

Why you wrongly think that Western countries are in population decline.

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It seems that if people have heard one thing about demography and population dynamics, it is that when a human population has mean fertility below the replacement fertility level at 2.1 (children per female) it will be declining. This is incorrect.

Replacement fertility is defined for a stable age distribution. Consequently, when you don't have a stable age distribution, a mean fertility level below replacement does not mean that the population is shrinking. A stable age distribution results when fertility and mortality schedules (for each cohort) remains constant over time. Most "developed nations" have been under replacement fertility since about the '70s. And they are not declining yet. There is great inertia in the age distribution when a population that has been growing rapidly shifts to lower birth rates. All of those past births make for a bottom-heavy age distribution, or "pyramid". Now that the birth rate has shifted, it takes time for all those past births to percolate up through the system. Along the way, they will have children of their own. There is great inertia in the age distribution. This is elementary population dynamics, still almost everyone gets it wrong.

Replacement fertility will lead to stability once the age distribution is stable. And a stable age distribution requires a long period of constant reproduction and mortality schedules. None of these age specific rates remain constant for long. For instance, our longevity is constantly going up. Countries with below replacement level fertility will still be growing for a long time to come.

A rapidly growing population that slammed on the breaks and dropped below replacement fertility and a fixed fecundity and mortality schedule might still have enough momentum entombed

in a bottom-heavy age pyramid to keep growing for fifty years and double in size. It takes a long time for a bottom-heavy age pyramid to recalibrate and stabilize, and for reproductive rates below replacement fertility to translate into negative population growth.

Despite this fact, “leaders” in most countries have long exhorted *their* populations to have *more* kids, not less. The media has also fanned the flames by creating headlines recently about one model that, they purport, shows that many countries may have entered a phase of, quote, “rapid population decline” by the year 2100.

Even those countries that will be declining by 2100 won't really feel this change as *rapid*. Eighty years is a long time. And anyway, it is difficult to know exactly what assumptions and mechanisms to build into a long-term model that purports to be predictive. Many things can happen over a time span as long as eighty years. Including ecological collapse under the weight of all these people. Population sizes do not generally change quickly—except in the case of ecological collapse, which is not built into that model. Normal, incremental changes we have time to adapt to. Japan (since 2010) and Italy (since 2018) actually *do* have negative population growth, and they are coping.

All of you worried about an “aging population”: the “burden” of old people will not be hard to bear when we simultaneously have fewer young people to support. Young people don't pay taxes either (old people actually do). Schools, child support, child care, prisons, social workers, activities for kids, etc. are expensive too. Anyway, you don't fix the mistakes of the past by continuing to make the same mistake. The problem isn't that people are having too few babies today—on the contrary—the problem is that they had too many babies in the past. Let's not keep making this mistake.

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When it comes to models of the global human population, they generally do not show growth rates becoming zero, or

negative, this century. The “medium” population trajectory from the UN demographers show the population trend to be nearly flat by 2100, but not quite. It is of course possible to use other assumptions and parameter values, but the eventual growth rates could just as well prove to be higher rather than lower. Except, of course, in that ecological collapse scenario... Climate breakdown, biodiversity meltdown, etc., are not exactly favorable for the human condition. But here too there will be time lags, meaning that human populations won't likely start declining before they have done irreparable damage. **And no matter how you twist and turn, the colossal size of the human population is a dominant factor in that damage.**

Nor can you blame continued population growth in western countries on immigration. Generally these countries still have birth surpluses independent of immigration. It's simple: just go back and look at the number of births and the number of deaths in a given country.

I blame Hans Rosling for much of the confusion on human population issues and demography. People who dismiss concerns about the size of the global human population seem to have either gone to social sciences school and been told that “Malthus was wrong”, or have watched a Hans Rosling video on YouTube and been convinced that the problem will “fix itself”.

Every now and then, these people, like Rosling, Lomborg, Pinker, etc., come out of the woodworks and make a big splash talking about things well outside their area of expertise. Rosling at least seemed to mean well. Lomborg, not so much.

Rosling and United Nations demographers may be right that the global human population growth may flatten out in the next hundred years or so, at perhaps 11 or 12 billion (but other analyses, using other assumptions, do not necessarily show the same trend). They would be mistaken, however, in assuming that this takes care of the population issue. Stopping the growth is just a necessary first step towards

bringing the population size down. Population growth has to turn negative, and it has to do it in time.

Rosling didn't get it. And it is annoying when people are given such a large platform from which to preach about things they don't understand.

