Jean Laherrere 18 Sept 2020

In 2021, 68% of the world is going into extinction

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-Introduction

The UN World population prospects 2022 reports:

Two-thirds of all people globally live in a country or area where fertility is below 2.1 births per woman, which is roughly the level required for populations with low mortality to stabilize in the long run. In 2021, the average global fertility rate stood at 2.3 births per woman, falling from about 5 births per woman in the mid-twentieth century (figure II.1, Panel A). According to the assumptions about future fertility made in the United Nations projections (box III.1), by 2050, the average global fertility rate is expected to have declined to 2.1. To be more precise, with a probability of 95 per cent, global total fertility in 2050 is expected to lie between 1.88 and 2.42 births per woman (figure II. 1, shaded area around the projected trend).

Being below 2.1 births per woman is not the way "to stabilize in the long run" "with high mortality": it is going towards extinction. In the medium fertility UN2022 scenario, world fertility will be below 2.1 beyond 2060, being 1.8 in 2100. When the fertility reaches 2.1, it continues to fall.

In 2021, it means that two thirds of the world population are going into extinction: Europe and North America (1.5), Eastern and south-eastern Asia (1.5), Latin America and the Caribbean (1.9)

World Population Prospects 2022: Summary of Results

Table II.1

Total fertility for the world, SDG regions and selected groups of countries, 1990, 2021 and 2050 according to the medium scenario

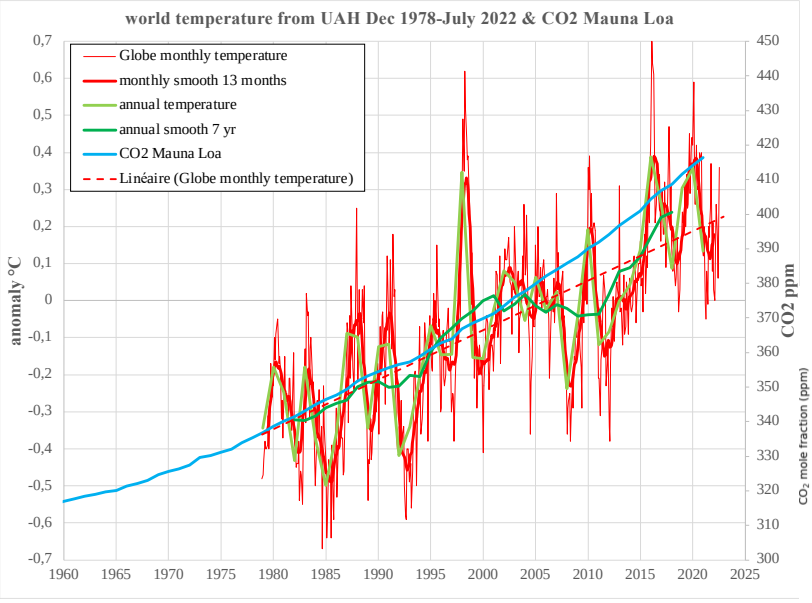
Region	Average number of births per woman		
	1990	2021	2050
World	**3.3**	**2.3**	**2.1**
Sub-Saharan Africa	6.3	4.6	3.0
Northern Africa and Western Asia	4.4	2.8	2.2
Central and Southern Asia	4.3	2.3	1.9
Eastern and South-Eastern Asia	2.6	1.5	1.6
Latin America and the Caribbean	3.3	1.9	1.7
Australia/New Zealand	1.9	2.6	1.7
Oceania*	4.7	3.1	2.4
Europe and Northern America	1.8	1.5	1.6
Least developed countries	6.0	4.0	2.8
Landlocked developing countries	5.7	4.0	2.7
Small island developing States	3.3	2.3	2.0

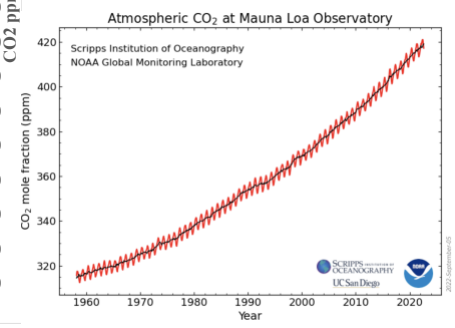
*excluding Australia and New Zealand

But Sub Saharan Africa young people (fertility 4.6) are moving to Europe (fertility 1.5): it is a law of Nature! Flow goes to empty places: it is called by some the Great Replacement

In France INED https://www.ined.fr/en/everything_about_population/demographic-facts-sheets/focus-on/world-population-prospects-2022/
Today, two-thirds of the world population live in a country or area where fertility is below 2.1 births per woman. In 2021, average fertility remained above that level in sub-Saharan Africa (at 4.6 children), Oceania, not including Australia and New Zealand (3.1), North Africa and Western Asia (2.8), and Central and Southern Asia (2.3).

But the media did not mention this important fact on population, too worried with the climate change, saying that the world temperature is worsening lately, when the world temperature measured monthly by satellite (UAH) is in July 2022 below the last peaks of El Nino 1988 & 2016. Today the world temperature is on decline, when CO2 concentration at Mauna Loa is increasing

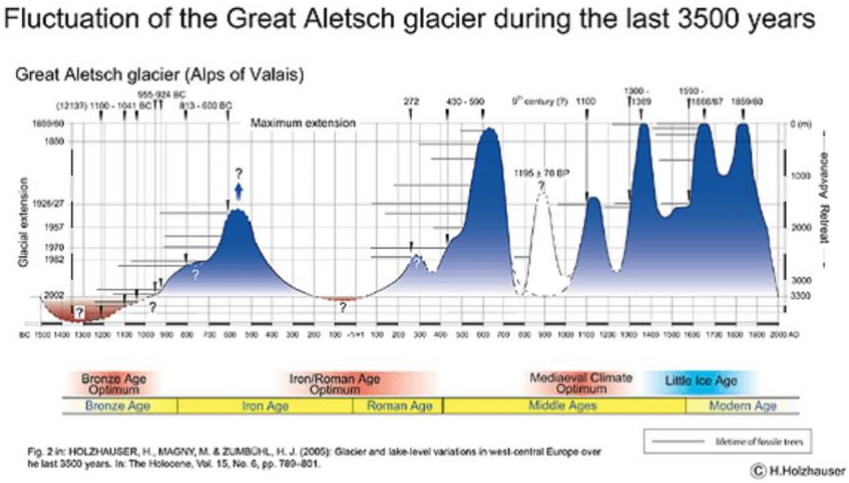




The annual correlation temperature (green) and CO2 (blue) looks good from 1980 to 2005, but poor from 2005 to 2015 where temperature was flat and below CO2, as if temperature should have been higher assuming that it follows CO2

This graph wonders about the IPCC claim that temperature is caused by CO2.
On Vostok, Caillon et al (including Jouzel) 2003 "Timing of atmospheric CO2 and Antarctic temperature changes across termination III" https://www.science.org/doi/10.1126/science.1078758 conclude that CO2 is caused by temperature during 240 000 years

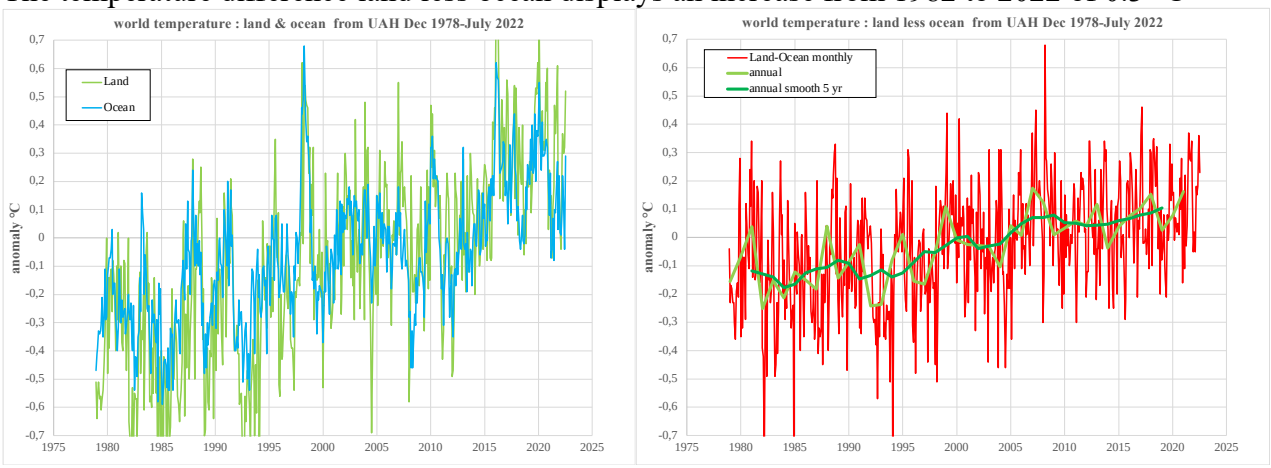
Temperature was warmer during the Bronze age and the Middle age as shown by the largest Alps glacier Aletsch



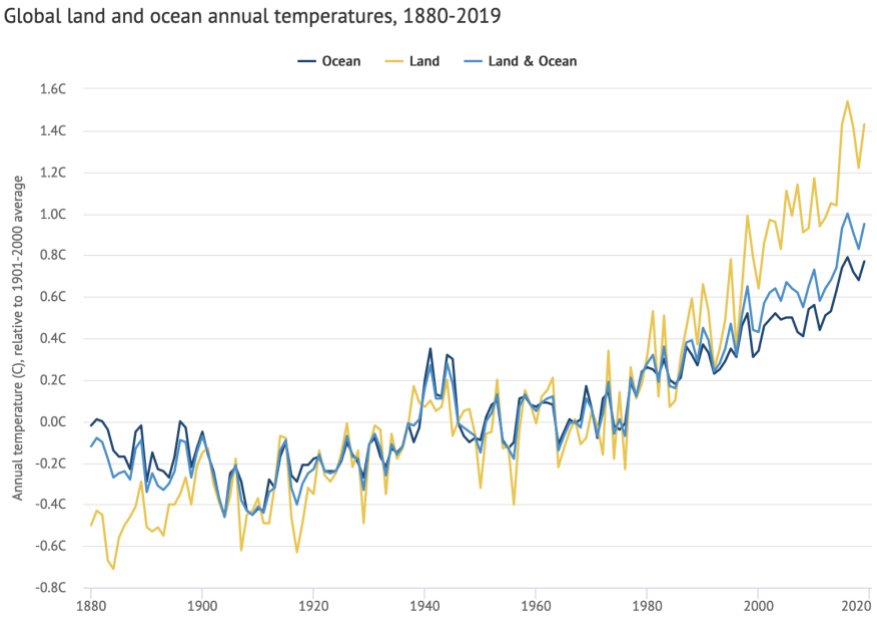
Item 1: Aletsch curve.

Climate has always changed and speaking about climate imbalance ignores that the rule of climate is to change. Since 11 000 years we are in a interglacial period and soon in geological term a new glaciation will return
Those who believe that reducing the CO2 anthropic emissions will reduce in the future the present warming risk in the medium term to be dissapointed. he capture and storage of carbon need too much energy to be feasable.

The 7 years smoothed annual world temperature increases since 1980 to 2000, is about flat 2000-2010, increases until 2016 and almost flat up to now
UAH reports for the world land and ocean and lately land is warmer than ocean
The temperature difference land less ocean displays an increase from 1982 to 2022 of 0.3 °C



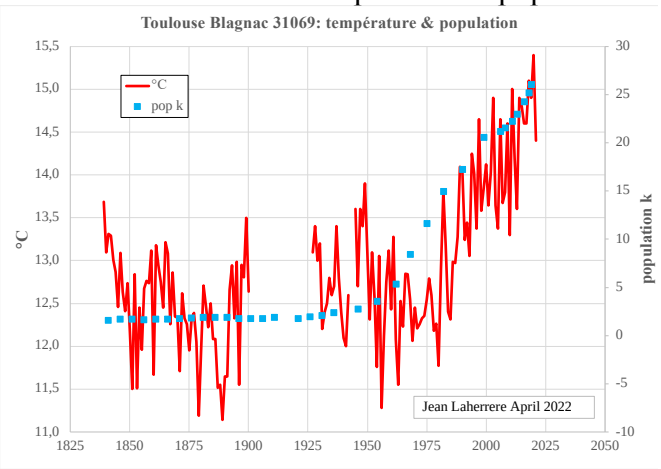
The last IPCC AR6 reports do not discuss such phenomena!
Dr Byrne in 2020 displays this graph 1880-2019 from NOAA data where land temperature increases more than ocean since 1980: the data come from stations and not from satellite
https://www.carbonbrief.org/guest-post-why-does-land-warm-up-faster-than-the-oceans/

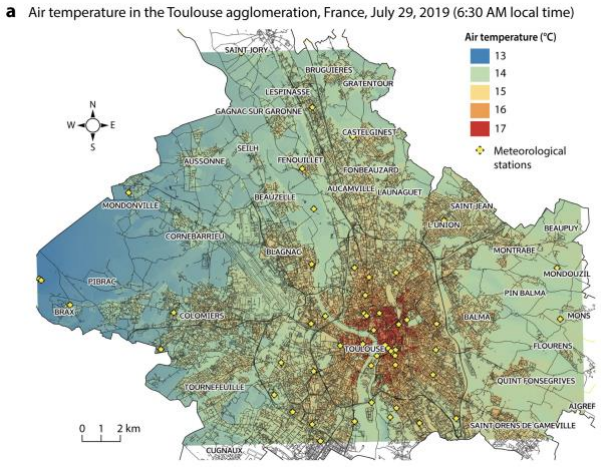


He explains that *the land-ocean warming contrast is driven by dryness rather than differences in heat capacity*.

My guess is that land temperature is warmer since 1980 because of ground artificialization

In my 2022 paper "France et le monde : température, population & SO2" mai https://aspofrance.org/2022/05/30/france-et-le-monde-temperature-population-so2/ I displays several historical temperature data from airports like page 7 Blagnac (Toulouse) where temperature increases since 1980 is compared with population and surface artificialization





Urban Climates and Climate ChangeValéry Masson, Aude Lemonsu, Julia Hidalgo and James Voogt

The UHI (urban heat island) arises mainly because of the artificialization of the surface. During the day, as much as half of the heat coming from the sun is stored in the urban fabric materials (brick, stone, concrete, roads, tiles, etc.).

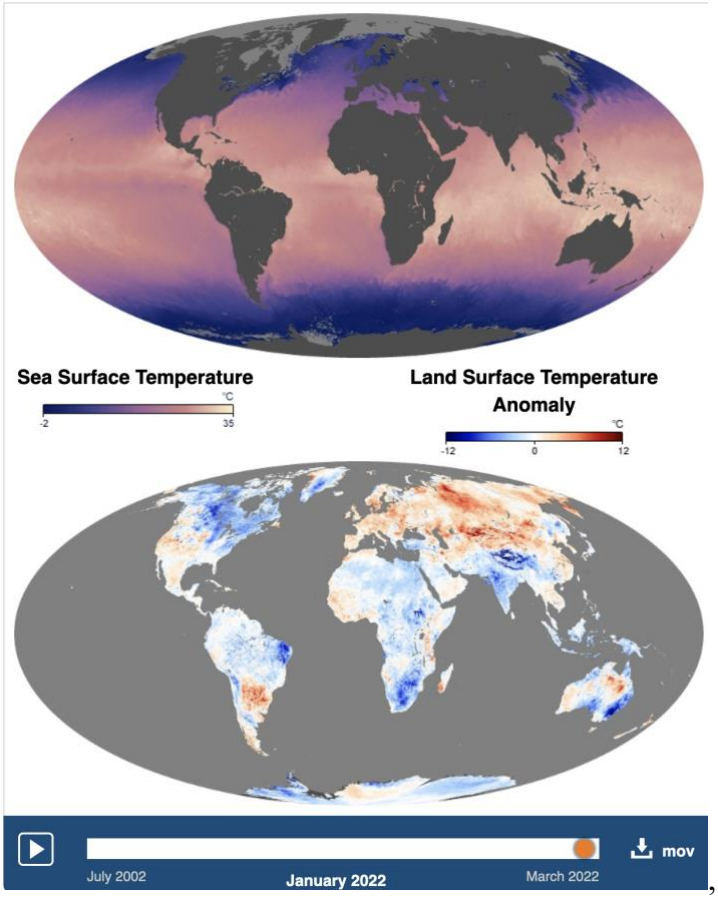
In the temperature map of Toulouse, the temperature of the airport (Blagnac) is at 14°C when the centre of the town is 17°C

In fact, world temperature is correlated with population and ground artificialization

It is likely that ground artificialization (urban warming) is as important as CO2 in the global warming, maybe more.

It could be more important to paint in white the roofs than to reduce CO2 anthropic emissions

The temperature of ocean and land varies a lot as shown for March 2022 by https://earthobservatory.nasa.gov/global-maps/MYD28M/MOD_LSTAD_M



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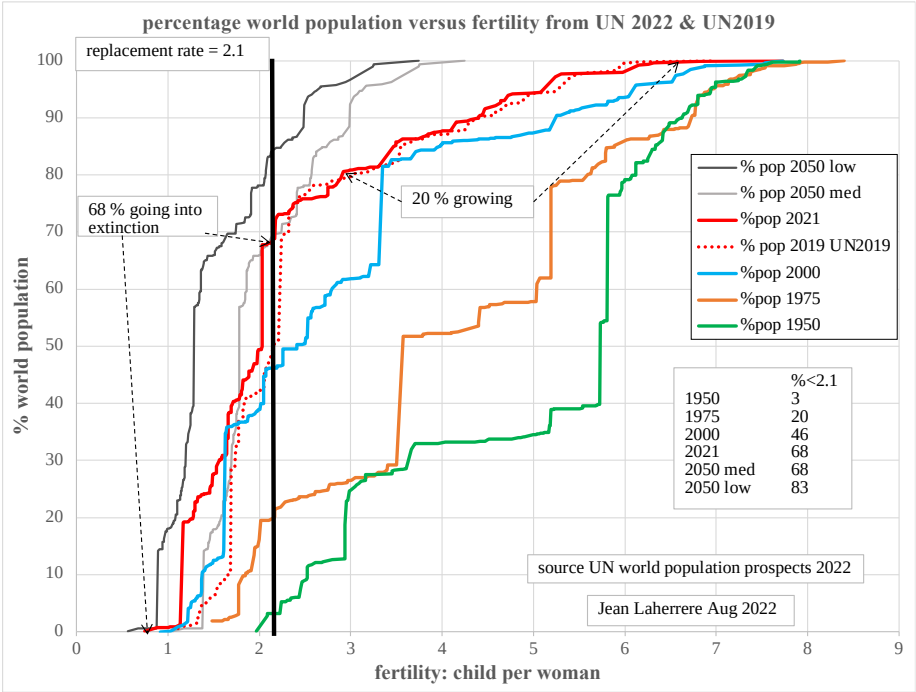
How to correctly sum all these different temperatures to get a reliable global data?
The global temperature is not easy to measure and difficult to compare with time when the number of stations varies with time. It is why satellite data are more reliable but start only since 1979!

-UN2022 World population prospects

Coming back to UN2022 fertility annual country data (from 1950 to 2100) the annual percentage of the world population versus fertility (number of births per woman) is plotted for 1950, 1975, 2000, 2021 as 2050 (medium fertility & low fertility). The replacement rate is given as 2.1 birth per woman
As indicated by UN2022 the percentage in 2021 of being below 2.1 is 68 %, but it is also 68 % in 2050 for the medium scenario which appears to be too optimistic (as it was in UN2019)



The UN2019 data (dotted red) was showing only for 2019 a percentage of 47 %: it appears that the new data displays a much more pessimistic view and this drastic change is ignored by the media

The new data shows that the percentage of the world population below 2.1 has increased from 3 % in 1950 to 68 % in 2021, when only 20% is growing with a fertility above 3 births per woman.

	% <2.1
1950	3
1975	20
2000	46
2021	68
2050 med	68
2050 low	83

UN 2022 scenario of medium fertility is rather utopic giving a percentage of 68% of below 2.1 in 2050 (as in 2021?) when the low fertility scenario gives 83 % This medium fertility scenario hopes that the lowest fertile countries will increase their fertility: it looks utopic!

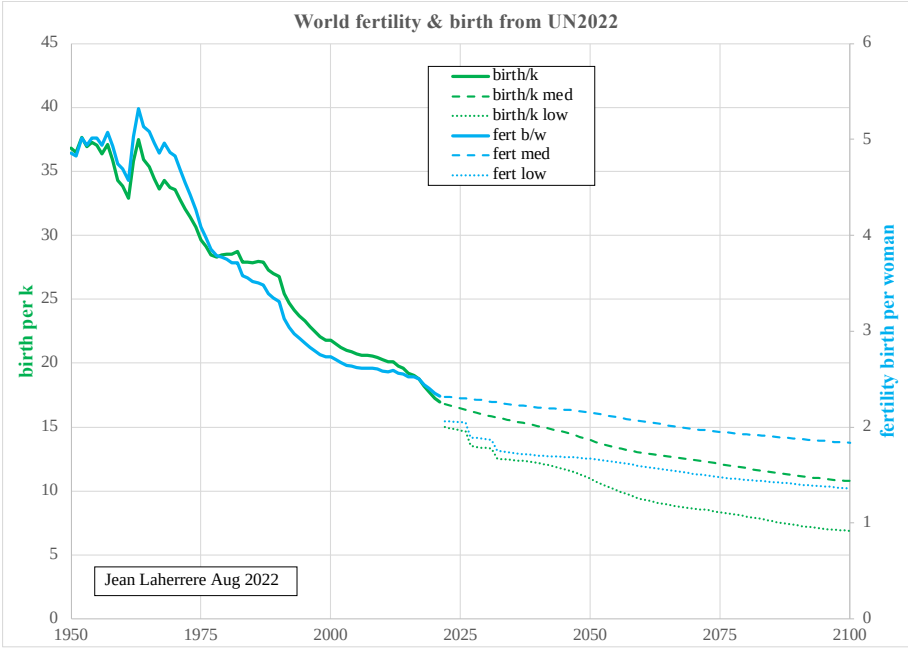
The lowest fertility country was in

1950	Luxembourg	1.97
1975	Germany	1.48
2000	Macao	0.91
2021	Hong Kong	0.74
2050 med	Hong Kong	1.06
2050 low	Hong Kong	0.56

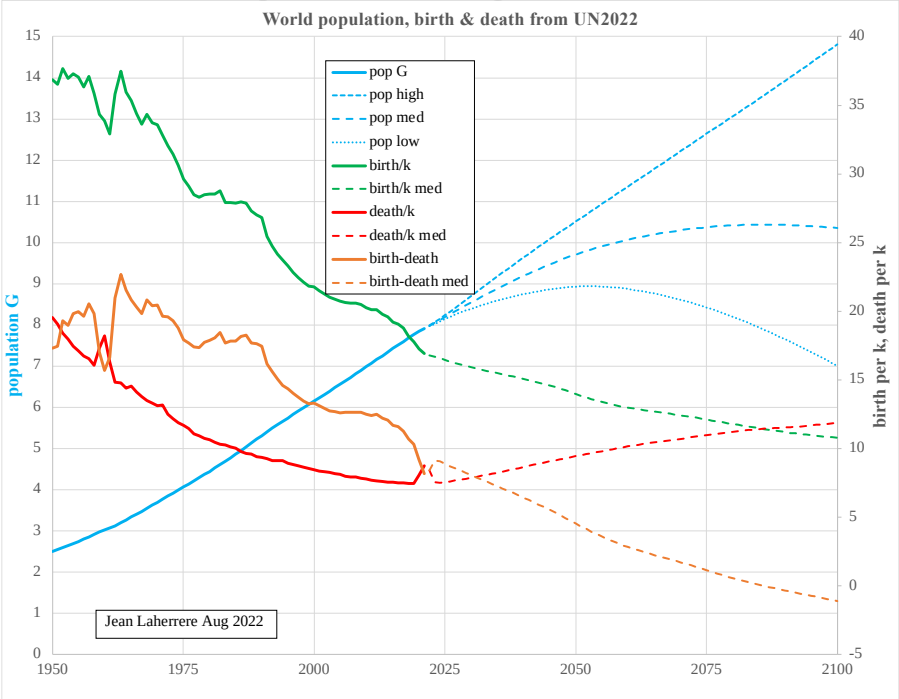
It looks queer to see Hong Kong fertility increasing by 43% from 2021 to 2050!

