

A REVISED EVI

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EVI, the economic vulnerability index, has been designed in 1999 by the CDP to be used for the identification of the LDCs, beside two other criteria, the level of income per capita and an indicator of human resources. It has actually been used in 2000 and 2003 by the CDP for its last two triennial reviews of the list of LDCs. After recalling the origin and nature of the EVI, and relying on the past experiment, we propose in this note a possible revision of EVI. It examines how to improve its components, with a special attention paid to remoteness. The way by which the components are averaged is also considered. Some results of simulations and their implications are presented.

1. THE PRESENT EVI IN PERSPECTIVE

Before 2000 (and from 1991) the LDCs were identified by 3 criteria: the GDP per capita, APQLI, an index of human resource, now (2003) transformed in HAI (human assets index) and EDI, an economic diversification index. In 1997 CDP took the initiative to consider vulnerability as a possible criterion, and not only as a qualitative information to be taken into account in the borderline cases, as agreed since 1991. This initiative was supported within the UN and addressed a large concern about vulnerability.

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1.1 Context of EVI and conceptual background

Interest for a vulnerability index first was expressed at the Barbados Conference in 1994, with reference to the SIDS, then reiterated by the General Assembly of the UN (1995, 1997) and by the Commission on Sustainable Development (1998).

Repeated wishes have subsequently been expressed within UN of a vulnerability index to be built, with reference to the LDCs: GA 1997, ECOSOC 1998, 1999...

Several other attempts to propose a vulnerability indicator (Commonwealth Secretariat, Caribbean Development Bank, SOPAC...) have been analysed by the CDP in its 1999 report but not retained, since they were not designed to be used for LDCs identification and not appropriate to this aim (cf. 1999 CDP Report).

Meaning and specificity of EVI

Since designed to reflect a significant and structural obstacle to growth in LICs, beside a low level of human capital, the EVI is an index focused on a vulnerability

- economic, not ecological (as such)
- structural, not generated by policy
- concerning low income, rather than medium income countries

Most relevant elements of vulnerability

The relevant vulnerability is the risk that growth be durably affected by exogenous shocks (prevalent in low-income countries). Vulnerability can be seen as the result of 3 components: shocks, exposure to the shocks, resilience. EVI is intended to reflect mainly 2 among these 3 elements of vulnerability

- 1) the (structural) exposure to the shocks
- 2) the size of the shocks,
but to a less extent the resilience, more dependent on policy.

1.2 Content and adequacy of the present EVI

In 2000/2003, EVI has been measured from 5 components, with a 6th one used in 2003 for a supplementary measure

- 1) (small) population size (in log)
- 2) (small) share of manufacturing and modern services in GDP
- 3) export concentration coefficient (UNCTAD index)s
- 4) instability of exports of goods and services
- 5) instability of agricultural production
- (6) "homeless": share of population displaced by natural disasters

Structural exposure is reflected by 1), 2), 3). Size of the shocks is reflected by 4), 5), (6).

But there may be possible inadequacies and omissions

Vulnerability before and beside EVI in LDCs identification

Qualitative elements of vulnerability have always been noted as useful additional information by the CDP. Even before 2000, it has been clearly stressed in the 1991 CDP report on the revision of the criteria.

Since 2000 and the new revision of the criteria, beside EVI, a "vulnerability profile" is to be prepared for countries on the borderline with regard to one or the other criterion . Such "profiles" have actually been prepared (by UNCTAD) for countries considered for graduation in 2000 and 2003.

Econometric test of relevance

Estimating over 30 years a cross-country GDP per capita (y) growth regression:

$$y \text{ growth} = f(y_0, \text{HAI}, \text{EVI})$$

EVI (with the 5 components, recalculated on average for the whole period) is found to be a significant negative factor, beside y_0 (negative too: convergence factor) and HAI (positive)

The 6th component (homeless) appeared itself significant when separately added and EVI even more significantly negative when including homeless

Why to revise...

To better reflect the structural obstacles/handicaps to growth in low income countries, to give a more comprehensive picture of the sources of economic vulnerability in these countries and to pay attention to the specific vulnerability of some countries (SIDS...)

... and how to do it

Changing the components and their definition and possibly changing the way by which the components are aggregated

2. IMPROVING THE COMPONENTS OF EVI

Components can be improved by 3 ways:

- Addition: remoteness
- Deletion: export concentration
- Transformation: possibly the share of manufacturing and modern services

2.1 Adding remoteness

Adding remoteness from the main world markets has been suggested by the CDP in its 2003 report.

