

Detailed Methodology

Every number used is transformed into an index ranging from 0 to 1 using the following formula for the variable x :

$$i(x) = \frac{x - \min(x)}{\max(x) - \min(x)}$$

For variables evolving along an exponential pattern (such as GDP or number of patents), the formula used is:

$$i(x) = \frac{\ln x - \ln \min(x)}{\ln \max(x) - \ln \min(x)}$$

The numbers used in the following formulas are not the raw variables, but the corresponding indexes.

I- Quality of Life Index (QLI):

$$QLI = 0.2 \cdot HI + 0.2 \cdot EdI + 0.2 \cdot WI + 0.15 \cdot DeI + 0.15 \cdot PI + 0.1 \cdot EnI$$

where

HI: Health Index

EdI: Education Index

WI: Wealth Index

DeI: Democracy Index

PI: Peace Index

EnI: Environment Index

1) Health Index:

For countries surveyed in mortality amenable to health care by the Commonwealth Fund:

$$HI = \left(\frac{1}{2}LE + \frac{1}{2}(1 - AM) \right) \cdot AH$$

For other countries:

$$HI = \left(\frac{1}{2}LE + \frac{1}{2}(1 - IM) \right) \cdot AH$$

where

LE: life expectancy at birth

AM: mortality amenable to health care

IM: adjusted infant mortality

AH: access to health care (index ranging from 0.9 to 1)

2) Education Index:

For countries surveyed by PISA:

$$EdI = \sqrt{\left(\frac{2}{3}LR + \frac{1}{3}SLE \right) \cdot \left(\frac{1}{2} + \frac{1}{2}PISA \right)}$$

For other countries:

$$EdI = \left(\frac{2}{3}LR + \frac{1}{3}SLE \right)_{\text{adjusted}}$$

where

LR: adult literacy rate

SLE: school life expectancy

PISA: results of the Programme for International Student Assessment, each subject weighed 1/3

3) Wealth Index:

$$WI = 2 \cdot GDPpc \cdot \left(1 - \left(\frac{1}{2} \right)^{\frac{1-Gini}{1+Gini}} \right)$$

(median value of the Lorenz curve according to the Pareto distribution)

where

GDPpc: gross domestic product at purchasing power parity per capita

Gini: Gini coefficient of national income distribution

4) Democracy Index:

$$Del = \frac{2}{5}(1 - FHpr) + \frac{2}{5}(1 - FHcl) + \frac{1}{5}(1 - FHfp)$$

where

FHpr: Freedom House political rights score

FHcl: Freedom House civil liberties score

FHfp: Freedom House freedom of the press score

5) Peace Index:

$$PI = 1 - GPI$$

where

GPI: Global Peace Index

6) Environment Index:

$$EnI = EPI$$

where

EPI = Environmental Performance Index

II- National Power Index (NPI):

$$NPI = 0.35 \cdot Ecl + 0.35 \cdot MI + 0.1 \cdot DiI + 0.1 \cdot TI + 0.1 \cdot Pol$$

where

Ecl: Economy Index

MI: Military Index

DI: Diplomacy Index

TI: Technology Index

PoI: Popularity Index

1) Economy Index:

$$Ecl = 0.5 \cdot GDP + 0.4 \cdot \sqrt{GDP \cdot \left(\frac{1}{2}CAB + \frac{1}{2}PF\right)} + 0.1 \cdot NC$$

where

GDP: gross domestic product

CAB: current account balance

PF: effort needed to balance the government budget and reimburse the government debt over a 10 year period, as percentage of government revenue

NC: number of Fortune Global 500 corporations

2) Military Index:

$$MI = \frac{1}{2} \cdot MPP \cdot DI + \frac{1}{2} (NS + (1 - NS) \cdot DI)$$

where

MPP: military power projection

DI: Defense Index

NS: nuclear security

a. military power projection

$$MPP = 0.7 + 0.3 \cdot \left(\frac{1}{4}CG + 0.09 \cdot OT + 0.06 \cdot OB\right) \cdot (0.7 + 0.3 \cdot CG)$$

where

CG: logistical capability for long distance military deployment, including an aircraft carrier battle group (takes the value 0 or 1)

OT: number of continents and oceans directly accessible through the territory

OB: number of additional continents and oceans directly accessible through military bases on foreign soil

b. Defense Index

$$DI = \frac{1}{3}MP + \frac{2}{3}MS$$

where

MP: manpower fit for military service

MS: military expenditures

c. nuclear security

$$NS = NP \cdot NI$$

where

NP: extent of nuclear protection (index ranging from 0 to 1)

NI: independence of nuclear strike force from foreign powers (index ranging from 0.2 to 1)

3) Diplomacy Index

$$DI = \frac{1}{3}UN + \frac{1}{3}SC + \frac{1}{3} \cdot \left(\frac{2}{3}DC + \frac{1}{3}DM \right)$$

where

UN: United Nations membership (takes the value 0 or 1)

SC: permanent United Nations Security Council membership (takes the value 0 or 1)

DC: number of countries with diplomatic missions

DM: number of diplomatic missions

4) Technology Index:

$$TI = NP + ID$$

where

NP: number of patents in force

ID: number of industrial designs

5) Popularity Index

$$PoI = \frac{1}{2}ODA + \frac{1}{2} \cdot \left(\frac{1}{2} \cdot (1 + PP - PN) \right)$$

where

ODA: official development aid

PP: percentage of “mainly positive” views in the BBC attitudes toward countries poll

PN: percentage of “mainly negative” views in the BBC attitudes toward countries poll

III- Quality and Power Index (QPI):

$$QPI = \sqrt{QLI \cdot NPI}$$

where

QLI: Quality of Life Index

NPI: National Power Index