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Fertility in the United States Is Below Replacement

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KEY TAKEAWAYS

The fertility rate in the U.S. is below replacement and is unlikely to rise above replacement-level fertility in the near future.

Decades of fertility decline and sub-replacement fertility in the U.S. has caused the population to age.

If fertility in the U.S. does not rebound, there is a possibility the population could contract before the end of the century.

For decades, the total fertility rate in the United States has been below the replacement fertility rate—the level of fertility necessary for the current generation to replace itself.

Fertility is a key component of population dynamics. Along with mortality and migration, fertility plays a role in determining everything from population growth to the age structure of the population. Population dynamics, in turn, have important implications for economic growth, the size of the labor force, the solvency of Social Security and Medicare, old-age and child dependency, and population ageing.

High levels of immigration in the U.S. have so far largely staved off the effects of sub-replacement fertility. Population projections from the U.S. Census Bureau and the United Nations Population Division disagree as to whether the U.S. population will

continue growing through 2100 or will begin declining before the end of the century. Without a substantial increase in fertility, the United States will continue to be increasingly dependent on immigration to slow down population ageing and prevent population contraction.

The following charts illustrate the state of fertility in the United States and projections for future trends in fertility.

The Total Fertility Rate: The Standard Measure of Fertility

The most common measure for fertility is the period total fertility rate. The period total fertility rate is the number of children that women on average are on pace to have if current age-specific fertility rates remain the same as women age through their reproductive years.[1] It is an estimate of the average number of children per woman throughout their reproductive lifetime.

A key assumption of the total fertility rate is that women will continue to have children at the same rates at each age as seen in the observation year. But age-specific fertility rates change over time. In the United States, women in their twenties 10 years ago had more children than women currently do in their twenties. And women now in their thirties are likely to have more children than women in their thirties did 10 years ago. Over the past several decades, women in the U.S. have gradually delayed having children. This has caused fertility rates for women under 30 to gradually fall, and fertility rates for women over 30 to gradually rise. Chart 1 shows age-specific fertility rates by five-year age groups in the United States since 1970.

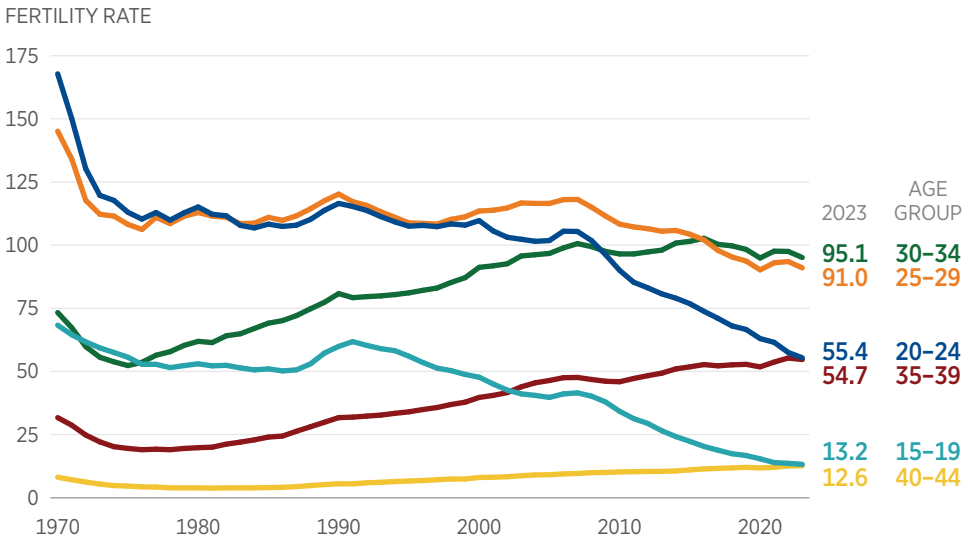
The total fertility rate is not able to capture these changes in age-specific fertility rates over time. When women delay childbearing, the total fertility rate will tend to understate the number of children that women have by the end of their reproductive years. By contrast, when women transition to childbearing at earlier ages, the total fertility rate will tend to overestimate the completed number of children per woman.

Adjusting for the Timing of Births

Demographers have developed methods to measure fertility in ways that account for changes in fertility that occur as a result of changes in the timing of births. The Bongaarts–Feeney tempo-adjusted total fertility rate is perhaps the most widely used adjusted measure of total fertility. The Bongaarts–Feeney method[2] adjusts the birth-order-specific total fertility rate[3] for changes in the mean age at birth at each birth order. This accounts for

CHART 1

Age-Specific Fertility Rates by Five-Year Age Groups in the U.S.



