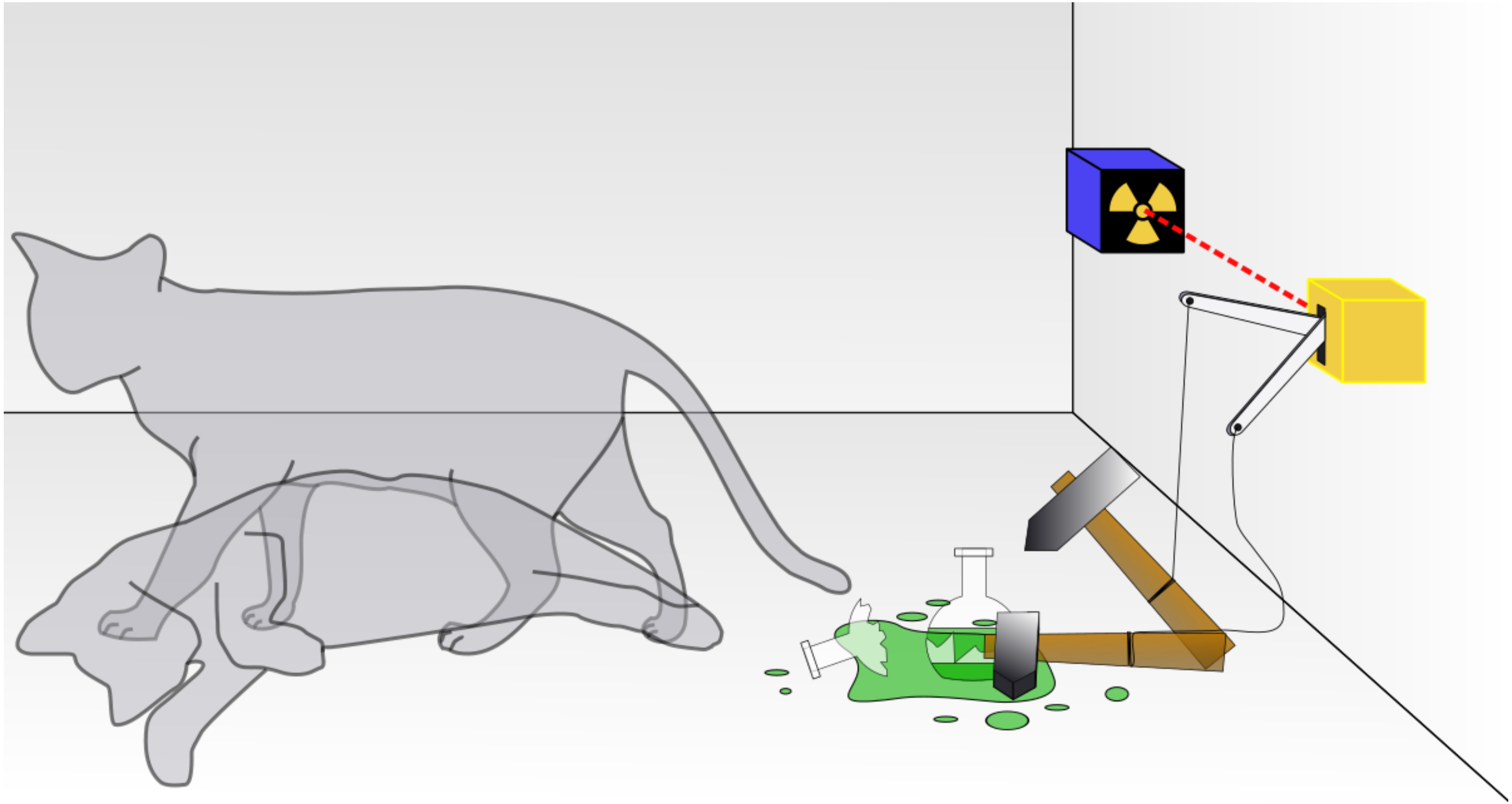
Human Life Indicator: a beautiful but useless innovation

