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The retrospective economic vulnerability index, 2015 update

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Abstract

This document presents detailed calculation principles for annual retrospective series of the Economic Vulnerability Index according to the UN-CDP definitions of the 2015 Review. It is organized as successive technical sheets explaining calculation of the retrospective EVI components and presenting adjustments that had to be made to obtain retrospective series. Retrospective series cover 145 developing countries (among which 48 LDCs and 97 non-LDCs) over the 1990-2013 period (starting in 1975 for some components and countries). These series are gathered in the companion database which is publicly available on the Ferdi's website. An associated website allows users to build their own EVI from these retrospective series (http://byind.ferdi.fr/).

Acknowledgments
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Glossary

EVI: Economic Vulnerability Index

LDCs : Least Developed Countries

UN-CDP : United Nations Committee for Development Policy

1. Introduction

Economic vulnerability can be defined as the likelihood that a country's economic development could be hindered by unforeseen exogenous shocks (Guillaumont, 2008; 2009). Economic vulnerability of developing countries has been an important issue in the development literature for around 50 years but its interest has been growing since the 1990s. In 2000, economic vulnerability, measured by the Economic Vulnerability Index (EVI), replaced a former Economic Diversification Index as a criterion for the identification of Least Developed Countries (LDCs), besides the GDP per capita and an index of human capital (Guillaumont 2009a, chapters 2 and 6; Guillaumont 2009b). Since then, the EVI calculation principles have been revised at the 2003, 2006, 2009 and 2012 Triennial Reviews of the list of the LDCs by United Nations Committee for Development Policy (UN-CDP) to identify Least Developed Countries, the main change having occurred in 2006. Despite an increase in country coverage, from 130 to 145, no major change in the calculation principles has occurred between the 2012 and the 2015 Reviews.

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. While the two former determinants mainly depend on country structural features (geographic localization, structure of exports, and so on), resilience relies rather on country current economic policy and is not considered in the EVI, which is supposed to reflect a structural handicap.

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 simple arithmetic average of 2 sub-indexes, with the following weights in the 2012 and 2015 Reviews:

- The **exposure sub-index**, which is a weighted average of 5 component indexes: 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 **shocks sub-index**, which is a weighted average of 3 component indexes: the victims of natural disasters (25%), the instability in the agricultural production (25%), and the instability in exports of goods and services (50%).

Components are built on different kinds of primary data (number, percent, index), which are normalized through a *min-max* procedure, to get component indices ranging from 0 to 100, with high scores corresponding to a high level of vulnerability. The sum of components' weights equals 1 so that the EVI is also lying between 0 and 100.

2. Why a retrospective EVI?

The 2006, 2009, 2012 and 2015 Triennial Reviews of the EVI are available on the United Nations Committee for Development Policy (UN-CDP) website. However these official EVI values, as well as the former from the 2000 and 2003 Reviews, are dedicated to cross-country comparison purposes at the year of the respective Reviews. Due to the revisions in methodology occurring over time, and primary data updating, these official EVI values do not allow intertemporal comparisons, for instance to assess the changes in vulnerability (see Cariolle et al. 2015 for a discussion on the consequences of these changes in the methodology and of data updating). This problem can be solved by calculating 'retrospective EVI' series based on constant definitions.

This paper presents an updated version of the retrospective EVI previously calculated by the Ferdi that followed the previous UN-CDP Reviews' calculation principles (Cariolle, 2011 and Cariolle and Goujon, 2013). These retrospective series were at that time made available to the public through the Ferdi website. Since January 2015, the byind.ferdi.fr website (Build your Index) also allows the users to compute their own retrospective EVI, by applying another composition of the index, different from the one retained by the UN-CDP. More recently, the UN-CDP has opened *StatPlanet Graphical Interface*, a visual and retrieval tool for 2006, 2009, 2012 and 2015 data.[1] Some data come from the Ferdi former 2012 retrospective series (eg remoteness 2006 and 2009). The UN-CDP is planning to publish its own retrospective series soon.

We then use here the definition of the index of the 2015 Review of UN-CDP and updated data covering 1970-2013. This document presents the retrospective EVI calculation method in the form of a technical sheet for each EVI component.

The retrospective calculation follows some general rules:

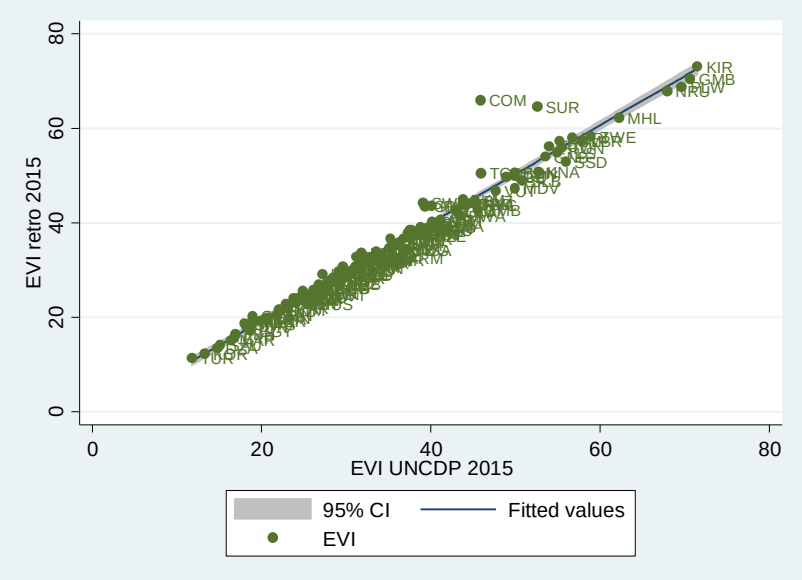
- Calculations of retrospective EVI closely follow UN-CDP methodology. Some marginal adjustments were however necessary and are described in the "special treatment" sections.
- Annual EVI is calculated for the longest period for which data is available (back to 1975 for some components, but back to 1990 for the EVI).
- Sources of primary data are identical to those used by the CDP 2015 Review.
- Our calculations have been done at the end of 2015, some months after the UN-CDP's ones, and then can make use of primary data further updated.
- Comparisons are made to ensure there are no significant or unexplained differences between CDP's official figures and our results for the last covered year 2013.

[1] http://esango.un.org/sp/ldc_data/web/StatPlanet.html

2.1. UN-CDP 2015 EVI official values versus retrospective 2015 EVI values

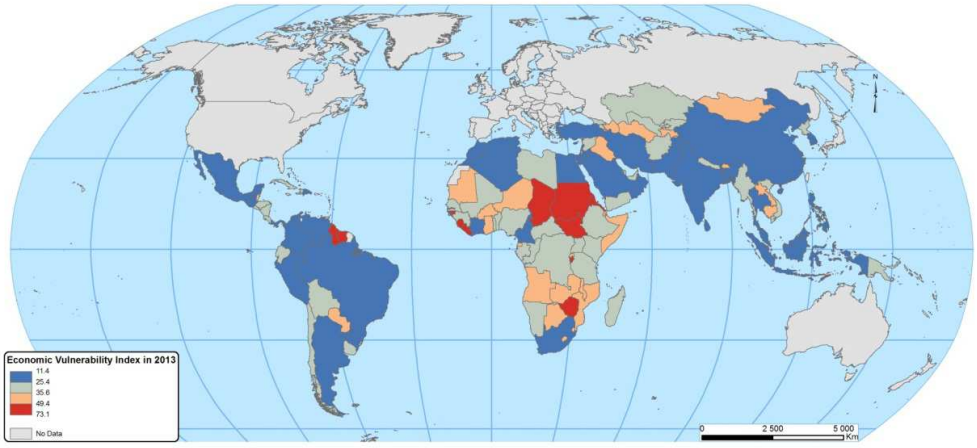
Graph 1.1 displays the high correlation (Spearman's rank correlation coefficient = 99.3%) between the EVI official values from the UN-CDP 2015 Review and those of our retrospective EVI 2015 (values correspond to the year 2013). The gaps in ranking observed for countries such as Comoros and Suriname arise mainly from the recent updating of the primary data on exports of goods and services that occurs between CDP's and our calculations (see further).

Graph 1.1. Correlation between EVI scores of the UN-CDP 2015 Review and of the retrospective 2015 database, year 2013



For the year 2013, the retrospective 2015 EVI average is 41.6 for LDCs against 31.6 for non-LDCs. In Annex 1 we report the distribution of the retrospective 2015 EVI and its components for the year 2013, for both LDC versus non-LDC groups.