NOTE: Prior to 1985, the National Center for Health Statistics based age-specific fertility rates on a 50 percent sample of births in some states.
SOURCES: National Center for Health Statistics. For more information, see appendix.

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the pace at which women on average are progressing through the number of children they are having.

Because the tempo-adjusted fertility rate adjusts for the timing of births, it is often a more accurate measure of the number of children women will have over their lifetimes.

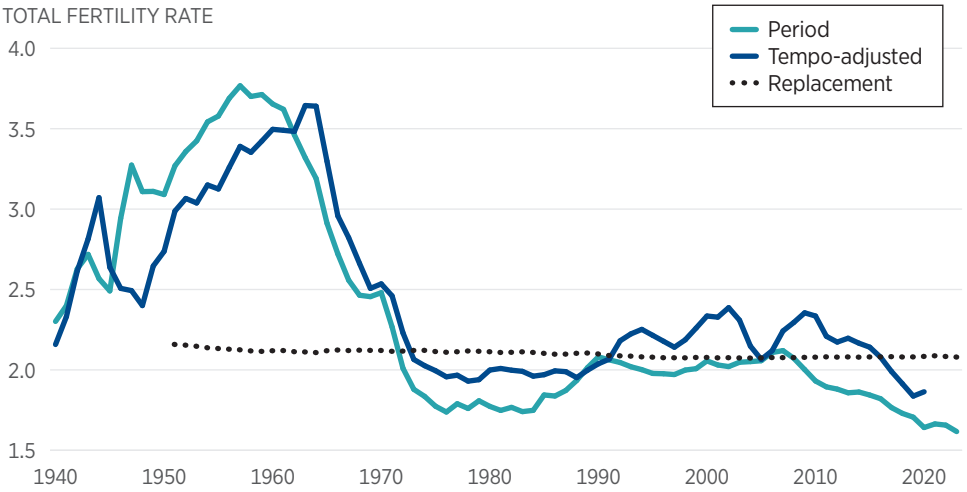
The tempo-adjusted total fertility rate is plotted against the period total fertility rate in Chart 2.

Since 2007, the tempo-adjusted fertility rate has been higher than the total fertility rate. This is an indication that women are delaying childbearing. As a result, the average number of children per woman will likely end up being higher than what the period total fertility rate appears to indicate.

The only time in the past 50 years that the total fertility rate has been above replacement was in 2006 and 2007. Since then, the total fertility rate has been below replacement. And while the tempo-adjusted fertility rate has historically been higher, since 2016, even the tempo-adjusted fertility rate has fallen below replacement.

CHART 2

Total Fertility Rate and Tempo-Adjusted Total Fertility Rate in the U.S.



SOURCES: National Center for Health Statistics; Max Planck Institute for Demographic Research and Vienna Institute of Demography; United Nations, Department of Economic and Social Affairs; and author's calculations. For more information, appendix.

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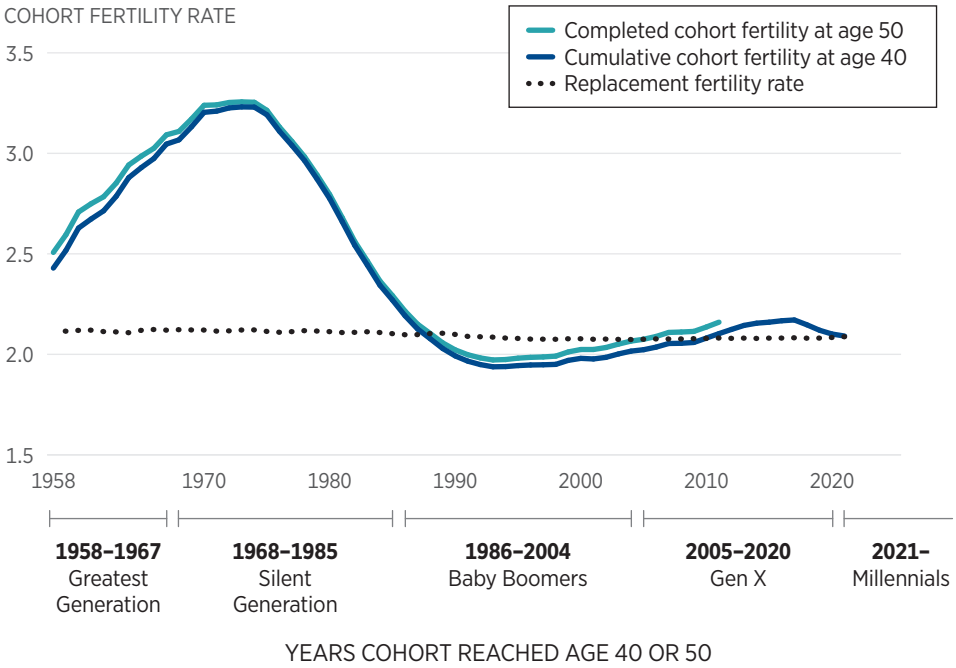
Some of the decline in the total fertility rate in recent years has been due to women postponing births, but fertility is not declining as a result of postponement alone. Births postponed are becoming births forgone. As the tempo-adjusted fertility-rate time series appears to indicate, even after accounting for fertility postponement, the fertility rate is still below replacement. As a result, women who are currently in their childbearing years are unlikely to have the number of children that will result in population replacement by the end of their childbearing years.