Remoteness involves high transport costs and relative isolation. It is a structural obstacle to trade and growth and a possible source of vulnerability when shocks occur. It reflects a specific handicap of numerous SIDS, the vulnerability of which has been several times referred to by ECOSOC. It may also be adjusted upward for landlocked countries.

There are several meanings of remoteness in the literature, for instance in the gravity models of trade. Here remoteness is designed as (an index of) a weighted average of the distance to the main world markets

Weighting the distance

To calculate a country remoteness, the average distance has here been weighted by the relative shares in world trade of the main world importers (=identical weights for all countries). It is a potential average distance to the world market.

This weighting is preferable to the relative shares of the main importers in each country exports (giving an actual average trade distance, different for each country, but endogenous).

Other weights are conceivable, for instance the minimum average distance to z% of the world market (differing for each country, and exogeneous)

Adjusting for landlockness

Landlocked countries face higher difficulties to trade, with higher transportation costs for a given distance, justifying an upward adjustment of the remoteness measure for landlocked countries.

It has been done by estimating the relative impact on the trade/GDP ratio (x) of the 2 following (among other) variables: D, the average distance to main markets (an index) and L, landlockness (a dummy variable). If a and b are the respective coefficients found for these two variables, an “adjusted remoteness” is given by the index of $D' = (aD + bL)/(a + b)$

Found: (b/a) about 10%

Empirical relevance of remoteness

Coming back to the growth regression relying on LDCs identification criteria, we find that (adjusted) remoteness, as an additional variable, has a significant negative coefficient. Moreover remoteness, when included in EVI as an additional component, increases the negative impact of EVI on growth.

2.2 Other relevant changes

To be given up: the export concentration coefficient

Reasons

- limited to goods, not including services (no classification of services corresponding to the SITC)
- sometimes misleading, for at least 2 reasons:
 - *breaking down of exports of a same kind of product between several items of SITC
 - *highest coefficients observed for oil exporters, which are not the most structurally vulnerable: their vulnerability is more related to the policy and the existence of mineral resources has not to be a factor for a country to be included or retained on the list of the LDCs

To be (possibly) replaced / transformed

The share of manufacturing and modern services in GDP (actually 100-this share) could be replaced by the share of agriculture (including forestry and fisheries) in GDP

Reasons

- here again not to make inclusion easier (graduation more difficult) for countries benefiting from mineral resources
- among modern services, tourism rather increases the exposure to shocks than the reverse
- special exposure to shocks due to agricultural policies in developed countries

Against the share of agriculture

- not stable over time (as the share of manufacturing) due to the change of relative prices (lower when agricultural prices are lower)
- however possible to take a multi-year average

2.3 A new content of EVI

From the previous remarks, a new content of EVI seems needed. The revised EVI would then rely on

- 2 (3) indices of the exogenous shocks

1. external shocks: the instability of exports of goods and services

2. natural shocks: the instability of agricultural production *and* the homeless component of the natural disaster index, the two averaged rather than separately considered

- 2 (3) indices of the structural exposure to the shocks, corresponding to

1. the (log of the) population size

2. remoteness (adjusted)

3. possibly, the relative share of agricultural value added

3. CHANGING THE AGGREGATION

How to combine the components

With equal weights, 4 main solutions, among others...

- Arithmetic average, as usual and presently

- Geometric or "semi-geometric"

- Arithmetic average of the log-indices of components

- Average of the ranks

For specific weights, possible econometric estimates

A semi-geometric averaging

Referring to the possibly new content of EVI, we can separately measure 2 indices, an index of the shocks and an index of the exposure to the shocks, then take the geometric average of these two indices.

This "semi-geometric" averaging can then be defined as follows:

- . the two (three) exogenous shocks indices, because they are substitute, are *arithmetically* averaged, in an *index of the shocks*
- . by the same way, an *index of the exposure* to the shocks is designed as an *arithmetic* average of the indices respectively related to population size and to agricultural share and to remoteness
- . but the index of shocks and the index of exposure to the shocks are *geometrically* averaged, because shocks and exposure can be assumed to have multiplicative effects (the impact of the shocks depends on the exposure)

Econometric weighting

Principle: weights drawn from the coefficients of the components in a growth regression estimate

Limits: sensitivity of results correlation between the components

Combining changes on components and different kinds of averaging

A large set of possibilities (formulas) is presented at the end of the note.

