

Assuming the Future: Evaluating World Population Projections

By
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Extended Abstract

World population, now at 7 billion, is expected to be nearing stabilization at 10 billion by the end of the century according to the United Nations. In addition to fundamental baseline demographic data and methodology, world population projections are the product of crucial assumptions concerning the future paths of fertility, mortality and international migration for countries, areas and territories across the globe.

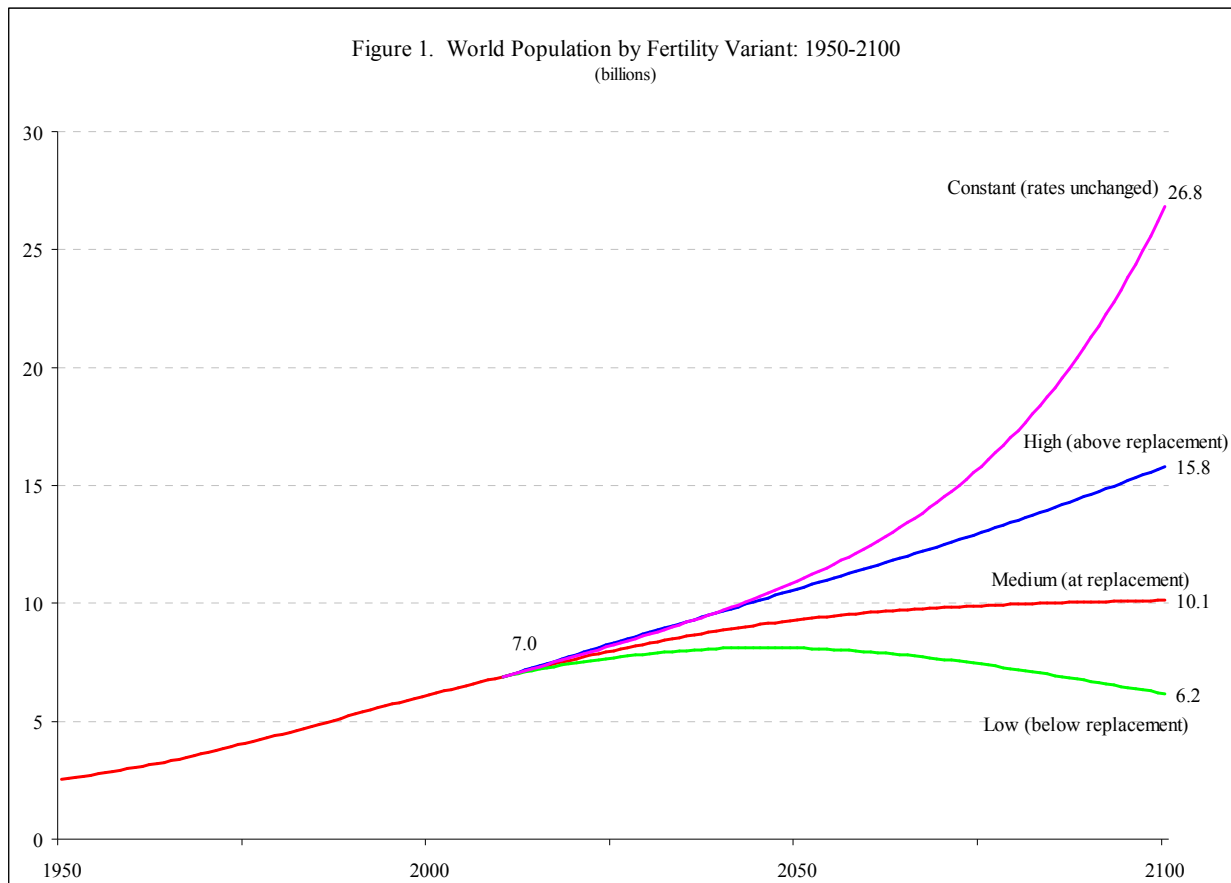
Population projections are usually evaluated on the basis of how close they come to the actual population some years or decades later. This paper, in contrast, evaluates the reasonableness of the assumptions concerning the components of population change. The criteria for this evaluation of future demographic assumptions are: (a) past trends; (b) future outcomes; and (c) policy responses.

Such evaluations are essential in order to refine and adjust projection assumptions so they are consistent with sound empirical evidence and research. Also, well thought-out assessments of the assumptions for the future are needed given the significant and far reaching implications of population projections.