-World

UN2022 medium fertility scenario is different from the birth per K scenario, being higher because the UN utopic goal of fertility increasing in the developed countries to be closer to the replacement ratio of 2.1, but the medium fertility is more optimistic than the medium birth which is not connected to the utopic replacement ratio to all.



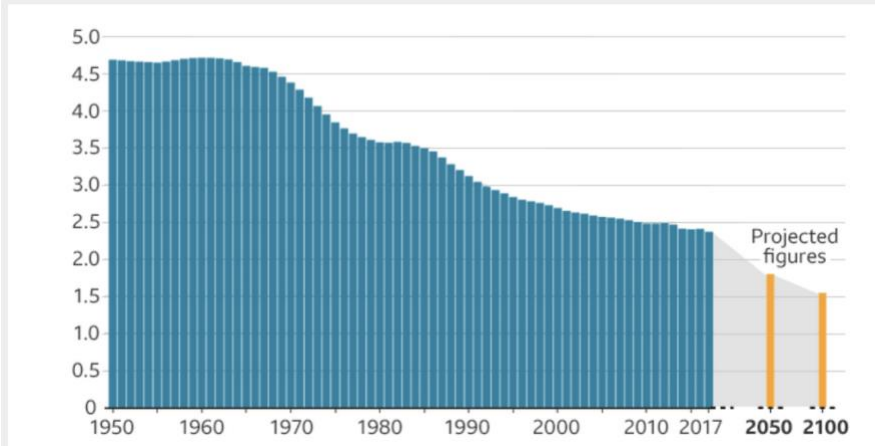
It appears for 2100 that fertility low scenario is close to birth /k medium scenario?
UN 2022 medium scenario is too optimistic according to its own data.



Furthermore, world death is sharply increasing since 2025, making the countries below 2.1 subject to extinction

UN2022 medium fertility forecasts a peak in 2086 at 10.43 G when UN2022 low fertility a peak in 2053 at 8.94 G and UN2022 high fertility no peak before 2100
The range of uncertainty for the world population in 2100 is huge between 7 to 14.8 G, more than the double. It means that no one is able to justify a reliable forecast, it is the same for forecasting the weather beyond 2 weeks, the climate beyond few years, the energy price beyond few months.

A 2020 study 'Dramatic' decline in worldwide total fertility rates predicted
https://www.focusonreproduction.eu/article/News-in-Reproduction-Population

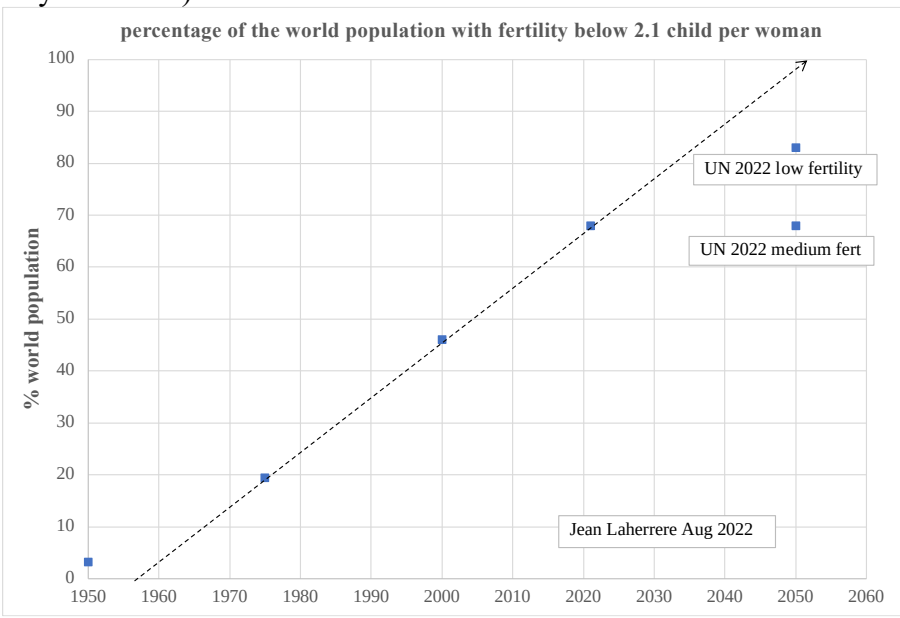


A 1.5 value is forecasted in 2100 against 1.835 value for UN2022 medium fertility and 1.359 for low fertility.

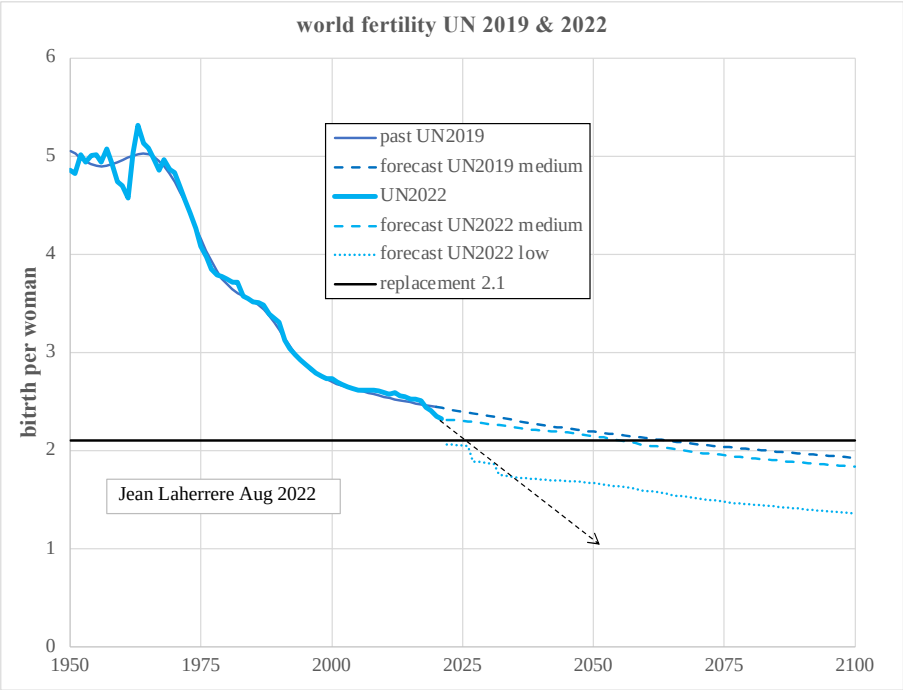
-Evolution of percentage of fertility below 2.1

From UN2022 the percentage of the world population with fertility below 2.1 birth per woman grows differently with time

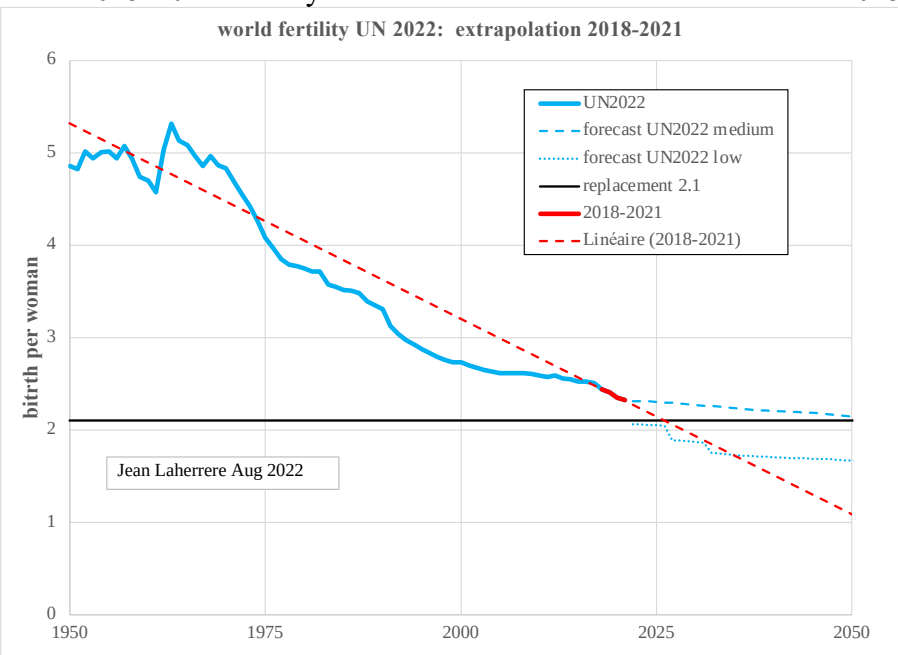
The values are in line for 1975, 2000 and 2021, but their extrapolation is above 2050 values (optimistic fertility scenarios)



UN 2022 medium fertility is close to UN 2019 medium fertility (2.1 reached around 2060) but in disagreement with the past 3 years



The extrapolation of 2015-2021 fertility data is that 2.1 will be reached in about 2025

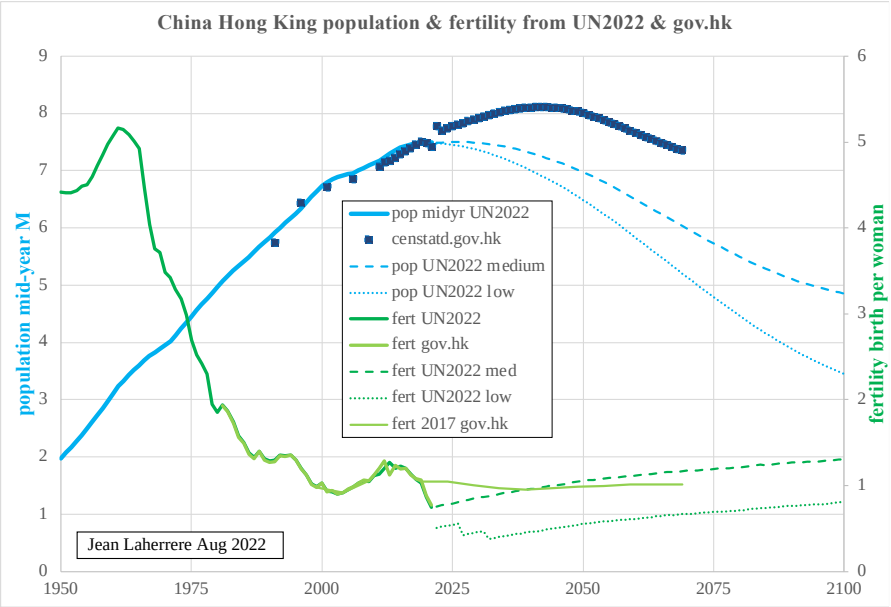


But it is hard to forecast fertility data, as historical data for France, Germany and UK display different behaviors

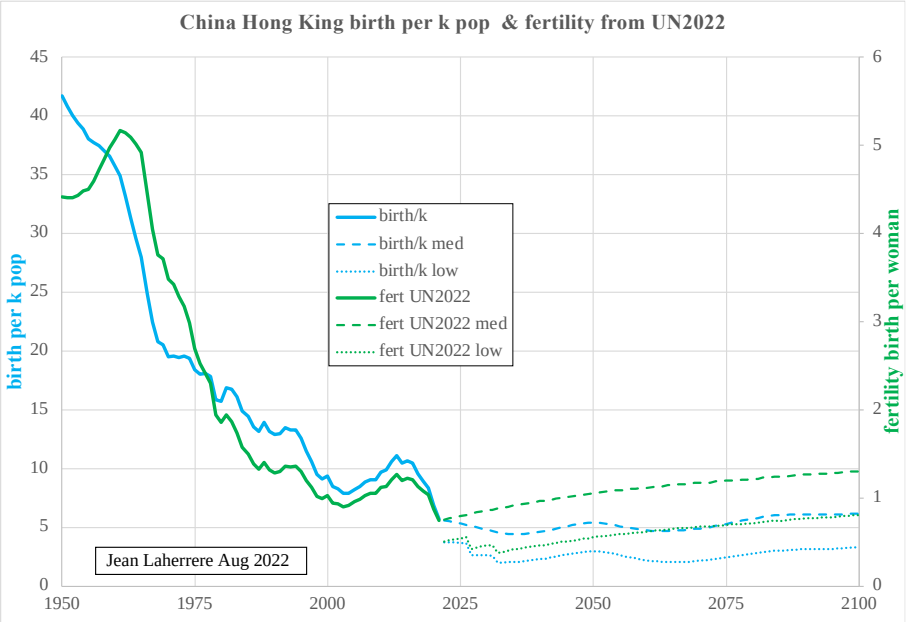
-Hong Kong

Hong Kong is the country with the lowest fertility in 2021 and in 2050

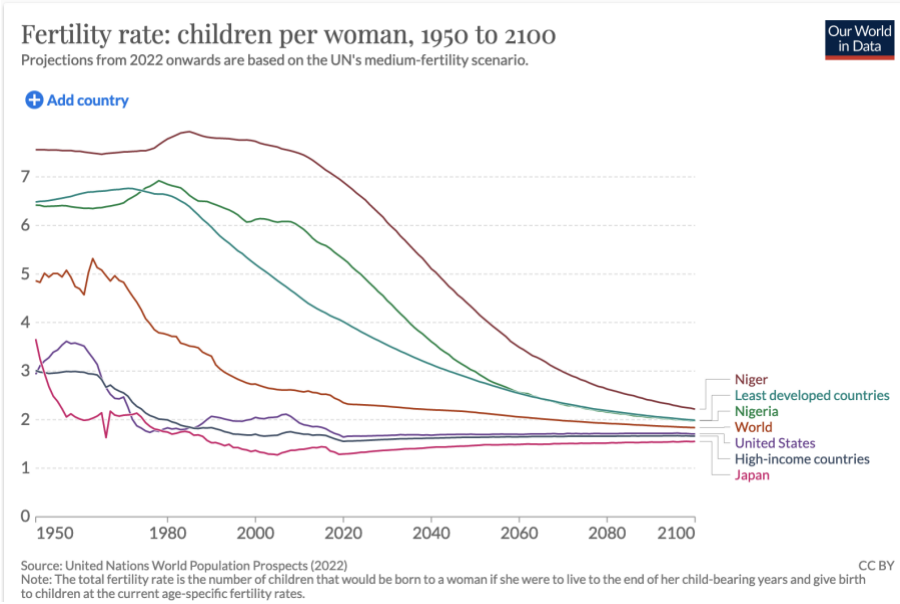
Population forecasts from UN2022 are compared with forecasts from gov.hk, whhich is less optimitic on fertility rise aftrt 2050



Hong Kong population forecast in 2070 is 7.4 M for gov.hk against 6 M for UN2022 medium fertility and 5.1 M for low fertility: the difference is important, but both forecasts decline beyond 2040



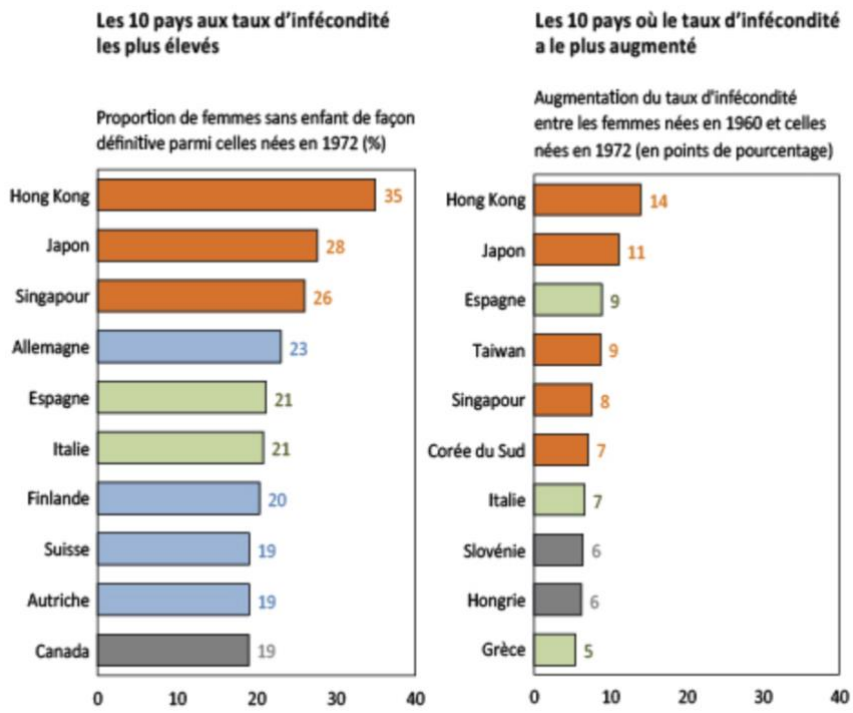
It is obvious that the UN2022 medium forecast on fertility (dashed green) increase is much more optimistic than the birth rate (dashed blue): which one is the good forecast? My guess is birth because the UN utopic goal for future fertility, high for developed countries, low for the least developed countries. On the graph below by OWID it is obvious that beyond 2021 Niger, Nigeria and least developed fertility trend is declining sharper than in the past, when high income fertility is higher than in 2021



UN2022 medium population forecast peaks in 2026 around 7.5 M against gov.hk peak in 2041 at 8.1 M, which looks very optimistic

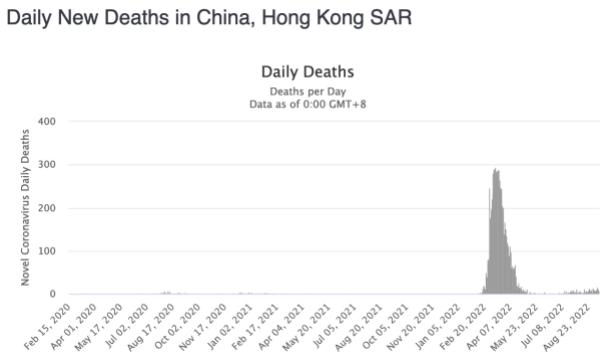
The HK site reports on the declining fertility without any mention of future improvement
https://www.info.gov.hk/gia/general/202109/08/P2021090800493.htm
According to information from the Census and Statistics Department, Hong Kong's total fertility rate has been lower than the replacement level of 2.1 (i.e. the fertility rate to sustain the natural population unchanged) for more than three decades and has remained between 0.9 and 1.3 since mid-1990s. Our total fertility rates in the past three years were 0.87 (2020), 1.05 (2019) and 1.07 (2018) respectively. As in other Asian developed economies such as Singapore and South Korea, a decreasing marriage rate, as well as delayed marriage and childbearing are the main contributing factors of our low fertility rate. The total fertility rate further decreased in 2020 under the influence of the pandemic, and similar pattern was also observed in other Asian regions or countries.
It is hard to forecast Hong Kong population future as China policy of "one country two systems" looks in trouble, as China future (as Evergrande) : wait and see for November 2022 20th National Congress as the president Xi Jinping vows to peg the country's modernization to the principle of 'wealth and happiness for all': it t is an very optimistic goal!
But lie is very often used within the world, starting with Santa Claus, with eternal economic growth and eternal life for most religions.

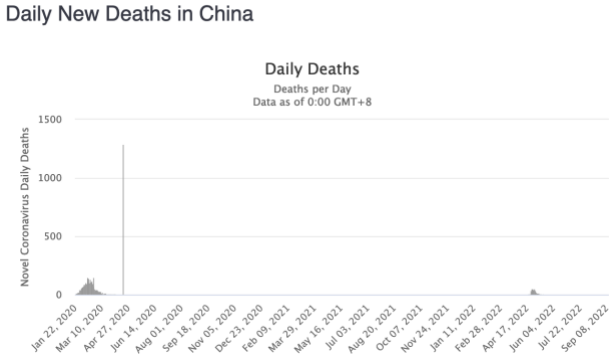
INED in 2021 https://www.ined.fr/fr/publications/editions/population-et-societes/un-tiers-des-femmes-d-asie-de-l-est-resteront-sans-enfant/ puts Hong Kong as number one for lowest fertility, followed by Japan , Singapour and Germany



Tomáš Sobotka, ***Population & Sociétés,*** n° 595, INED, décembre 2021.

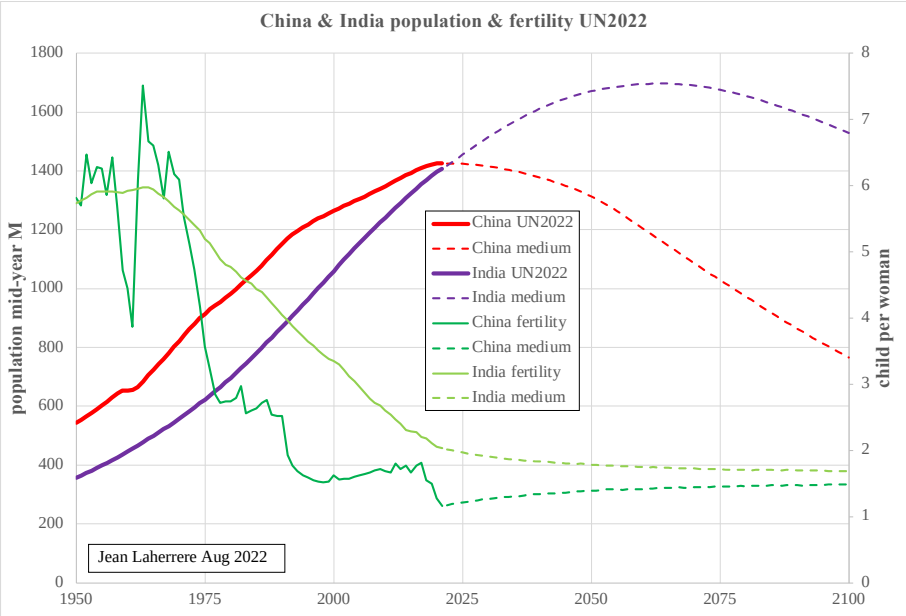
Hong Kong (pop 7.6 M) covid19 deaths reported by worldometer displays a peak at 300 deaths in April 2022 when China (1448 M) peak is about 100 deaths in February 2020; amazing discrepancy as it is the same country!