4. RESULTS OF SIMULATIONS

4.1 – Impact of the change in the components (simulation with an arithmetic average) (cf table 1)

Homeless

Figures with and without “homeless” already available in the last (2003) CDP report

Impact of "homeless" when added as a 6th component: relative vulnerability of SIDS is increased (Samoa, Vanuatu, ...)

See graph I, comparing the present EVI with 5 and with 6 components

A measure of the total impact on ranking: the average of the absolute rank difference with and without (col.1 and 2): 4.1

Adding remoteness

Measurement: adding remoteness as a 7th component to the present EVI

Impact: higher relative vulnerability for fare islands, but not for others (depending on the remoteness measurement); higher vulnerability for landlocked when adjusted distance is used

See graph III, comparing EVI with and without remoteness, without the export concentration and share of manufacturing components and for the arithmetic average (i.e. EVI 1b and EVI 1d)

Total impact measure: average of absolute rank difference (col.3 and 5): 5.7.

Other change in the components

Impact of the deletion (export concentration) and transformation (manufacturing): high for specific countries (oil exporters , such as Angola, Yemen, Eq. Guinea...have lower EVI, agricultural countries such as RCA, Haiti, Lao have higher EVI...)

See graph II, comparing EVI with and without the export concentration and share of manufacturing components, without remoteness and for the arithmetic average.

Major total impact: average absolute rank difference (between col.2 and 3: 10.0), similar to the total impact of the replacement of the present EVI by the revised one with the combined new components.

4.2 Impact of alternative averaging

Two kinds of simulation have been done

From the present (6) components (table 2.1)

Most significant gap between arithmetic and geometric averages, due to high impact of a

"bad" value in any component: increased vulnerability of very small countries, similar, but dampened impact of the arithmetic average of the logs.

From the modified components of the revised EVI, and with a "semi-geometric" average (table 2.2)

Table 2.2 = with revised EVI b , i.e., without export concentration, share of manufacturing and remoteness.

Table 2.3 = with revised EVI c , i.e., with all the new components and lightly lower impact.

Relevance evidenced of "semi-geometric" or arithmetic average of the logs. Both indices increase the EVI of small countries, both to a lower extent than with the geometric one

Anyway: impact of averaging rather lower than that of the choice of the components.

4.3. Implications for the identification of LDCs

There may be large differences in ranks according to the EVI retained. Differences are especially important for oil (mineral) exporters, found less vulnerable, and for small islands found more vulnerable.

But the implications for inclusion are limited. Only one country, Papua New Guinea, among the not LDCs who already meet the GNI and HAI criteria would then qualify for inclusion. With the present EVI PNG stands at the 15th rank, so is below the lower quartile (16th rank), and not eligible. With measures of the revised EVI PNG is well above the lower quartile. This holds with modified components and arithmetic average (21, 20, 29), and even more with new components and new averaging of the table 2.2 (31, 33, 30) or of the table 2.3 (29, 31, 39).

And there is no implication for graduation. The change in the level of EVI does not change the eligibility for graduation. The only countries qualifying for graduation are still those meeting the 2 other criteria (GNI and HAI). As no additional LDC with a GNI above the threshold meets

any of the revised EVI graduation criterion. None other than those identified in the 2003 report is found eligible for graduation.

CONCLUSIONS

EVI has already been used for two triennial reviews of the list of LDCs, and endorsed by ECOSOC as a relevant criterion. It has brought a real improvement in LDCs identification. But EVI still needs to be improved for this use, as suggested above. Anyway EVI is not a comprehensive vulnerability index available for any use and any country. It is designed to be used for LDCs identification, taking in view that the GNI per capita and an index of human assets are simultaneously ,but separately, considered.

**Revised EVI: The Different Formulas
and their correspondance in the columns of the so-called
Table "VII.2bis" and "VII.2.ter"**

Notation

P: population

MA: share of manufacturing

AGR: share of agriculture

CX: concentration of exports of goods

IX: instability of exports of goods and services

IA: instability of agricultural production

HL: homeless (natural disaster index)

R: remoteness from main world markets

NB – All variables are expressed as indices, after a max-min transformation
(for instance, here log P means the max-min index of the log of the population
and stands between 0 and 100)

Arithmetic averages (with actual max and min)