Cohort Fertility

The total fertility rate and tempo-adjusted total fertility rate are hypothesized measures of fertility based on the age-specific fertility rates in the period observed. These measures do not indicate how many children women, on average, actually end up having. In order to ascertain the actual average number of children per woman, it is necessary to resort to cohort fertility.

CHART 3

Cumulative Cohort Fertility at 40 and 50 Years of Age



SOURCES: Max Planck Institute for Demographic Research and Vienna Institute of Demography; United Nations, Department of Economic and Social Affairs; and author's calculations. For more information, see appendix.

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The most definitive measure of cohort fertility is the completed cohort fertility rate. The completed cohort fertility rate is the number of children per woman in a cohort when the cohort reaches 50 years of age. This measure indicates approximately how many children women, on average, ended up having over their childbearing years. Chart 3 shows the completed cohort fertility rate for U.S. women born between 1918 and 1971.

The main drawback of using completed cohort fertility as a measure of fertility is that it is far removed from the time when women are in their prime childbearing years (20 years to 35 years of age). Completed cohort fertility is a better measure of fertility levels from 15-30 years ago rather than in the present. If the aim is to draw conclusions about fertility within a particular year, period measures of fertility, such as the total fertility rate and tempo-adjusted fertility rate, are more appropriate.

Cohort fertility can be observed at any age desired, but as a measure of how many children women will have over their lifetimes, cohort fertility must be observed at the end, or close to the end, of the reproductive lifespan.

Setting the cumulative cohort fertility at age 40 (instead of at age 50 as with completed cohort fertility) still captures the vast majority of births women in each cohort will ever have, but births the cohorts have between ages 40 and 50 will be left out. As a result, cumulative cohort fertility at age 40 will be lower than the eventual completed cohort fertility. The benefit of this is that it shows cohort fertility for an additional 10 years out. Additionally, cumulative cohort fertility at age 40 is more proximate to the ages at which women are in their prime childbearing years. Chart 3 shows the cumulative cohort fertility by age 40 of U.S. women born between 1918 and 1981.

Replacement Fertility Rate

The replacement fertility rate is the total fertility rate necessary to result in the long-run replacement of a population closed to migration. If the total fertility rate stays below the replacement fertility rate for a long period of time, the population will eventually shrink if there is insufficient immigration to account for the difference.

The replacement fertility rate is equivalent to the total fertility rate when the net reproduction rate is equal to 1.0. The net reproduction rate is the number of daughters that women on average have over their lifetimes, after accounting for female mortality from birth until their childbearing years. If the net reproduction rate is 1.0, the number of daughters is theoretically exactly replacing the generation of women in their reproductive years.

It is often said that replacement fertility is 2.1 children per woman. But in fact, the replacement fertility rate changes over time in response to changes in the number of daughters born relative to women of reproductive age and changes in female mortality.

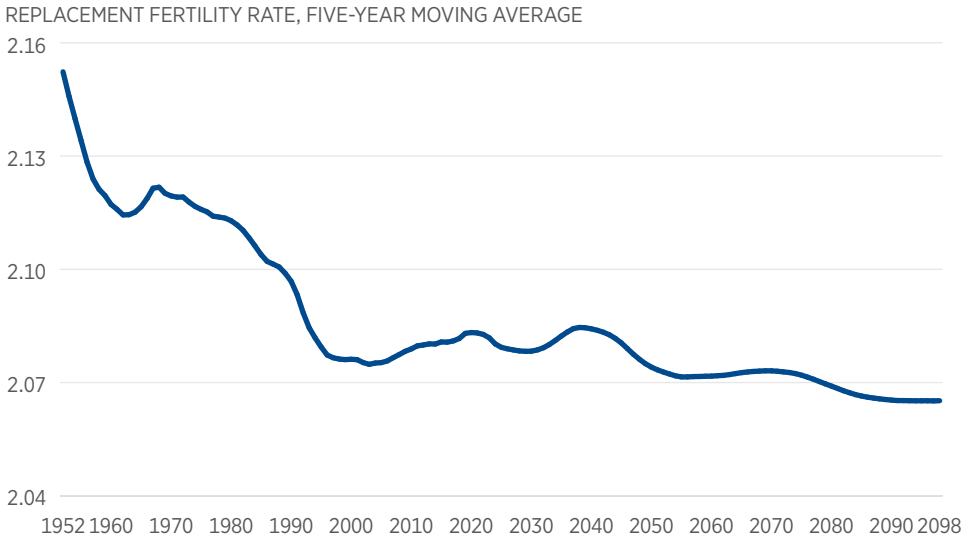
Chart 4 shows replacement fertility rate estimates and projections as a five-year moving average from 1950 to 2100. They are based on estimates and projections of the net reproduction rate and age-specific fertility rates from the United Nations Population Division.[4] While there are several ways to estimate replacement fertility, the replacement fertility rate in Chart 4 was estimated under the assumption that age-specific fertility rates proportionally scale with the net reproduction rate.[5]

