

# Controversy and Consensus on the Demographic Transition\*

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## **Abstract**

This chapter reviews how longstanding empirical and theoretical debates over the shift from high to low mortality and fertility have given way to a more integrated understanding across disciplines. It begins by formally laying out basic demographic relationships that illuminate the mechanics of the demographic transition. Building on these relationships as a conceptual framework, it then documents key facts about the demographic transition using a range of historical and contemporary data. It then revisits areas of initial controversy and subsequent convergence, focusing especially on those relevant to economists studying populations. With respect to mortality decline, debates have hinged on the contributions of rising income and nutrition, public health intervention, and medical innovation. With respect to fertility decline, debates have centered on the contributions of mortality decline, cultural diffusion, socioeconomic change, and access to family planning services and methods. Scholarly disagreement over these issues has narrowed over the last half-century.

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# 1 Introduction

When Malthus (1798) formulated his famous theory of population, children across the world faced higher mortality risk than they do today, and women bore more children (Lee, 2002). Virtually every country has since then experienced mortality and fertility decline. Together, these dual declines have come to be known as the demographic transition. The varied history of the transition has fueled lively debates over both the facts of demographic change and the theory of the forces driving it. Was mortality decline a precursor to fertility decline? Did rising riches or scientific progress drive mortality decline? Did economic or social or ideational forces drive falling family size? What role did family planning programs and technologies play?

Disparate points of view on these questions have converged considerably over the last half-century. Early disagreements often reflected disciplinary divides, for example between medical and social scientists or between social demographers and economists. Across fields, researchers now recognize that mortality decline reflected sometimes successive and sometimes overlapping advances in nutrition, public health infrastructure, and medical technology. They also now broadly accept that mortality decline often preceded but sometimes succeeded fertility decline. And they now acknowledge that fertility decline emerged from the interaction of changing economic constraints, evolving institutions, and the diffusion of new ideas, practices, and technologies. Some of this synthesis stems from advances in data and methodology, while some is the result of growing openness to perspectives from other fields. The result is not complete agreement but more integration, and researchers now regularly draw insights from other disciplines.

This chapter summarizes that synthesis, with an emphasis on the facts and debates most relevant to economists. It begins by laying out the accounting identities that link fertility and mortality to population growth, clarifying the mechanics of the demographic transition. It illustrates these mechanics in data on demographic transitions in various contexts, contrasting early transitions in Western populations with postwar transitions in the rest of the world. It then reviews leading debates over the causes of mortality and fertility decline, focusing on areas where accumulated research findings have narrowed disagreement across disciplines. The chapter seeks to provide not an exhaustive intellectual history but instead a coherent guide to what is known, what remains contested, and how economics and adjacent fields have learned from each other.

Among the debates most relevant to economists, those focused on fertility have been more varied and longer-lasting than those focused on mortality. This disparity arguably reflects the central role of scientific and medical innovation in mortality decline. Economists have contributed both theoretically and empirically to research on mortality (Cutler et al., 2006), but advances in science and medicine remain paramount. And while behavior and choice—the core objects of economic inquiry—matter for health, they are central to fertility, making the latter a focal point for differences of opinion between economists and social demographers. On this topic, social demographers have given more weight to shifting ideals as well as behaviors proximate to fertility, like contraceptive use and marriage. Meanwhile, economists have given more weight to changing technologies and economic constraints. Over time, however, these differences in emphasis have narrowed, and the two perspectives increasingly inform one another.

The growing consensus on the demographic transition offers several conclusions regarding the drivers of mortality and fertility decline. Those related to mortality align with previous reviews of the literature by economists (Cutler et al., 2006). In the historical West, rising income and nutrition may have contributed to initial mortality declines, but public health brought about large-scale improvements in the late-19<sup>th</sup> and early-20<sup>th</sup> centuries, and medicine continued these advances since the mid-20<sup>th</sup> century. In low- and middle-income countries after World War II, these forces have overlapped to a much greater extent, so that populations now commonly sustain a “double burden” of infectious and noncommunicable disease (Bygbjerg, 2012).