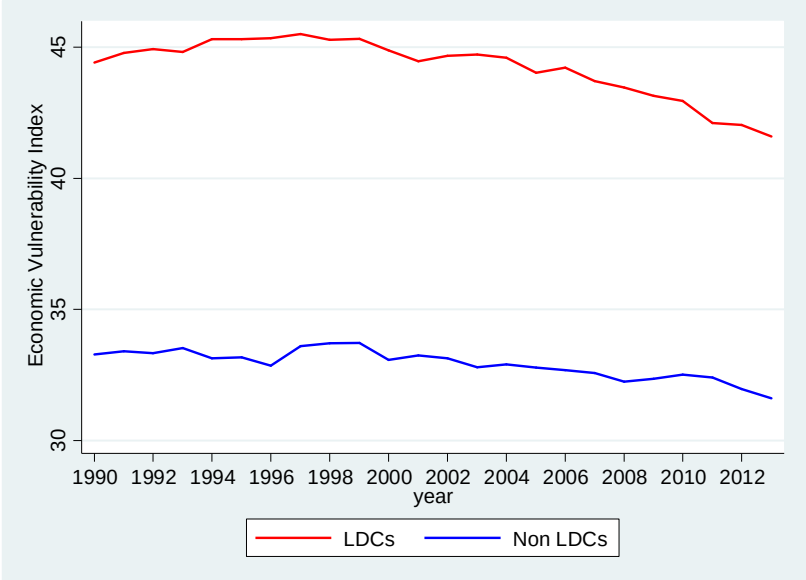
Graph 1.2. EVI scores of the retrospective 2015 database on the map, year 2013



2.2. Evolution of the retrospective 2015 EVI

Graph 1.3 below plots the average evolution of the retrospective 2015 EVI in LDCs and non LDCs, from 1990 to 2013. Data cover a complete set of 145 countries (48 LDCs and 97 Non LDCs). Structural economic vulnerability measured by the EVI is significantly higher in LDCs than in non-LDCs in average over 1990-2013. Although average EVI has decreased in both categories of countries, it decreases faster in LDCs than in non-LDCs in recent years, specifically since 2003-04. Retrospective 2015 EVI values for the years 1990, 2000, 2010 and 2013 in the 48 LDCs are reported in annex 2.

Graph 1.3. Evolution of the average retrospective 2015 EVI, LDCs versus non-LDCs



The rest of the document presents the retrospective EVI calculation method in the form of a technical sheet for each of the 8 EVI components.

3. Population size

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 is the economy (and the higher is the EVI population size index).

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 1970 to 2013 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. The indicator measures the population in a country as of 1 July of the year. Population size (in millions) is log-linearized and normalized using an inversed *min-max* formulae.

3.2. Bounds used for normalization

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

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

The smaller the country population, the higher the index.

3.3. Differences with previous databases

No difference, except as a consequence of raw data updating in the UNDESA World Population Prospects database.

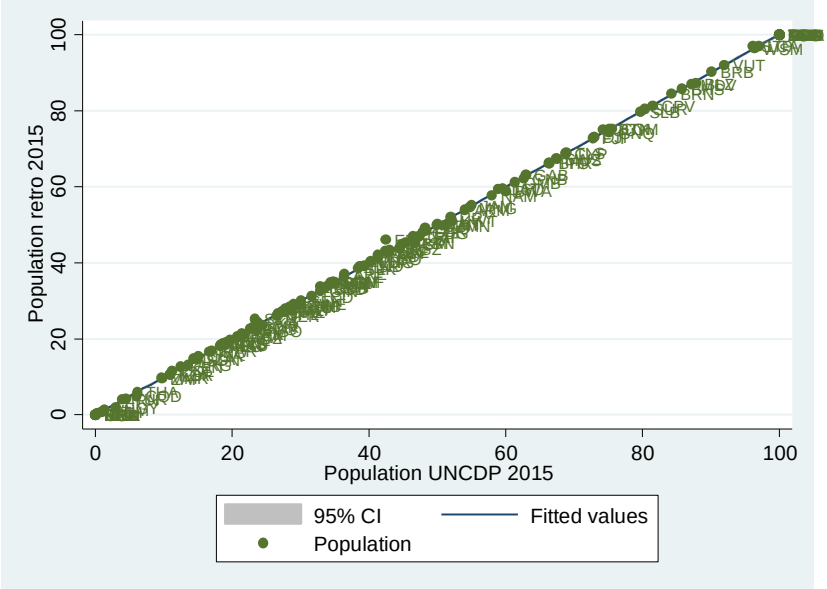
3.4. Special treatments

No special treatment for this index

3.5. Population size index, UN-CDP EVI 2015 versus retrospective EVI 2015

Graph 2.1 shows a high correlation (Spearman's rank correlation coefficient=99.3%) between the population index of the UN-CDP 2015 review and of the retrospective 2015 database.

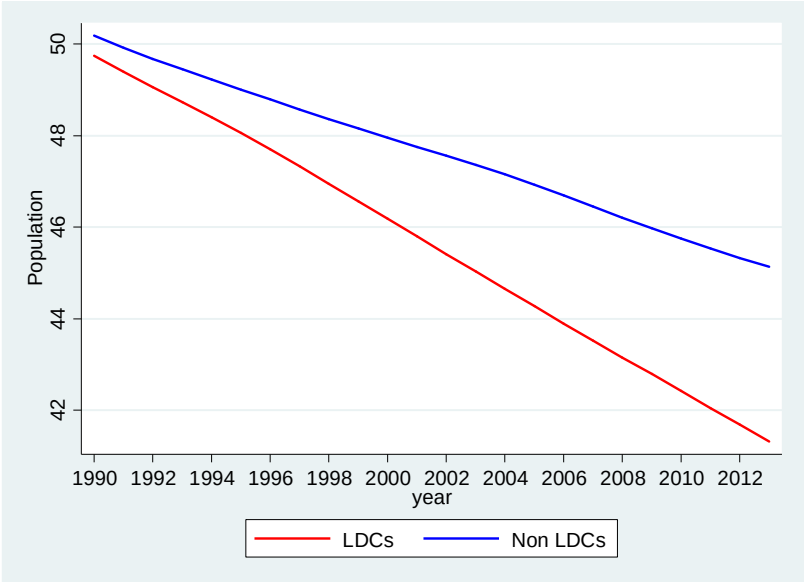
Graph 2.1. Correlation between the Population size index of the UN-CDP 2015 review and of the retrospective 2015 database, 2013.



3.6. Evolution of the retrospective 2015 Population size index

As previously noted, the smaller the population, the higher is the value of population index indicating a greater vulnerability. According to graph 2.2, the average population index is higher in non-LDCs than in LDCs.

Graph 2.1. Evolution of the retrospective 2015 Population size index, LDCs versus non-LDCs averages



The difference between the two categories of countries in terms of population is tending to grow as the years go by. For instance, in 1990 the population index LDCs was 49.7 in LDCs versus 50.2 in non-LDCs while in 2013 the score is 41.3 in LDCs versus 45.1 in non-LDCs. These trends reflect a higher average rate of population growth in LDCs, which has been almost twice the average rate of non-LDCs.

4. Remoteness from world markets

Countries that are isolated from the rest of the World face particular problems that severely hamper their development. Remoteness induces high transportation costs and constraints on economic diversification, thereby reducing the ability of countries to respond to shocks. Remoteness from the World markets mostly characterized low-income Small Island Developing States (SIDS) and landlocked developing countries.

4.1. 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 and 2015 Reviews. The following calculation is done for each year.[2]

For each country i, partner countries j are ranked according to their distance from country i. The group of the closest countries is hence progressively selected until 50% of the World market is reached for country i (by the simple sum of partners' market shares). The trade-weighted average distance is then computed vis-à-vis this group of selected partners, using the distances between country i and selected partners j, and selected partners' market shares:

$$Min \sum_{j \in J} Dij * \frac{X_j}{X} \;\; with \;\; J = \left\{ j \; such \; that \sum_{j \in J} Xj \; \geq X/2 \right\}.$$

Where X_j / X is the market share of partner j and Dij is the distance between country i and partner j.

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

- X is the 3-year Average Trading Volume = 0.5 * (3-year Avg. Imports + 3-year avg. Exports)
- Market share of country j = X_j / X = Avg. 3-year trading volume of country j / Avg. 3-year World Volume

The trade-weighted average distance is normalized at this stage (using a log-transformation) to get a Distance index that lies between 0 and 100. *Distance index* is then adjusted for the additional handicap of being a landlocked country:

[2] CDP Secretariat. Note on Measuring remoteness for the identification of LDCs. August 2015

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

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

Remoteness is then normalized using a second min-max procedure such that the Remoteness index now lies between 0 (lowest remoteness) and 100 (strongest remoteness).