Tel Aviv University, Prof. Isaac Sasson's BMI Demography Lab meeting

Ilya Kashnitsky*, Assist Prof, CPop SDU*

9 May 2022

The current state of this project



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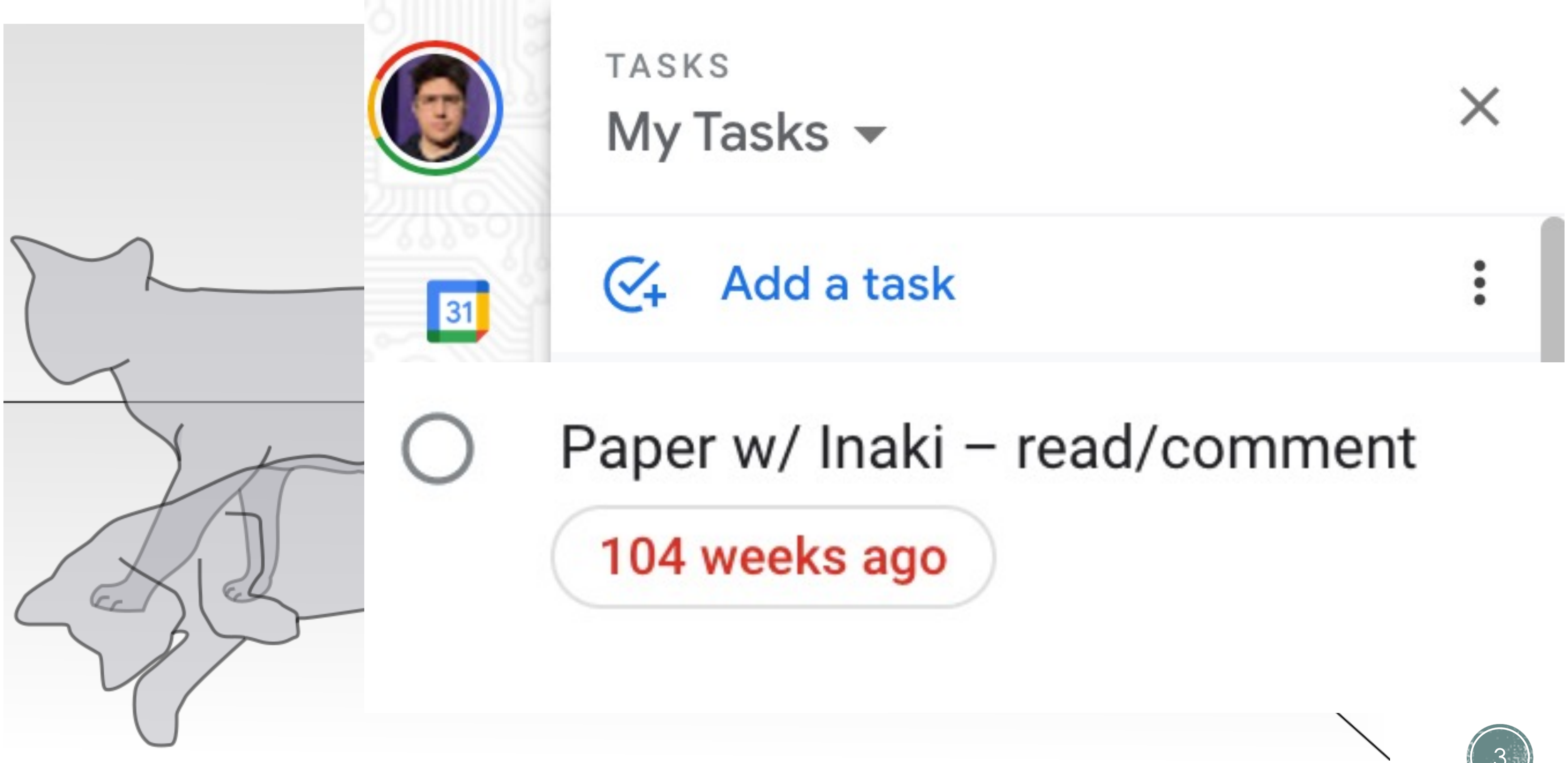

Exciting paper in PDR

DATA AND PERSPECTIVES

A Simple Measure of Human Development: The Human Life Indicator

SIMONE GHISLANDI
WARREN C. SANDERSON
SERGEI SCHERBOV

Ghislandi, S., Sanderson, W. C., & Scherbov, S. (2019). A Simple Measure of Human Development: The Human Life Indicator. *Population and Development Review*, *45*(1), 219–233. https://doi.org/10.1111/padr.12205

Our measure, called the Human Life Indicator (HLI), is the geometric average of those lifetimes:

$$HLI = \prod_{i=1}^{N} (age_i + a_i)^{d_i}$$

where age_i is the age at the lower end of the age interval i in a life table, a_i is the average number of years lived in the interval by those who die in the interval, d_i is the fraction of deaths in age interval i among all deaths, and N is the number of age intervals in the life table.

TABLE 2 Correlations between HLI and HDI and its components

	HLI	HDI	GNI/POP	EYS	MYS
HLI	1.00				
HDI	0.93	1.00			
GNI/POP	0.66	0.74	1.00		
EYS	0.84	0.92	0.63	1.00	
MYS	0.80	0.91	0.59	0.83	1.00

SOURCE: UNDP 2016b.
NOTES: Correlations between the Human Life Indicator (HLI), the Human Development Index (HDI), Gross National Income per capita (GNI/POP), Expected Years of Schooling (EYS), and Mean Years of Schooling (MYS). Based on all countries in the 2014 Human Development Report.