The conclusions regarding fertility cluster around three themes. First, falling child mortality led to falling gross (ever-born) but not net (surviving) fertility. This lesson suggests that the smaller families of today have roots in forces that go beyond simple survival probabilities. Second, new ways of thinking about children affected the timing of fertility decline, but these ideas diffused after new technologies and economic considerations had altered the calculus of childrearing. Economic fundamentals *and* diffusion were both important. Third, although modern contraceptive methods have helped women and their partners attain their desired fertility, access alone did not reduce fertility at the population level. Nevertheless, family planning programs that go beyond access, persuading women and their partners to use contraception, may have played a larger role.

The chapter proceeds as follows. Section 2 introduces some basic demographic relations, some from accounting identities and some from stable population theory, which help clarify the mechan-

ics of the demographic transition. In addition to providing a framework for the subsequent facts, this section can serve as a primer on population dynamics for economists. Building on this framework, Section 3 documents facts about historical and contemporary demographic transitions that economists would benefit from knowing. The focus is on historical Sweden, which has the oldest vital registration system in the world, and on non-Western populations after 1950. Section 4 then discusses key debates (and their resolution) about mortality decline and fertility decline, with an eye toward the role of economists in those debates. Section 5 concludes with some reflections on interdisciplinary conversation and key questions for the future of population.

## 2 Mechanics of the Demographic Transition

The demographic transition is the historic shift from high death and birth rates to low death and birth rates (Coale, 1987). It started in Europe circa 1800 and is now underway or complete in virtually every population around the world (Lee, 2002). In the classic model of the transition, mortality decline precedes fertility decline, leading to elevated rates of population growth. The global transition has followed this order. The vast majority of national transitions have too, but with a few notable exceptions.

Most demographers attribute the classic descriptive model of the transition to Notestein (1945), although one can find earlier or contemporaneous descriptions from Thompson (1929), Landry (1934), and Davis (1945). All of these canonical references combined a description of the transition with a theory of its causes, together making up what has become known as Demographic Transition Theory (Kirk, 1996). Demographic Transition Theory emphasizes broad concepts like modernization but proposes many specific mechanisms still being explored today. The chapter does not attempt to provide a full intellectual history of Demographic Transition Theory but instead uses the classic descriptive model to motivate a look at the key facts for economists to know, as well as a discussion of the major intellectual debates of the last half-century.

A bit of formal demographic theory illuminates the mechanics of population change during the transition. Simple accounting identities and results from stable population theory clarify how mortality and fertility jointly determine population growth. Because these relationships typically fall outside standard economics curricula, a brief primer can help economists interpret the empirical

patterns and debates surrounding the demographic transition.

The starting point is the demographic balancing equation, an accounting identity that relates changes in population size to fertility, mortality, and migration:

$$\Delta P_t = B_t - D_t + M_t \tag{1}$$

where  $\Delta P_t$  is the change in population from period  $t$  to period  $t+1$ , while  $B_t$  is the number of births,  $D_t$  the number of deaths, and  $M_t$  the net number of migrants (immigrants minus emigrants), all in period  $t$ . The classic model of the demographic transition focuses mainly on births and deaths, with less attention to migration, and this chapter follows in that tradition. In the case of the global transition, in- and out-migration are trivially zero, so that population change depends only on births and deaths. Notably, Equation 1 decomposes the absolute increment of population change, not the more commonly reported growth rate.

To express the balancing equation in terms of the growth rate, one can divide both sides of Equation 1 by the midperiod population:

$$r_t = \underbrace{CBR_t - CDR_t}_{r_t^N} + NMR_t \tag{2}$$

All variables are now crude demographic rates.  $CBR_t$  is the crude birth rate, or the number of births per unit of population.  $CDR_t$  is the crude death rate, or the number of deaths per unit of population.  $NMR_t$  is the net migration rate, or immigration net of emigration per unit of population. The birth rate minus the death rate is the natural rate of population growth  $r_t^N$ , while the natural rate plus net migration is the overall rate of population growth  $r_t$ .

Equation 2 provides an even clearer framework for understanding population dynamics during the demographic transition. The classic transition starts with a decline in the crude death rate but not the crude birth rate, leading to an increase in the natural growth rate. This increase translates to higher actual population growth so long as emigration and immigration do not adjust to offset the decrease in mortality. Eventually, the crude birth rate falls too, and the population returns to a lower growth rate.