Import and export data for each country over 1970-2013 are retrieved from UN Statistics National Accounts Main Aggregates Database. http://unstats.un.org/unsd/snaama

Distance data come from a CERDI/FERDI database. Bilateral Physical distance is calculated as distance between capital cities.

Remoteness index is available from 1972 to 2013 for the whole sample.

4.2. Bounds used for normalization

Normalization formulae (1st stage) for Distance: $Distance\ index = \frac{log(distance) - log(Min)}{log(Max) - log(Min)} \times 100$

Distance: Lower and upper bounds are specific for each year.

Normalization formulae (2nd stage) for Remoteness: $Remoteness\ index = \frac{Remoteness - Min}{Max - Min} \times 100$

Remoteness: Lower bound = 10 Upper bound = 90

4.3. Differences with previous databases

Following the unchanged CDP definition, there is no difference in the calculation principle between the 2015 and the 2012 retrospective series. The definitions of the 2012 and 2015 series significantly differ from the ones of the 2009 series (on the way market shares are computed and trade partners are selected, see Cariolle, 2011, and Cariolle and Goujon, 2013).

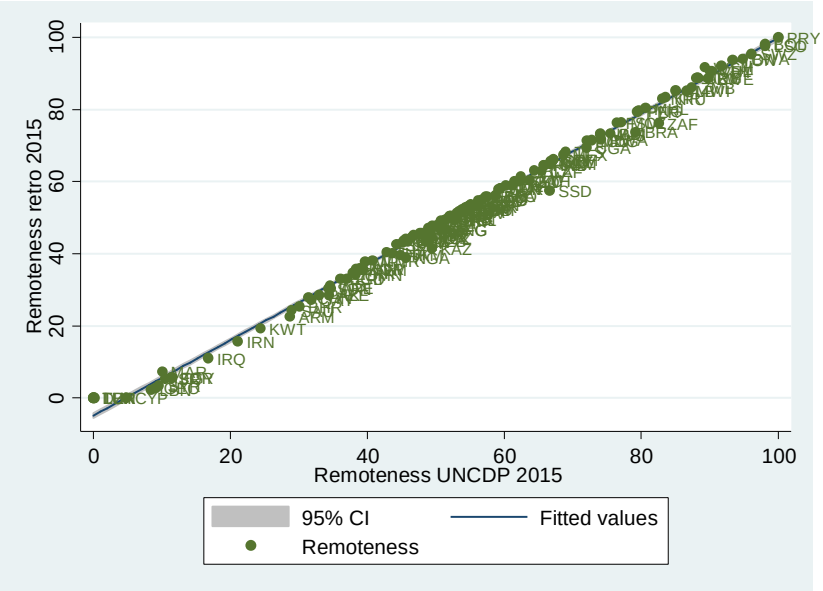
4.4. Special treatments

No special treatment for this index.

4.5. Remoteness index, UN-CDP EVI 2015 versus retrospective EVI 2015

Graph 3.1 displays the almost-perfect correlation between the official EVI and the retrospective EVI for the year 2013, with a Spearman's rank correlation coefficient of 99.8%.

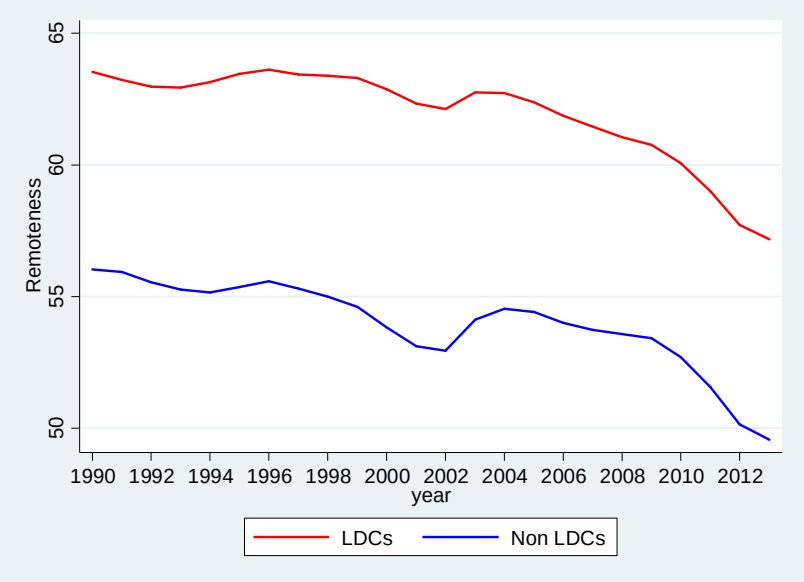
Graph 3.1. Correlation between the remoteness index of the UN-CDP 2015 Review and of the retrospective 2015 database, 2013



4.6. Evolution of the retrospective 2015 Remoteness index

The remoter the country is, the higher the index is, signaling a higher vulnerability. Graph 3.2 shows that LDCs are remoter from world markets than non-LDCs and that the gap between LDCs and non-LDCs remained stable over time. Remoteness decreases over time for both categories of countries with a substantial acceleration since the year 2009, signaling the rebalancing of market shares in favor of the south.

Graph 3.2. Evolution of the retrospective 2015 Remoteness index, LDCs versus non-LDCs averages



5. Export concentration

This indicator measures the sectoral concentration of a country's exports of merchandises. Highly concentrated exports are a source of vulnerability.

5.1. Data sources and calculation principles for retrospective series

The export concentration index is derived from a Herfindahl-Hirschmann 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 primarily lying between 0 and 1, a high level of concentration being associated with a score close to 1 (a country exporting only one product out a large number of products would score 1). The Herfindahl-Hirschmann 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* 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 concentration index used in the EVI 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 concentration index Hj drawn from UNCTAD and from our own calculation: The Hj index annual data are available from 1995 until 2013 at the UNCTAD website http://unctadstat.unctad.org/. Annual data for the period before 1995 are calculated by CERDI and FERDI using trade data from COMTRADE.

5.2. Bounds used for normalization

Normalization procedure: $Export\ concentration\ index = \frac{Export\ concentration - Min}{Max - Min} \times 100$

Lower bound: 0.1 Upper bound: 0.95

5.3. Differences with previous versions

Following the revision in the UN-CDP practices, the 2009 retrospective concentration index was based on annual data while the 2012 and 2015 versions are based on a 3-year rolling average of the data.

Various attempts to fill pre-1995 missing data that were applied for the retrospective EVI 2009 have been ruled out in the 2012 and 2015 versions, implying that this component is now less

documented than in the 2009 database. However, country and time coverage improved in the UNCTAD database, and so between the 2012 and 2015 retrospective EVI versions.

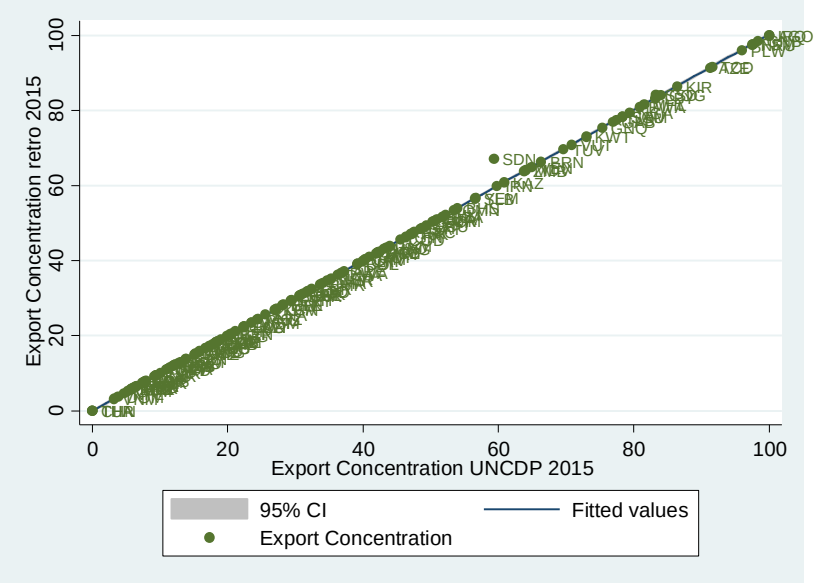
5.4. Special treatment

Prior to 1995, we apply the data of Sudan to Sudan and South Sudan. Following UN-CDP practices, missing data for South Sudan in 2012-2013 have been completed by the average data on the three previous years (for 2012, we use the average data on 2009-2011; for 2013 we use the average data on 2010-2012 knowing that data for 2012 is an estimate).