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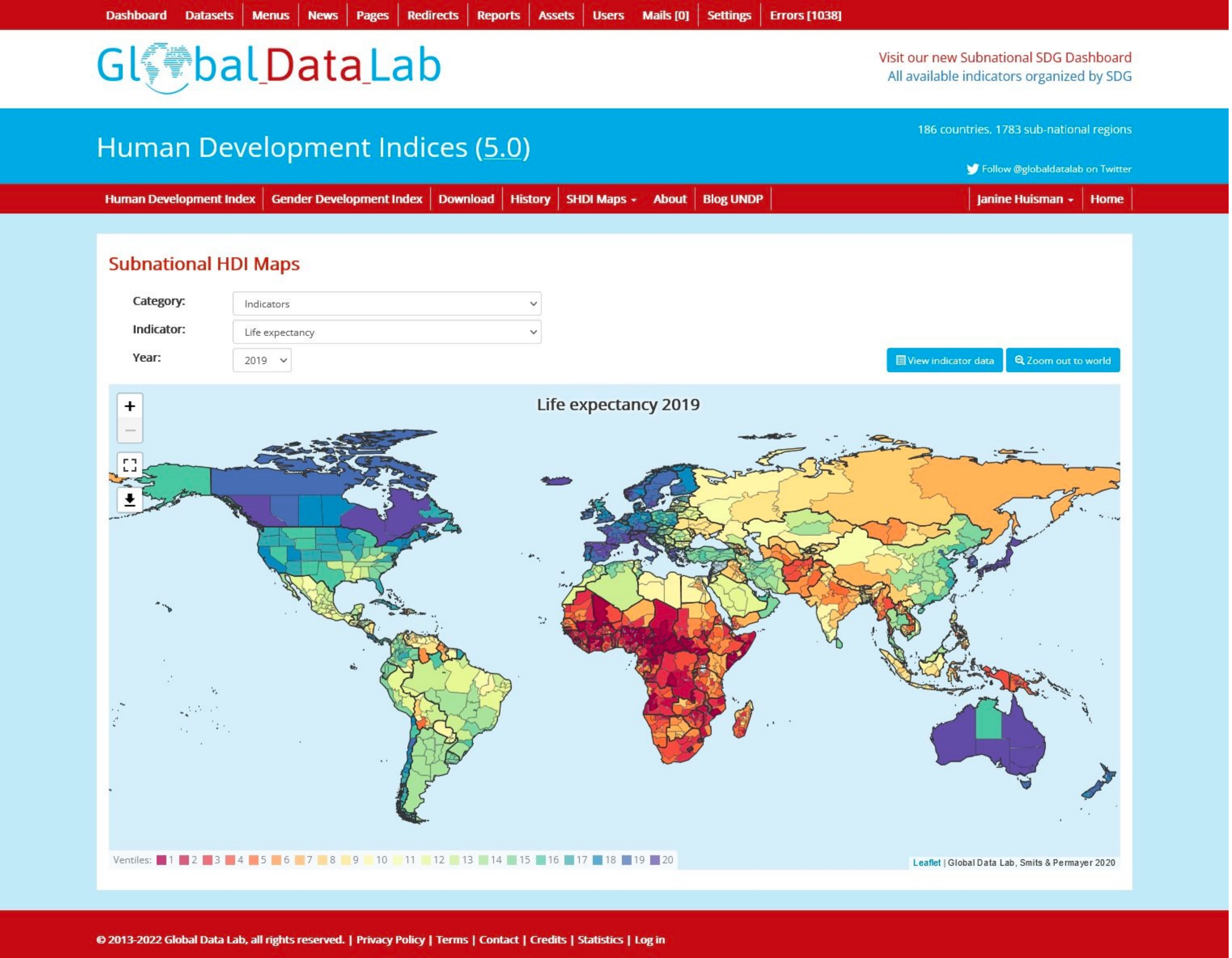
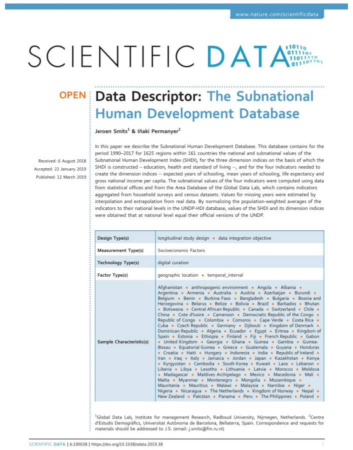
Where's the comparison with simple life expectancy?