The crude rates in Equation 2 have advantages and disadvantages. On the one hand, they are

easily measured in many historical and cotemporary populations, and they have direct implications for population size. On the other hand, they are sensitive to variation in age structure. This sensitivity is especially pronounced for death rates; all else equal, older populations have higher crude death rates because older adults are more likely to die in any given time interval.<sup>1</sup>

To compare like with like, researchers commonly use measures like life expectancy and the total fertility rate, which remove the influence of the age structure. These measures are typically calculated using period data, meaning they aggregate age-specific rates at a point in time. Life expectancy at birth quantifies how long a person would expect to live if she faced current age-specific mortality rates over her lifetime.<sup>2</sup> The total fertility rate quantifies how many children a woman would expect to have if she experienced current age-specific fertility rates over her lifetime. These measures are appealing because they are invariant to age structure and have an intuitive scaling, but they have greater data requirements than crude rates, and they relate to the population growth rate in a less obvious way.

Given their ubiquity in descriptions of the demographic transition, a way to link these measures to population growth is useful for making sense of the mechanics of the transition. Stable population theory (Tuljapurkar, 2018)—which provides a steady-state interpretation of the age structure of mortality and fertility—offers such a link. Suppose the population is closed to migration, and mortality and fertility rates at each age are constant over time. Then the population growth rate converges to an “intrinsic” rate  $r^I$ , which one can approximate as:

$$r^I \approx \frac{\ln(\pi_f) + \ln(\ell_\mu) + \ln(TFR)}{T} \quad (3)$$

where  $\pi_f$  is the probability a birth is female,  $\ell_\mu$  is the probability of surviving to the mean age of childbearing,  $TFR$  is the total fertility rate, and  $T$  is the mean generation length (Preston et al., 2001, p. 153).<sup>3</sup> This approximation is the basis for the common calculation that the “replacement level” of the total fertility rate is 2.1, which leads to  $r^I = 0$  in a population with a natural sex ratio and high female survival.

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<sup>1</sup>For example, according to United Nations (2024) estimates, Nigeria and Japan have the same crude death rate, even though the Japanese face lower mortality risk at every age and enjoy a 30-year life expectancy advantage.

<sup>2</sup>Hereafter, “life expectancy” refers to period life expectancy at birth.

<sup>3</sup>Equation 3 is approximate because it assumes (i) the sex ratio does not vary with maternal age, and (ii) the female survival curve is linear between the minimum and maximum ages of childbearing.

Many discussions of global health and the demographic transition focus on life expectancy at birth  $e_0$ , not survival to the mean age of childbearing  $\ell_\mu$ . Conveniently, however,  $e_0$  and  $\ell_\mu$  have an extremely strong relationship, which in pre-transitional and transitional populations is well-described by a constant-elasticity model. The constant-elasticity functional form allows one to approximate how much  $TFR$  must fall when  $e_0$  rises to avoid an increase in the intrinsic growth rate. Suppose life expectancy rises from  $e_0$  to  $e'_0$ . Then to maintain the pre-existing intrinsic growth rate,  $TFR$  must adjust to  $TFR'$  as follows:

$$TFR' \approx (e'_0/e_0)^{-\epsilon} TFR \quad (4)$$

where  $\epsilon$  is the elasticity of  $\ell_\mu$  with respect to  $e_0$ . Model life tables (Coale and Demeny, 1966; United Nations, 1982), which demographers use to describe mortality processes, suggest  $\epsilon = 0.9$  in pre-transitional and transitional populations.<sup>4</sup> By Equation 4, an elasticity of 0.9 implies that a doubling of  $e_0$  requires a 47% decline in  $TFR$  to leave  $r^I$  unchanged. Similarly, a 50% increase in  $e_0$  requires a 31% decline in  $TFR$ , and a 25% increase in  $e_0$  requires an 18% decline in  $TFR$ . All these changes are within the range observed over the demographic transition.

The natural rate of population growth  $r^N$  rarely matches the intrinsic rate  $r^I$  because age-specific fertility and mortality rates tend to change over time, so that the population never attains a steady-state age structure. During the demographic transition, populations tend to grow long after  $r^I \leq 0$  due population momentum: young cohorts are larger than old, so the number of births continues to rise even after  $TFR$  reaches (or drops below) the replacement level. In China, for example,  $TFR$  fell below 2.1 more than three decades ago, but deaths started outnumbering births only in the last few years (United Nations, 2024). The subsequent changes in age structure are a systematic part of the demographic transition, with an initial excess of young people (“youth bulge”) that turns first into an excess of prime-aged adults (“demographic dividend”) and then into an excess of elderly adults (“population aging”).