Overpopulation is a question about the underlying ecology, and Rosling was not an ecologist. The various environmental crises we are in the middle of should tell anyone that things are not going well in the world. But that is not what Rosling looked at. The fact that the global human population growth rate is a little lower now than it was at its peak does not mean that we are not overpopulated—in fact it is exactly what you would expect if we were overpopulated. If we are already too many it is not enough to slow population growth rates, the absolute population *size* must decline, not just the growth rate. If the human population is going to level off at 11 or 12 billion, that doesn't help much if the ecology can only bear the weight of 1 billion humans (with current average behavior patterns). And the population may well crash abruptly from 11 billion, when the repercussions of ecological effects really kick in. Statistics about the current state isn't really what you need, because there are lags in ecological systems. The real issue is the future consequences (and to a lesser extent past and present consequences) of billions of people on the ecology of the planet. And Rosling doesn't look at that. Nor does the fact that a lot of people are ignorant about the state of the world mean that there is no problem. On the contrary. Rosling himself is ignorant about the state of the world. He doesn't even know what variables to look at.

Rosling has done a lot of damage, precisely because a lot of people believe that the problem has been defused (by itself). He gets a lot of mileage out of the claim that people don't know the actual facts and they should look at the data. Then he doesn't look at the data himself (beyond fertility rates), and he knows no ecology (and doesn't look at the relevant data). To say something about the future you need to know something about mechanisms, not just extrapolate from current trends. So he is not much of a

statistician either. No one would argue that population growth rates globally aren't decelerating. But that doesn't mean we don't have a problem with the absolute population size. Like Lomborg, Pinker, and the climate deniers, Rosling has done a lot of damage, not least to people's understanding of demography and understanding of the actual state of affairs.

It seems like most population deniers actually think that populations are declining in countries where the second derivative of population size is negative. That the growth rate is declining does not mean that the population size is declining. So the problem is not solving itself, because what we need is not simply for the growth rate to shrink, and for the population size to stabilize. What we need is to get the growth rate into negative territory and for the overall population size to decline.

Birth rates need to come down in rich countries and poor countries alike. We have been too many humans for a long time already. Being a population denier is not helping. And you still need to do all the things the population deniers suggest we do, and more. But will we?

Perhaps the language we commonly use to describe population growth and growth rates can be confusing. It helps if you've had some basic calculus. A declining growth rate does not mean that the population is shrinking, merely that it is not growing quite as fast as it used to be. A shrinking population would mean that the population growth rate is *negative*. This is extremely basic calculus. The growth rate is the first derivative of the population size (how the population size changes with time). When the growth rate is declining, we are talking about the second derivative of population size—the way in which the growth rate is changing over time. A declining population is one where the first derivative of the population size, the population growth rate, is negative. A declining growth rate just means that the second derivative of the population size is negative: the growth rate is getting smaller than it was, but it is typically not yet negative, and the population size itself is still growing. Positive first derivative, negative second

derivative. But this probably doesn't help, because if you knew what a derivative was you would know all this already. The point is, a declining growth rate does not mean a declining population. Only when the growth rate gets into negative territory does the population size also start shrinking.

It might also help a little to get into the concept of exponential growth. However, technically, we are no longer in a stage of exponential growth. Exponential growth is what you have when you have a constant growth rate over time. Like if you get the same, fixed interest rate in the bank year after year. But, as just stated, the growth rate is no longer constant, it is declining. One simple model that exhibits such a declining growth rate as population size, or population density, grows is *sigmoidal*, or S-shaped, growth. Other options are possible, such as, for instance, an overshoot of the level the environment can tolerate, and a subsequent crash in population size.

But if you did have exponential growth, we could use the "rule of 69". A growth rate of 0.01 means the population size is increasing with 1 percent per year, year over year. 0.02 means a two percent increase in population size per year, and so on. The rule of 69, which you get by doing integral calculus on the equation for exponential growth, states that the doubling time of such a population is equal to 69 divided by the growth rate, in percent. So a population with a growth rate of 0.02, or 2 percent, doubles in $69/2$ years, or approximately 35 years. With a growth rate half that, one percent, which is about where the global population growth rate of humans is today, exponential growth would mean that the population size doubles in $69/1=69$ years. In that case, a population of 7.8 billion in 2020 would grow to 15.6 billion by 2089.

It is probably true that we have entered our last doubling in human population size. But that should not become a source of complacency. The human population size needs to come down, everywhere. Not just the population growth rate.