. Present	$1/5 [(100 - \log P) + (100 - MA) + CX + IX + IA]$	<i>col.1(bis and ter)</i>
. Extended	$1/6 [(100 - \log P) + (100 - MA) + CX + IX + IA + HL]$	<i>col.2(bis and ter)</i>
Revised 1a	$1/4 [(100 - \log P) + AGR + IX + 0,5 (IA + HL)]$	<i>col.3 (bis)</i>
. Revised 1b	$1/3 [(100 - \log P) + IX + 0,5 (IA + HL)]$	<i>col.3 (ter)</i>
Revised 1c	$= 1/4 [(100 - \log P) + 0,5 (AGR + R) + IX + 0,5 (IA + HL)]$	<i>col.1 (4)</i>
Revised 1d	$= 1/4 [(100 - \log P) + R + IX + 0,5 (IA + HL)]$	<i>col.2 (4)</i>

Semi-geometric (with bounds)

Revised 2a	$= 100 - 1/2 \sqrt{[\log P + (100 - AGR)].(200 - IX - 0,5IA - 0,5HL)}$	<i>col.4 (bis)</i>
. Revised 2b	$= 100 - \sqrt{\log P . [100 - 0,5IX - 0,25IA - 0,25HL]}$	<i>col.4 (ter)</i>
Revised 2c	$= 100 - 1/2 \sqrt{(\log P + 100 - 0,5 AGR - 0,5 R)(200 - IX - 0,5 IA - 0,5 HL)}$	<i>col.3 (4)</i>
Revised 2d	$= 100 - 1/2 \sqrt{(\log P + 100 - R)(200 - IX - 0,5 IA - 0,5 HL)}$	<i>col.4 (4)</i>

Arithmetic of the logs (with bounds)

$$\text{Revised 3a} = 100 - 1/4[\log P + 300 - \log \text{AGR} - \log \text{IX} - 0,5(\log \text{IA} + \log \text{HL})] \quad \text{col.5 (bis)}$$

$$\text{Revised 3b} = 100 - 1/3[\log P + 200 - \log \text{IX} - 0,5(\log \text{IA} + \log \text{HL})] \quad \text{col.5 (ter)}$$

$$\text{Revised 3c} = 1/4[(100 - \log P) + 0,5(\log \text{AGR} + \log \text{R}) + \log \text{IX} + 0,5(\log \text{IA} + \log \text{HL})] \quad \text{col. 5 (4)}$$

$$\text{Revised 3d} = 1/4 [(100 - \log P) + \log \text{R} + \log \text{IX} + 0,5(\log \text{IA} + \log \text{HL})] \quad \text{col. 6 (4)}$$

Ranks

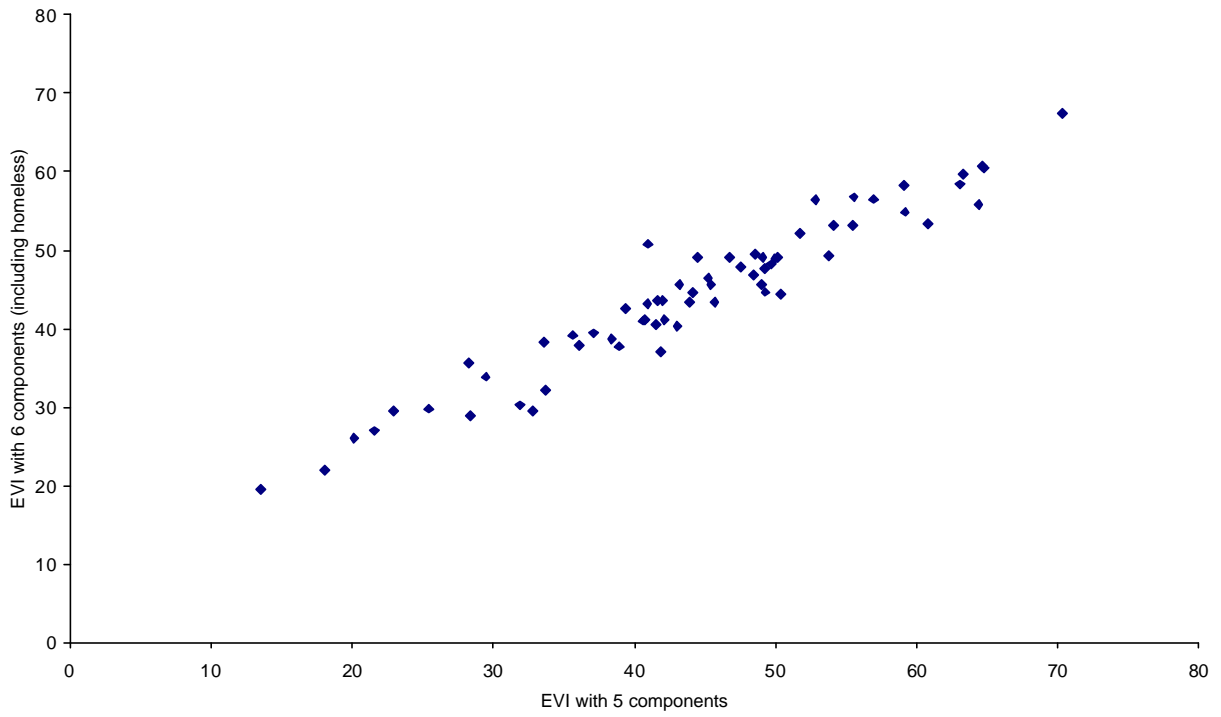
$$\text{Revised 4a} = \text{average of the ranks of the 4: P, (100-AGR), (100-Ix), (200-IA-HL)} \quad \text{col. 6 bis}$$