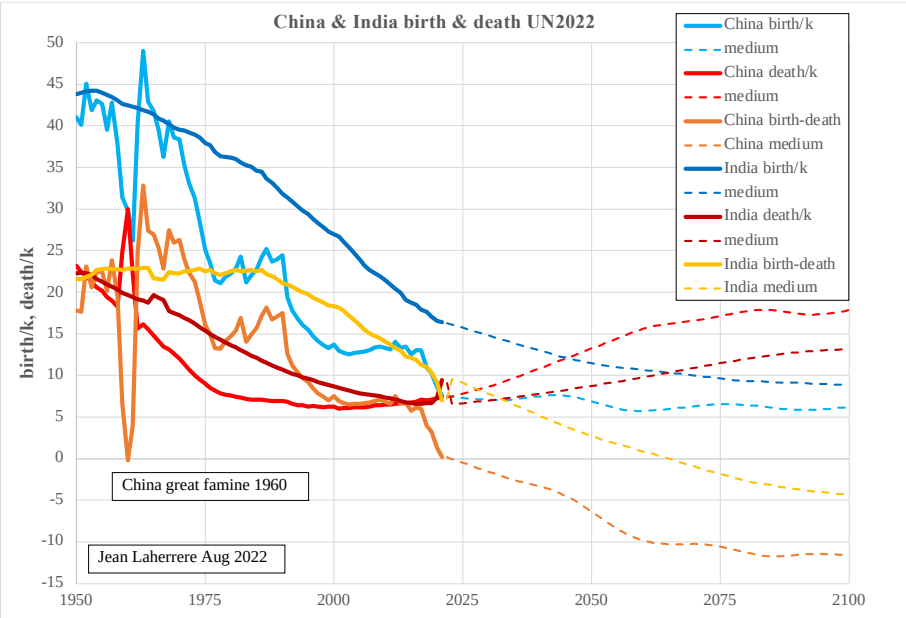


-China and India

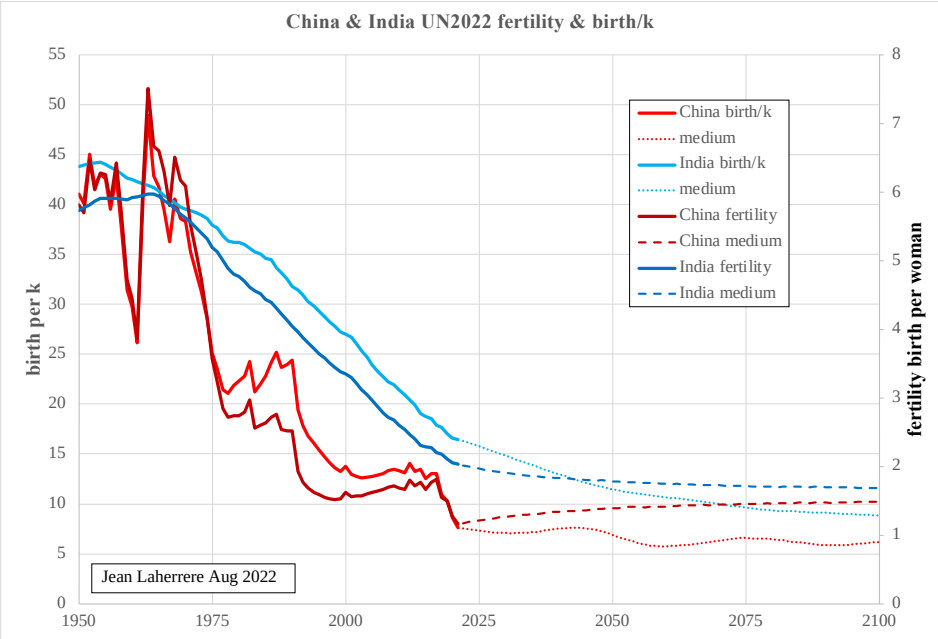
India population is presently the highest in the world, overpassing China at peak
UN2022 forecasts China population peak in 2020 at 1425 M (despite an optimistic rising fertility after 2020), when India population will peak in 2063 at 1670 M for a declining fertility



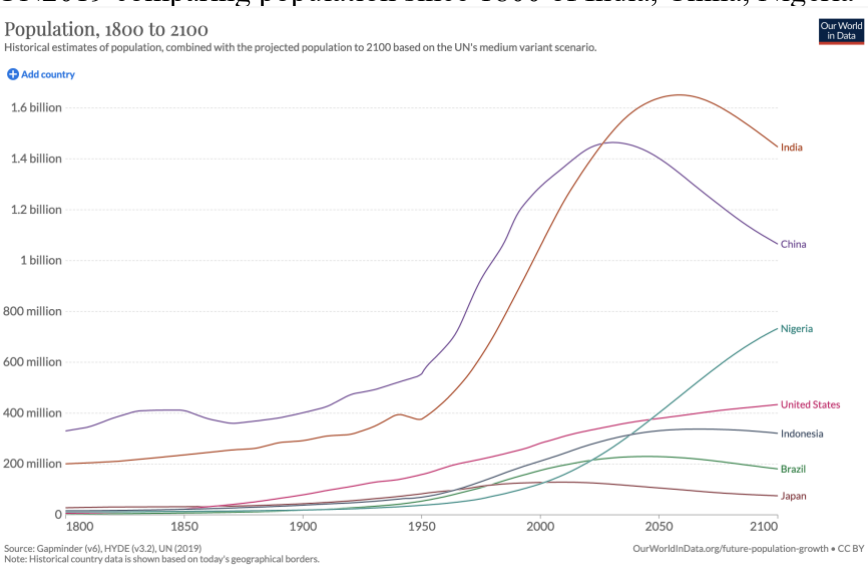
It is hard to understand why China fertility will grow beyond 2025 when India fertility will decline
What is obvious is that China population will decline from now when India population will decline only after 2060



The comparison the scenario medium for fertility and birth/k for China and India shows that the fertility forecast is too high



The data from UN2019 comparing population since 1800 of India, China, Nigeria

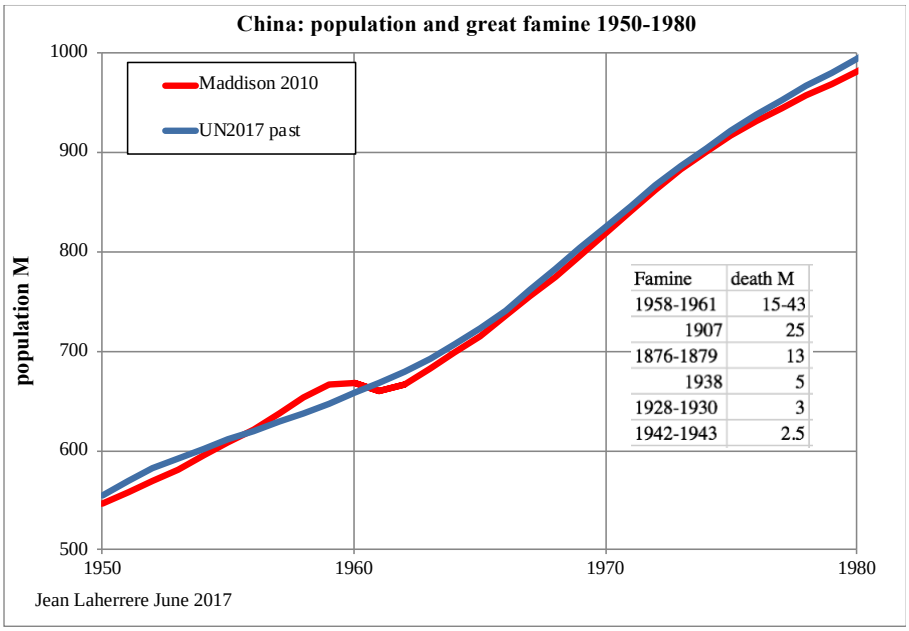


-China

China fertility displays a drastic value in 1960 with the great famine with UN2022, when it was not in UN2019: UN happily corrects its mistakes

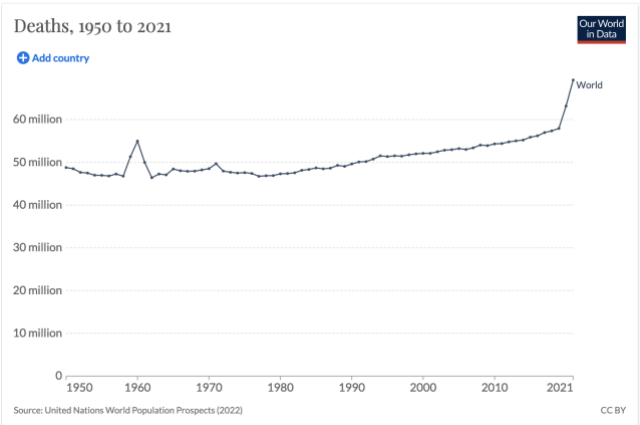
In my paper "UN 2019 world population forecasts" https://aspofrance.org/2019/07/28/un-2019-world-population-forecasts/

But past population is poorly reported by the UN, omitting the great famine 1958-1961, compared to data from Maddison. The UN hide facts to please their members!

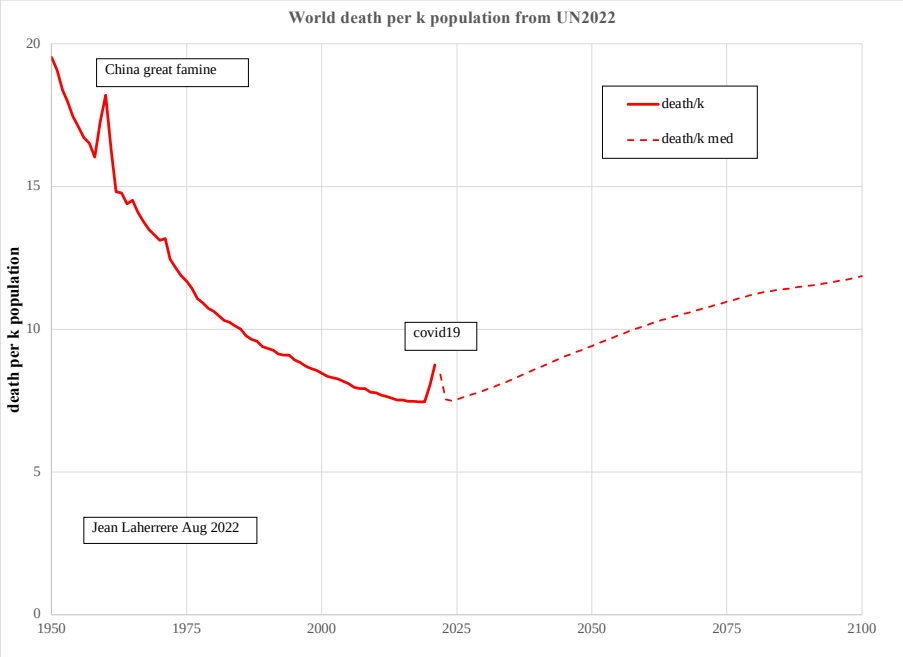


It was mentioned by V. Smil in 1999
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1127087/
China's great famine: 40 years later Vaclav Smil, BMJ. 1999 Dec 18;
Forty years ago China was in the middle of the world's largest famine: between the spring of 1959 and the end of 1961 some 30 million Chinese starved to death and about the same number of births were lost or postponed.

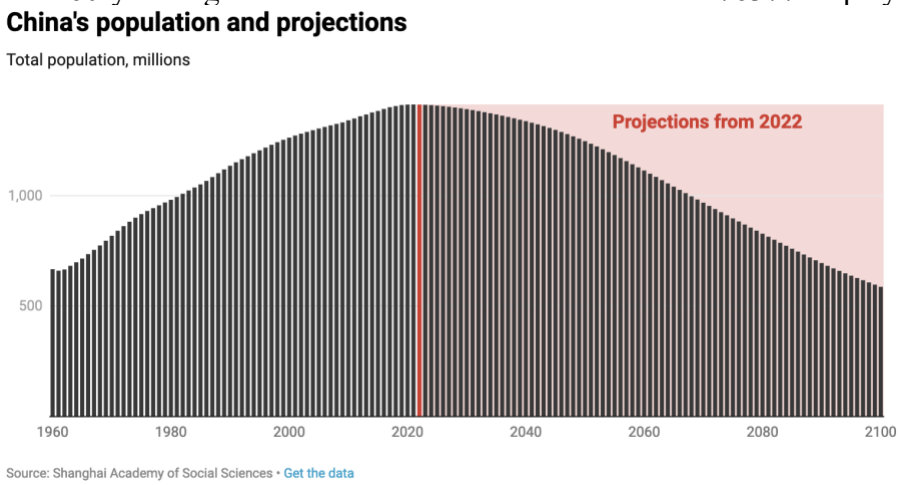
This Chinese great famine is obvious on world population growth rate by Owid showing UN2022 data
https://ourworldindata.org/world-population-update-2022
Five key findings from the 2022 UN Population Prospects
population growth1950-2021 deaths 1950-2021



The impact for the world of China 1960 death famine is about the same as covid19: it is higher when compared in deaths per M

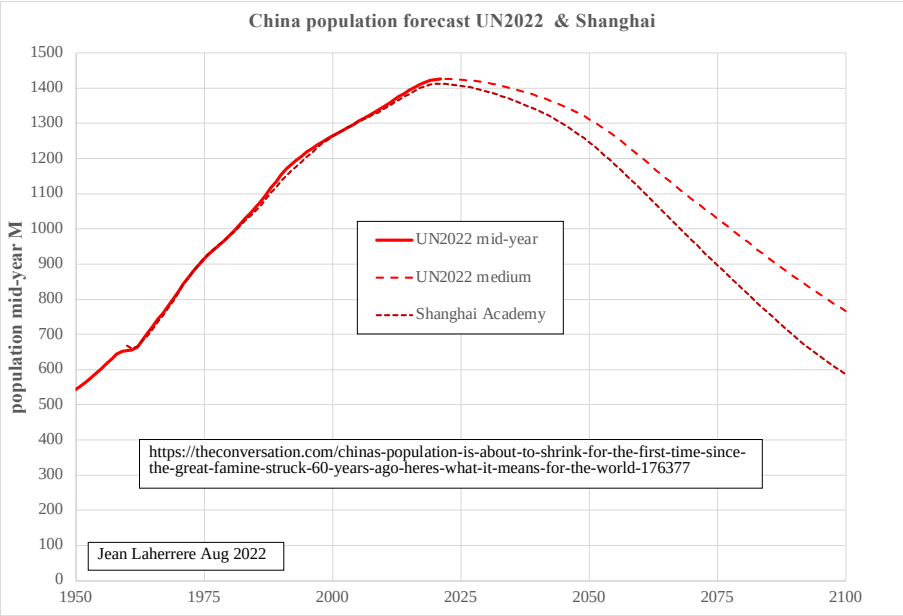


The site https://theconversation.com/chinas-population-is-about-to-shrink-for-the-first-time-since-the-great-famine-struck-60-years-ago-heres-what-it-means-for-the-world-176377 displays a forecast



from Shangai Academy of Social Affairs with a peak in 2020

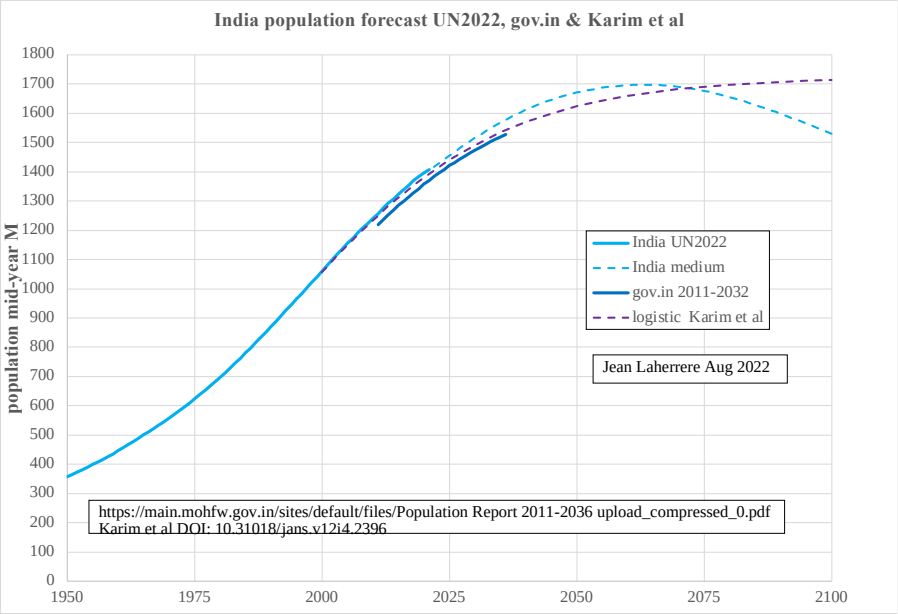
Shanghai forecasts for China in 2100 is 587 M against 767 for UN2022 medium, or 30 % higher.



It appears that UN2022 medium scenario is too optimistic on China

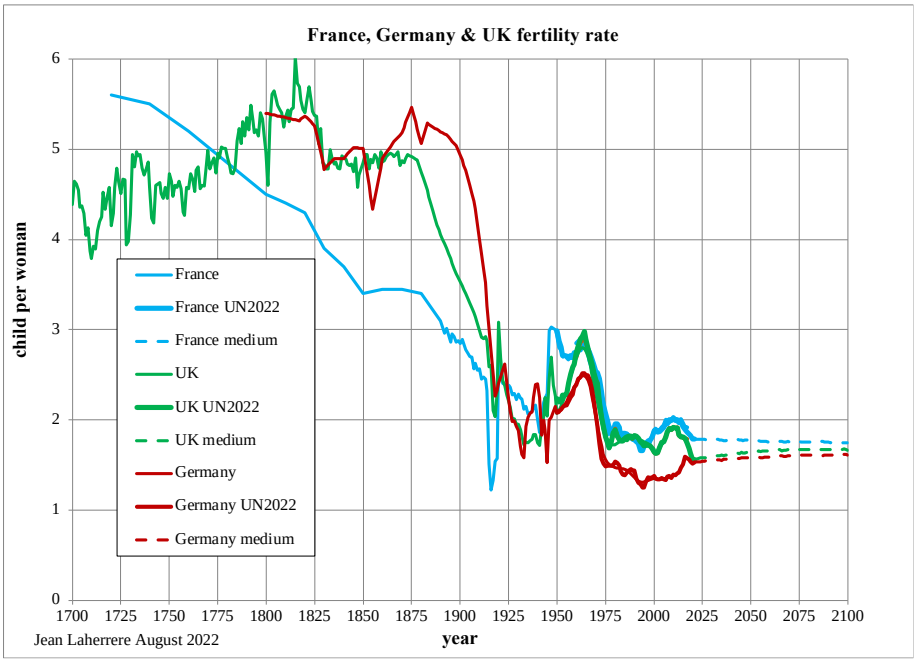
-India

India population UN2022 medium forecast is compared with gov.in 2011-2036 forecast and Karim et al 2000-2100 logistic forecast: they are very close up to 2075.

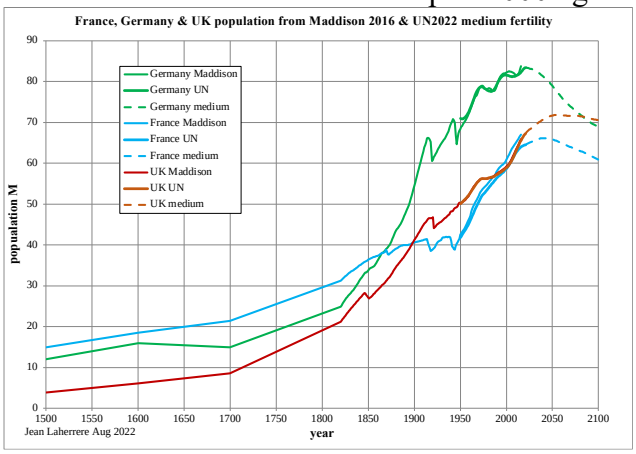


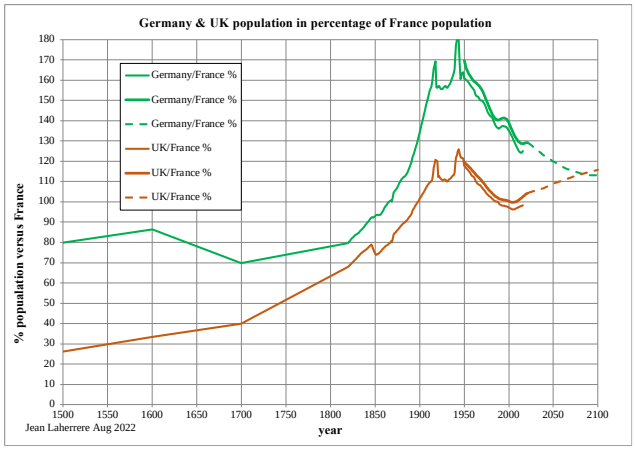
-France, Germany & UK

Fertility rate varied differently with time for France, Germany and UK, explaining some behavior and some wars.