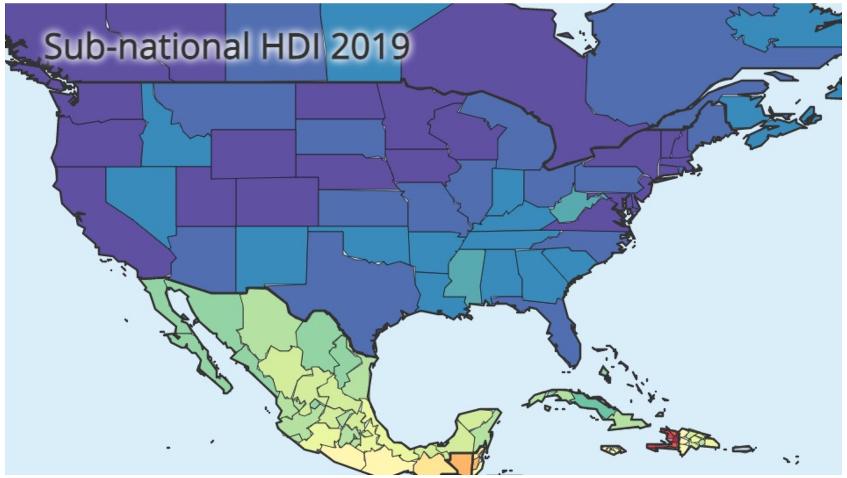
Subnational Human Development Index

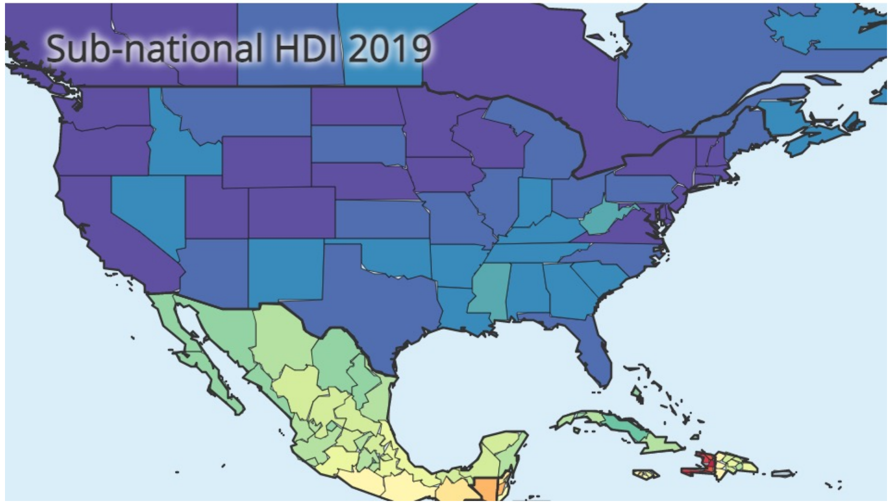


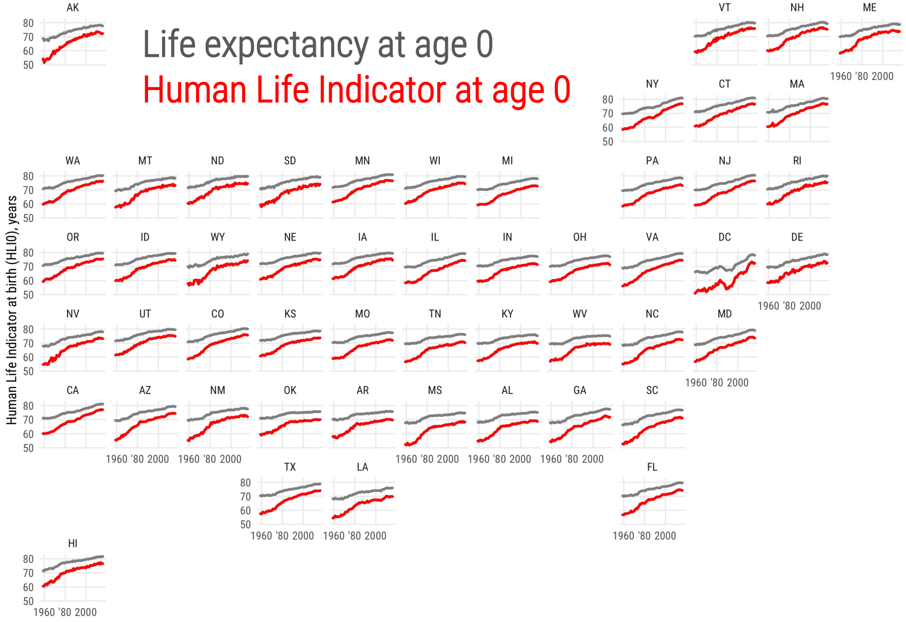

SCIENTIFIC DATA
OPEN Data Descriptor: The Subnational Human Development Database
Jeroen Smits & Iñaki Permanyer

globaldatalab.org/shdi


Life expectancy at age 0
Human Life Indicator at age 0
Human Life Indicator at birth (HLI0), years
AK VT NH ME
NY CT MA
WA MT ND SD MN WI MI PA NJ RI
OR ID WY NE IA IL IN OH VA DC DE
NV UT CO KS MO TN KY WV NC MD
CA AZ NM OK AR MS AL GA SC
TX LA FL
HI
80
70
60
50
1960 '80 2000