Projections for the Total Fertility Rate

According to U.N. Population Division fertility projections, the total fertility rate in the United States is predicted to remain below replacement until at least 2045. The U.N. Population Division's hierarchical Bayesian

CHART 4

Replacement Fertility Rate Estimates and Projections as a Five-Year Moving Average from 1950 to 2100



SOURCES: United Nations, Department of Economic and Social Affairs, and author's calculations. For more information, see appendix.

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model of fertility predicts that there is a 95 percent chance that the total fertility rate will remain below the replacement rate until 2045 and there is an 80 percent chance that it will remain below replacement through 2100. The U.N.'s median projection of fertility predicts a slight and gradual rise in the total fertility rate through the remainder of the century.

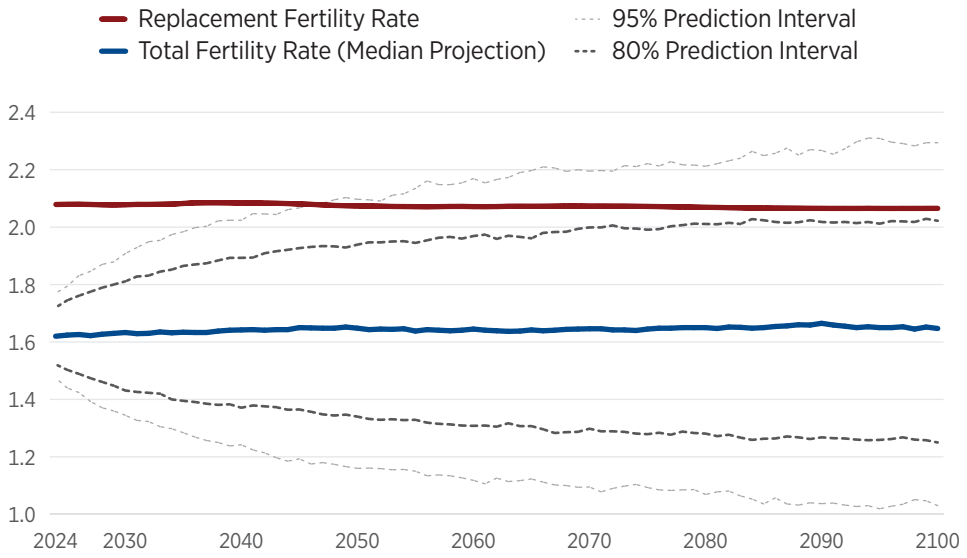
Population Projections for the United States

It remains unclear whether the U.S. population will continue growing through 2100 or if the population will begin contracting sometime before the end of the century. Population projections from the U.S. Census Bureau and the U.N. Population Division somewhat diverge on this point. Population projections for the United States through the year 2100 from both the U.S. Census Bureau and the U.N. Population Division are shown in Chart 6.

According to the U.N. Population Division's current probabilistic population projections, the total population of the United States is projected to increase through at least the year 2034 with 95 percent probability under the medium variant population projection scenario and until 2042 with

CHART 5

Projected Total Fertility Rate in the U.S.



SOURCE: United Nations, Department of Economic and Social Affairs; and author's calculations. For more information, see appendix.