This discussion makes clear that migration, sex ratios, and age structure all play a direct role in population dynamics during the demographic transition. However, to avoid too broad a scope,

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<sup>4</sup>Setting the mean childbearing age to 29, the average for national populations since 1950 (United Nations, 2024), estimation of  $\ln(\ell_\mu) = \alpha + \epsilon \ln(e_0) + u$  in any of the model tables with life expectancy below 70 leads to  $\hat{\epsilon} = 0.9$ , with  $R^2$  exceeding 98%.

the chapter focuses on the dynamics of mortality and fertility that are most fundamental to the transition. Readers interested in economic perspectives on these other dimensions of population change may consult Hanson (2010), Abramitzky and Boustan (2017) and Blanc and Wacziarg (2025) on migration; Sen (1992), Anderson and Ray (2010), and Jayachandran (2015) on sex ratios; and Weil (1997), Lee and Mason (2011), and Piggott and Woodland (2016) on population aging.<sup>5</sup>

### 3 Data on the Demographic Transition

Section 2 laid out demographic relationships that govern the trajectory of population growth during the demographic transition. The current section illustrates these relationships using historical and contemporary data, with two purposes. First, the historical and contemporary records bring out areas of similarity and dissimilarity in the experience of the demographic transition in various populations and periods. Second, the historical and contemporary records highlight the sheer diversity of data resources available for different parts of the world. Unequal measurement of demographic processes implies unequal progress in understanding and developing policy solutions to demographic challenges.

#### 3.1 The Global Transition

The contours of the global demographic transition are visible in the time series of population growth rates since antiquity. To this end, Figure 1 displays global population growth since 400 BCE. Representative demographic data were scarce for most populations before the mid-20<sup>th</sup> century, so the historical time series is more approximate and less granular than the contemporary one. For the period before 1950, the figure uses a well-known historical series from Biraben (1979), which has a frequency of 40-200 years. Then it relies on United Nations (2024) annual estimates up to 2023 and annual projections through 2100.

Population growth fluctuated at a low rate until roughly the 18<sup>th</sup> century. The global population grew moderately at the height of Ancient Greece and the Persian Empire (roughly 400 BCE), then stagnated for a millennium. It resumed growth circa 1000 CE but then contracted during the Black Death in the 1300s. Another period of moderate growth followed until the 18<sup>th</sup> century. These

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<sup>5</sup>Bongaarts and Guilmoto (2015), though not economists themselves, also reconcile competing claims about course of the sex ratio over the demographic transition, including those by economists.

low-growth dynamics are believed to have prevailed for all preceding human history (Galor, 2011; Livi-Bacci, 2025) and are closely associated with Malthus’s (1798) theory of population, in which population growth is constrained by slow technical progress.

This state of affairs came to a dramatic end in the 18<sup>th</sup> century, when population growth took off as mortality fell amid scientific and economic advance (Galor, 2011; Livi-Bacci, 2025). Population growth accelerated at an increasing rate until the 1960s, when it peaked at just over 2% per year, sparking concerns about a “population bomb” (Ehrlich, 1968). These concerns subsequently dissipated as fertility fell and productivity rose around the world (Lam, 2011). The rise and fall of population growth since the 18<sup>th</sup> century reflect the global demographic transition. The UN projects that the population will start shrinking before the 22<sup>nd</sup> century, marking a definitive end to the global transition.

The gradual increase in population growth over the 19<sup>th</sup> century and the spike in the 20<sup>th</sup> century occurred in different regions of the world. In Europe and the Western offshoots, mortality started declining by the mid-19<sup>th</sup> century, and fertility started declining by the turn of the 20<sup>th</sup>. Outside the West, these transitions started well into the 20<sup>th</sup> century. The next two subsections explore these separate histories in detail.