5.5. Export concentration index, UN-CDP EVI 2015 versus retrospective EVI 2015

Graph 4.1 below displays an almost perfect correlation between both indexes, with a Spearman's rank correlation coefficient of 99.0% (signaling that there has been no significant update in the raw database of Hj from UNCTAD).

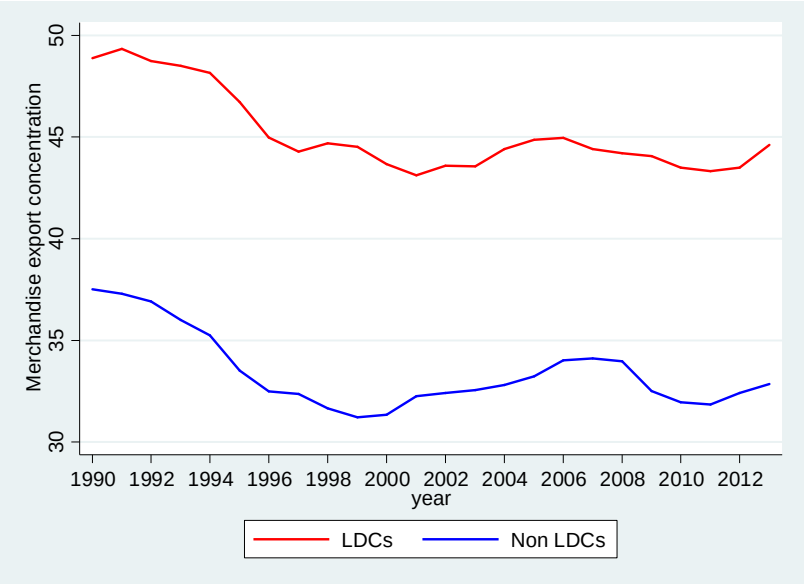
Graph 4.1. Correlation between the export concentration index of the UN-CDP 2015 Review and of the retrospective 2015 database, 2013



5.6. Evolution of the retrospective 2015 Export concentration index

Graph 4.2 below displays the evolution of LDCs and non-LDCs averages. The more concentrated the merchandise exports are, the higher the index is. The figure clearly shows that export concentration in LDCs is higher than in non-LDCs and that the gap remains over time. Concentration has decreased in the 1990s, but more rapidly for non-LDCs on average, and is more or less stable since then for both groups.

Graph 4.2. Evolution of the retrospective 2015 Export concentration index, LDCs versus non-LDCs averages



6. Share of agriculture, forestry and fisheries in GDP

Agriculture, fisheries and forestry are activities that are vulnerable to natural and economic shocks coming from World markets. A higher specialization in these activities would cause a greater vulnerability of the economy.

6.1. Data sources and calculation principles for retrospective series

The CDP uses a 3-year average of the share of agriculture in GDP, on 2011-2013 for the 2015 Review. The corresponding retrospective index in year t is accordingly based on a 3-year rolling average over [t; t – 2].

Following the UN-CDP EVI 2015 Review, raw data are retrieved from the United Nations Statistics Division in its National Account Main Aggregate Database: (http://unstats.un.org/unsd/snaama)

Raw data being available from 1970, the retrospective index is therefore calculated on 1972-2013 for a large sample of country.

6.2. Bounds used for normalization

Normalization formulae: $Share\ of\ agriculture\ index = \frac{Share\ of\ agriculture - Min}{Max - Min} \times 100$

Lower bound = 1% Upper bound = 60%

6.3. Differences with previous versions

As in 2012, the 2015 UN-CDP values and retrospective series are based on a 3-year rolling average. It differs from the 2009 retrospective series that was based on annual data, following the then UN-CDP definition.

6.4. Special Treatments

For Yemen on 1970-1987, values of the share of agriculture to GDP are averages of the two Yemen's values.

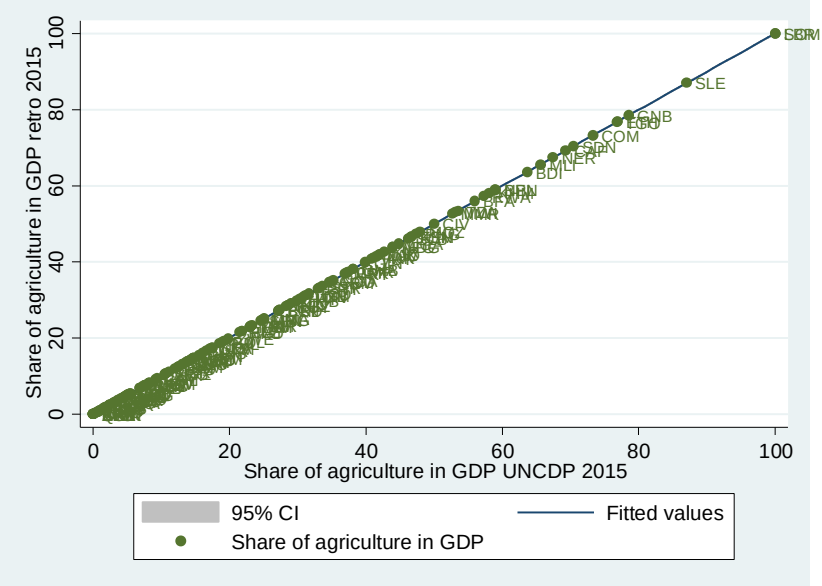
For Sudan from 1970 to 2007, we used data of former Sudan.

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

6.5. Share of agriculture index, UN-CDP EVI 2015 versus retrospective EVI 2015

Graph 5.1 shows a perfect correlation between both indexes with a Spearman's rank correlation coefficient that equals 100%, suggesting no change in the primary data used over 2015.

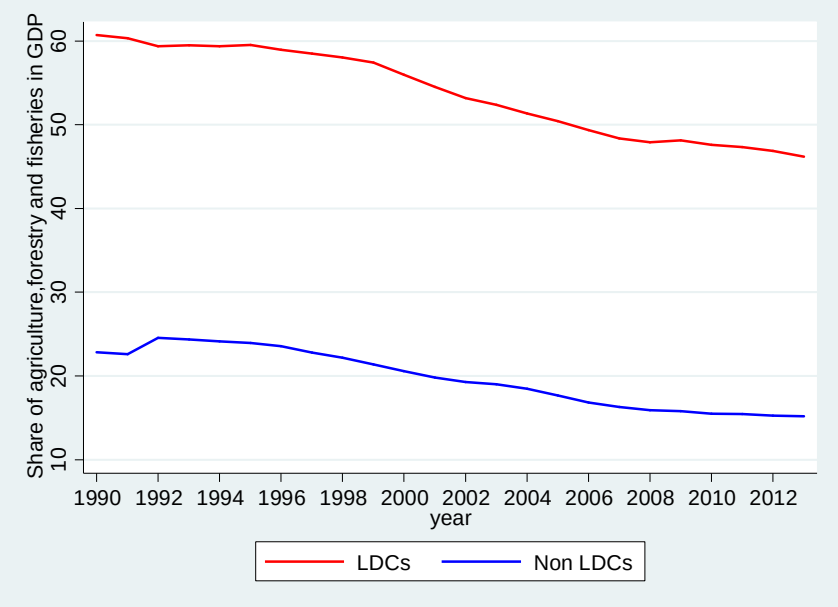
Graph 5.1. Correlation between the share of agriculture index of the UN-CDP 2015 Review and of the retrospective 2015 database, 2013



6.6. Evolution of the retrospective 2015 Share of agriculture index

According to graph 5.2., LDCs have a much higher share of agriculture, forestry and fisheries in GDP than non-LDCs, on average. The average index has decreased over time for both groups but faster in LDCs, resulting in a slight reduction of the gap between the two groups.

Graph 5.2. Evolution of the retrospective 2015 Share of agriculture index, LDCs versus non-LDCs averages



7. Share of population living in low elevated coastal zone

This component that was introduced in the 2012 UN-CDP EVI aims at capturing vulnerability of coastal countries facing the rise in sea level combined with extreme climatic events such as storm surges associated with climate change.

7.1. Data sources and calculation principles for retrospective series

It measures the share of the population in a country that lives in low elevated coastal zones, defined as areas contiguous to the coast below a certain elevation threshold. The elevation threshold used by UN-CDP decreased from 10 meters in the 2012 review to 5 meters in the 2015 review. This is the only significant change in the UN-CDP's EVI methodology between 2012 and 2015. Accordingly, UNCDP also halved the upper bound used in the normalization procedure to get the index (see below).

In the 2015 Review, the UN-CDP uses data from CIESIN-LECZ Version 2 (2013) [3], available at http://sedac.ciesin.columbia.edu/data/sets/browse. Data are available for the years 1990, 2000 and 2010 (and 2100)[4]. The UN-CDP uses data for the year 2010 unless otherwise indicated (see "special treatment" section below).