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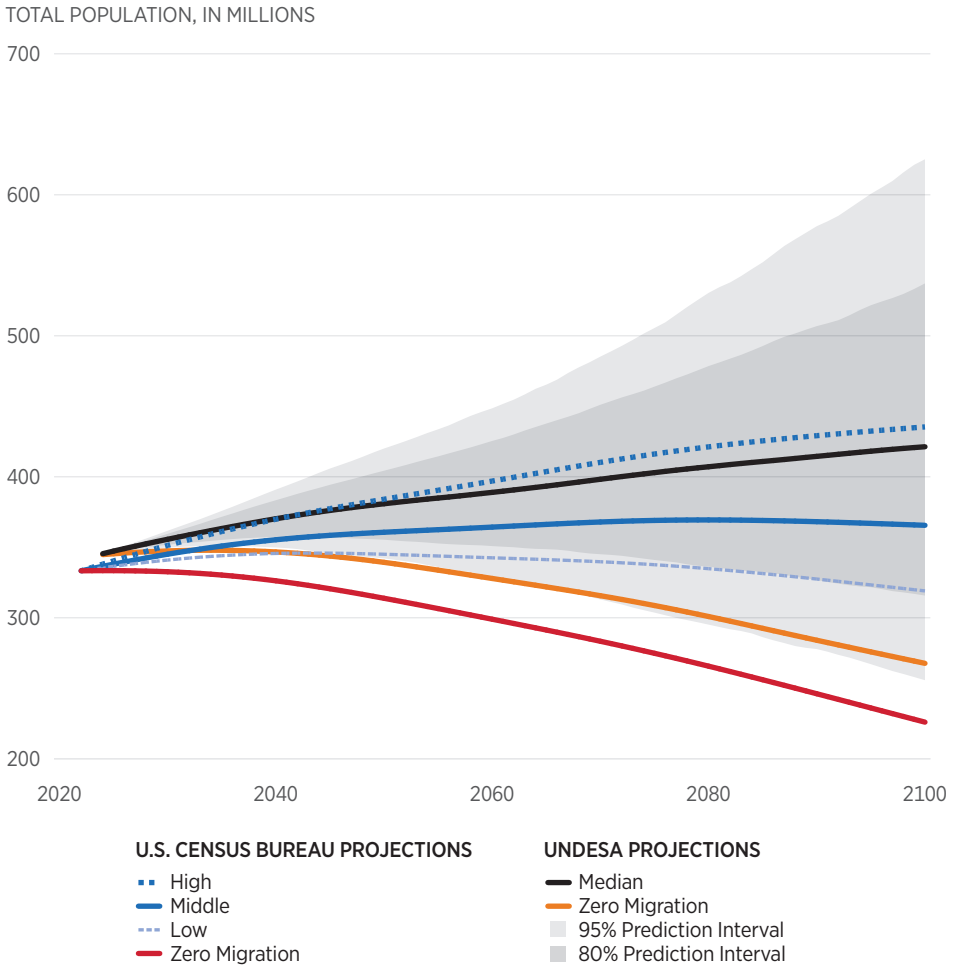
80 percent probability. The median estimate of the medium variant projection continues to increase through to the year 2100, but after 2034, the uncertainty in the projections becomes wide enough that the possibility of population contraction thereafter cannot be excluded. The medium variant projection assumes median projected fertility (as shown in Chart 5), median projected mortality, and projected net migration levels.[6]

The U.S. Census Bureau in 2023 produced three population projections under varying assumptions about the future levels of foreign-born immigration.[7] The U.S. Census Bureau's mid projection predicts the U.S. population will peak in 2080 and begin declining thereafter. Under the high immigration scenario (where immigration is set to be 50 percent higher than under the mid projection),[8] the U.S. population is projected to continue increasing through 2100. Under the low immigration scenario (where the change in immigration compared to the mid projection is set to be equal to the exponentiated difference in logs between the hi and mid projections),[9] the U.S. population is projected to peak in 2043 and begin declining thereafter.

Much of the population growth of the United States through 2100 is expected to come from immigration. The U.N. Population Division's zero-migration projection shows how the population of the United States is projected

CHART 6

Population Projections for the U.S.



SOURCES: U.S. Census Bureau, and United Nations, Department of Economic and Social Affairs. For more information, see appendix.