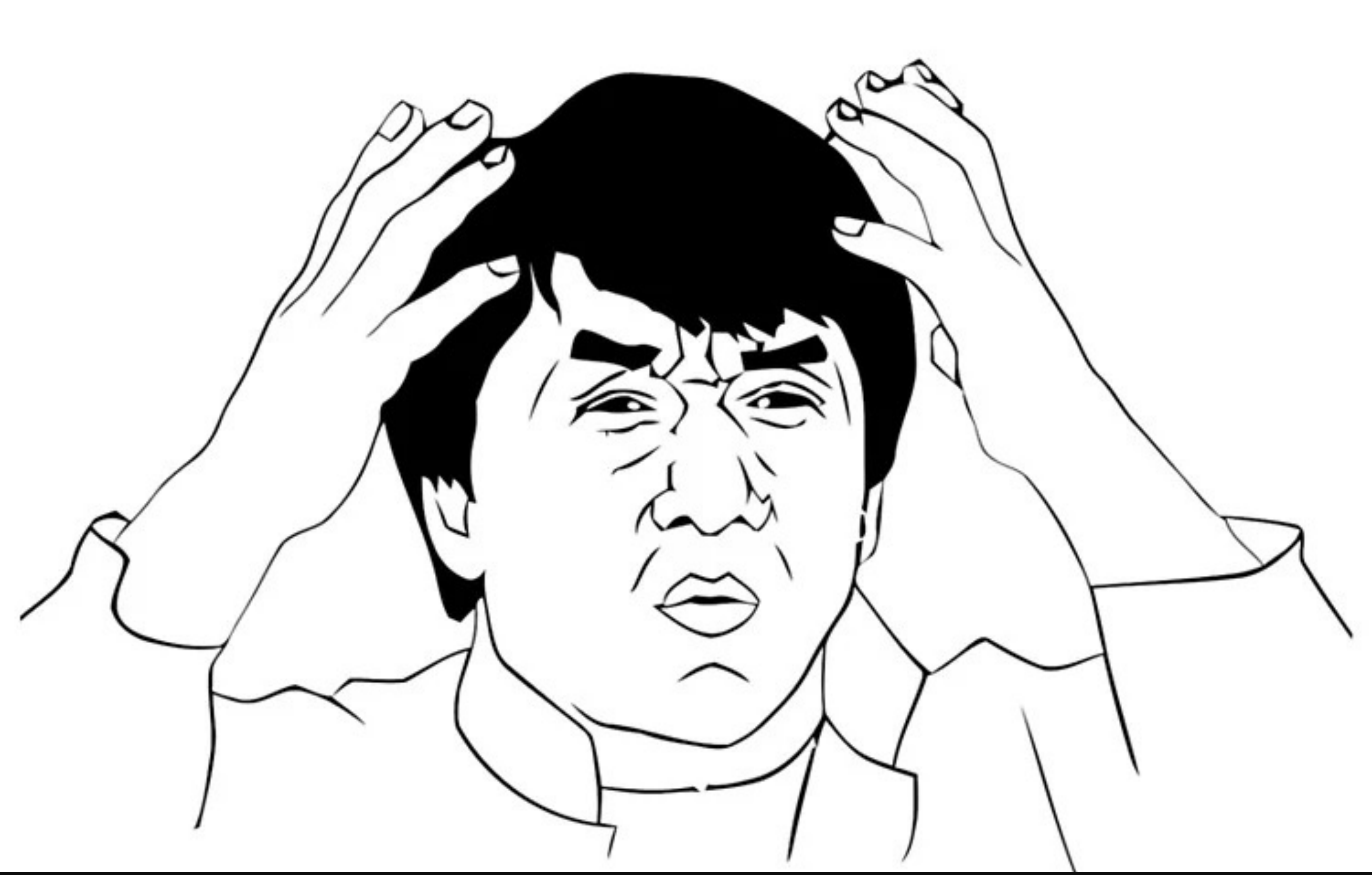

Sub-national HDI 2019





	A	B	C
1	year	cor_hli_shdi	cor_e0_shdi
2	1990	0.691	0.704
3	1991	0.713	0.730
4	1992	0.722	0.718
5	1993	0.735	0.742
6	1994	0.730	0.727
7	1995	0.747	0.740
8	1996	0.739	0.745
9	1997	0.796	0.806
10	1998	0.829	0.822
11	1999	0.809	0.814
12	2000	0.803	0.811
13	2001	0.770	0.800
14	2002	0.831	0.843
15	2003	0.834	0.857
16	2004	0.818	0.856
17	2005	0.867	0.876
18	2006	0.856	0.877
19	2007	0.862	0.875
20	2008	0.851	0.881
21	2009	0.855	0.876
22	2010	0.880	0.887
23	2011	0.878	0.887
24	2012	0.876	0.889
25	2013	0.895	0.901
26	2014	0.883	0.893
27	2015	0.860	0.888
28	2016	0.896	0.896

How is this possible?



Demographic Research: Volume 44, Article 5
Descriptive Finding

A decade of TFR declines suggests no relationship between development and sub-replacement fertility rebounds

Hampton Gray Gaddy[1]

Abstract

BACKGROUND
Human development is historically associated with fertility declines. However, demographic paradigms disagree about whether that relationship should hold at very high levels of development. Using data through the late 2000s, Myrskylä, Kohler, and Billari (2009, 2011) found that very high national levels of the Human Development Index (HDI) were associated with increasing total fertility rates (TFRs), at least at high levels of gender parity.

OBJECTIVE
This paper seeks to update that finding and to introduce the Human Life Indicator (HLI) as a novel measure of development within this debate.

RESULTS
Among the countries that reached HDI 0.8 before 2010 (n = 40), there is no clear relationship between changes in the HDI and the TFR at HDI > 0.8 through 2018. Conditioning on high levels of gender parity does not change this finding. This negative result is closely tied to the sharp declines in fertility seen in most highly developed countries since 2010 – a median decline of 0.125 in tempo-adjusted TFR through the most recent available year (n = 23). Furthermore, the longer historical coverage of the HLI shows that at all high levels of development, at least one country has exhibited almost every level of TFR between 1.2 and 2.0.

CONCLUSIONS
Fertility declines over the last decade mean that the previous suggestion that very high levels of development and gender equality foster fertility increases is no longer supported on the national level.

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Demographic Research: Volume 44, Article 5

Furthermore, the HDI formula has been criticised for failing to adequately conceptualise human development itself. It is derived from estimates of life expectancy at birth, educational attainment, and gross national income (GNI) per capita – three variables that are highly correlated with each other. It has also been criticised for containing implicit, perverse trade-offs between these variables. For example, in 2016, Senegal could have kept its HDI constant by increasing its population's mean education by one year but decreasing its GNI per capita by 23.3% (Ghislandi, Sanderson, and Scherbov 2019). The HDI's use of period life expectancy at birth can be criticised on similar grounds, as period life expectancy can stay constant despite growing lifespan inequality (see van Raalte, Sasson, and Martikainen 2018).