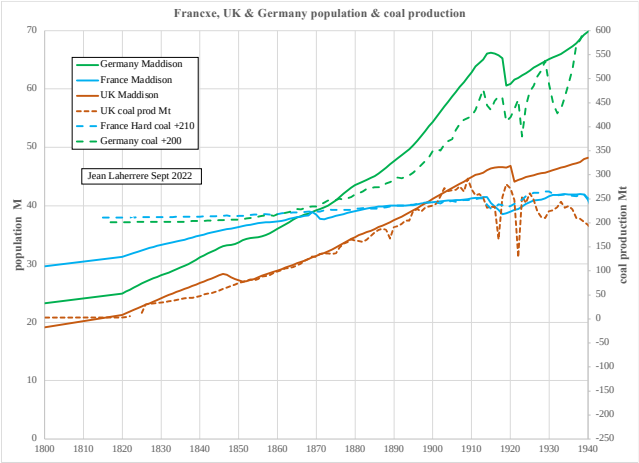


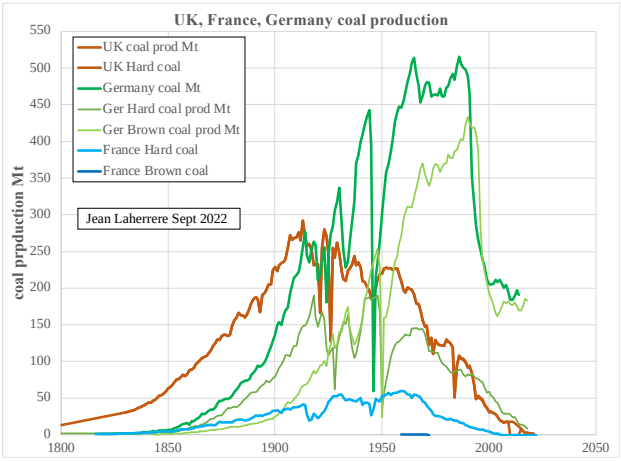
UK fertility overpassed France fertility by far from 1775 to 1920 and Germany from 1800 to 1914
France population was higher than UK up to 1860 and higher than Germany up to 1900.
The result of war can be found not in the arms but in fertility. The baby boomers in France after the Second War corrected the trend up to 2000 against UK.





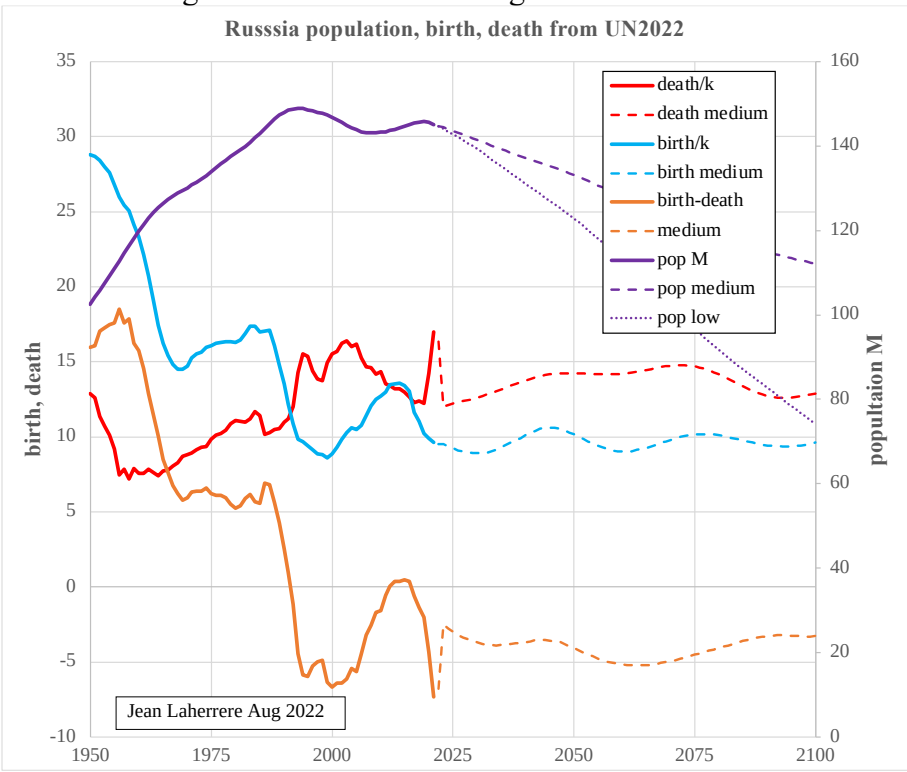
Hugo Duterne in a 2019 mémoire " Le lien entre énergie et évolutions démographiques passées et présentes" correlates past population with energy production and it appears that for UK, France and Germany the correlation population and coal production (main energy before 1940) looks good for the period 1850-1940





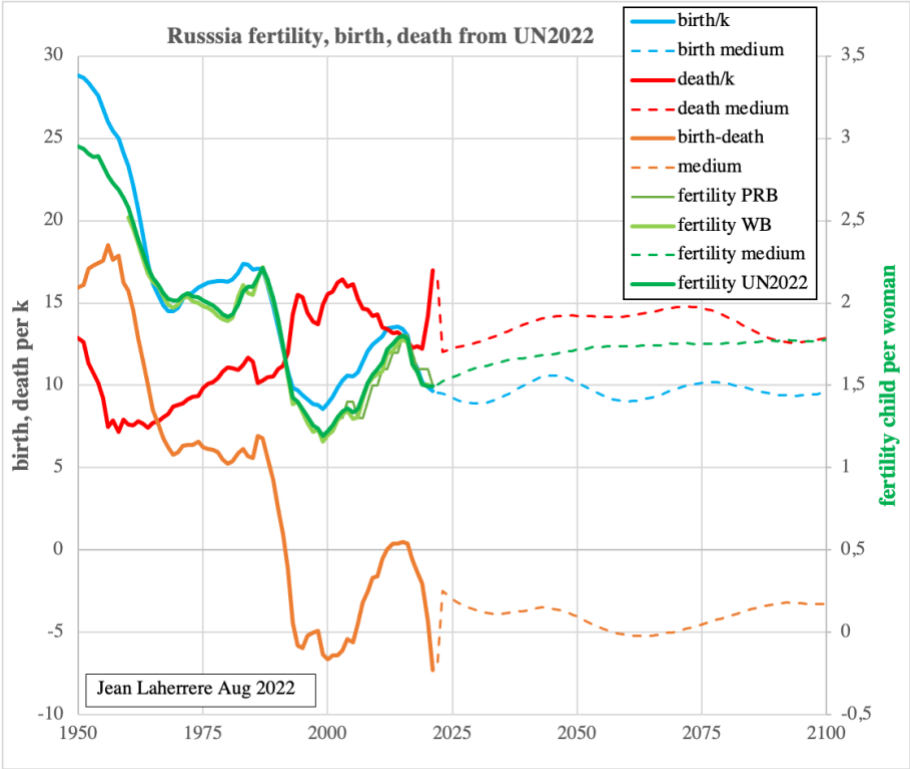
-Russia

Russia population is declining since 1993 because a high death rate and a low birth rate.

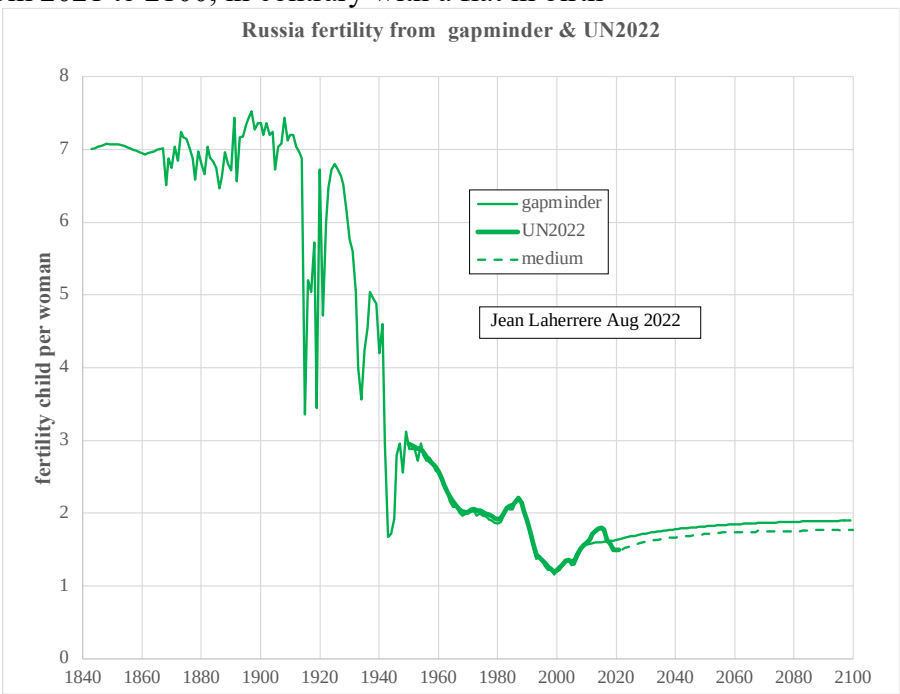


In 2100 Russia population will be 112 M for the medium scenario and 74 M for the low scenario

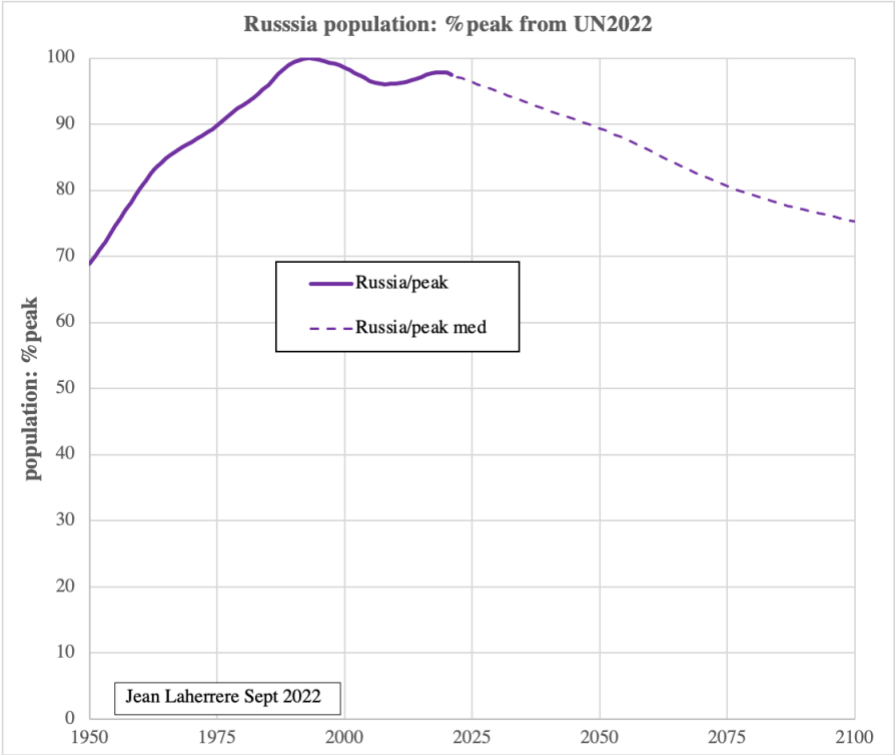
UN2022 medium fertility (dashed green) is above birth rate (dashed blue) because UN utopic views



Russia fertility displays a drastic cliff from 7 to 2 from 1930 to 1970, UN2022 medium forecasts a fertility rise from 2021 to 2100, in contrary with a flat in birth



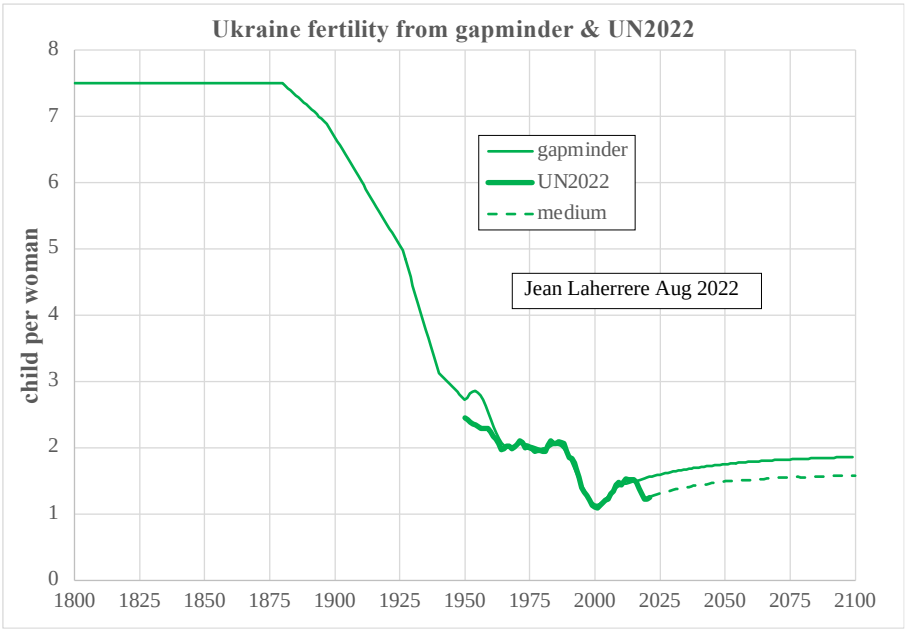
The plot of the percentage of Russia population versus the value of the peak displays a crooked peak and an unsymmetrical decline



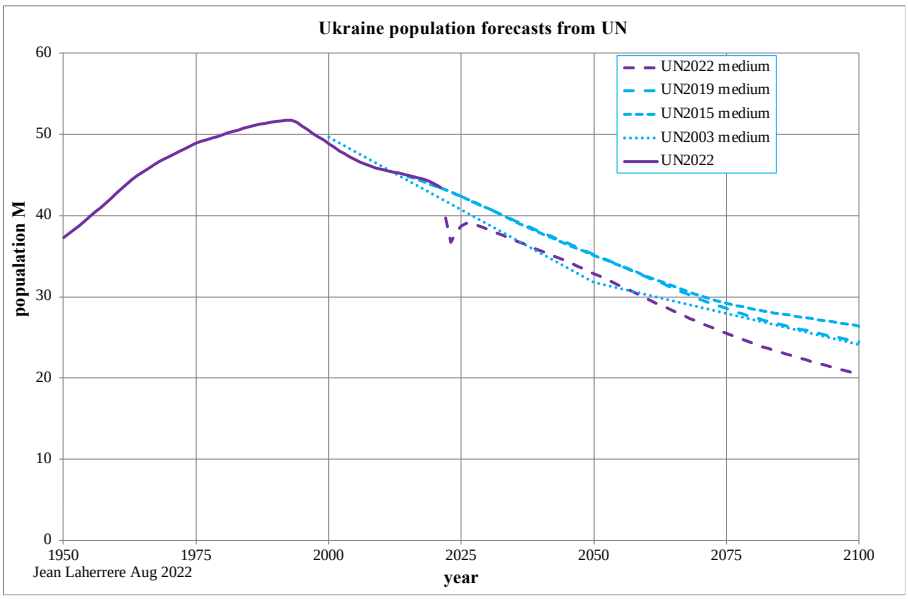
-Ukraine

Because of the war between Russia and Ukraine, it is interesting to compare fertility and population forecasts

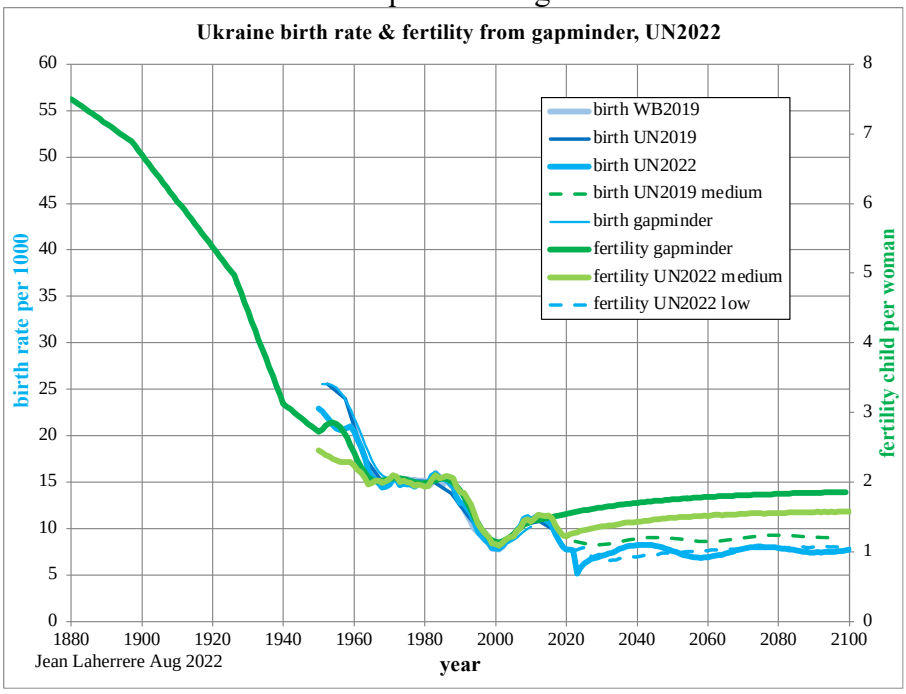
Ukraine fertility dropped before Russia, from 7 to 2 from 1900 to 1960, presently in 2021 at 1.25 birth per woman



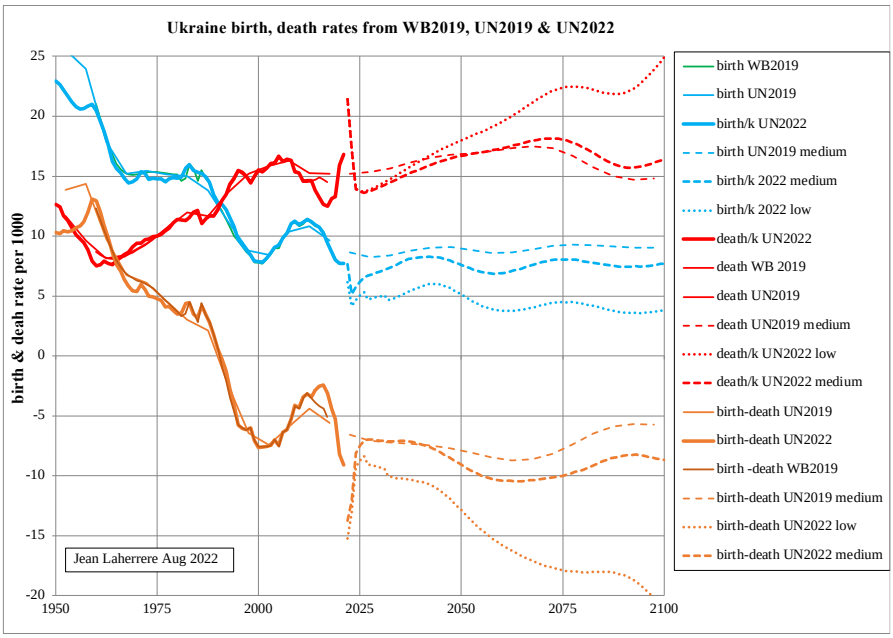
Previous UN forecasts were higher for 2100: 21 M for UN2022, 26 M for UN2015



For UN2022 medium scenario in 2100, fertility should be 1.58 birth per woman when the correlation with birth it should be around 1: quite a change

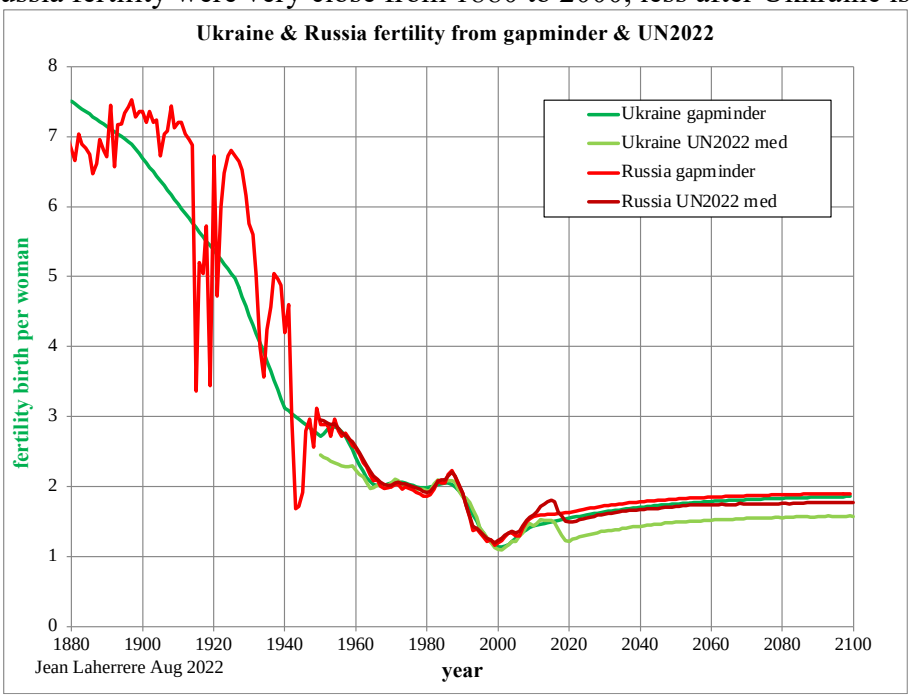


For the medium scenario, UN2022 birth is lower than UN2019

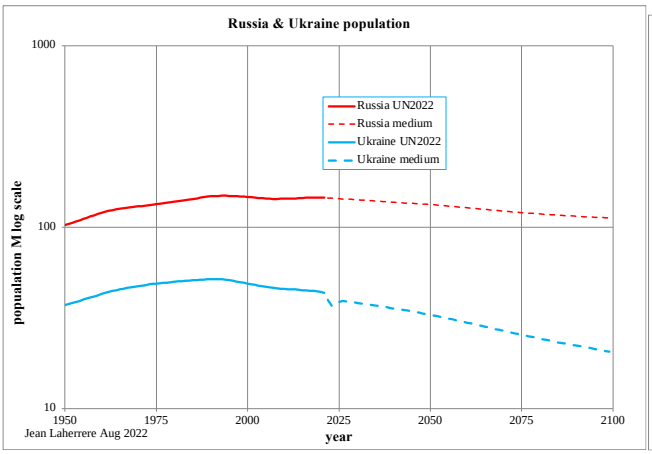


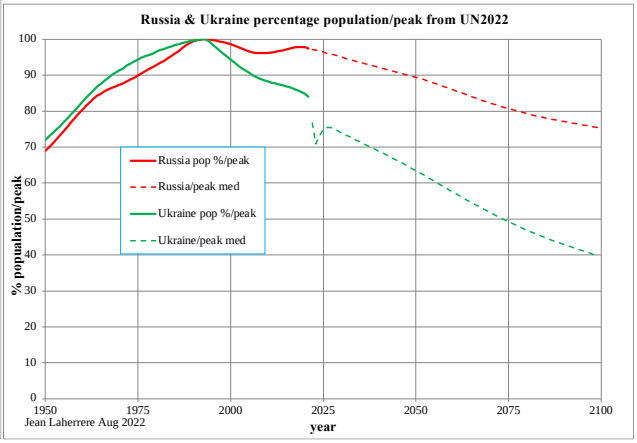
-Ukraine & Russia

Ukraine and Russia fertility were very close from 1880 to 2000, less after Ukkraine is below