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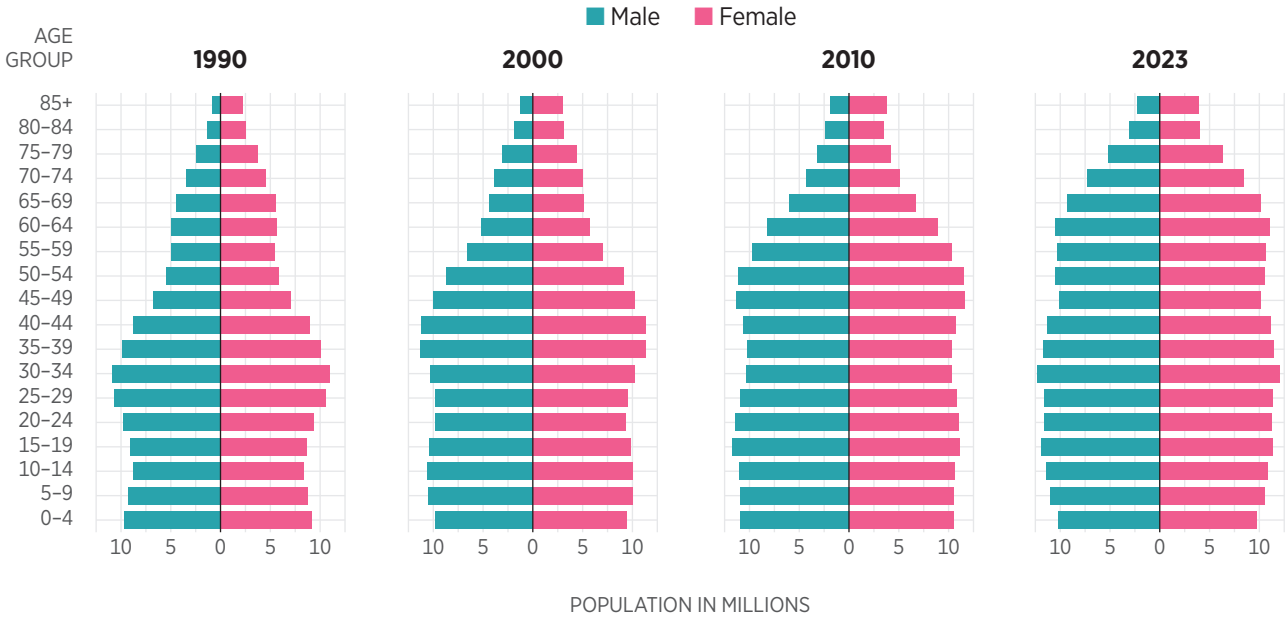
to grow if no new immigrants came into the country and no U.S. residents left the country after 2024. Net migration is set to zero for this projection, but the fertility and mortality assumptions remain the same as the medium variant projection. The U.N. Population Division projects that, if net migration were to be hypothetically set to zero from 2024 and on, the total population of the United States would peak in 2034 and begin contracting thereafter. The U.S. Census Bureau similarly has a zero-immigration population projection that shows how the population is projected to change if there was no foreign-born immigration into the U.S. starting in 2022. The U.S. Census

CHART 7

U.S. Population by Age and Sex



SOURCES: U.S. Census Bureau, State Population by Characteristics, and U.S. Census Bureau, U.S. Census Intercensal Population Estimates. For more information, see appendix.

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Bureau's zero-immigration projection differs somewhat from the U.N. Population Division's zero-migration projection as it does not make any assumptions about changes in emigration levels or domestic-born immigration. According to the U.S. Census Bureau, if foreign-born immigration were to be set to zero from 2022, the U.S. population would have already begun contracting in 2024.

The U.S. Population Is Ageing

The fertility rate in the United States has been below replacement for most of the past 50 years. This has caused the U.S. population to age. Chart 7 contains population pyramids which show the age structure of the U.S. population by sex and by five-year age groups in 1990, 2000, 2010, and 2023.

In 1990, the population pyramid is wide at the base, bulging in the middle, and pointed at the top. This indicates that there were relatively large cohorts of children zero to nine years of age. The bulge in the center shows the baby boomers who were between 25 years and 44 years of age at this time. The gradual peaking of the pyramid indicates relative gradual diminishment of population size with increasing age.

As time goes on, the population pyramids become less peaked and more uniform across age groups. In later years, the population of older age groups are relatively larger compared to younger age groups. In 2023, the population pyramid is even tapering at the base as each successive five-year age group of children gets comparatively smaller relative to older age groups.

Chart 7 shows that the U.S. population is ageing as younger cohorts are becoming smaller relative to older cohorts. The ageing of the U.S. population will threaten the solvency of Social Security and Medicare Part A as there will be fewer laborers per retiree to pay into the trust funds that finance these systems as time goes on.

Implications of Declining Fertility

Continued sub-replacement fertility could have unfavorable consequences for the size of the labor force, the solvency of Social Security, the solvency of Medicare Part A, and the social capital available for families to invest in caring for their elderly relatives.

Declining or sub-replacement fertility in a population closed to migration causes the population to age if life expectancy remains stable or increases. In a population that is open to migration, a population with sustained sub-replacement fertility and stable mortality will age if the age composition of net migrants does not make the population younger. If sub-replacement fertility is sustained for a long-enough time and if net migration is negative or insufficient to counteract sub-replacement fertility, the population will eventually contract.