For these reasons, this paper adds consideration of the Human Life Indicator (HLI) as an alternative measure of development (Ghislandi, Sanderson, and Scherbov 2019). Whereas life expectancy at birth is the arithmetic mean of the period life table age-at-death distribution, the HLI is its geometric mean. Therefore, the HLI is closely related to population longevity, but it contains a penalty for populations with high degrees of lifespan inequality. As such, the HLI contains none of the trade-offs, somewhat arbitrary caps, and highly correlated components of the HDI. It can also be easily calculated over long periods of time, given the availability of historical life tables, and it recognises the longstanding observation that the combined length and equality of life is a fundamental measure of population wellbeing (Sen 1998; Edwards and Tuljapurkar 2005; Peltzman 2009).

doi.org/10.4054/DemRes.2021.44.5

EUROPEAN POPULATION CONFERENCE 2020

PADOVA, ITALY

24-27 June, 2020

Equality-Efficiency Tradeoffs in Population Health

Iñaki Permanyer, *Centre for Demographic Studies and ICREA*
Ilya Kashnitsky ★, *Interdisciplinary Centre On Population Dynamics, University Of Southern Denmark*

While there is widespread agreement that increasing the average length of life in a population is a major social achievement, equity concerns have surfaced in the academic and policy-making arenas. Indeed, whenever general improvements are shared inequitably and benefit some groups to the detriment of others, it is difficult to speak about unequivocal social progress. This is why the recent years have witnessed a surge in interest for the study of lifespan inequality and its implications for the implementation of fair and well-informed population health policies. In this paper, we present novel methods to assess how ‘efficiency’ (i.e. overall/mean attainment) and ‘inequality’ contribute to the overall health performance of societies. Such methods allow investigating whether, and to what extent, the improvements or deteriorations we observe in population health can be attributable to changes in the average number of years individuals are expected to live (i.e. ‘efficiency’) or to the way in which those years of life are distributed across individuals (i.e. ‘inequality’). Using data from the Human Mortality Database, we identify those countries and years where the principles of ‘more efficiency’ and ‘less inequality’ go in the same or in opposite directions to identify potential tradeoffs between the two dimensions of health.

See extended abstract

epc2020.popconf.org/abstracts/200855

In order to measure the *overall health performance* of a given society, we use the following index derived from standard life tables

$$H_\varepsilon := \begin{cases} \left(\sum_i d_i (age_i + a_i)^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}} & if\ \varepsilon \neq 1 \\ \prod_i (age_i + a_i)^{d_i} & if\ \varepsilon = 1 \end{cases} \qquad [1]$$

where age_i is the age at the lower end of the age interval i in a life table, a_i is the average number of years lived in the interval by those who die in the interval, d_i is the fraction of deaths in interval i, and $\varepsilon \geq 0$ is the so-called 'inequality aversion parameter'. H_ε is an inequality-adjusted measure of average length of life, that is: it measures the average length of life penalizing those distributions that have a relatively high variation in the length of lives. When $\varepsilon = 0$, there is no aversion to inequality, and H_0 reduces to the arithmetic mean, which corresponds to the standard life expectancy at birth. When $\varepsilon = 1$, H_1 is the geometric mean of the age-at-death distribution (which coincides with the 'Human Life Indicator' (HLI) recently proposed by Ghislandi et al 2019), and when $\varepsilon = 2$, H_2

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corresponds to the harmonic mean. In general, the higher the value of ε, the higher the aversion to inequality and the larger the corresponding correction for inequality. Following Atkinson (1970), one has that

$$H_\varepsilon = f(e_0, I_\varepsilon) := e_0(1 - I_\varepsilon) \qquad [2]$$

where e_0 is the arithmetic mean of the age-at-death distribution (i.e. $e_0 = H_0$) and I_ε is the Atkinson index of (lifespan) inequality, which is defined as

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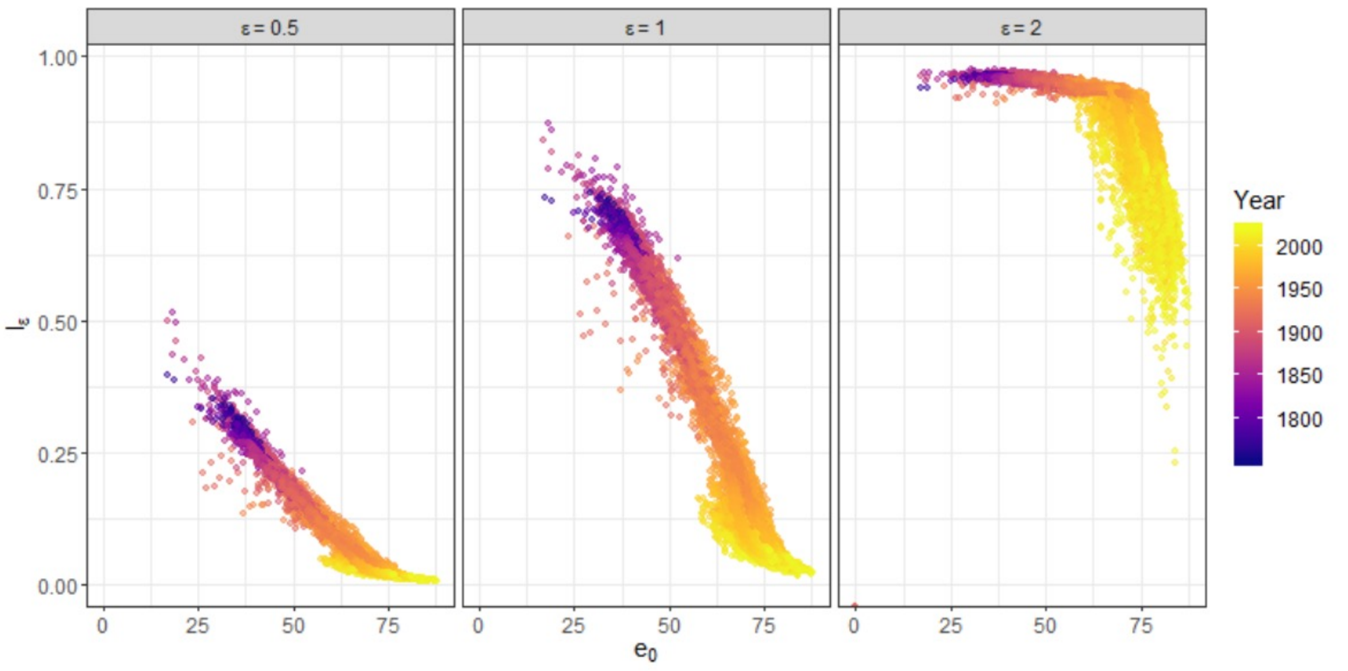