$$\text{Revised 4b} = \text{average of the ranks of the 3: P, (100-Ix), (200-IA-HL)} \quad \text{col. 6 ter}$$

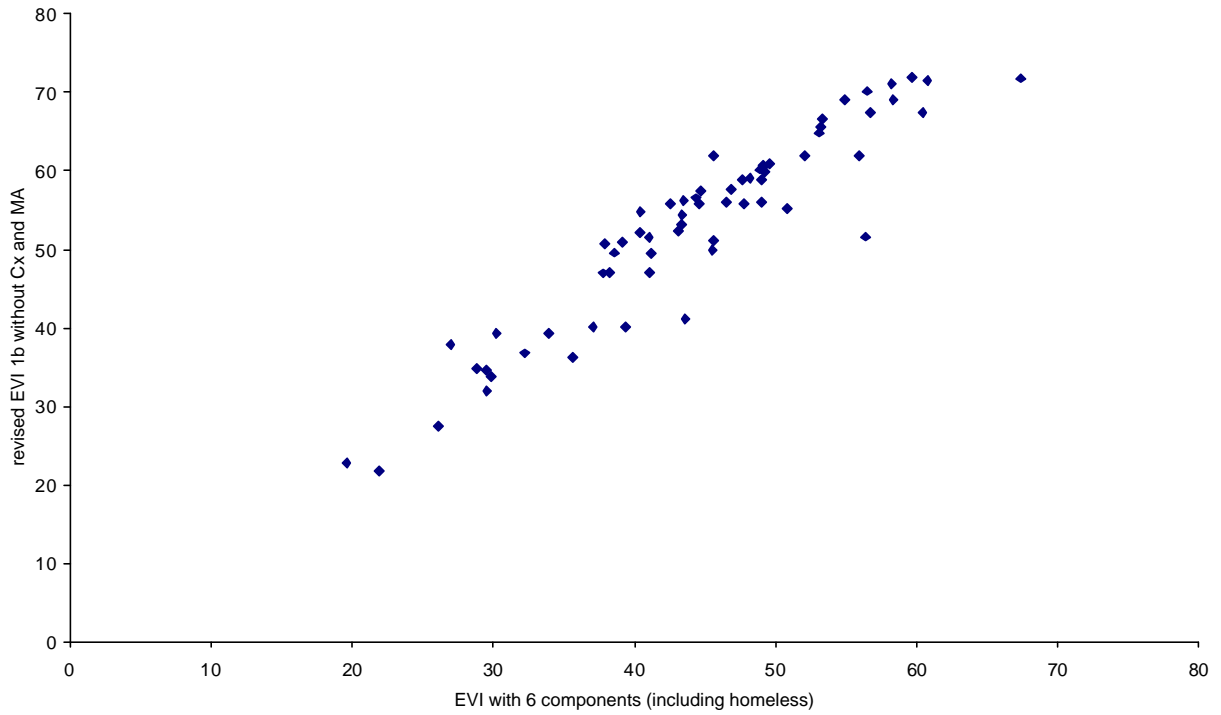
$$\text{Revised 4c} = \text{average of the ranks of the 4: P, (200 - AGR - R), IX, (200 - IA - HL)} \quad \text{col. 7 (4)}$$

$$\text{Revised 4d} = \text{average of the ranks of the 4: I, (100 - R), IX, (200 - IA - HL)} \quad \text{col. 8 (4)}$$