The U.S. population has aged over the past several decades as a result of declining fertility and sub-replacement fertility. The population over 60 years of age today represents a larger proportional share of the total population than it did 30 or 50 years ago. Old-age dependency has increased and is predicted to continue increasing into the future.[10] This, in turn, has led to fewer working-age adults per retiree, placing a strain on Social Security and Medicare.[11]

Continued sub-replacement fertility could eventually result in a smaller labor force if the number of births is too low and if more persons do not enter the labor force, if older workers do not delay retirement, or if the number of job-seeking immigrants drops. Continued sub-replacement fertility could also lead to increased social isolation and loneliness among the elderly as the population continues to age and fewer working-age adults are able to accompany, care for, and financially support persons of advanced age. Studies have shown that the prevalence of social isolation and loneliness are significantly greater

among older adults who are living alone than among those living in multi-person households.[12] As sub-replacement fertility rates continue to prevail, and as a rising share of adults believe they are unlikely to have any children,[13] the number of older adults living alone will likely increase.

If the U.S. population were to contract, the issues associated with population ageing would be exacerbated and homes, businesses, and schools could be closed or abandoned in locations of depopulation, causing communities to become vacant or die out.

Without a change of course, fertility in the U.S. is not expected to rebound anytime in the near future. Unless the fertility rate rises above the replacement level, the United States will be dependent on immigration to prevent population contraction.

If the U.S. population were to contract, some of the unfavorable consequences of population contraction could perhaps be addressed through technology. Artificial intelligence and increased automation may be able to replace some of the lost labor due to population contraction. However, technology cannot account for the loss of social capital, increased social isolation, and the dying out of communities that occur when populations shrink.

If Americans decide that public policy should support an increase in the fertility rate, policymakers should address the obstacles that prevent married couples from attaining the number of children they would like to have. Americans' ideal family size is above replacement-level fertility,[14] so supporting married couples in achieving their desired fertility would at the very least narrow the gap between the total fertility rate and the replacement level.

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Appendix: References for Charts 1–7

Chart 1

Joyce A. Martin et al., "Births: Final Data for 2015," *National Vital Statistics Reports*, Vol. 66, No. 1 (January 5, 2017).

Michelle J.K. Osterman et al., "Births: Final Data for 2022," *National Vital Statistics Reports*, Vol. 73, No. 2 (April 4, 2024).

Brady E. Hamilton, Joyce A. Martin, and Michelle J.K. Osterman, "Births: Provisional Data for 2023," *Vital Statistics Rapid Release*, No. 35 (April 2024).

Chart 2

Period Total Fertility Rate (1940–1979):

U.S. Centers for Disease Control and Prevention, National Center for Health Statistics, *Vital Statistics of the United States: Natality*, *2003,* Vol. I, Table 1-7. Total Fertility Rates and Birth Rates, by Age of Mother and Race: United States, 1940–2003 (September 2005).

Period Total Fertility Rate (1980–2015):

Joyce A. Martin et al., "Births: Final Data for 2015.," *National Vital Statistics Reports*, Vol. 66, No. 1 (January 5, 2017).

Period Total Fertility Rate (2016–2022):

Michelle J.K. Osterman et al., "Births: Final Data for 2022," *National Vital Statistics Reports*, Vol. 73, No. 2 (April 4, 2024).

Period Total Fertility Rate (2023):

Author's calculations from: Brady E. Hamilton, Joyce A. Martin, and Michelle J.K. Osterman, "Births: Provisional Data for 2023," *Vital Statistics Rapid Release*, No. 35 (April 2024).

Tempo-Adjusted Total Fertility Rate:

Human Fertility Database, Max Planck Institute for Demographic Research and Vienna Institute of Demography, www.humanfertility.org (data downloaded April 22, 2024).

Replacement Fertility Rate:

Author's calculations from: United Nations, Department of Economic and Social Affairs, Population Division, "World Population Prospects 2024," https://population.un.org/wpp/ (accessed January 2, 2025).

Chart 3

Cumulative Cohort Fertility:

Human Fertility Database, Max Planck Institute for Demographic Research and Vienna Institute of Demography, www.humanfertility.org (data downloaded April 22, 2024).

Replacement Fertility Rate:

Author's calculations from: United Nations, Department of Economic and Social Affairs, Population Division, "World Population Prospects 2024," https://population.un.org/wpp/ (accessed January 2, 2025).

Chart 4

Author's calculations from: United Nations, Department of Economic and Social Affairs, Population Division, "World Population Prospects 2024" (medium variant projections), https://population.un.org/wpp/ (accessed January 2, 2025).

Chart 5

United Nations, Department of Economic and Social Affairs, Population Division, "World Population Prospects 2024" (probabilistic projections), https://population.un.org/wpp/ (accessed January 2, 2025).