[3] Center for International Earth Science Information Network - CIESIN - Columbia University. 2013. Low Elevation Coastal Zone (LECZ) Urban-Rural Population and Land Area Estimates, Version 2. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://dx.doi.org/10.7927/H4MW2F2J.

[4] for 202 countries with contiguous coastal elevations in the following categories: less than or equal to 1m, 3m, 5m, 7m, 9m, 10m, 12m, or 20m;

Since estimates from CIESIN are available only for 1990, 2000 and 2010, annual data are generated for years between these estimates. We simply assume linear trends in the series:

- for years between 1990 and 2000, we interpolate data using the annual average change between 1990 and 2000: *Annual average change*$_{1990\text{-}2000} = (LECZ_{2000} - LECZ_{1990})/11$
- for years between 2000 and 2013, we inter and extrapolate data using the annual average change between 2000 and 2010: *Annual average change* $_{2000\text{-}2010} = (LECZ_{2010} - LECZ_{2000})/11$

In the retrospective EVI 2012, we constructed data for years prior to 1990, by extrapolating data using the trend between 1990 and 2010. We do not replicate this here.

7.2. Bounds used for the max-min procedure

Normalization formulae: $Population\ in\ LECZ\ index = \frac{Share\ of\ population\ in\ LECZ - Min}{Max - Min} \times 100$

Lower bound = 0; Upper bound = 35.

The upper bound has been halved from 70 in the 2012 Review to 35 in the 2015 Review, following the change in the elevation threshold from 10 to 5 meters.

7.3. Differences with previous databases

This component of the EVI did not appear in the 2006-2009 reviews since it has been introduced in the methodology of the UN-CDP 2012 Review. Except revisions on the threshold and on the upper bound, and change in the primary databases, the calculation principle is the same in the 2015 and 2012 Reviews.

In the 2012 Review, the UN-CDP used data on population in LECZ for the year 2000 from the CIESIN-LECZ Version 1 (2007)[5]. In the retrospective EVI 2012, we used updated data of CIESIN-PLACE III (2012)[6] that then provided estimates for years 1990, 2000, and 2010 (at this time, we however detected some erroneous data that we replaced by estimates from the CIESIN-PLACE II (2007)[7].

In the 2015 retrospective series, we use the same database than the UN-CDP, CIESIN-LECZ Version 2 (2013), which is the latest available from CIESIN. Moreover, we follow the special treatments applied by UN-CDP for some territories (detailed in the database that can be retrieved from UN-

[5] McGranahan, G., D. Balk, and B. Anderson. 2007. Low Elevation Coastal Zone (LECZ) Urban-Rural Population Estimates, Global Rural-Urban Mapping Project (GRUMP), Alpha Version. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://dx.doi.org/10.7927/H4TM782G.

[6] Center for International Earth Science Information Network - CIESIN - Columbia University. 2012. National Aggregates of Geospatial Data Collection: Population, Landscape, And Climate Estimates, Version 3 (PLACE III). Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://dx.doi.org/10.7927/H4F769GP.

[7] Center for International Earth Science Information Network - CIESIN - Columbia University. 2007. National Aggregates of Geospatial Data Collection: Population, Landscape, And Climate Estimates, Version 2 (PLACE II). Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://dx.doi.org/10.7927/H4JW8BSC.

CDP website,[8] see below). This induces a very higher correlation between the UN-CDP 2015 and retrospective 2015 series than between the UN-CDP 2012 and retrospective 2012 series.

7.4. Special treatments

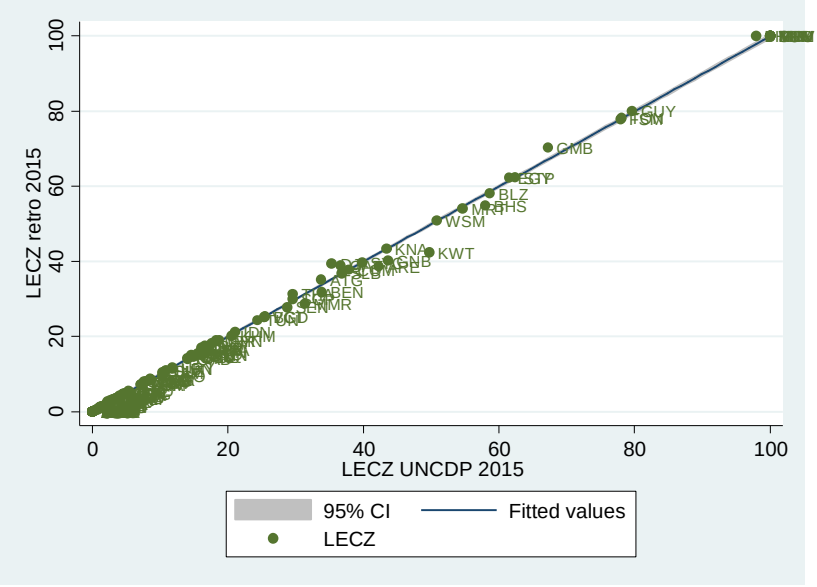
We strictly follow data adjustments made by the UN-CDP for the calculation of the LECZ component in the 2015 EVI. Dominica, Equatorial Guinea, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, the Solomon Islands, Tonga, have inappropriate values in CIESIN-LECZ version 2 (2013). For these countries, we use data from CIESIN-PLACE III (2012).

However, in the CIESIN-PLACE III, values for the year 2010 are not correct for the Marshall Islands, Micronesia, Nauru, Palau, Seychelles, and Tuvalu. Therefore, we apply the value of the year 2000 for the 2010 data. Given that these countries are islands, and the low value of the upper bound, these treatments do not induce major changes. Similarly, the erroneous values of the Maldives and Kiribati for the year 2010 in the CIESIN-LECZ version 2 lead us to replace them by their values in the year 2000.

7.5. Population in LECZ index, UN-CDP EVI 2015 versus retrospective EVI 2015

Graph 6.1 below displays a 99.9% correlation between LECZ scores of the UN-CDP 2015 review and 2013 scores of our retrospective database. This high correlation is explained by the fact that we use the same primary database version (the latest available) and apply the same treatment of special cases than UN-CDP (see below).

Graph 6.1. Correlation between the population in LECZ index of the UN-CDP 2015 Review and of the retrospective 2015 database, 2013

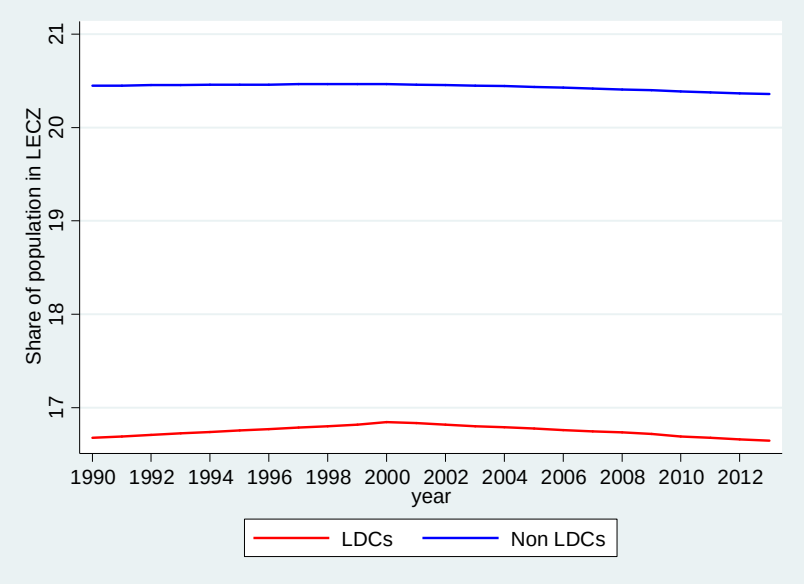


[8] http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_data.shtml

7.6. Evolution of the retrospective 2015 Population in LECZ index

The graph 6.2 shows a higher share of population in LECZ in non-LDCs than in LDCs, on average, the former group including more landlocked countries. The index has remained almost stable over time for both groups.

Graph 6.2. Evolution of the retrospective 2015 Population in LECZ index, LDCs versus non-LDCs averages.



8. Export instability

8.1. Data sources and calculation principles for retrospective series

Following UN-CDP, raw data are exports of goods and services in constant USD, retrieved from the United Nations Statistics Division's National Account Main Aggregates Database (http://unstats.un.org/unsd/snaama). We get data for the period 1970-2013.