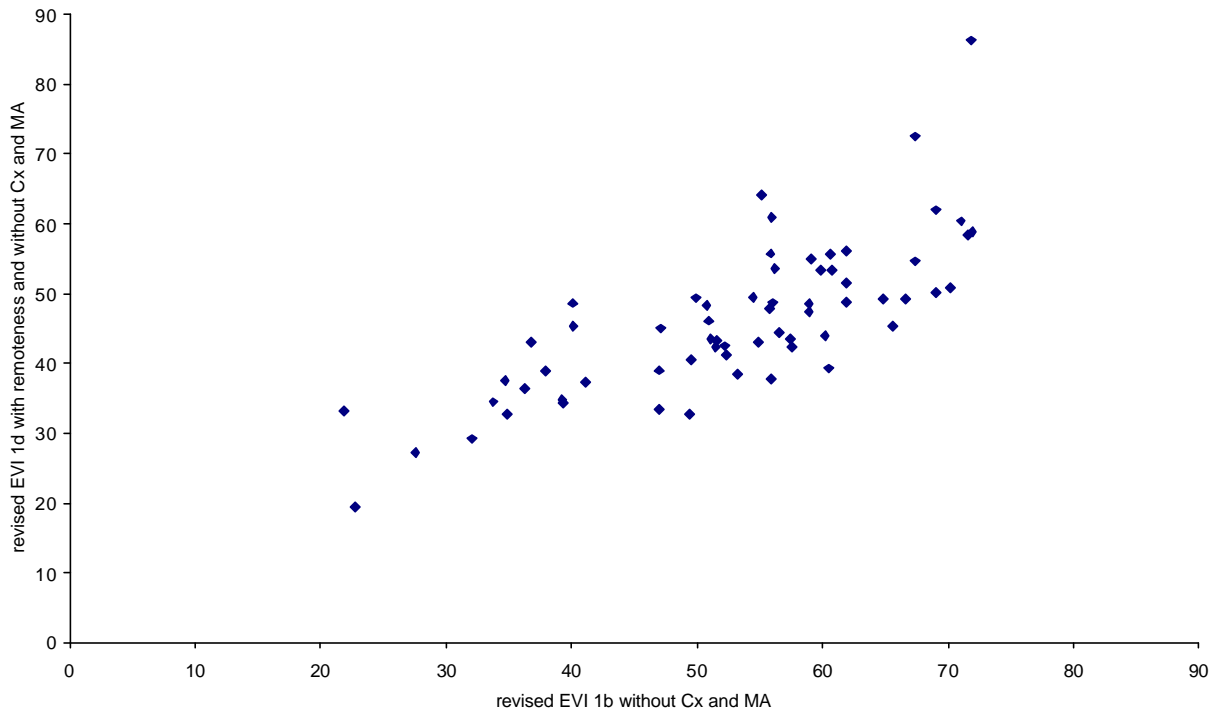
Graph I. Impact of homeless
Averages (arithmetic)



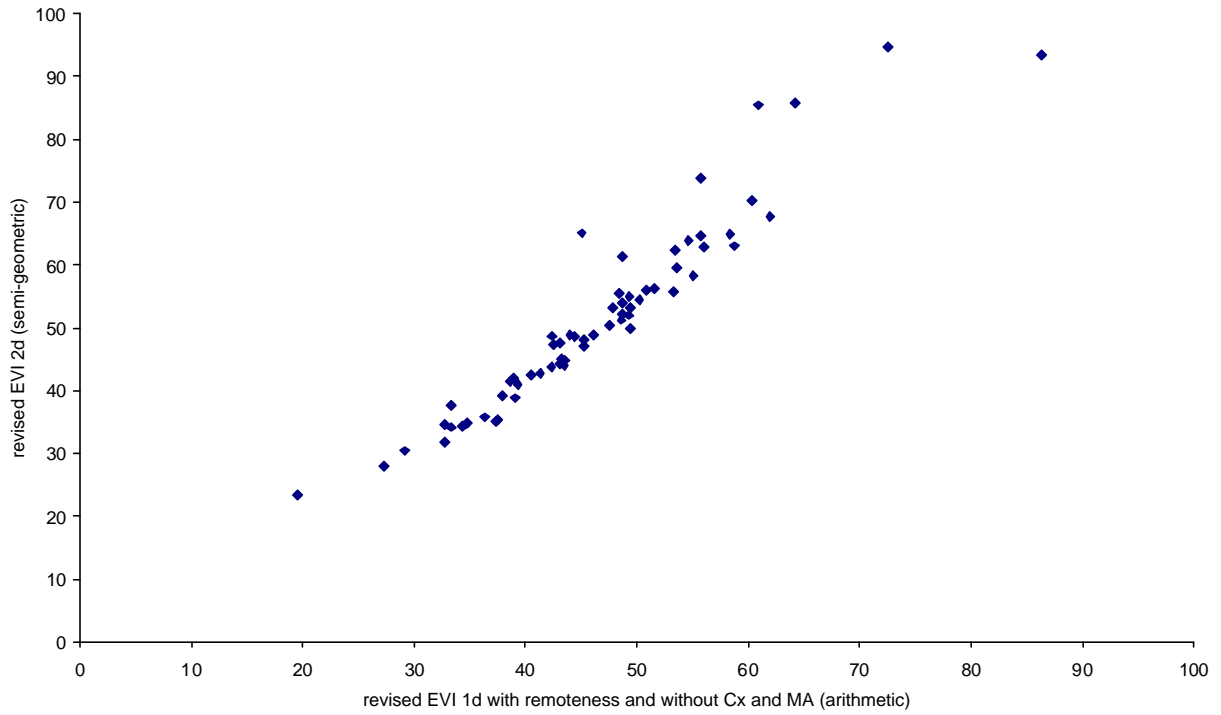
Graph II. Impact of the deletion of export concentration and share of manufacturing
Averages (arithmetic)