Fig 1. Efficiency (e_0) by inequality (I_ε) over time for values of $\varepsilon = 0.5, 1, 2$. Source: Own elaboration based on HMD data.

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Thank you!

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nature

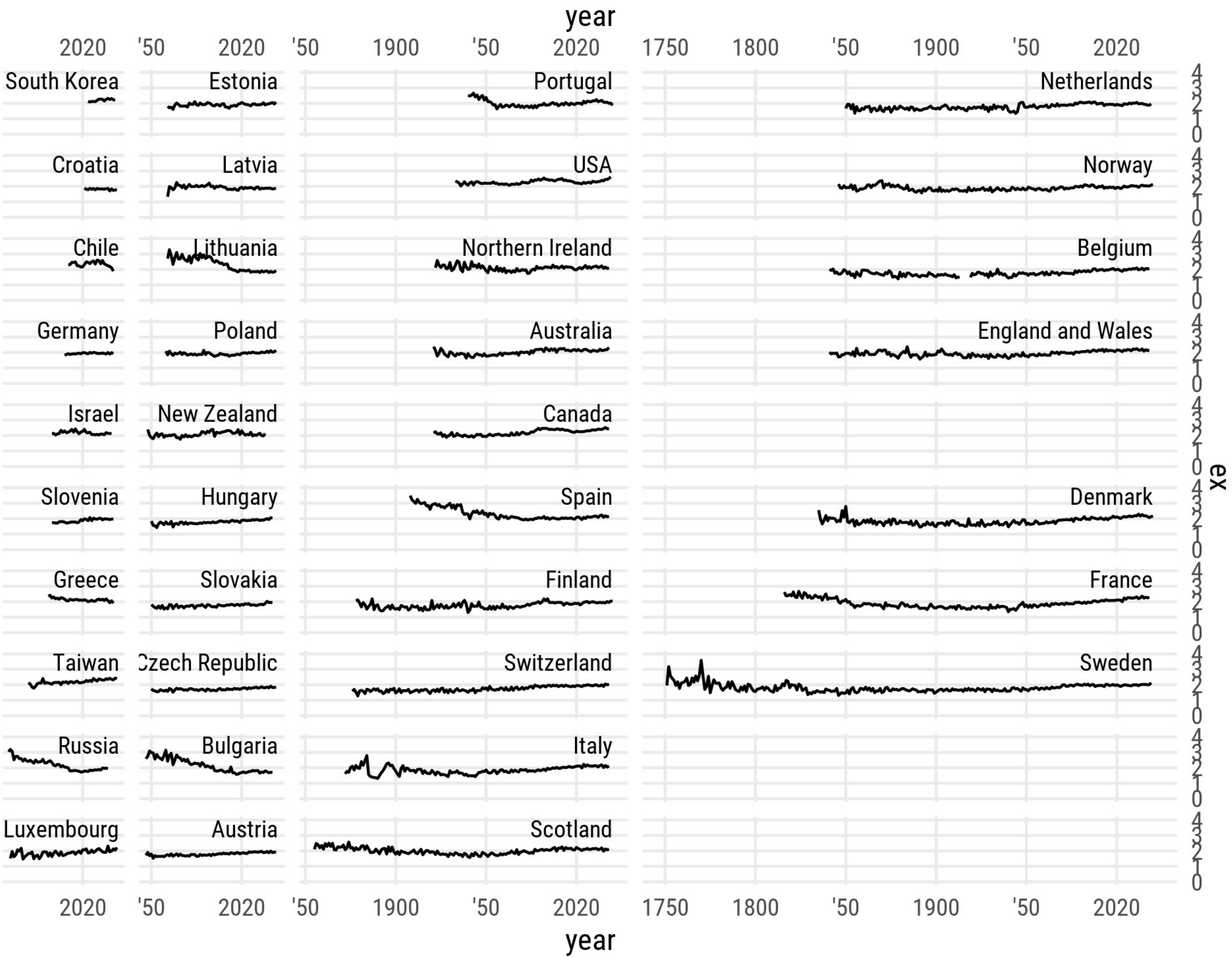
OUTLOOK | 19 January 2022

Does the human lifespan have a limit?