### 3.2 Sweden’s Transition

In Europe and the Western offshoots, many countries did not have complete vital registration during the early stages of the demographic transition. Data limitations thus complicate a comprehensive look at the demographic transition in the West, and detailed accounts of the transition are most informative on a country-by-country basis. For an example of a European transition, this subsection focuses on the demographic history of Sweden, home to the world’s oldest national vital statistics system. Sweden began requiring the registration of all births, deaths, and marriages in 1686 and began organizing them into a national vital statistics system in 1749 (Sköld, 2004).<sup>6</sup> Figures 2-3 use compilations of Swedish vital statistics from the Human Mortality Database (2025) and the Human Fertility Collection (2025) to portray the country’s demographic transition.

Figure 2 reports rates and counts of birth, deaths, and population change over time, with crude vital rates in Panel A, counts of vital events in Panel B, and population growth rates in Panel C.

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<sup>6</sup>Finland’s vital statistics system is as old as Sweden’s because it was part of Sweden until 1809.

Together, the time series reveal staggered mortality and fertility decline, as in the classic model of the demographic transition, leading to an increase and then decrease in the natural rate of population growth. Due to migration, these patterns are somewhat obscured in the overall rate of population growth.

For almost the entire time series, crude birth rates exceeded crude death rates, leading to a positive natural rate of population growth (Figure 2, Panel A). In the early years, circa 1800, the difference was moderate and disrupted by occasional mortality and that contributed to short bouts of population decline. Crude death rates declined throughout the 19<sup>th</sup> century, and crude birth rates followed suit only late in the century, leading natural population growth to rise and then gradually decline, reaching zero in the late 20<sup>th</sup> century. With some squinting, one can also discern acceleration and deceleration in the time series of the overall growth rate (Figure 2, Panel C). However, Sweden had high emigration rates in the late 19<sup>th</sup> century and has had high immigration rates in the early 21<sup>st</sup> century, offsetting the hump shape in the natural rate.

The hump shape is even more dramatic in the natural increment, rather than growth rate, of population change (Figure 2, Panel B). The number of births surged in the 19<sup>th</sup> century while the number of deaths held mostly steady. Sweden added roughly 50,000 people per year throughout the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, an expansion that would be matched again only briefly during the Baby Boom of the 1940s. Like the natural rate, the natural increment has since fallen to low levels and was briefly negative circa 2000.

One very striking feature of Figure 2, Panel A, is that the crude death rate essentially flatlined from 1950 to present, a period of unprecedented medical advance. Figure 3 makes clear that this puzzle is an artifact of an aging population. The figure graphs life expectancy, the total fertility rate, and age-specific mortality and fertility rates—all invariant to the age structure—over time. Figure 3, Panel A, makes clear that the rising trend in life expectancy has continued to the present. Life expectancy at birth was 32 in 1800, 45 in 1850, 52 in 1900, 71 in 1950, and 80 in 2000. Moreover, the onset of rising life expectancy roughly coincided with the onset of declining crude death rates in the early 19<sup>th</sup> century.

Figure 3, Panel B, disaggregates mortality rates by age in every 50<sup>th</sup> year, revealing consistent declines at every age. Reductions were especially large at young ages, where mortality tends to

drive most variation in life expectancy before and during the mortality transition.<sup>7</sup> The under-1 mortality rate was 270 per 1000 in 1800, 107 per 1000 in 1900, and 3 per 1000 in 2000. Put differently, a Swedish woman giving birth in 1800 faced a greater than 1-in-4 risk that her child would die within the next year. Her counterpart giving birth two centuries later faced less than a 1-in-300 risk of the same.

Turning to fertility, the total fertility rate declined with similar timing to the crude birth rate, albeit with somewhat later onset. In Figure 2, Panel A, the crude birth rate started falling in 1860; in Figure 3, Panel A, the total fertility rate started a sustained decline in 1880. Despite this 20-year gap in onset, both measures indicate that fertility decline lagged mortality decline (which started around 1800) by at least half a century. Both measures also suggest that fertility decline caught up with mortality decline sometime around 1920. In Figure 2, the crude birth rate declined enough by 1918 to return the *natural* rate of population growth to its pre-1800 average.<sup>8</sup> To time when declining total fertility caught up with rising life expectancy, one can use the stable population approximation in Equation 4. Assuming an elasticity of 0.9 as in Section 2, the total fertility rate declined enough by 1917 to return the pre-transition *intrinsic* growth rate to its pre-1800 average.