The United Nations population projections, which are issued biennially for all countries and territories, are the most widely used and frequently cited in the public media. According to the UN medium variant projection, world population at the close of the 21st century will be approaching stabilization at 10.1 billion, increasing annually by nearly 6 million compared to 78 million today (Figure 1).

Briefly, the UN medium variant projection rests on three key assumptions. First, fertility rates will converge - from above or below - to the replacement level by the close of the 21st century. Second, mortality will improve throughout the 21st century with small gains the higher the life

expectancy already reached. And third, the future paths of international migration will by and large remain unchanged to mid-century, after which net migration will gradually decline to zero.



Source: United Nations, *World Population Prospects: The 2010 Revision*.

Pegged to the medium variant projection, the UN high and low variant projections retrain the mortality and migration assumptions, but assume fertility rates move toward about a half-child above replacement (2.51) and a half-child below replacement (1.55), respectively (Table 1). The high and low variants foresee a world population at the end of the 21st century of 15.8 billion growing by 120 million annually or a world of 6.2 billion inhabitants declining by 50 million annually, respectively.

The fourth UN population projection, the constant variant, assumes that national fertility rates remain basically unchanged. Although unlikely, the constant variant is instructive because it illustrates the demographic future if fertility rates were to remain essentially where they are today. According to this variant, world population at the end of the century reaches 26.8 billion

inhabitants with an annual growth of 644 million or more than eight-times today's annual increase.

Table 1. Total Fertility Rate for World by Variant: 2005-2100

Period	Medium Variant	High variant	Low variant	Constant-fertility variant
2005-2010	2.52	2.52	2.52	2.52
2010-2015	2.45	2.70	2.20	2.60
2015-2020	2.39	2.79	1.99	2.68
2020-2025	2.33	2.84	1.83	2.75
2025-2030	2.29	2.79	1.79	2.83
2030-2035	2.25	2.74	1.76	2.92
2035-2040	2.22	2.71	1.74	3.01
2040-2045	2.19	2.67	1.72	3.12
2045-2050	2.17	2.64	1.71	3.22
2050-2055	2.15	2.62	1.68	3.33
2055-2060	2.12	2.60	1.66	3.45
2060-2065	2.11	2.58	1.64	3.57
2065-2070	2.09	2.56	1.63	3.69
2070-2075	2.08	2.55	1.62	3.82
2075-2080	2.06	2.54	1.60	3.94
2080-2085	2.05	2.53	1.59	4.07
2085-2090	2.04	2.53	1.57	4.19
2090-2095	2.04	2.52	1.56	4.32
2095-2100	2.03	2.51	1.55	4.44

Source: United Nations, World Population Prospects: The 2010 Revision.

Barring a cataclysmic global mortality disaster, the projection of the world's population rests largely on the critical assumption that fertility rates will settle close to the replacement level of about two children per woman. Is this central assumption about future fertility levels reasonable and credible?

Past research has shown that powerful forces are responsible for bringing down fertility so rapidly, including mortality decline, urbanization, education, economic development, improvements in the status of women and modern contraceptives. Additional forces pushing fertility below two children per woman are the decline of marriage, divorce and separation, cohabitation, economic independence of women, costs of child rearing, childless life styles and saving for longer years of retirement and old age care.

Admittedly, it is difficult to imagine such rapid fertility transitions in today's high fertility countries in sub-Saharan Africa and Asia. However, rapid transitions from high to low fertility levels have occurred in a variety of diverse social, economic and political settings, such as Albania, Algeria, Brazil, China, Costa Rica, Iran, Mexico, Thailand, Tunisia, Turkey and Viet Nam. Therefore, there is every reason to assume that a similar transition will take place in currently high fertility countries over the coming decades.

In contrast, the assumption that the fertility of below replacement nations will return to replacement levels appears dubious. While a future rebound can not be ruled out - it rebounded in some European nations after WWII - the general pattern over the last half century has been unmistakable: once fertility has fallen below the replacement level, it tends to stay there. And this has especially been the case for scores of countries where fertility has declined below 1.5 children per woman, such as Canada, Germany, Hungary, Italy, Japan, Russia and South Korea.