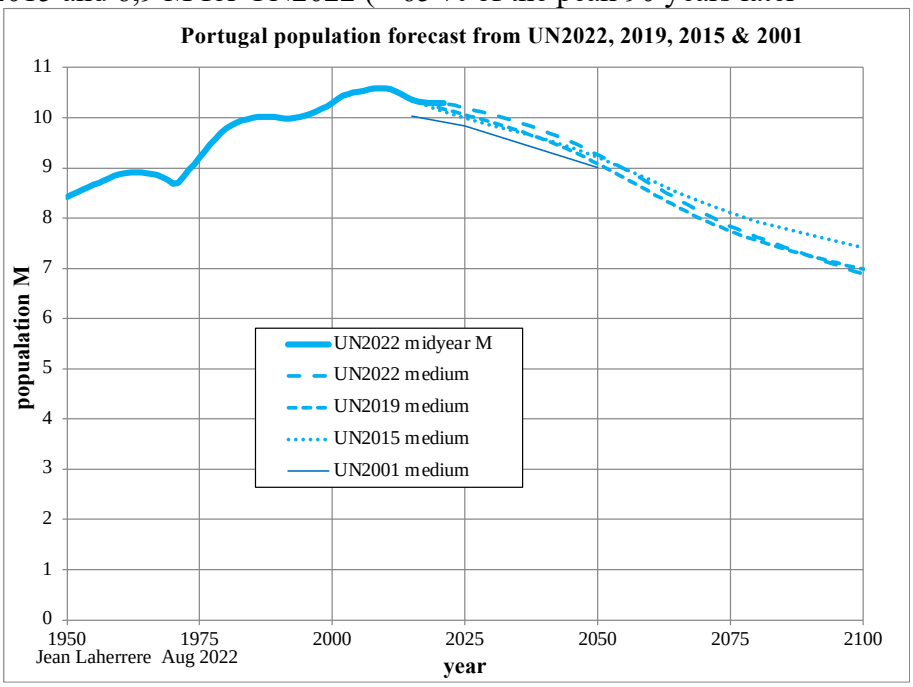
In a log scale or in % versus peak; it appears for the medium scenario that the future of Ukraine population is darker than of Russia population



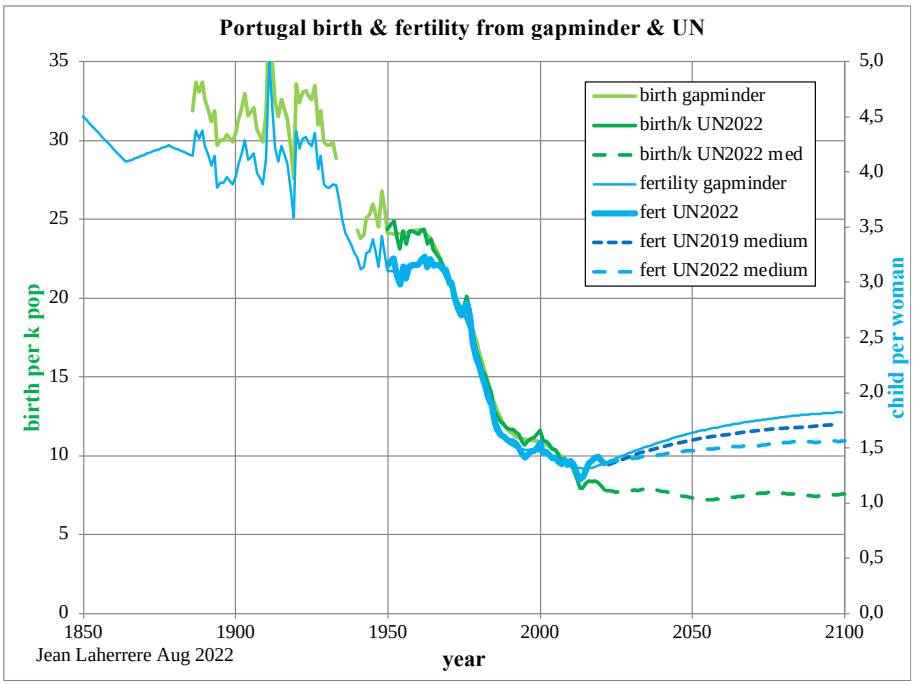


-Portugal

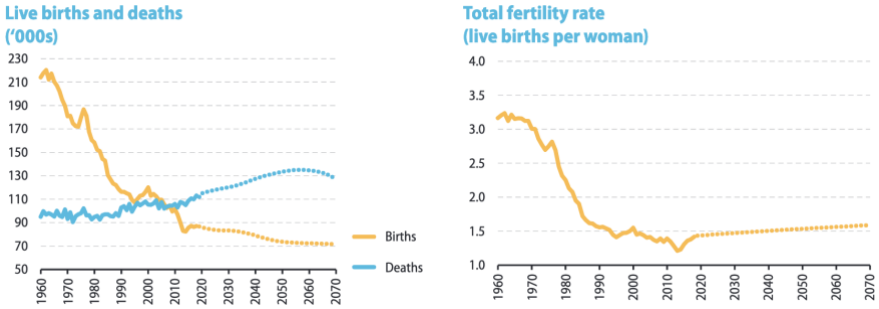
Portugal population has peaked in 2009 at 10.6 M and the forecast for 2100 medium scenario was 7.4 M for UN2015 and 6,9 M for UN2022 (= 65 % of the peak 90 years later



The comparison of fertility and birth is displayed in the following graph for the period 1970-2015 and show that the medium fertility scenario is too high (1.56 in 2100) compared with the birth for k population and should be 1.1.

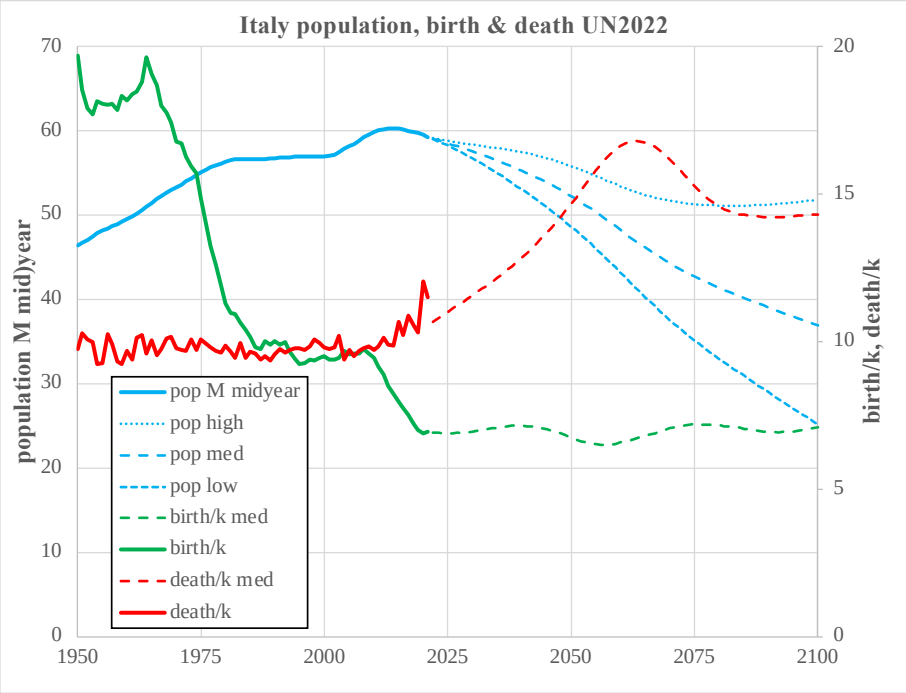


Eurostat also forecasts birth in decline and fertility on rise: it seems incoherent!
https://ec.europa.eu/eurostat/documents/12743486/14207633/PT-EN.pdf

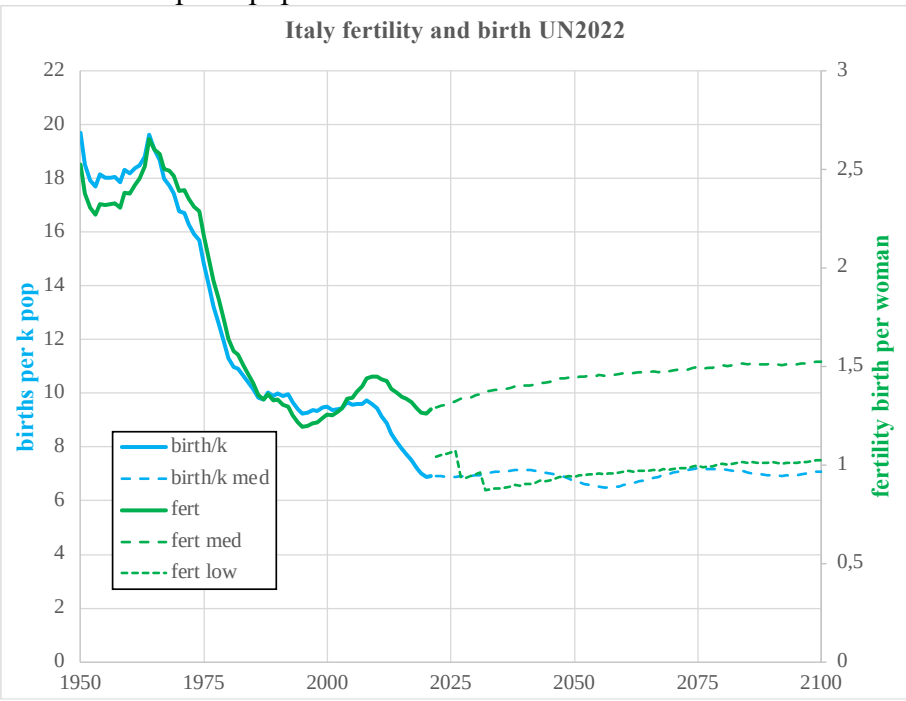


-Italy

Italy population peaked in 2014 at 60.3 M



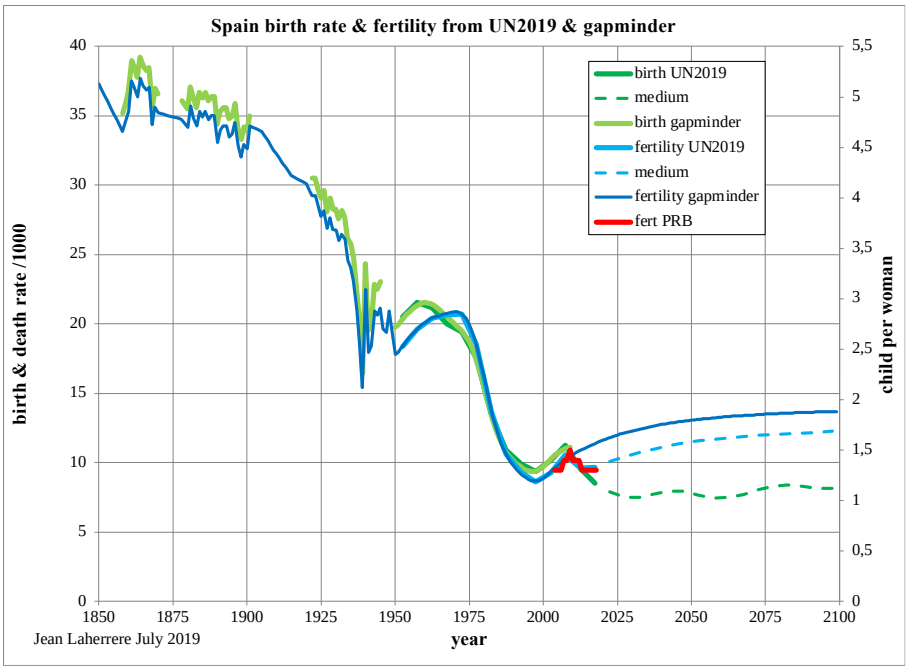
Italy fertility is 1.28 births per woman in 2021 and UN2022 medium scenario forecasts fertility rise to 1.5 for 2100, when the birth per k population is flat in line with the low scenario fertility



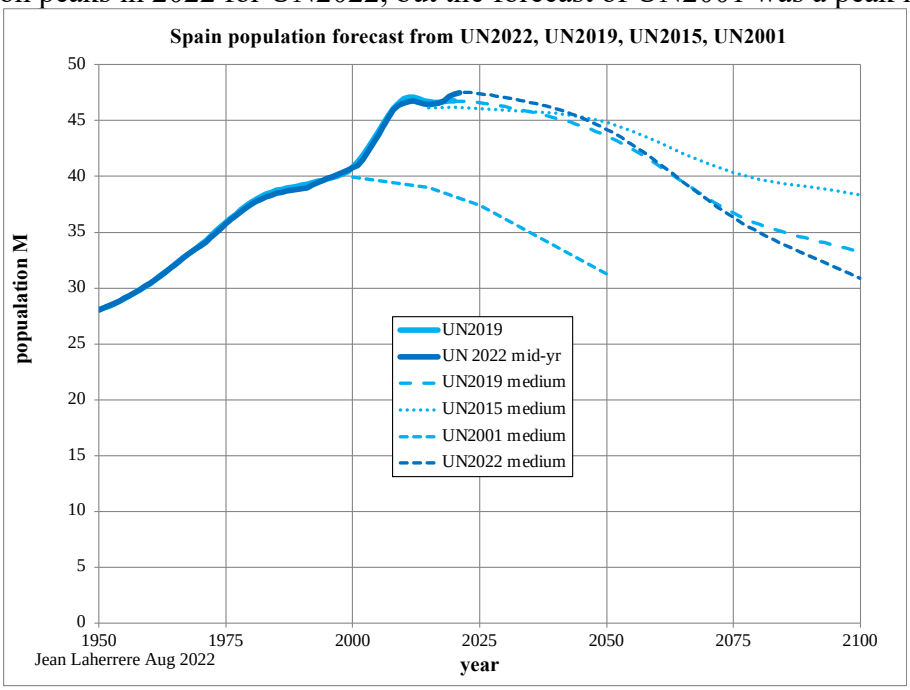
The scenario fertility medium is too optimistic as always for developed countries

-Spain

Spain medium scenario is also too optimistic for fertility compared to births

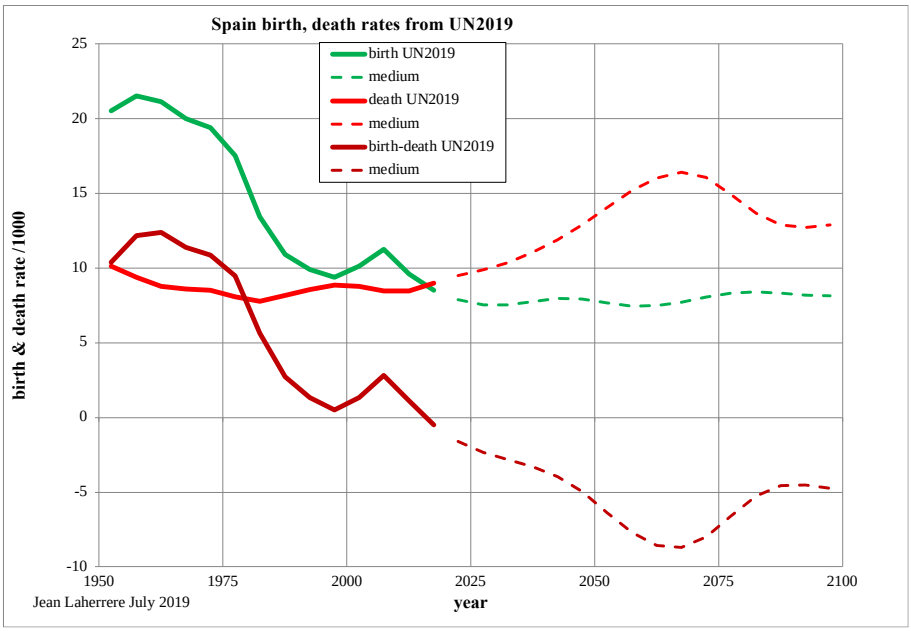


Spain population peaks in 2022 for UN2022, but the forecast of UN2001 was a peak in 2000



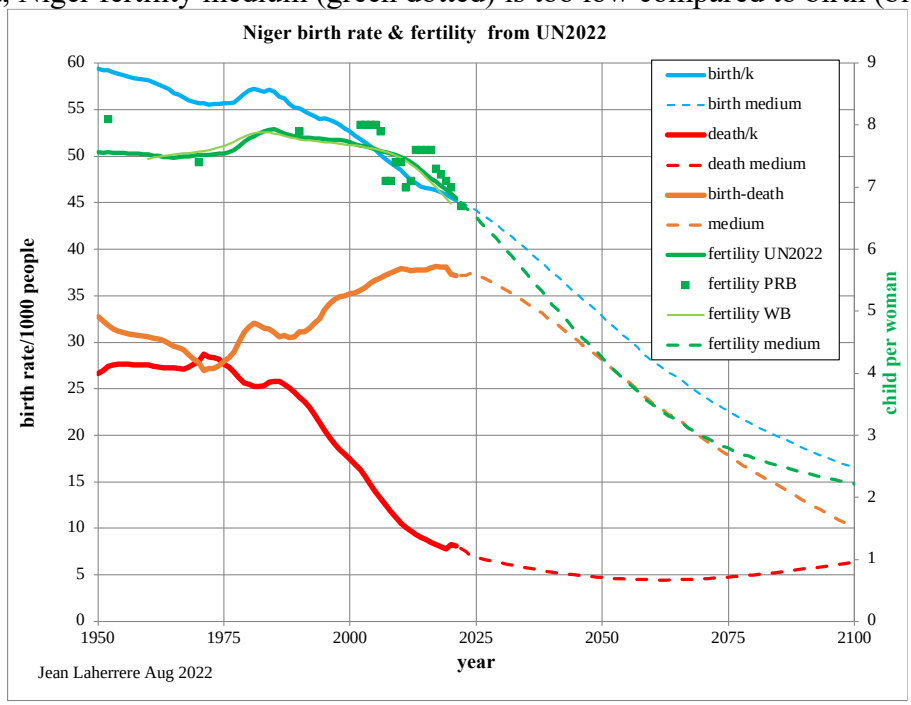
It is amazing to see how much wrong was UN2001 medium forecast

UN2022 medium scenario displays a strange peak in deaths at round 2070!

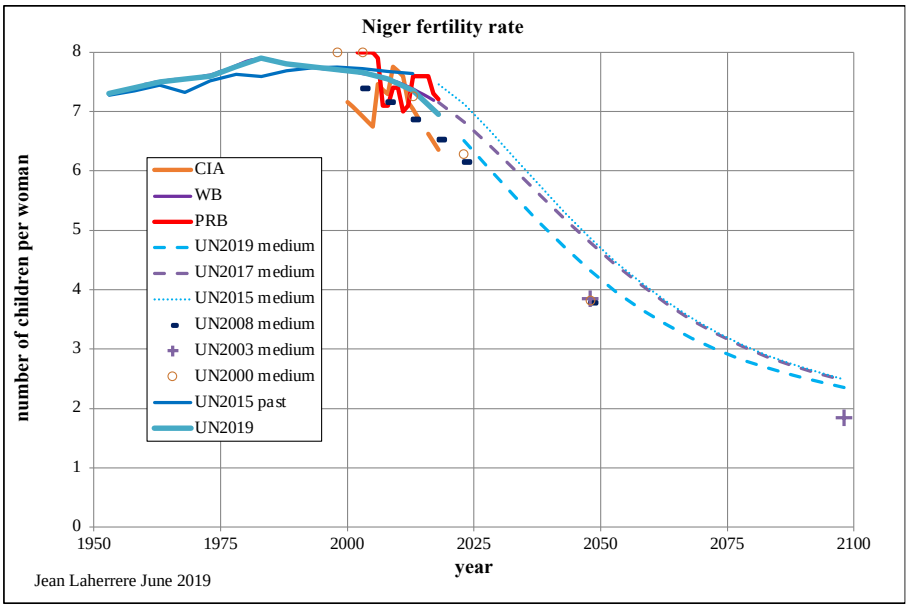


-Niger

As for Nigeria, Niger fertility medium (green dotted) is too low compared to birth (blue dotted)

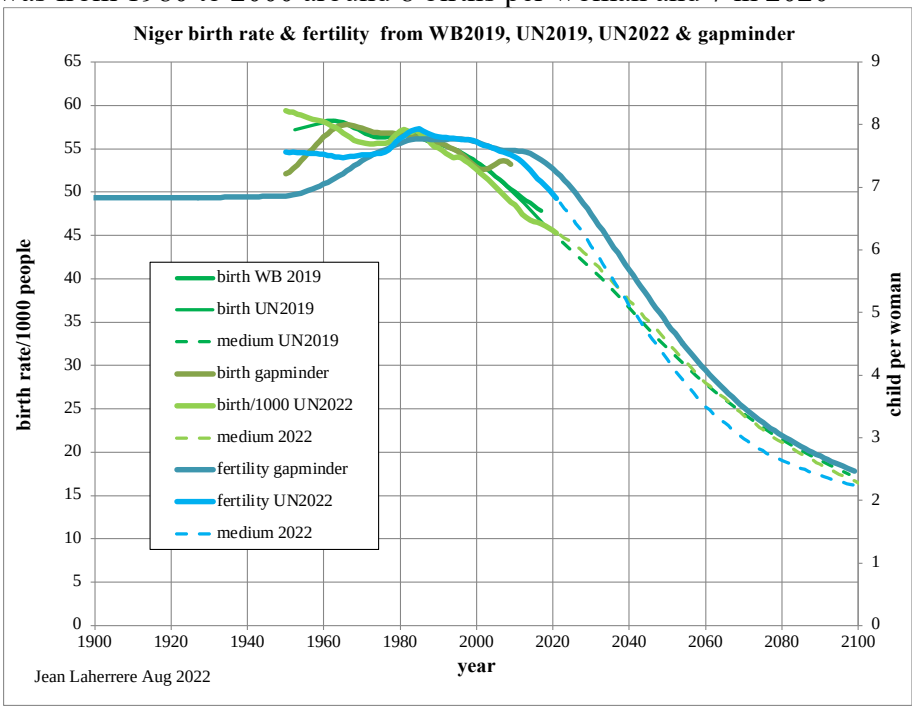


UN is always optimistic in forecasting high fertility for developed countries below the replacement ratio and low fertility for undeveloped countries

