70	10,34
N (non missing)	7	22	23	23
Sample held constant				
average	..	36,32	36,42	32,62
median	..	31,71	36,83	30,28
std dev	..	10,20	9,75	10,45
N		22	22	22

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