In the 2015 Review, the UN-CDP assumes the reference value around which export deviations are computed as a mixed trend (with both deterministic and stochastic components) estimated over 1993-2013 (21 years), using data transformed in logarithm, following the equation:

$$Log\ Y_t = \alpha + \beta \cdot \log Y_{t-1} + \gamma \cdot T + u_t$$

with Y_t being the export variable, and T a time trend. Estimated Y_t from the equation are then rescaled using an exponential transformation. The deviations between observed exports values Y_t and the estimated Y_t from the above equation, ε_t, are used to compute the instability index, according to the following formula:

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

We follow UN-CDP that computes this indicator over 21 years (1993-2013). Our retrospective series is computed for each year t over a rolling window [t; t-k] with k = 20, starting in 1990, as we get raw data starting in 1970.

8.2. Bounds used for the max-min procedure

Normalization formulae: $Export\ instability\ index = \frac{Export\ instability - Min}{Max - Min} \times 100$

Lower bound = 5 Upper bound = 35

8.3. Differences with previous databases

In the 2015 version, raw data are exports of goods and services in constant USD.

In the 2012 version, following the then UN-CDP practice, raw data were exports of goods and services in current USD, deflated by the import unit value index for developing and emerging countries retrieved from the IMF International Financial Statistics. This causes discrepancies between the two versions 2012 and 2015, being UN-CDP's or our retrospective series. Moreover, instability index is computed on a 21 years period in 2015, against 20 in 2012.

In the 2012 retrospective series, we used exports data prior to 1970 from an older version of the IMF database to compute instability index for the 1980s (for less than half of the countries). We don't replicate this in 2015.

Compared to the 2009 series, the period used to compute instability index is also different (see Cariolle, 2009, and Cariolle and Goujon, 2013).

8.4. Special treatments

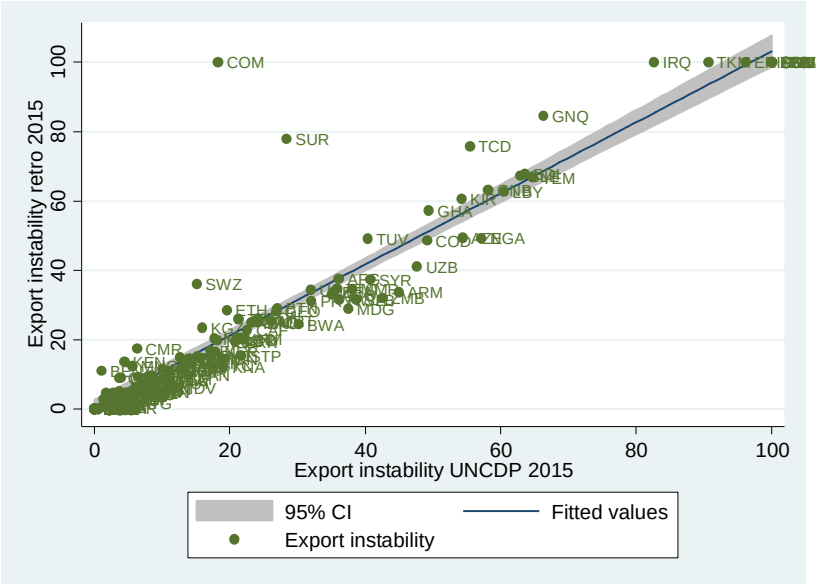
Following the UN-CDP practice, we generate historical annual data on exports for Sudan and South Sudan by splitting exports of former Sudan before 2008. We first compute the relative weight of exports of both countries over 2008-2013. Second, we apply this relative weight to the series of annual exports data of former Sudan over 1970-2007.

We similarly generate annual data for Ethiopia and Eritrea over 1970-1989 from former Ethiopia data, by using relative weight of both countries over 1990-2013.

8.5. Export instability index, UN-CDP EVI 2015 versus retrospective EVI 2015

The graph 7.1 displays a 96.4% correlation between export instability scores of the UN-CDP 2015 review and 2013 scores of our retrospective database.

Graph 7.1. Correlation between the export instability index of the UN-CDP 2015 Review and of the retrospective 2015 database, 2013

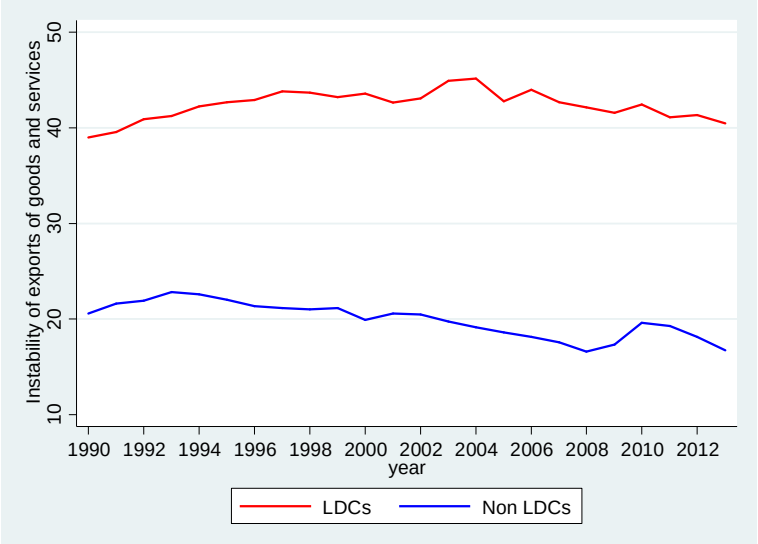


One can observe discrepancies in some export instability scores between UN-CDP and our estimates (e.g. Suriname, Comoros). Given that we use the same methods, they are explained by primary data updating in UN-stats between the UN-CDP 2015 Review and our calculations (for instance, for Comoros, before the max-min transformation, the UN-CDP reports an instability score of 10.5% against 37.8% for our estimates).

8.6. Evolution of the retrospective 2015 Export instability index

According to graph 7.2, LDCs experienced greater export instability than non-LDCs, on average, and the gap has slightly widened over time. Indeed, export instability index has slowly decreased since the 1990s in non-LDCs, but only since the 2000s in LDCs.

Graph 7.2. Evolution of the retrospective 2015 Export instability index, LDCs versus non-LDCs averages



9. Instability of agricultural production

9.1. Data sources and calculation principles for retrospective series

Instability of agricultural production reflects, among other things, the vulnerability of countries to natural shocks, in particular impacts of droughts and disturbances in rainfall patterns.

Following the UN-CDP, we use as raw data the volume index of aggregate agricultural production, net of quantities used for feed and seed, released by the Food and Agriculture Organization of the United Nations available from http://faostat3.fao.org/home/E. We get annual data for the period 1960-2013.

Then, the index of instability follows the same calculation principles as for the export instability index. The UN-CDP computes the reference value as a mixed trend (with both deterministic and stochastic components) estimated over 1993-2013 (21 years), using data transformed in logarithm, following the equation:

$$Log\ Y_t = \alpha + \beta \cdot \log Y_{t-1} + \gamma \cdot T + u_t$$

With Y_t the volume index of agricultural production and T a time trend. Estimated Y_t from the equation are then rescaled using an exponential transformation. Because the UN-CDP estimates this trend over 21 years (1993-2013), we estimate it each year over (t; t-k) with k = 20.

The difference between observed agricultural production values Y_t and the estimated Y_t from the above equation, ε_t, are used to compute the instability index, according to the following formula:

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

We follow UN-CDP that computes this indicator over 21 years (1993-2013). Our retrospective series is computed for each year t over a rolling window [t; t-k] with k = 21, starting in 1980, as we get raw data starting in 1960.

9.2. Bounds used for the max-min procedure

Normalization formulae: $Agricultural\ instability\ index = \frac{Agricultural\ instability - Min}{Max - Min} \times 100$

Lower bound= 1.5 Upper bound = 20

9.3. Differences with previous databases

Here we follow the UN-CDP 2015 review that uses a 21-year period to compute instability index. The UN-CDP 2012 review at that time used a 20-year period. Other period lengths were used in the 2009 version (see Cariolle, 2009).

Continuous data updating in FAO database is a major cause of discrepancies between UN-CDP Versions, as well as between our retrospective series.