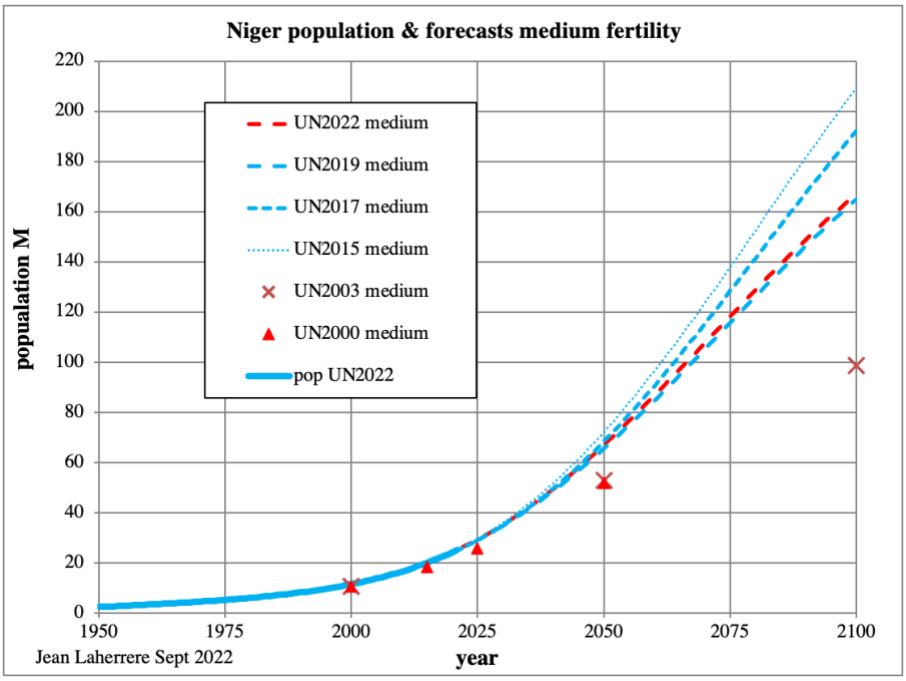


UN2008 was forecasting Niger fertility for 2018 at 6.5 births per woman the real value is 7
NGOs (mainly evangelists) bring antibiotics but rarely contraceptive pills. But also, in underdeveloped countries, children are necessary to pick wood and water and are the retirement planning

Niger fertility was from 1980 to 2000 around 8 births per woman and 7 in 2020



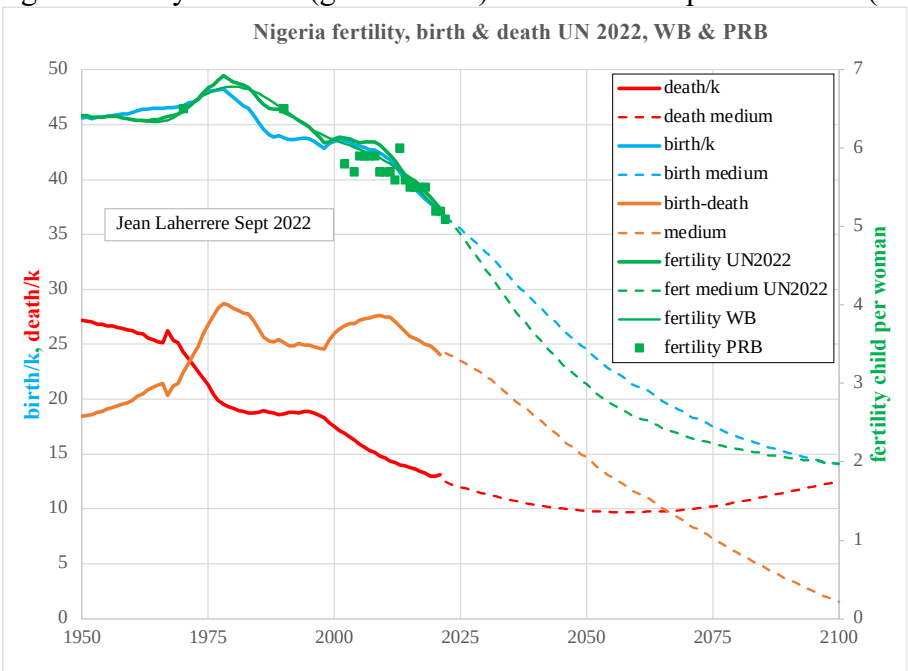
The past population forecasts were too low: for 2100 UN2000 medium was 100 M, UN2022 is 160 M



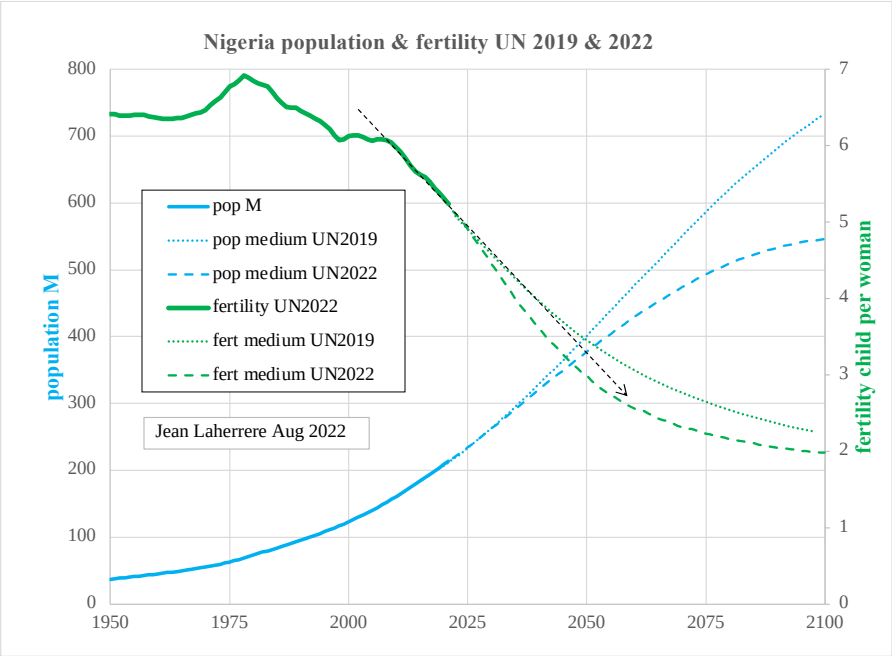
Niger population was forecasted for 2100 for the medium fertility scenario at 100 M in 2003, 210 M in 2015, 190 M in 2017 and 165 M in 2022: quite a change!

-Nigeria

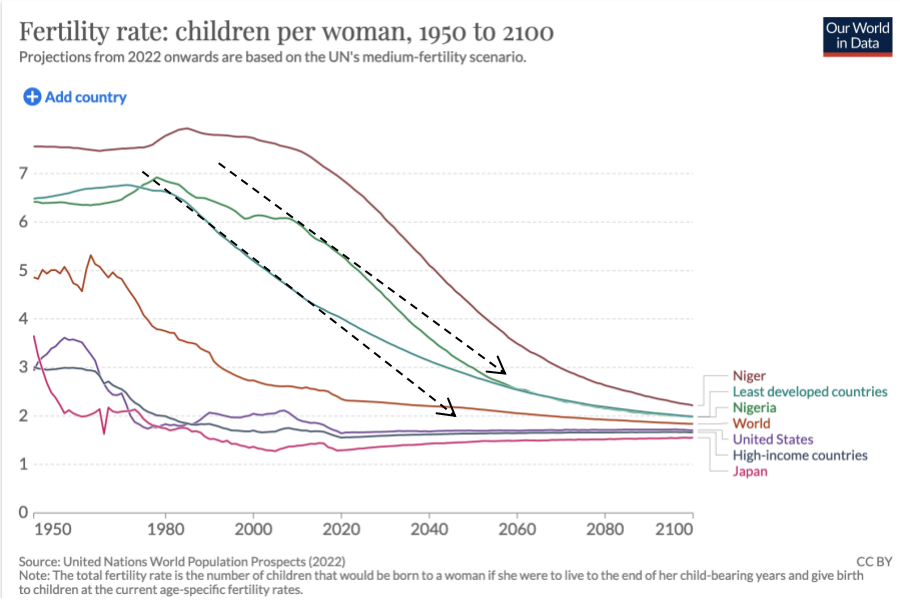
As for Niger, Nigeria fertility medium (green dotted) is too low compared to birth (blue dotted)



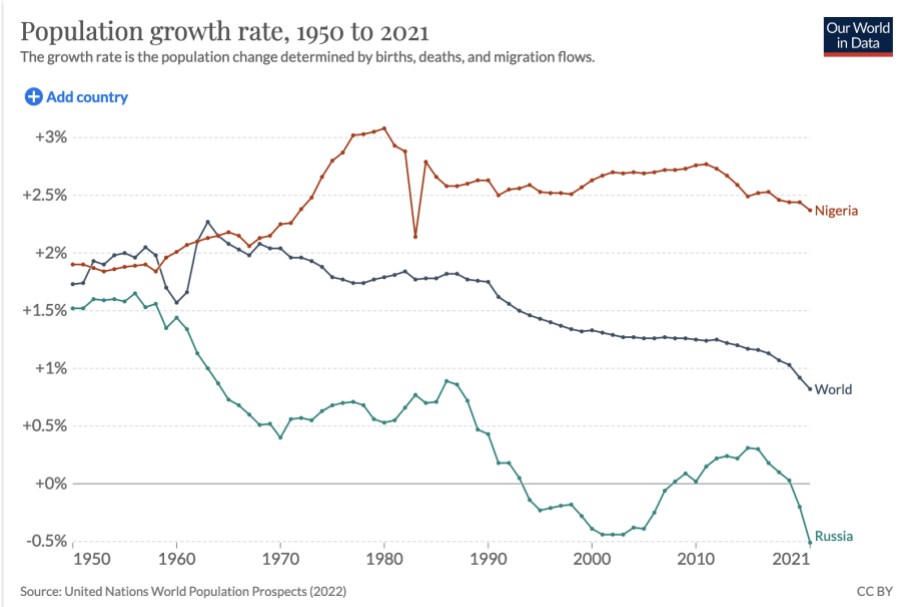
For 2100 UN2022 forecasts 548 M with 2 birth per woman when UN2019 forecasted 733 M (30% more) for 2.3 birth per woman, but UN2019 curve is more in line with the past than UN2022
The fertility UN2022 medium scenario is lower than UN2019



Beyond 2020 Nigeria fertility rate medium is below the past trend when the least developed countries. is above



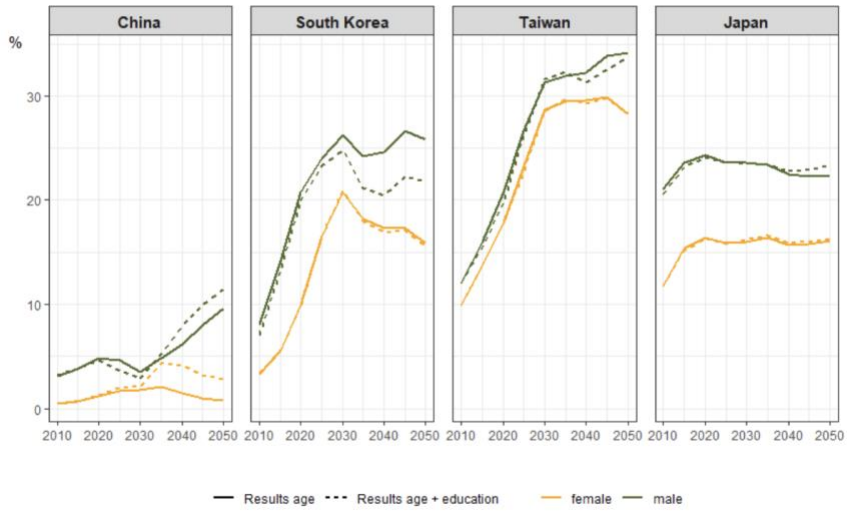
Nigeria population growth rate is almost flat since 1990 around 2,5% when it is 1% for the world in 2021 and negative for Russia



-South & North Korea

Esteve et al displays the percentage of never married people by age 45-49 for China, South korea, Taiwan and Japan.: Demographic change and increasing late singlehood in East Asia, 2010–2050 Albert Esteve et al 2020 https://www.demographic-research.org/volumes/vol43/46/43-46.pdf

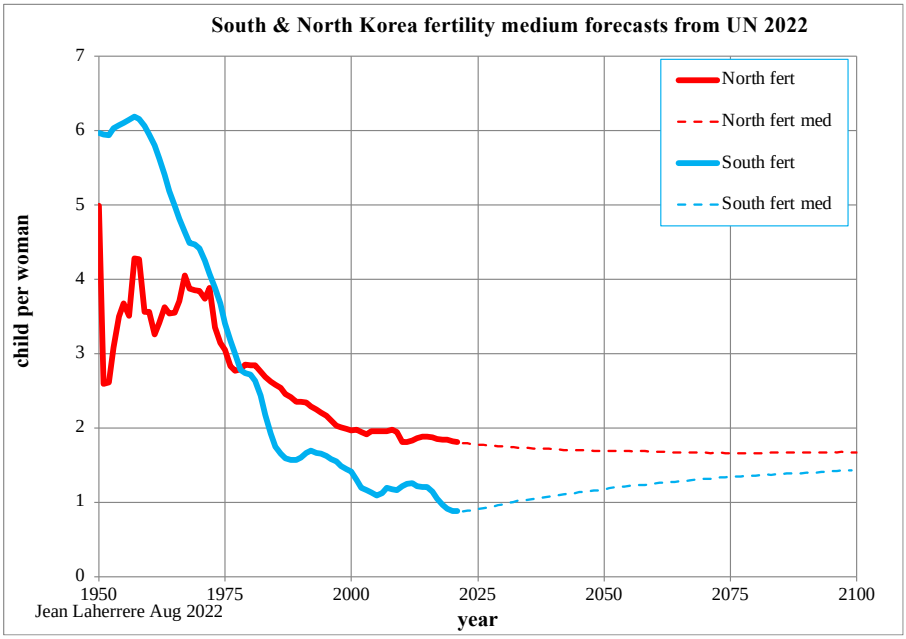
Figure 4: Estimated proportions of never-married people by age 45–49 from 2010 to 2050 by applying constant contemporary forces of attraction by age-only, α_{ij} (solid line), and by age and education, α_{ijkl} (dashed line), to population projections in four East Asian societies



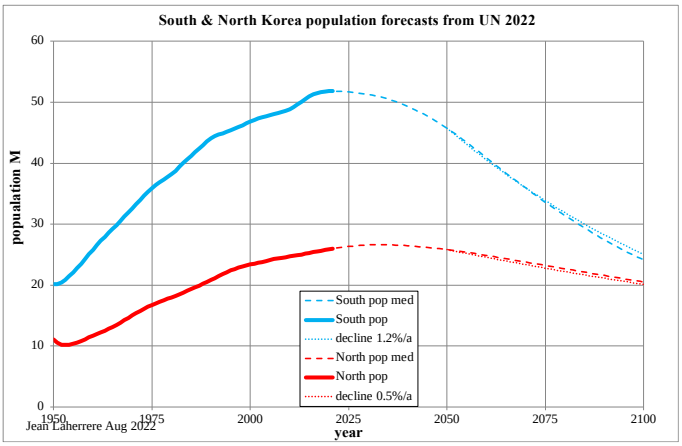
Source: Own elaborations.

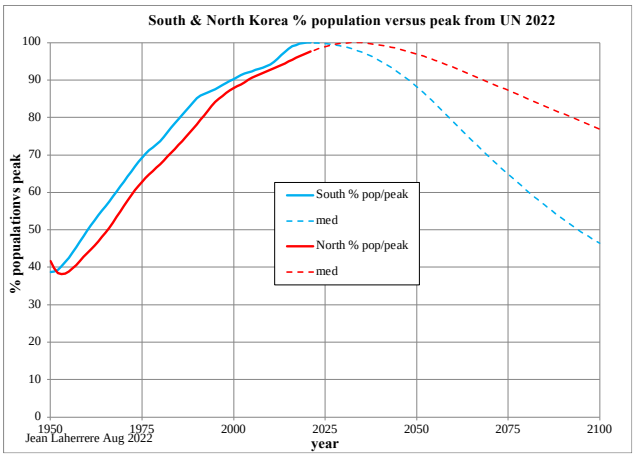
South Korea displays a huge increase from 2010 to 2030 as Taiwan, meaning a large decrease in fertility, contrary with UN2022 forecast.

North Korea fertility which was lower in 1950 than in South Korea is since 1950 higher



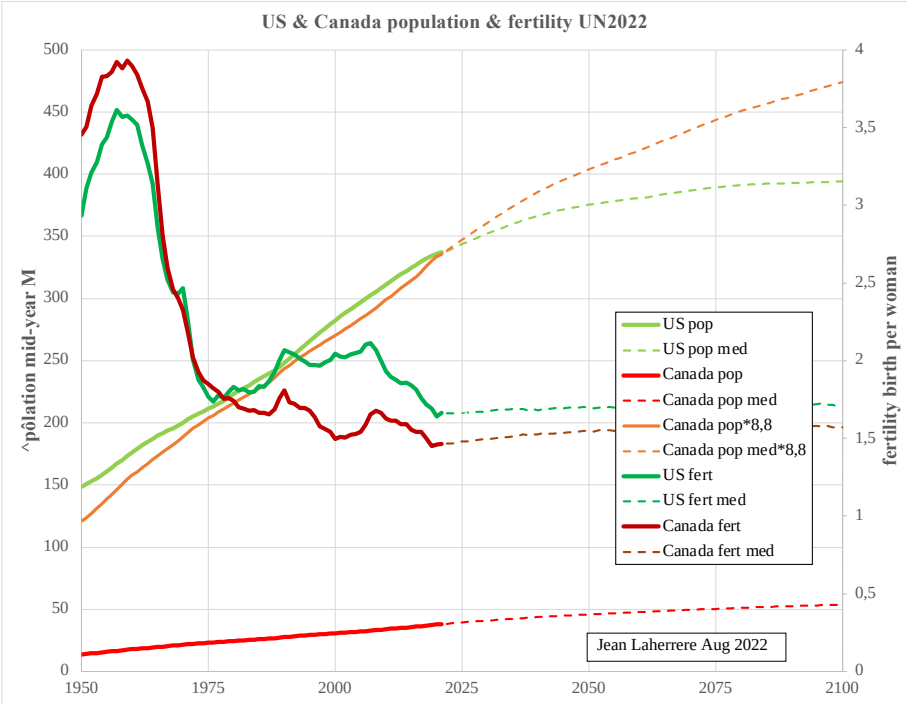
South Korea population has peaked in 2020 when North Korea will peak in 2033
Beyond 2050 South Korea population will decline at 1.2 %/a against 0.5 %/a for North Korea = less than half!





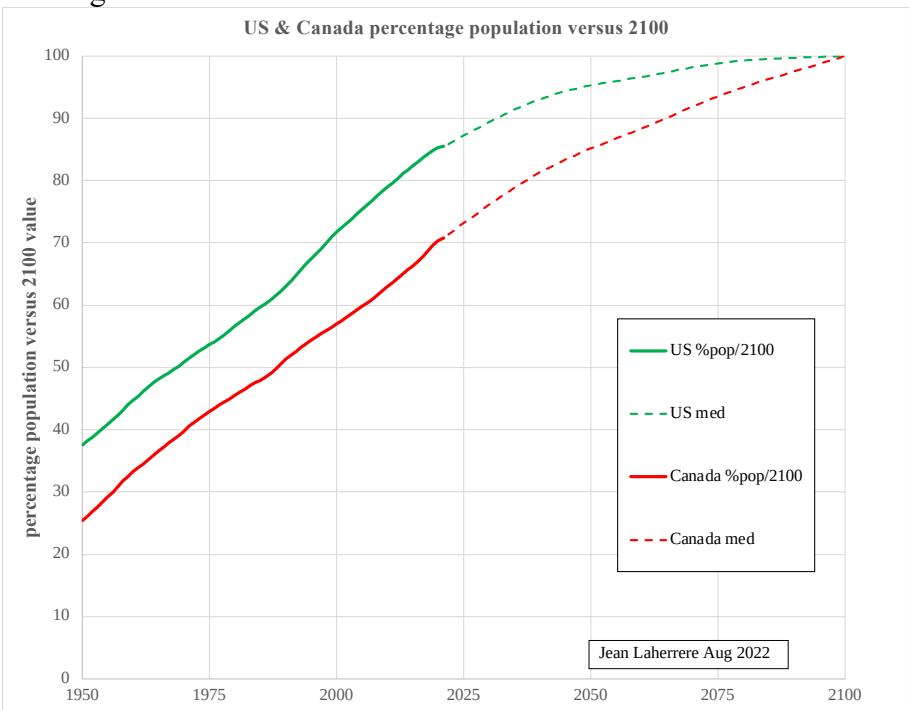
-US & Canada

Canada fertility was similar at US fertility from 1965 to 1975, but beyond much less.



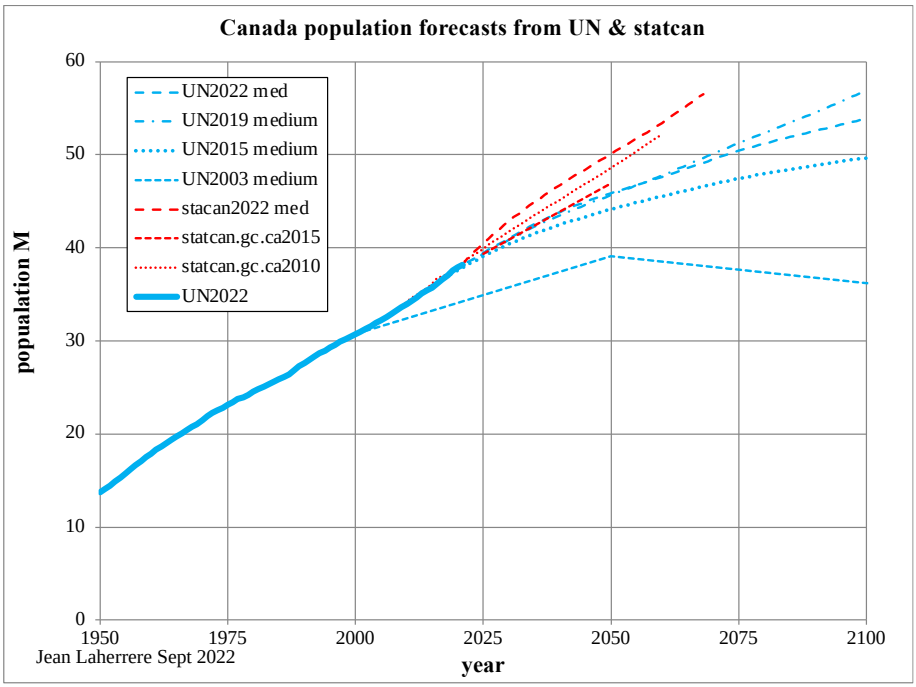
But in 2100 both will have not reached a peak. The population versus 2100 percentage displayed a similar trend from 1950 to 1990, from 1990 to 2020 Canada percentage diminished, but from 2020 to 2100 it increases

It should be interesting to find the reasons of this different behavior between two x close countries.