Graph III. Impact of remoteness
Averages (arithmetic)



Graph IV. Impact of averaging
Averages



Graph V. Combined impact of several changes (homeless + remoteness - export concentration - share of manufacturing, ... and averaging)

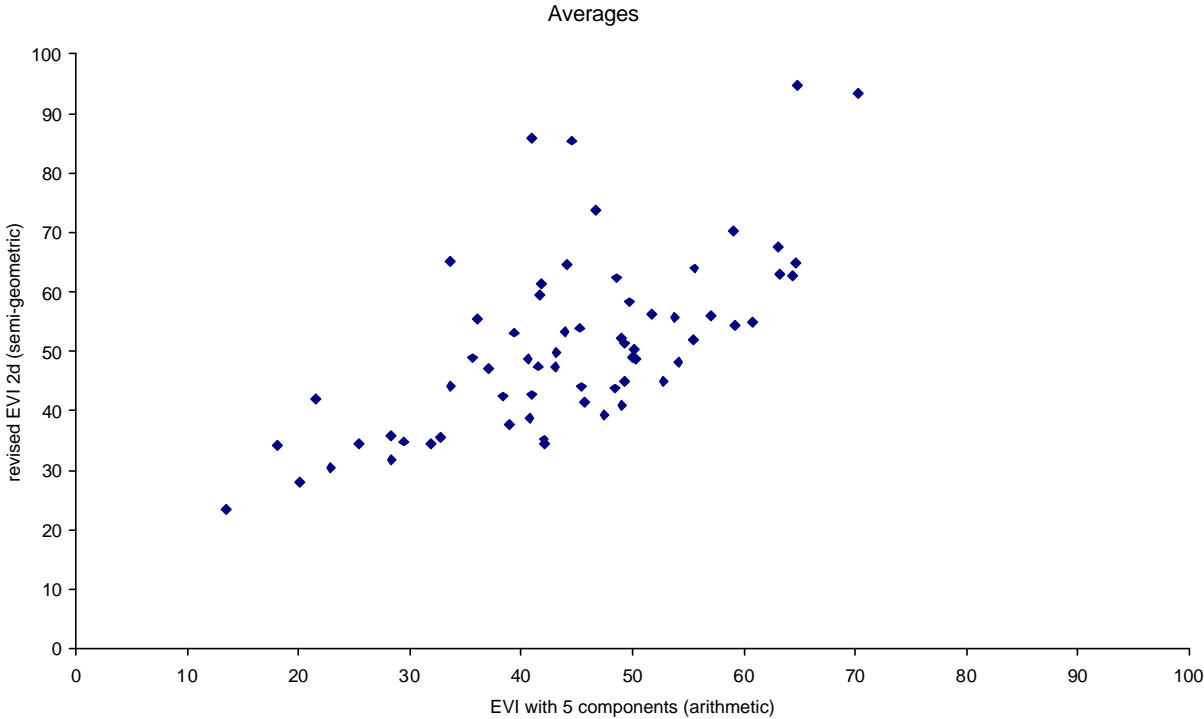


Table 1 EVI: Impact of the composition of the index when EVI is an arithmetic average of its components for 64 LDCs and other low income countries, 2003 data