9.4. Special treatments

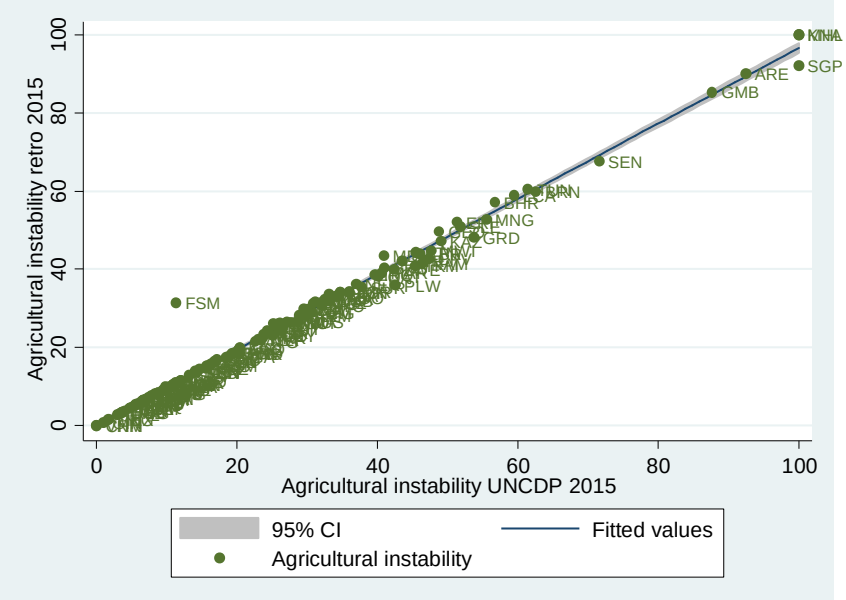
Following the UN-CDP practice, prior to 1995, the average value of the Federated States of Micronesia is used for Palau and Micronesia. Likewise, as done by the CDP, we apply the values of former Sudan to Sudan and South Sudan.

9.5. Agricultural production instability index, UN-CDP EVI 2015 versus retrospective EVI 2015

The graph 8.1 below displays a 99.3% correlation between agricultural instability scores of the UN-CDP 2015 review and 2013 scores of our retrospective database.

The difference in instability scores between the two databases are explained by updates of FAO-stats since the UN-CDP 2015 review. Additionally, for Micronesia, the difference can be explained by the specific treatments used by the UN-CDP for generating values and the period used for the calculation of the instability (period of 19 years while the period of 21 years has been used for the other countries).

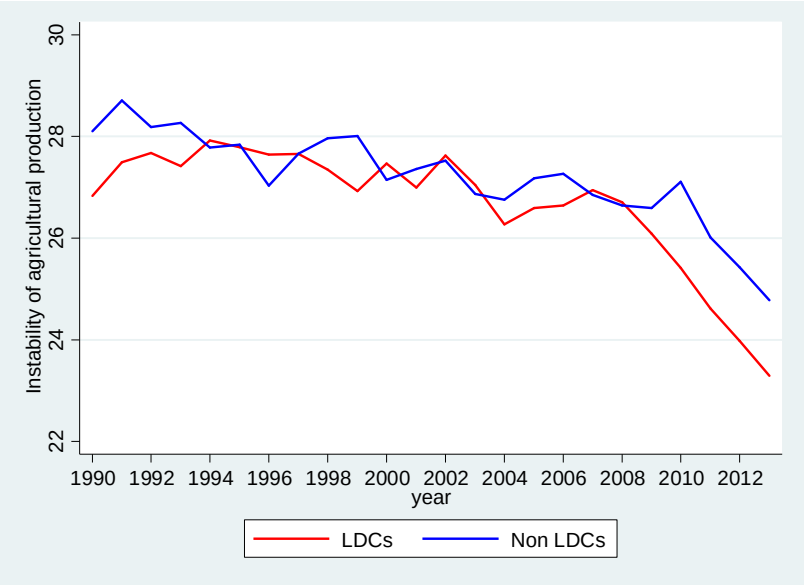
Graph 8.1. Correlation between the agricultural production instability index of the UN-CDP 2015 Review and of the retrospective 2015 database, 2013



9.6. Evolution of the retrospective 2015 Agricultural production instability index

According to graph 8.2, until recently, the average index of agricultural production instability is similar and shows a very slow decreasing trend for both groups. The average index falls more rapidly since 2008 for non-LDCs and later since 2011 for LDCs.

Graph 8.2. Evolution of the retrospective Agricultural production instability index, LDCs versus non-LDCs averages



10. Victims of natural disasters

10.1. Data sources and calculation principles for retrospective series

This index measures the average share of the population hurt by 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). This index reflects vulnerability to natural shocks, in particular the human impact of natural disasters associated with these shocks.

In the 2015 Review, the UN-CDP uses data on victims of natural disasters from OFDA/CRED international Disaster Database (EM-DAT) available at http://www.emdat.be . This database is updated on a timely basis and, according to EMDAT, updates may imply major modifications in the historical data. Moreover, regarding these historical series, the further we go on the past, the lesser is the quality of disaster recording. Data on total 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. We get annual data for the period 1960-2013.

We follow UN-CDP methodology to compute the disaster index as an average on a period of 20 years. The UN-CDP in its 2015 Review uses data on the period 1994-2013.

We first calculate the annual number of people killed or affected by natural disaster from EMDAT, which we report to total population, for each year on the 1960-2013 period. Second, we calculate an annual average of the share of victims to total population on a rolling period of 20 years.

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

10.2. Bounds used for normalization

Normalization formula:

$$\text{Disaster victim index} = \frac{\log(\text{victims}) - \log(\text{Min})}{\log(\text{Max}) - \log(\text{Min})} \times 100$$

Where *victims* is the 20-year annual average of victims as a % of total population

Lower bound = 0,005 Upper bound = 10

10.3. Differences with previous versions

Apart from raw data updating and fulfilment by EMDAT, no major change was applied between the 2012 and 2015 versions of UN-CDP's and between our retrospective series.

Since the 2012 UN-CDP Review, the index of "victims of natural disaster" has replaced the index of "homeless due to natural disaster" previously used in the 2006 and 2009 Reviews. For the retrospective EVI 2009, the calculation method was also different (see Cariolle, 2009).

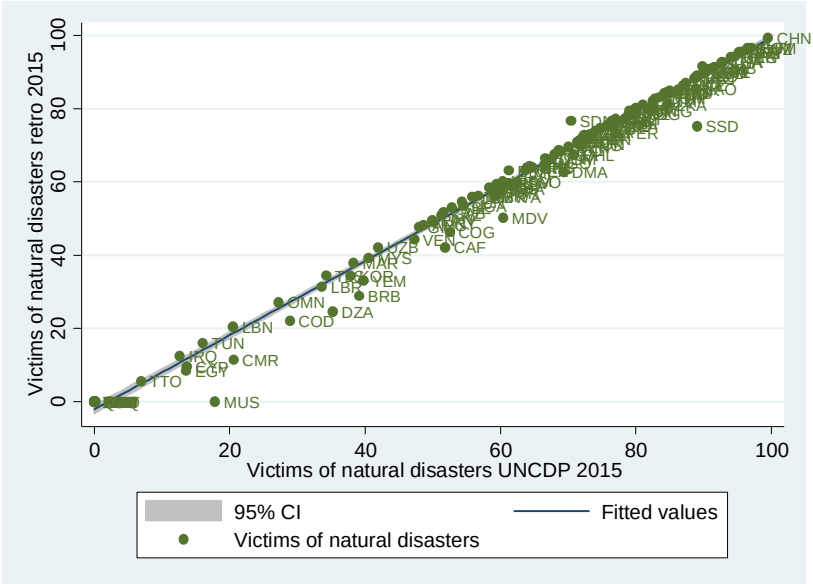
10.4. Special treatments

We generate pre-2012 data on victims for Sudan and South Sudan. For each year, we calculate the share of their population in total population of Former Sudan, and then multiply it by the total victims of natural disasters recorded by Former Sudan.

10.5. Victim of disaster index, UN-CDP EVI 2015 versus retrospective EVI 2015

Both indexes are highly correlated at 99.3% (graph 9.1). Differences in estimates for some countries are explained by an update in EMDAT database between UN-CDP's and our calculations.