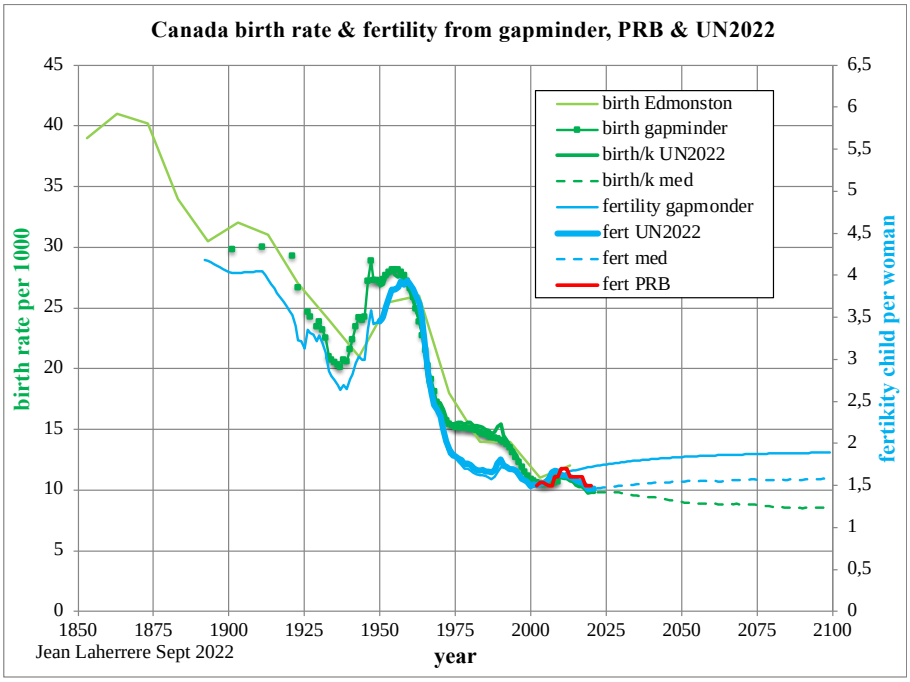


-Canada

UN forecasts on Canada population are quite lower than those from Staticits Canada =statcan.gc.ca

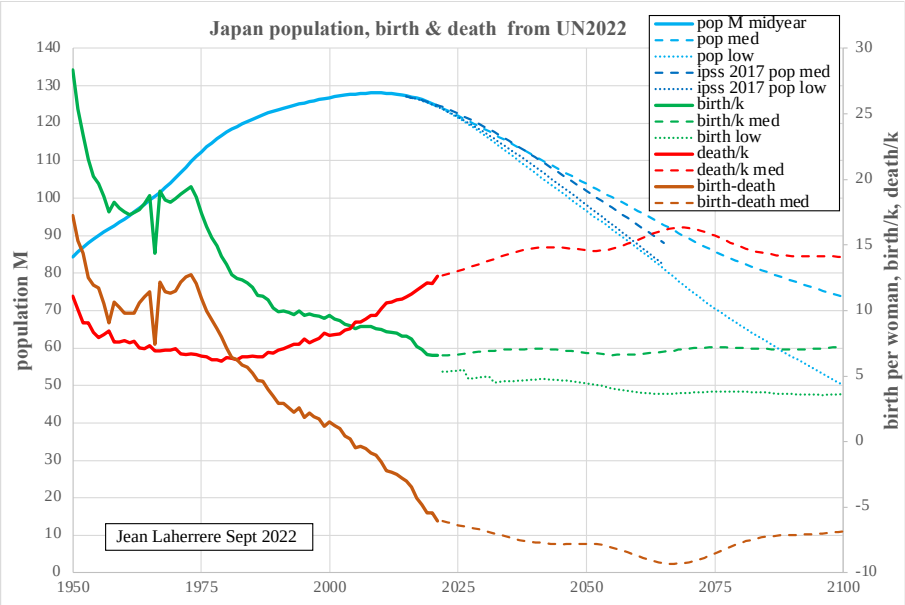


It is strange, but I trust more Statcan than UN

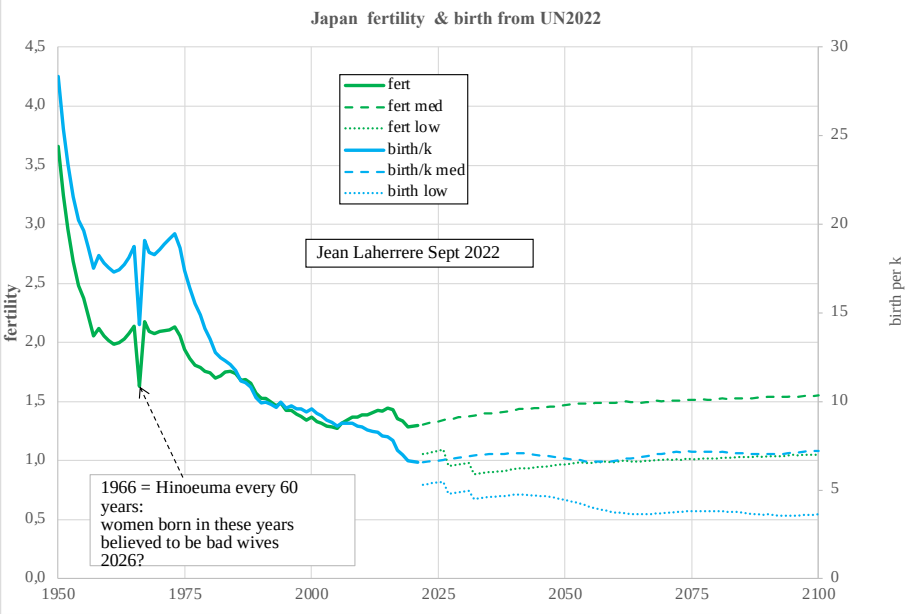


-Japan

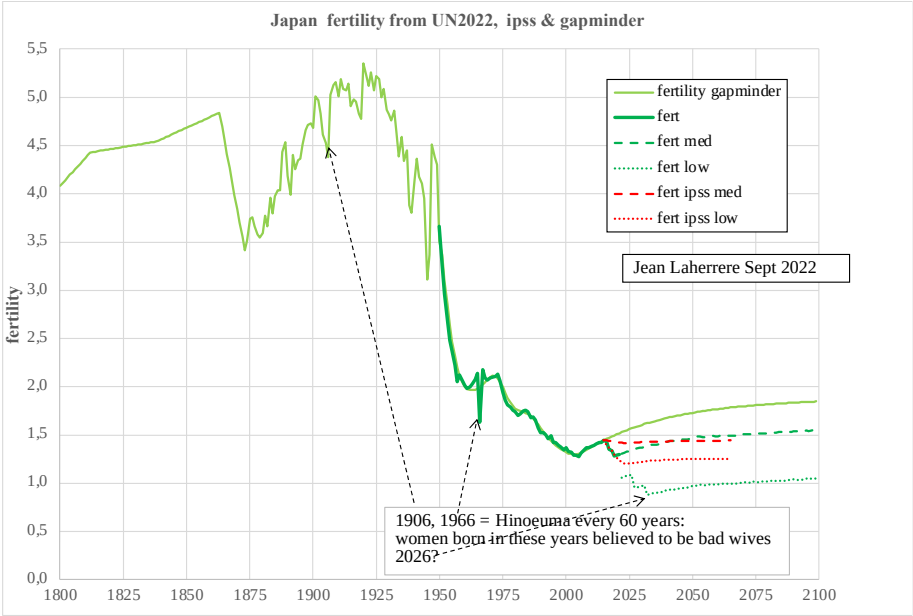
Japan population has peaked in 2009, but UN2022 medium forecast is higher than the Japanese ipss forecast medium, because a too optimistic fertility forecast



UN2022 medium fertility increases from 2022 to 2100 when birth is flat



Japan fertility peaked in 1920, with some strange behavior for Hinoeuma years 1906 and 1966

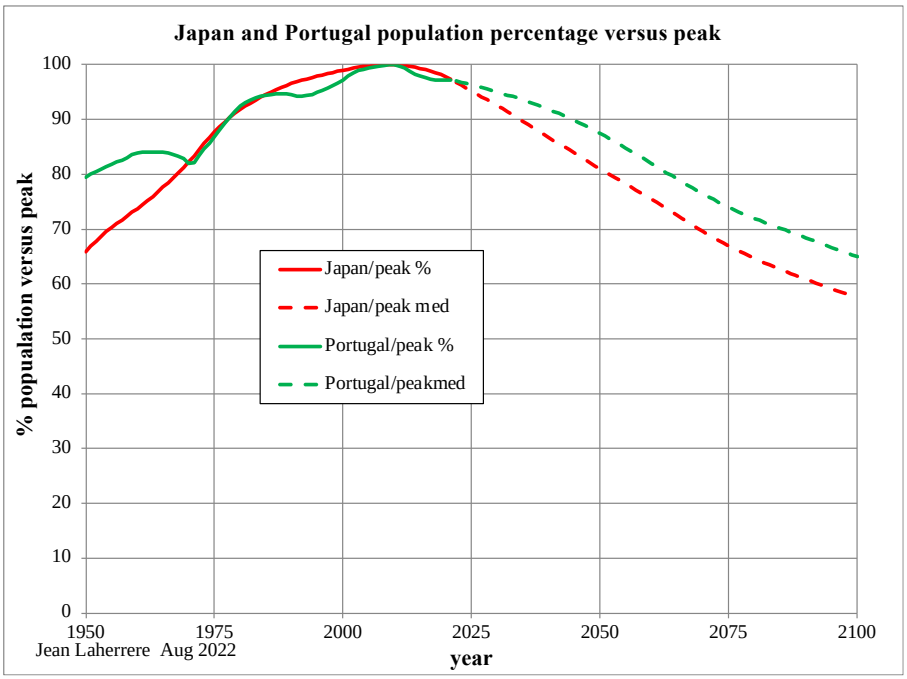


https://blogs.worldbank.org/opendata/curse-fire-horse-how-superstition-impacted-fertility-rates-japan
Many Japanese families chose not to have children in 1966 due to their superstition of "Hinoe-Uma (Fire-Horse)". Fire-Horse is the 43rd combination of the sexagenary cycle, which happens every 60 years. The superstition is that women born in this year of the "Fire-Horse" have a bad personality and will kill their future husband.
The drop was also severe in 1906, what about in 2026? UN and ipss do not forecast any fertility drop in 2026.

From UN2019 Japan is the country with the largest percentage of people over 65 years = 28 % followed by Italy 23 %

UN2019	country	% 65 yr	pop 65 yr	pop M
1	Japan	28,2	35,6	126,2
2	Italy	22,8	13,8	60,3
3	Greece	21,8	2,3	10,7
4	Portugal	21,8	2,2	10,3
5	Germany	21,4	17,8	83,1
6	France	20,3	13,2	64,8
7	Sweden	19,9	2,1	10,3
8	Hungary	19,3	1,9	9,8
9	Spain	19,1	9,0	47,1
10	Netherlands	18,9	3,3	17,3
11	Belgium	18,7	2,2	11,5
12	United Kingc	18,3	12,2	66,8
13	Romania	18,2	3,5	19,4
14	Poland	17,5	6,7	38,4
15	Canada	17,2	6,4	37,4
16	Ukraine	16,5	6,9	42,0
17	United States	16	52,8	329,2
18	Australia	15,8	4,0	25,3
19	South Korea	15,1	7,8	51,9
20	Russian Fede	14,6	21,4	146,7
21	Taiwan	13,9	3,3	23,6
22	China	11,9	166,4	1398,0
23	Chile	11,8	2,3	19,1
24	Thailand	11,5	7,6	66,4
25	Argentina	11,4	5,1	44,9
26	Colombia	11,4	4,6	44,9
27	North Korea	9,5	2,4	25,7
28	Turkey	8,8	7,3	82,6
29	Brazil	8,5	17,8	209,3
30	Peru	8,4	2,7	31,8
31	Sri Lanka	7,8	1,7	21,9
32	Mexico	7,2	9,2	126,6
33	Morocco	7,1	2,5	35,6
34	Viet Nam	7	6,7	95,7
35	Venezuala	6,8	2,0	28,5
36	Malaysia	6,4	2,1	32,8
37	Algeria	6,2	2,7	43,4
38	India	6,1	84,9	1391,9
39	Iran	6,1	5,1	83,9
40	South Africa	6	3,5	58,6
41	Myanmar	5,9	3,2	54,1
42	Indonesia	5,6	15,2	268,4
43	Bangladesh	5,1	8,4	163,7
44	Philippines	5,1	5,5	108,1
45	Pakistan	4,3	9,3	216,6
47	Egypt	3,9	3,9	99,1
48	Ethiopia	3,5	3,9	112,1
49	Democratic F	3	2,6	86,8
50	Nigeria	2,7	5,4	201,0

Japan population forecast is compared with Portugal with a plot as a percentage of the peak

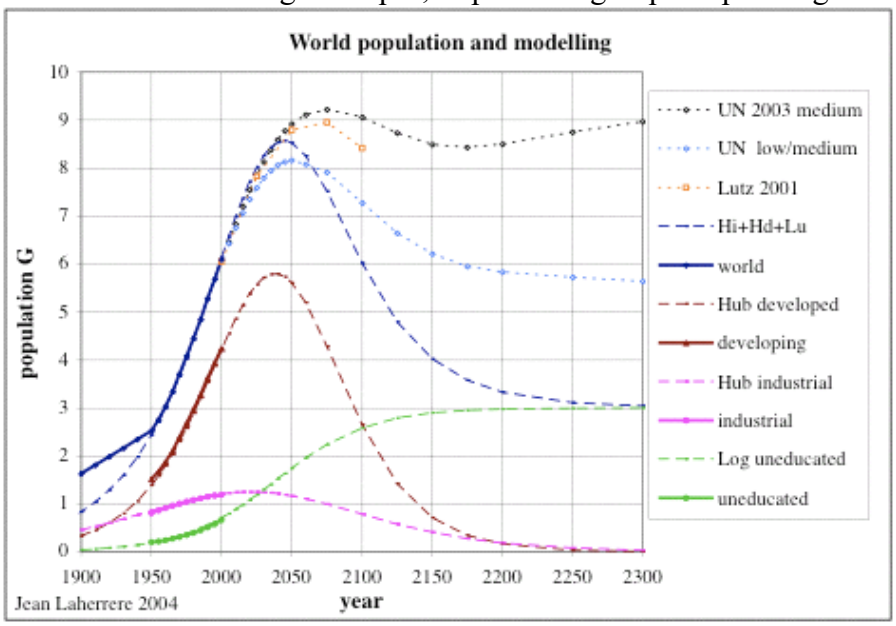


It appears that 90 years after the peak the population will decline to about 60%

-Modelling with Hubbert linearization and other models

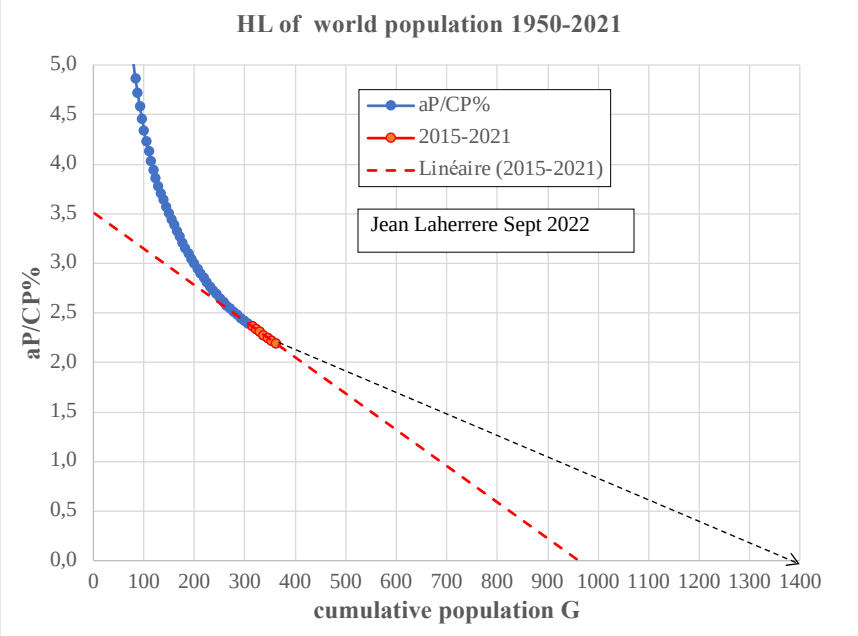
Most of the forecasting of the fossil fuels production is done using the Hubbert linearization (HL) assuming a logistic function as it was done by Bourgeois-Pichat (INED) in 1988

In my paper "Réflexions sur les lois de la nature et les prévisions énergétiques" UMR ESpace 6012, Université d'Avignon 9 décembre 2005 www.hubbertpeak.com/laherrere/Avignon-1.pdf, www.hubbertpeak.com/laherrere/Avignon-2.pdf, http://www.groupe-dupont.org/Seminaire.htm

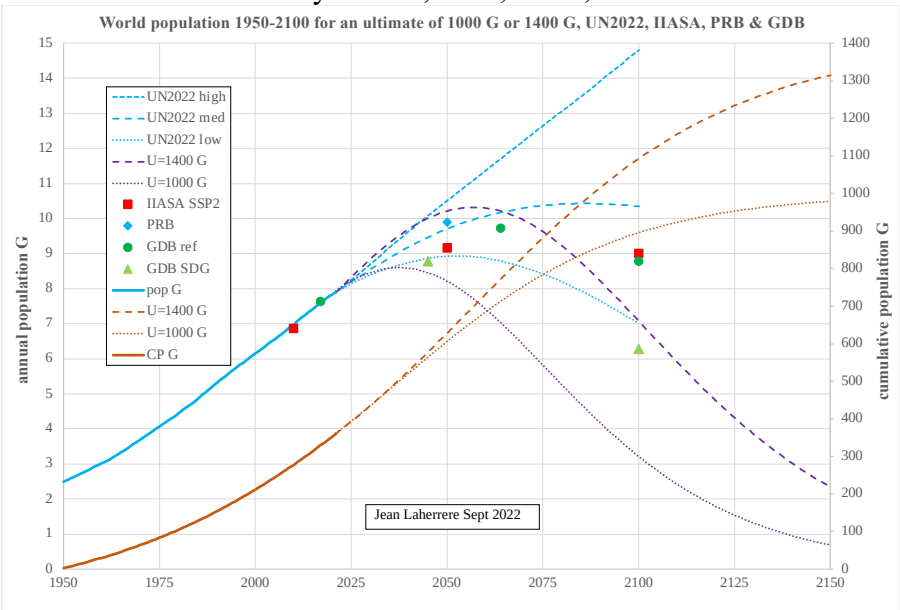


My 2004 forecast using Bourgeois-Pichat's approach was a peak around 2050 at 8.5 G when UN2003 med was a peak on 2060 at 9.2 G followed by a trough in 2175 with a rise beyond, because the uneducated forecast was assumed to not follow a Hubbert curve but a S curve with an asymptote at 3 G

In my new world forecast, with UN2022 data, instead of developing, industrial and uneducated I take only the world, but in the next chapter I take two population : the more and the less developed countries.
The HL for UN2022 data for one cycle is trending towards an ultimate of 1000 G from the last 7 years, but the plot is not linear but hyperbolic, making the extrapolation less reliable, another ultimate of 1400 G is also taken to recognize the hyperbolic trend.



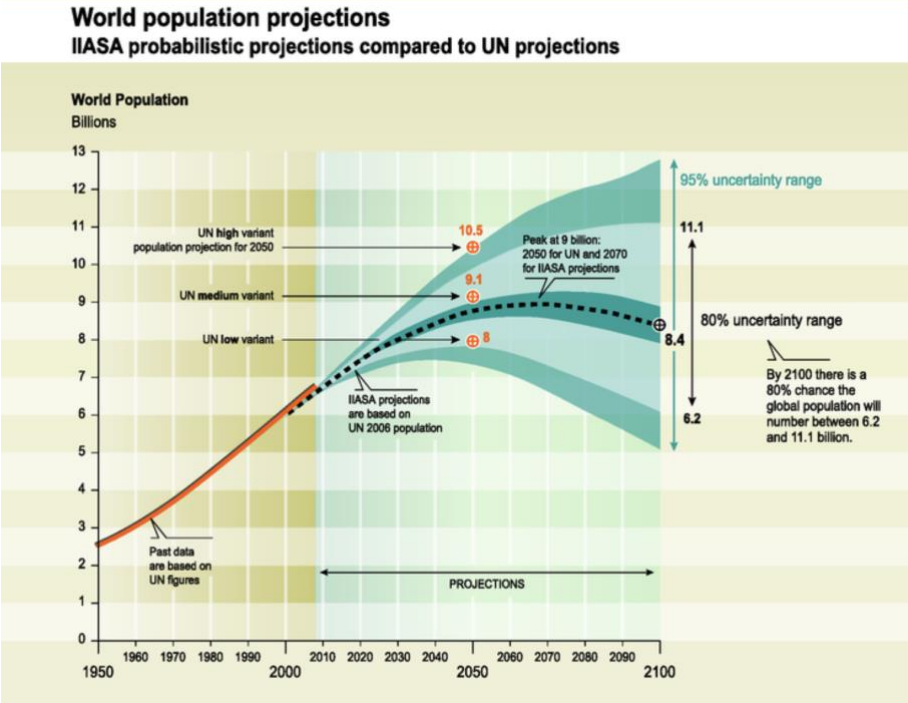
The 1000 G ultimate gives a peak in 2037 at 8.6 G, which is not far from UN2022 low scenario for the peak (2050) but the forecast for 2100 is much lower at 3.2 G against 7 G for UN2022 low.
The 1400 G ultimate gives a peak in 2057 at 10,3 G, not too far from UN2022 medium, but the forecast for 2100 is 7 G, which is the UN2022 low scenario
The next graph includes the forecasts by IIASA, PRB, GDB, UN2022 and HL



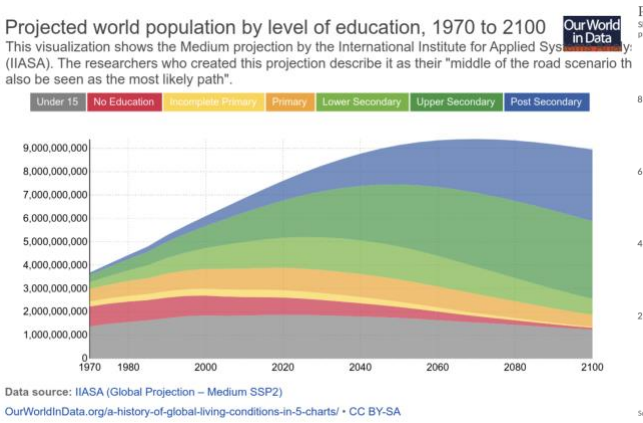
It appears that the forecast UN2022 medium is similar with HL U=1400 G up to 2070.
The HL 1400 G forecasts a population of 7G in 2100 not far to the GDB SDG value of 6.3 G