	1		2		3		4		5		Rank differences			
	Present EVI at 5		Present EVI at 6 (with homeless)		Revised EVI (1a) VII.2bis col 3		Revised EVI (1b) VII.2ter col 3		Revised EVI (1c) VII.2.4 col 1					
	value	rank	value	rank	value	rank	value	rank	value	rank	1-2	2-3	3-5	1-5
Average														
49 LDCs	47.36	36.94	47.02	37.18	44.98	37.39	43.54	36.57	46.83	37.27	4.12	10.04	5.67	9.55
15 other low income	34.04	18.00	35.40	17.20	32.51	16.53	30.86	19.20	35.49	16.93	3.60	5.73	3.33	8.27
64	44.23	32.50	44.30	32.50	42.06	32.50	40.57	32.50	44.17	32.50	4.00	9.03	5.13	9.25
Median														
49 LDCs	46.74	37.00	46.85	38.00	44.65	39.00	42.25	39.00	47.06	40.00	3.00	9.00	5.00	8.00
15 other low income	33.69	13.00	32.21	10.00	31.21	13.00	34.95	20.00	36.56	15.00	3.00	5.00	3.00	3.00
64	44.34	32.50	44.63	32.50	43.03	32.50	39.10	32.50	44.05	32.50	3.00	7.00	4.00	7.00

Table 2.1 EVI: Impact of the way by which components are averaged when EVI is an average of the 6 components of the present EVI for 64 LDCs and other low income countries, 2003 data

	1		2		3		4		Rank differences				
	arithmetic		geometric		arithmetic of the logs		rank average						
	value	rank	value	rank	value	rank	value	rank	1-2	1-3	1-4	2-3	
Average													
49 LDCs	56.44	37.29	71.00	36.31	29.16	37.16	59.19	36.84	8.65	5.92	4.80	5.10	
15 other low income	41.25	16.87	51.73	18.20	18.18	17.27	83.51	18.07	4.27	5.07	3.07	2.93	
64	52.88	32.50	66.48	32.06	26.59	32.50	64.89	32.44	7.63	5.72	4.39	4.59	
Median													
49 LDCs	56.21	38.00	68.53	37.00	27.66	37.00	57.33	38.00	5.00	4.00	5.00	5.00	
15 other low income	39.32	12.00	44.54	10.00	15.50	12.00	93.33	10.00	2.00	3.00	2.00	2.00	
64	55.45	32.50	66.08	32.50	26.14	32.50	63.33	32.50	4.00	4.00	4.00	4.00	

Table 2.2 EVI: Impact of the way by which components are averaged when EVI is an average of the 6 components of the revised EVI (b) for 64 LDCs and other low income countries, 2003 data

	1		2		3		4		Rank differences				
	arithmetic		semi-geometric		arithmetic of the logs		rank average						
	value	rank	value	rank	value	rank	value	rank	1-2	1-3	1-4	2-3	
Average													
49 LDCs	43.54	36.57	50.25	36.86	34.70	36.73	64.10	36.61	6.20	7.31	4.57	2.61	
15 other low income	30.86	19.20	30.16	18.07	18.30	18.67	90.03	18.87	4.07	6.67	4.87	3.67	
64	40.57	32.50	45.54	32.45	30.85	32.50	70.18	32.45	5.70	7.16	4.64	2.86	
Median													
49 LDCs	42.25	39.00	45.55	38.00	30.30	37.00	63.17	38.00	5.00	6.00	4.00	2.00	
15 other low income	34.95	20.00	29.60	15.00	16.85	15.00	84.67	17.00	3.00	5.00	2.00	3.00	
64	39.10	32.50	41.21	32.50	28.08	32.50	69.42	32.50	4.00	5.50	3.50	2.00	

Table 2.3 EVI: Impact of the way by which components are averaged when EVI is an average of the components of the revised EVI (c) for 64 LDCs and other low income countries, 2003 data

	1		2		3		Rank differences		
	arithmetic		semi-geometric		arithmetic of the logs				
	value	rank	value	rank	value	rank	1-2	1-3	2-3
Average									
49 LDCs	46.83	37.27	51.14	37.43	38.27	36.78	4.04	6.12	3.76
15 other low income	35.49	16.93	36.74	16.40	26.92	18.53	1.73	4.00	3.73
64	44.17	32.50	47.76	32.50	35.61	32.50	3.50	5.63	3.75
Median									
49 LDCs	47.06	40.00	52.85	40.00	36.45	40.00	3.00	5.00	3.00
15 other low income	36.56	15.00	35.53	11.00	27.88	18.00	1.00	3.00	2.00