Super-centenarians offer clues as demographers and scientists lock horns over one of the world's oldest research questions.

Michael Eisenstein

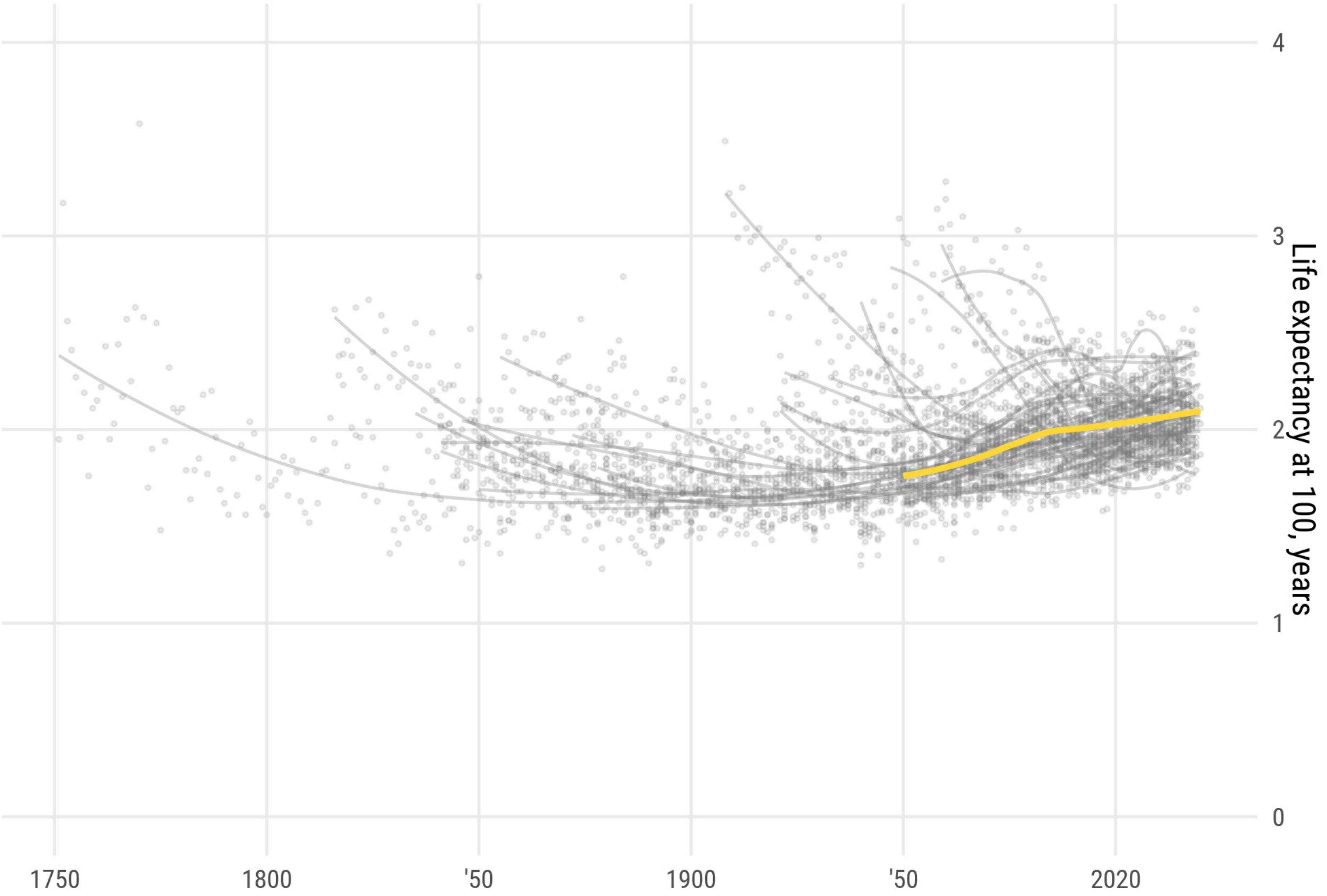
But he points out there is robust evidence that we might be experiencing a phenomenon known as compression of mortality, in which populations are generally surviving to older ages without meaningfully pushing the outer limits of longevity. Gavrilov sees a similar pattern. “You have much better survival to age 100,” he says, “but the remaining life expectancy at age 100 is the same, with no documented progress in the last 80 years.” In other words, the exceptionally elderly are still at the mercy of nature’s coin toss.



year
South Korea
Estonia
Portugal
Netherlands
Croatia
Latvia
USA
Norway
Chile
Lithuania
Northern Ireland
Belgium
Germany
Poland
Australia
England and Wales
Israel
New Zealand
Canada
Slovenia
Hungary
Spain
Denmark
Greece
Slovakia
Finland
France
Taiwan
Czech Republic
Switzerland
Sweden
Russia
Bulgaria
Italy
Luxembourg
Austria
Scotland
2020 '50 2020 '50 1900 '50 2020 1750 1800 '50 1900 '50 2020
0 1 2 3 4
ex

Period life expectancy at age 100

Yellow line is a LOESS smoother from 1950 through countries with at least 100 years of observation. Data: HMD



Period life table probability of reaching age 100