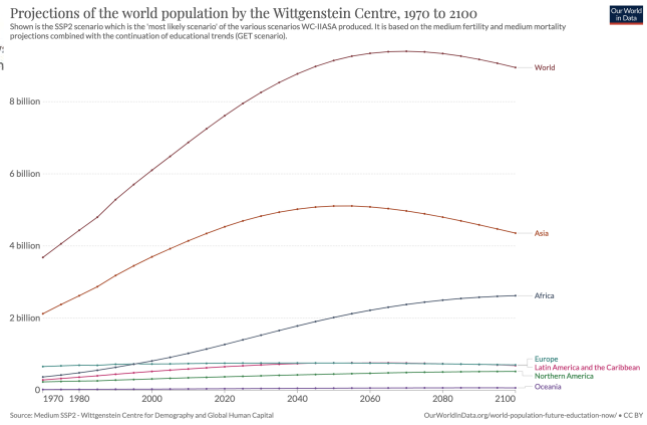
It is important to find another population forecast to compare with UN2022
IIASA has a long past of population forecasts, but their last forecasts are old

2010
IIASA https://www.eea.europa.eu/data-and-maps/figures/world-population-projections-iiasa-probabilistic
World population projections - IIASA probabilistic projections compared to UN projections Dec 2010

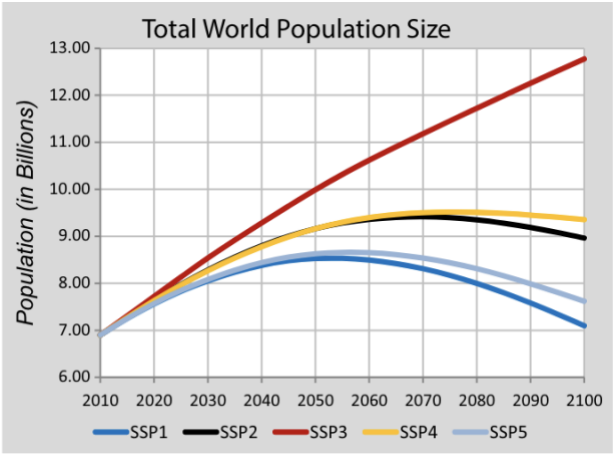


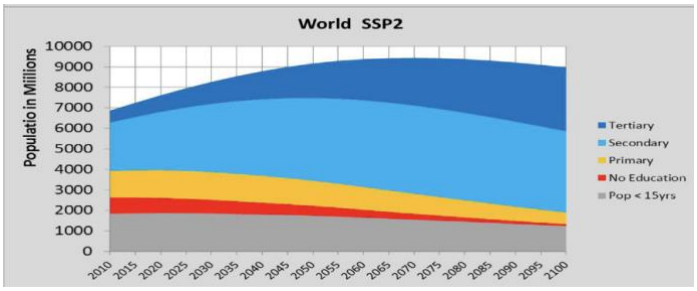
2014 IIASA plotted by owid = SSP2 (shared socioeconomic pathways) where IIASA peak for medium in 2070 at 9.4 G
SSP2: This is the middle of the road scenario that corresponds exactly to the medium variant of the new IIASA-VID-Oxford projections. It combines for all countries medium fertility with medium mortality and medium migration and the Global Education Trend (GET) education scenario





"The human core of the shared socioeconomic pathways: Population scenarios by age, sex and level of education for all countries to 2100" Samir KC, Wolfgang Lutz Elsevier July 2014



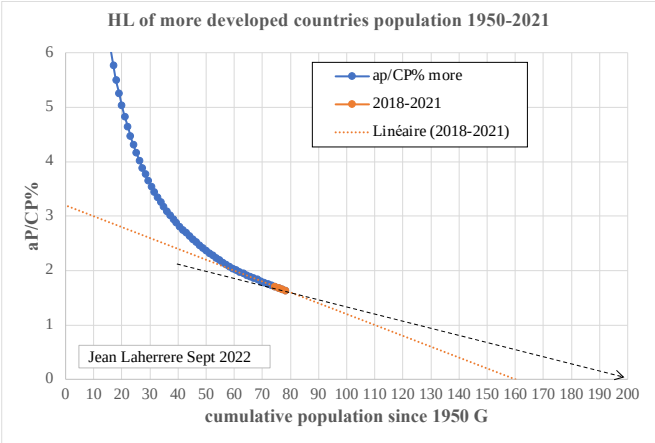


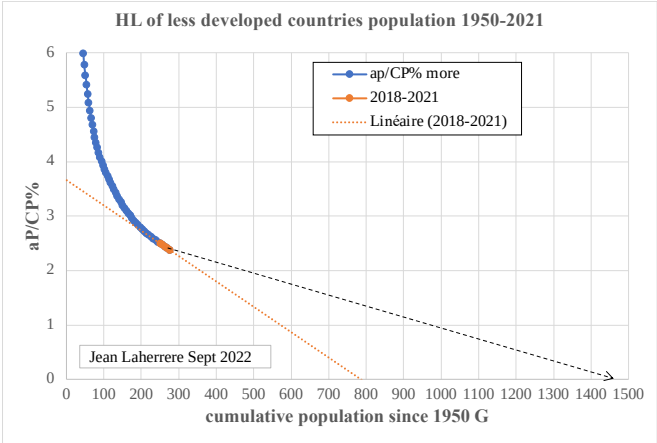
The Global Burden of Disease (GBD) Study 2019 by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington and funded by the Bill and Melinda Gates Foundation was published in The Lancet in July 2020
https://www.healthdata.org/news-release/lancet-world-population-likely-shrink-after-mid-century-forecasting-major-shifts-globalThe Lancet:
"World population likely to shrink after mid-century, forecasting major shifts in global population and economic power"
World population forecasted to peak in 2064 at around 9.7 billion people and fall to 8.8 billion by century's end, with 23 countries seeing populations shrink by more than 50%, including Japan, Thailand, Italy, and Spain.
https://ghdx.healthdata.org/record/ihme-data/global-population-forecasts-2017-2100
SDG = Sustainable development goals UN2015

HSBC https://www.research.hsbc.com/C/1/1/320/cjGpNND July 2022 comments the UN2022 data and states: *We've argued for some time that these forecasts had been a little optimistic in terms of the direction of travel for birth rates – and that fertility rates would move lower at a faster pace than the UN had previously suggested. If this continues, this peak in population might even come sooner than 2086*

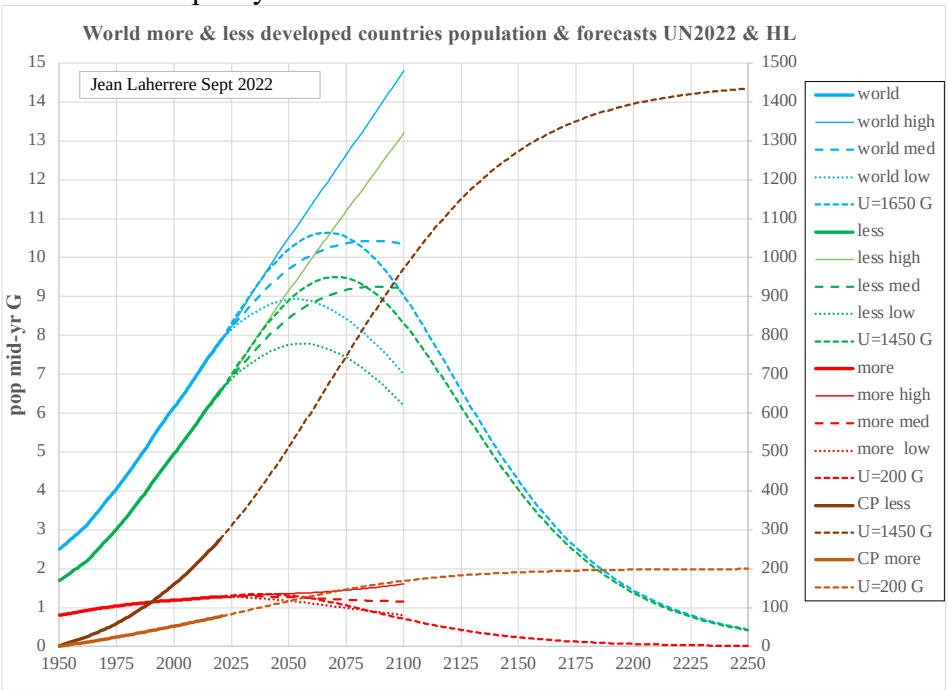
IIASA and GDB population forecasts are between UN2022 medium and UN2020 low, confirming that UN2022 medium is too optimistic

-Modelling the more & less developed countries population
UN2022 reports the data 1950-2021 for the more and the less developed countries
HL plots are not linear but hyperbolic and the extrapolation is not easy
The ultimates are taken as 200 G for the more developed and 1450 G for the less developed





UN2022 population forecast for 2100 is very large from 7 to 14.8 G, with peak between 2050 and beyond 2100, showing that they are unable to give a good forecast. I am not better, but I want to show another way and the discrepancy with other sources.



The forecast for 2100 using HL is lower than the forecast UN2022 medium (very optimistic), in particular for the more developed countries

pop G 2100	UN2022 med	HL
more developed	1.2	0.7
less developed	9.2	8.3
world	10.4	9

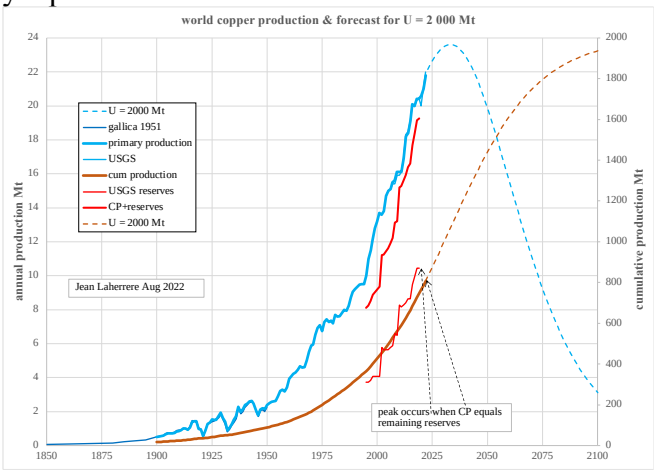
But the world peak year using HL is lower than UN2022 medium but the population peak is higher

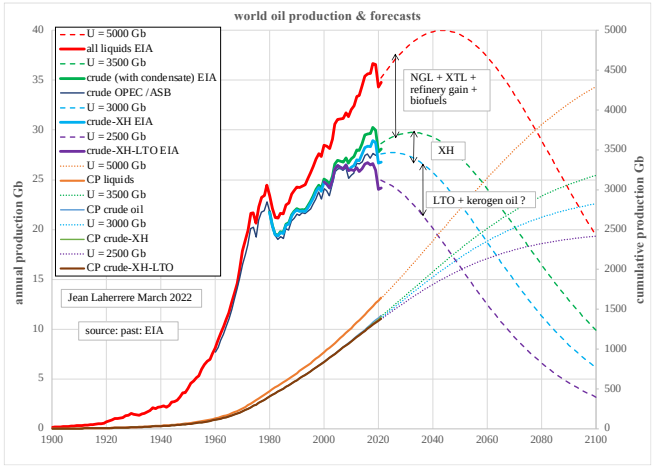
	year	year	pop G	pop G
peak	UN2022 med	HL	UN2022 med	HL
more developed	2034	2038	1.3	1.3
less developed	2088	2070	9.2	9.5
world	2085	2060	10.4	10.6

In 2250 under the HL ultimates more developed countries will be extinct and the world reduced to 0.5 G

The population decline after peak of countries as Russia (1993) Japan (2009) and Portugal (2009) leads to forecast that the world would decline by about one third 90 years after peak. The decline could be

sharper later: it means that human extinction could happen in few centuries! Fertility decreases with education.
In 1900 electric cars were considered as the future (https://aspofrance.org/2022/02/26/carburants-en-france-prix-inflation-et-smic-consommation-perte-fiscale-du-gazole-et-pertes-a-lexportation-prix-du-brut-et-declin-de-la-production-future/) but oil prevailed on battery. Today electric cars are again considered to replace thermic cars but needs 4 times more metals, in particular copper. But copper production peak is forecasted to be around 2030.
Crude oil production has peaked in 2018, and only extra-heavy oil and natural gas liquids have not yet peaked.

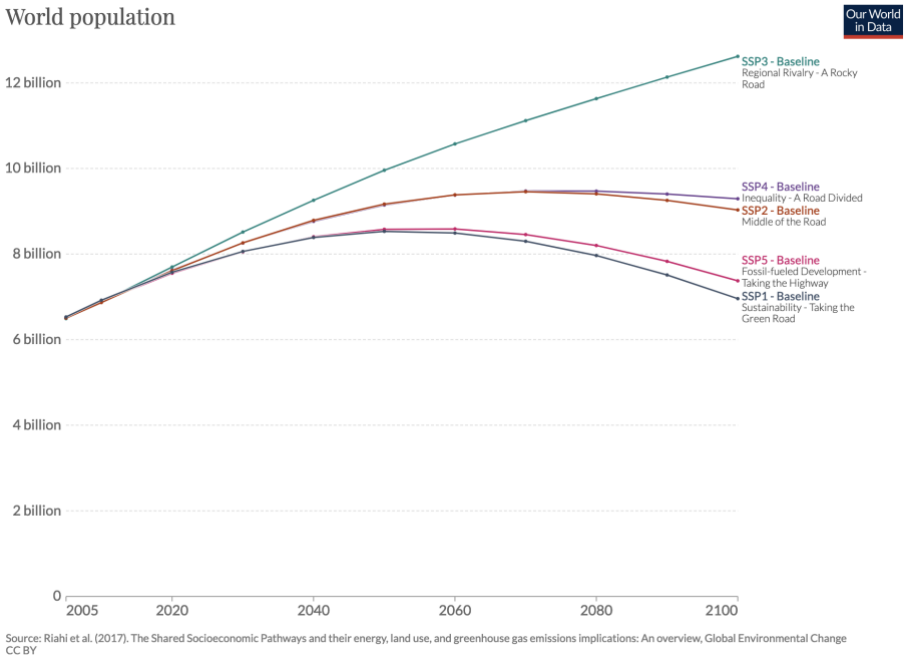




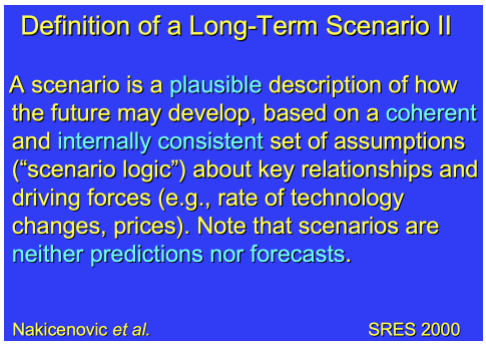
The earth is finite and some who dreams of eternal growth have to come back to reality.

Some want to call anthropocene the present time, starting when human activity has a significant impact on the planet (1850 or 1950?), but it appears that it will be too short to be a geological time. Nature will recover quickly when Homo Sapiens is gone: artificial ground will quickly be transpierced by plants.

IPCC scenarios used for AR6 2022 reports are the shared socio-economic (pathways) scenarios and the range in 2100 is between 7 (sustainability- taking the green road) and 13 G (regional rivalry- a rocky road)



I remind that the IPCC scenarios are neither forecasts or predictions, but storylines as stated in 2000 by Dr Nakicenovic who conceived at IIASA the first IPCC energy 40 scenarios SRES for the first IPCC report.

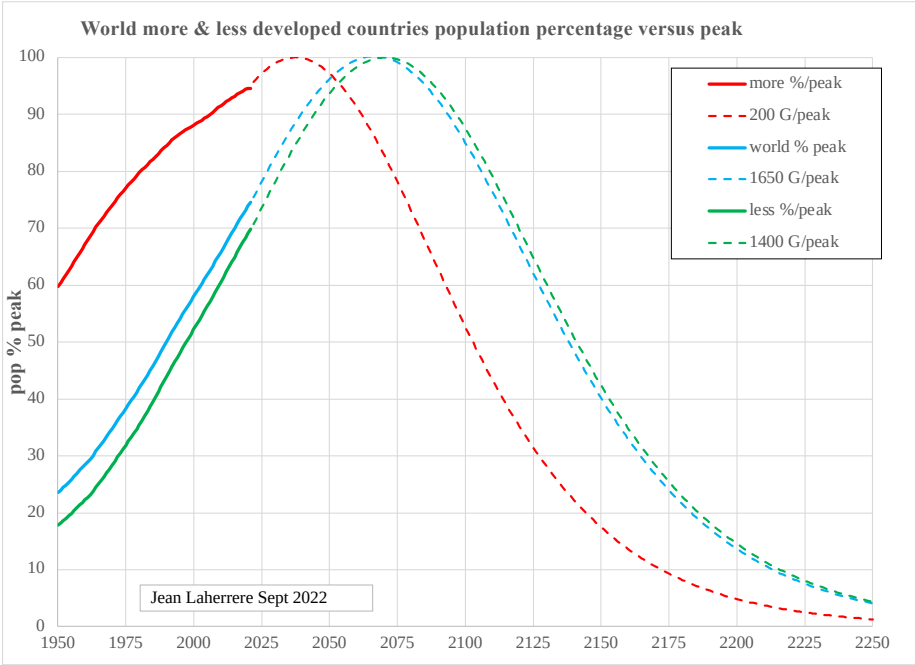


It is obvious by looking at the titles of SSP (Riahi et al): SSP1= Sustainability, SSP2= Middle of the road, SSP3= Regional rivalry, SSP4= Inequality, SSP5=Fossil-fueled development,

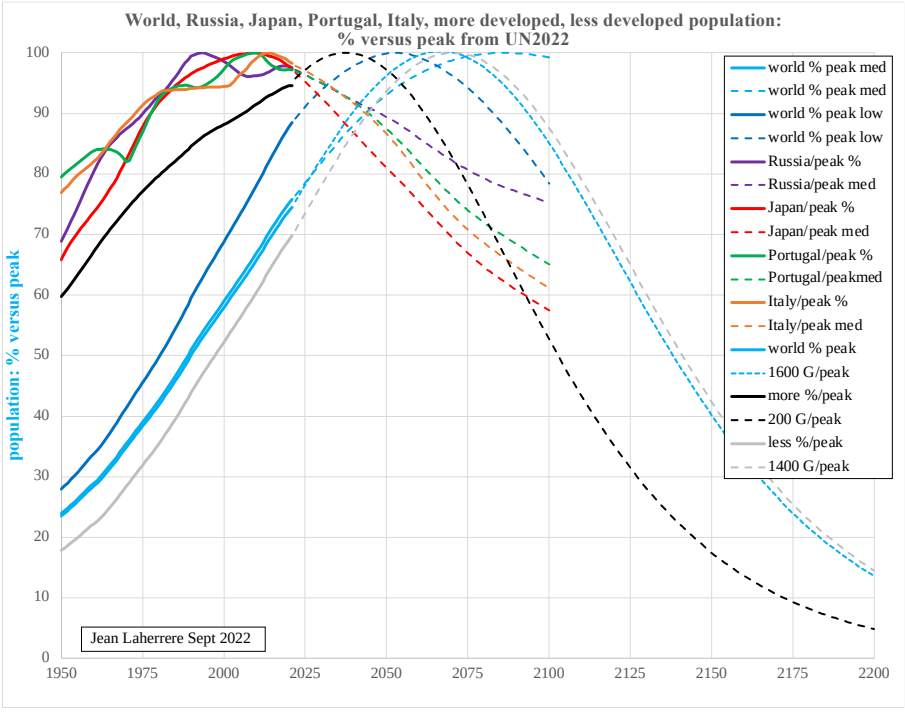
Fig. 1 Overview of SSPs
(Narratives in O'Neill et al., 2016, Glob Env Change, online first)
SSP1: low challenges for mitigation (resource efficiency) and adaptation (rapid development)
SSP3: high challenges for mitigation (regionalized energy / land policies) and adaptation (slow development)
SSP4: low challenges for mitigation (global high tech economy), high for adapt. (regional low tech economies)
SSP5: high challenges for mitigation (resource / fossil fuel intensive) and low for adapt. (rapid development)

These IPCC scenarios ignore the forecasts done by competent energy organisations as IEA or WEC The world is run by energy, not by economy. Economy started about 8 centuries ago, before only energy matters: biomass, food and wood.

-Percentage of population versus peak value
The plot for the more and less developed countries



The plot for the world with a peak in 2086 at 10.4 G for medium and a peak in 2053 at 8.9 G in 2053 and is compared with the data from Russia ; Japan, Italy and Portugal and the forecasts for more & less developed countries



-Conclusions

INED 2022: *Today, two-thirds of the world population live in a country or area where fertility is below 2.1 births per woman. In 2021, average fertility remained above that level in sub-Saharan Africa (at 4.6 children), Oceania, not including Australia and New Zealand (3.1), North Africa and Western Asia (2.8), and Central and Southern Asia (2.3).*

The UN2019 data was showing only for 2019 a percentage of 47 %: it appears that the new data displays a much more pessimistic view of the world and this drastic change on population is ignored by the media which worry more about the climate or the extinction of animal or plant species
In the long term two-thirds of the present world population will be replaced by population coming from countries with higher fertility: it is called by some the Great Replacement.
UN population forecasts for the medium scenario are based on utopic goals where developed countries will increase their low fertility values and the undeveloped countries will decrease the high fertility values faster. These UN2022 medium fertility forecasts should be considered as too optimistic, as the medium scenario on births displays a more pessimistic view, as IIASA and GDB forecasts.
The population decline after peak of countries as Russia (1993) Japan (2009) and Portugal (2009) leads to forecast that the world would decline by about one third 90 years after peak. The decline could be sharper later: it means that human extinction could happen in few centuries! Fertility decreases with education.
Some want to call anthropocene the present time, starting when human activity has a significant impact on the planet (1850 or 1950?), but it appears that it will be too short to be a geological time. Nature will recover quickly when Homo Sapiens is gone

The range of uncertainty for the world population forecast by UN2022 in 2100 is huge between 7 to 14.8 G, more than the double. It means that no one is able to justify a reliable population forecast, it is the same for forecasting the weather beyond 2 weeks, the energy price beyond few months, the climate beyond few years.
The weak point of UN populations forecasts is the utopic fertility scenarios to please its members.
The world population peak forecast using Hubbert linearization is sooner in time than UN2022 medium (2060 against 2085) but higher in population (10.6 G against 10.4 G)

NB: sorry for my broken English but some of my graphs are worth to be considered, in particular the correlation temperature-CO2 page 2 and percentage of population versus fertility page 6