Aiming to raise their very low fertility rates, which are viewed as jeopardizing the basic foundations of the nation and its survival, some European and East Asian countries have adopted family-friendly policies, incentives and programs. However, based on past experience and the numerous constraints governments face in this area of human behavior, few believe that such pro-natalist measures and efforts will be sufficient to raise fertility to replacement levels.

Most demographers are likely to agree that future fertility levels will most likely fall somewhere between 2.5 and 1.5 children per woman. Many may also agree, or at least appreciate, that it is demographically convenient to have the UN medium projections assume fertility rates eventually reach and settle near the replacement level of two children per woman because this leads to population stabilization.

However, other than the demographic expediency and political acceptability of population stabilization, there appears to be little, if any, empirical or theoretical rationale for the widely cited UN projections to assume convergence to replacement level fertility. The demographic patterns and reproductive behavior of men and women observed throughout Europe, East Asia

and numerous other places during the past half century lead to a different conclusion: convergence to below replacement fertility.

As noted earlier, the United Nations projections also assume that mortality will improve with small gains the higher the life expectancy already reached (Table 2). For those nations greatly impacted by the HIV/AIDS epidemic, a slow pace of mortality decline is generally assumed. Taking into account past trends, national policies and given that it is difficult to assume future wars, famines disasters, etc., these mortality assumptions do not appear unreasonable.

Table 2. Life Expectancy at Birth by Sex for World: 2005-2100
(Medium variant)

Period	Both sexes	Male	Female
2005-2010	67.9	65.7	70.1
2010-2015	69.3	67.1	71.6
2015-2020	70.4	68.2	72.8
2020-2025	71.4	69.2	73.8
2025-2030	72.4	70.1	74.8
2030-2035	73.3	71.0	75.7
2035-2040	74.1	71.8	76.5
2040-2045	74.9	72.5	77.3
2045-2050	75.6	73.2	78.0
2050-2055	76.3	73.9	78.7
2055-2060	76.9	74.6	79.3
2060-2065	77.5	75.2	79.9
2065-2070	78.0	75.8	80.4
2070-2075	78.6	76.3	80.9
2075-2080	79.1	76.9	81.4
2080-2085	79.6	77.4	81.9
2085-2090	80.1	78.0	82.4
2090-2095	80.6	78.5	82.9
2095-2100	81.1	79.0	83.3

Source: United Nations, *World Population Prospects: The 2010 Revision*.

With regard to international migration, the United Nations projections set the future path of international migration on the basis of past migration trends and consideration of policy stances of nations concerning future international migration flows. More specifically, the projected levels of net migration are by and large kept unchanged to mid-century, after which net migration gradually declines to zero (Table 3). The assumption that net migration basically comes to a halt by the end of the century does not appear plausible and is at odds with past

migration trends, population growth in both sending and receiving nations and national policies regarding future international migration.

Table 3. Annual Net Migration for More Developed Regions, Europe, North America and Oceania: 2004-2100

Period	(thousands)			
	More Developed Regions	Net migration (per year)		
		Europe	North America	Oceania
2005-2010	3 312	1 809	1 210	223
2010-2015	2 504	1 095	1 192	153
2015-2020	2 403	1 069	1 138	133
2020-2025	2 289	1 019	1 092	115
2025-2030	2 208	954	1 089	102
2030-2035	2 110	870	1 089	90
2035-2040	2 031	804	1 089	78
2040-2045	1 959	749	1 086	65
2045-2050	1 896	702	1 083	51
2050-2055	1 613	566	948	48
2055-2060	1 352	459	806	41
2060-2065	1 148	384	689	35
2065-2070	973	323	584	30
2070-2075	816	271	487	25
2075-2080	662	221	391	20
2080-2085	523	180	301	16
2085-2090	385	140	210	11
2090-2095	249	104	118	6
2095-2100	115	96	0	0

Source: United Nations, *World Population Prospects: The 2010 Revision*.

In summary, the United Nations medium variant projection expects world population to be approaching stabilization at 10.1 billion at the end of the century. This weighty message to scholars, government officials and the general public appears tenuous given that it rests on the dubious assumptions of convergence to replacement fertility and a halt to international migration. Appropriate and needed changes in the assumptions regarding future fertility and international migration levels in the United Nations population projections would be significant and far reaching, with major implications for many critical issues facing the planet, including global warming, biodiversity, the environment, energy, food/water supplies, urbanization and migration.