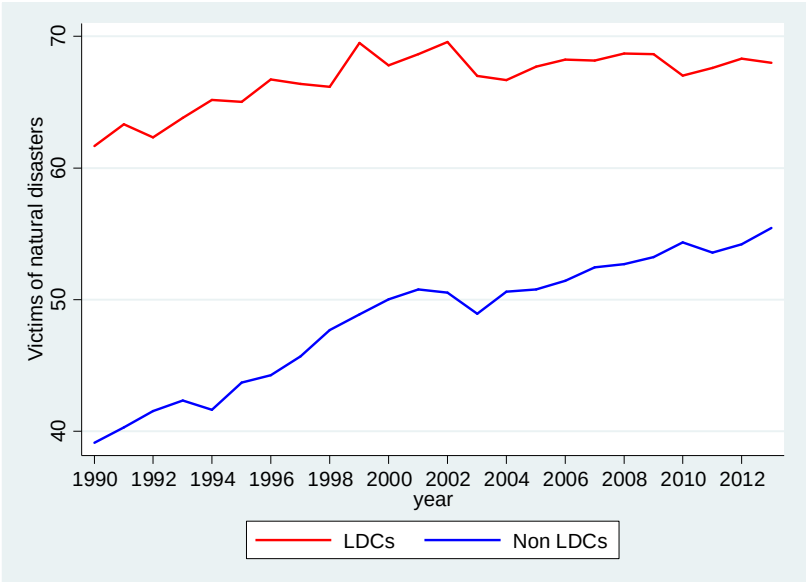
Graph 9.1. Correlation between the victim of disaster index of the UN-CDP 2015 Review and of the retrospective 2015 database, 2013



10.6. Evolution of the retrospective 2015 Victims of natural disasters index

Graph 9.2 shows that, on average, LDCs have been more affected by natural disaster than non-LDCs. The index increases for both groups. This may be partly due to a wider recording coverage of disasters and victims over time. However, this can also capture a real increase in disaster frequency or intensity due to climate change and/or an increase in population density in disaster-prone areas. The increasing trend is more acute for non-LDCs average, reducing the gap between LDCs and non-LDCs.

Graph 9.2. Evolution of the average retrospective 2015 Victims of natural disasters index, LDCs versus non-LDCs averages



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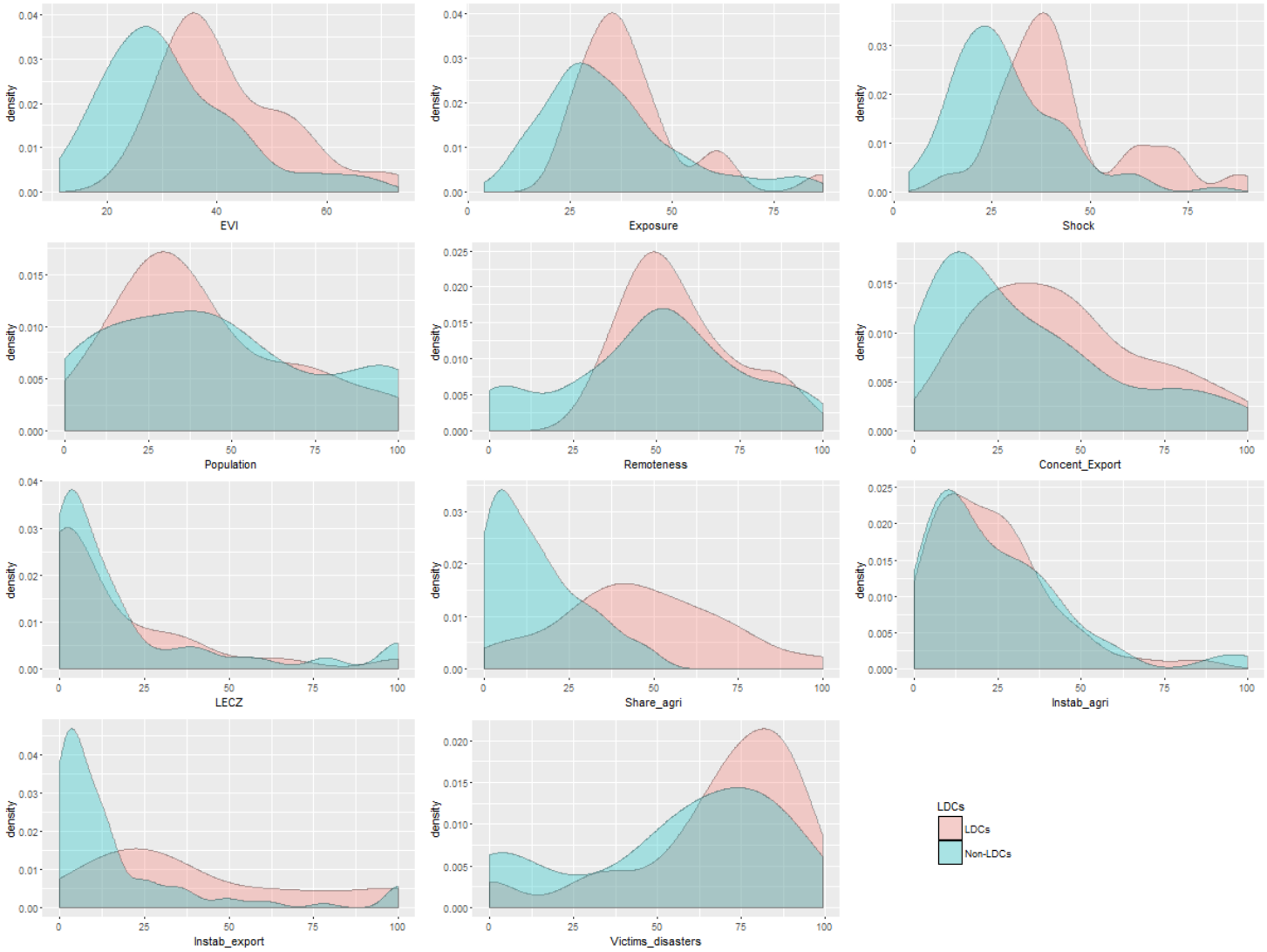
Annex 1: Distribution of the retrospective 2015 EVI and its components, LDCs versus non-LDCs, 2013



Annex 2: Evolution of the retrospective 2015 EVI in LDCs

Country	ISO_3	EVI 1990	EVI 2000	EVI 2010	EVI 2013
Afghanistan	AFG	31,02	36,25	36,30	34,65
Angola	AGO	33,76	36,40	34,42	38,43
Burundi	BDI	40,24	53,48	56,64	50,47
Benin	BEN	49,40	48,14	32,19	32,77
Burkina Faso	BFA	38,56	38,20	36,64	38,51
Bangladesh	BGD	35,37	31,69	26,64	24,33
Bhutan	BTN	34,91	43,97	40,70	40,13
Central African Republic	CAF	30,61	33,00	31,15	31,96
Democratic Republic of the Congo	COD	29,74	35,64	29,08	28,83
Comoros	COM	53,11	56,00	66,16	65,92
Djibouti	DJI	52,54	53,02	52,50	38,47
Eritrea	ERI				58,02
Ethiopia	ETH				33,55
Guinea	GIN	24,03	24,73	26,41	25,61
Gambia	GMB	54,72	48,49	68,34	70,49
Guinea-Bissau	GNB	50,45	57,07	56,62	53,98
Equatorial Guinea	GNQ	57,45	52,15	48,02	43,49
Haiti	HTI	32,68	36,83	35,70	33,27
Cambodia	KHM	43,95	52,46	43,65	37,57
Kiribati	KIR	81,47	84,71	80,40	73,06
Lao People's Democratic Republic	LAO	56,09	50,91	39,86	35,70
Liberia	LBR	46,99	65,83	59,43	57,25
Lesotho	LSO		43,15	42,58	42,51
Madagascar	MDG	36,48	30,81	33,40	34,21
Mali	MLI	38,19	32,55	32,55	32,25
Myanmar	MMR	34,93	33,21	33,55	32,05
Mozambique	MOZ	34,66	39,66	40,52	38,15
Mauritania	MRT	51,94	39,52	41,21	40,64
Malawi	MWI	40,30	44,98	42,86	40,28
Niger	NER	46,94	39,90	37,04	36,73
Nepal	NPL	38,80	33,05	29,05	26,95
Rwanda	RWA	47,17	44,47	45,14	39,37
Sudan	SDN	36,53	47,44	52,06	50,59
Senegal	SEN	45,91	34,94	31,98	32,10
Solomon Islands	SLB	65,75	56,37	50,28	48,89
Sierra Leone	SLE	29,30	37,56	43,33	49,69
Somalia	SOM	44,32	50,30	38,79	35,85
South Sudan	SSD			44,36	52,96
Sao Tome and Principe	STP	67,19	58,33	41,38	37,39
Chad	TCD	41,92	43,13	48,85	50,44
Togo	TGO	41,12	37,63	34,42	33,95
Timor-Leste	TLS			54,46	54,89
Tuvalu	TUV	73,72	71,10	59,47	56,15
United Republic of Tanzania	TZA	47,50	42,28	29,67	27,97
Uganda	UGA	37,62	35,71	32,76	32,00
Vanuatu	VUT	53,95	52,42	47,14	46,82
Yemen	YEM	40,20	46,86	42,12	34,50
Zambia	ZMB	38,08	40,40	46,17	42,68

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