Chart 6

U.S. Census Bureau Population Projections:

U.S. Census Bureau, "2023 Population Projections for the Nation by Age, Sex, Race, Hispanic Origin and Nativity," November 9, 2023, Downloadable CSV File NP2023_D1: "Projected Population by Single Year of Age, Sex, Race and Hispanic Origin for the United States: 2022 to 2100."

UNDESA Population Projections:

Author's calculations from: United Nations, Department of Economic and Social Affairs, Population Division, "World Population Prospects 2024" (probabilistic projections and zero-migration projections), https://population.un.org/wpp/ (accessed January 2, 2025).

Chart 7

U.S. Census Bureau, "Annual State Resident Population Estimates for 5 Race Groups (5 Race Alone or in Combination Groups) by Age, Sex, and Hispanic Origin: April 1, 2020 to July 1, 2023," State Characteristics Population Estimates, June 2024.

U.S. Census Bureau., "Annual Resident Population Estimates for 5 Race Groups (5 Race Alone or in Combination Groups) by Age, Sex, and Hispanic Origin for States and the District of Columbia: April 1, 2010 to July 1, 2020," State Characteristics Population Estimates, June 2021.

U.S. Census Bureau, "Intercensal Estimates of the Resident Population by Single Year of Age and Sex for States and the United States: April 1, 2000 to July 1, 2010," State Characteristics Intercensal Population Estimates, October 2012.

U.S. Census Bureau, *US Census Intercensal Population Estimates*, distributed by the National Bureau of Economic Research, compiled by Jean Roth (last modified August 28, 2006), https://data.nber.org/data/census-intercensal-population/(accessed February 19, 2025).

Endnotes

1. More specifically, the period total fertility rate (TFR) is defined as:

$$TFR = \frac{n}{1000} \cdot \sum_{i={}_{n}g_{x_1}}^{{}_{n}g_{x_k}} ASFR_i$$

where ${}_{n}g_{xi}$ is the age group of females aged x_i to $x_i + n$ where x is a finite sequence from x_1 to x_k with discrete jumps by n, with x_1 being the minimum age the total fertility rate is calculated over (typically age 10) and x_k corresponds to the age n-years less than the last year of the reproductive lifespan (the end of reproductive lifespan is typically defined as somewhere between 44 and 54 years), where n is the number of years in each n-year age group, and where $ASFR_i$ is the age-specific fertility rate where

$$ASFR_i = \left(\frac{B_i}{P_i}\right) \cdot 1000$$

where B_i is the number of live births to women in age-group ${}_{n}g_{xi}$ and P_i is the population of women in the corresponding age group.

2. John Bongaarts and Griffith Feeney, "On the Quantum and Tempo of Fertility," *Population and Development Review*, Vol. 24, No. 2 (June 1998), pp 271–291.
3. The birth-order-specific total fertility rate for any given birth order j is the sum of the age-specific fertility rates at birth order j ($ASFR_{ij}$) such that

$$ASFR_{i,j} = \left(\frac{B_{i,j}}{P_i}\right) \cdot 1000$$

where $B_{i,j}$ is the number of births to women in age group i and where the birth order is j.

4. United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects 2022*, 2022.
5. A. Sloggett, "Measuring Fertility," in *Population Analysis for Policy and Programmes* (Paris: International Union for the Scientific Study of Population, 2015), http://papp.iussp.org/ (accessed August 5, 2024).
6. United Nations, Department of Economic and Social Affairs, Population Division, "Methodology Report: World Population Prospects 2022," July 2022.
7. U.S. Census Bureau, *2023 National Population Projections Datasets*, 2023.
8. U.S. Census Bureau, "Methodology, Assumptions, and Inputs for the 2023 National Population Projections," November 2023.
9. *Ibid*.
10. United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects 2022*, 2022.
11. Stephen C. Goss, "The Future Financial Status of the Social Security Program," *Social Security Bulletin*, Vol. 70, No. 3 (2010).
12. Nanami Oe and Etsuko Tadaka, "Differences in Loneliness and Social Isolation Among Community-Dwelling Older Adults by Household Type: A Nationwide Survey in Japan," *In Healthcare*, Vol. 11, No. 11 (2023), p. 1647.
13. Rachel Minkin, Juliana Menasce Horowitz, and Carolina Aragão, "The Experiences of U.S. Adults Who Don't Have Children," Pew Research Center, July 25, 2024, https://www.pewresearch.org/social-trends/2024/07/25/the-experiences-of-u-s-adults-who-dont-have-children/ (accessed August 28, 2024).
14. Jonathan Abbamonte, "Americans Have Not Been Able to Have the Number of Children They Want," Heritage Foundation *Backgrounder* No. 3886, March 4, 2025, https://report.heritage.org/bg3886.