Records on the age of childbearing were spotty before 1891, which explains the lower frequency of the total fertility series before that year. Birth rates by single years of age are entirely unavailable before then. As a consequence, Figure 3, Panel C, restricts the 50-year snapshots of age profiles to 1900, 1950, and 2000: fewer snapshots of age profiles than were possible for mortality. Despite the shorter time horizon than Panel B, Panel C captures the most dramatic period of fertility decline in Sweden, which began just before 1900.

Figure 3, Panel C, reveals dramatic shifts in the age distribution of mothers giving birth. From 1900 to 1950, age-specific fertility rates fell for all ages above 23. Age-specific rates declined by more than 77% at all ages in the 40s and by more than 45% at all ages in the 30s. In contrast, teen childbearing increased, but not enough to offset the declines at older ages. The total fertility rate fell by 1.7 children, or 43%. From 1950 to 2000, fertility continued to drift downward, mainly due to lower childbearing at earlier ages. Age-specific rates declined by more than 65% at all ages

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<sup>7</sup>Life expectancy is the area under the survival curve, and child mortality erases a larger area under the curve than adult mortality.

<sup>8</sup>Mortality was elevated in 1918 due to the Spanish Flu, but the natural growth rate equaled its pre-1800 average again at several points in the 1920s.

below 23, delaying childbearing and reducing the total fertility rate further by 0.7 children, or 32%.

Figures 2-3 depict an archetypal demographic transition in Europe, but some broader context clarifies its generalizability to other European countries or other world regions. Within Europe, while many other countries followed similar patterns over time, some notably diverged. A prime example is France, where fertility decline preceded mortality decline by many decades (Coale and Watkins, 1986; Blanc, 2024; Gay et al., 2026). Outside Europe, a key distinction is the level of fertility at the start of the transition. As the next sub-section shows, most non-European populations started their transitions with total fertility rates of 6 or more. In contrast, Figure 3, Panel A, documents that Sweden’s total fertility rate hovered around 4.5 before the transition. This lower pre-transition level is due to the European Marriage Pattern (Hajnal, 1965), in which delayed marriage and non-marriage depressed fertility rates long before marital fertility started to decline. The European Marriage Pattern emerged in Western Europe after the Black Death and is a prototypical example of a preventive check on population in the Malthusian framework (Voigtländer and Voth, 2013). In contrast, the decline of European fertility in the 19<sup>th</sup> and early 20<sup>th</sup> centuries occurred within marriage and is generally understood as a departure from Malthusian dynamics (Coale and Watkins, 1986).

### 3.3 Non-Western Transitions

Representative data on vital rates outside the West were scarce in the recent past and remain far from universal today. Karlinsky (2024) estimated in data from 2015-2019 that only 55% of the world’s countries—21% in sub-Saharan Africa—registered more than 90% of the deaths within their borders. United Nations (2024) efforts to estimate birth and death rates around the world since World War II have thus relied heavily on data from censuses and sample surveys. These instruments can accurately and precisely measure rates of birth and child mortality—both fairly common events with mothers who survive to report them—but perform poorly in the measurement of mortality outside childhood. For countries with incomplete vital registration, the UN typically estimates life expectancy and crude death rates by combining census and survey data with modeling assumptions about age patterns in mortality. Estimates of the total fertility rate for these countries are more directly based on census and survey data. Because censuses and surveys are infrequent, many of these series are interpolated or smoothed. As such, they are more appropriate for studying

long-term trends than short-term fluctuations.

This subsection seeks to describe mortality and fertility change outside the West over multiple decades, so the UN series are fit for the task. The sample consists of six UN regions excluding Europe and the Western offshoots: Central/Southern Asia, East/Southeast Asia, the Middle East, Latin America and the Caribbean, Oceania, and sub-Saharan Africa. Mortality and fertility estimates, all from the UN, run from 1950 to 2023.

Figure 4 charts the evolution of crude birth and death rates in non-Western regions, documenting that already by 1950, birth rates substantially exceeded death rates. This excess underlies the spike in global population growth visible in Figure 1. Indeed, taking differences between birth and death rates in Figure 4, one can see that all six regions experienced annual rates of natural population growth in excess of 2.5% (or 25 per 1000, as depicted in the figure). Both birth and death rates declined since 1950, and in most regions, the gap has closed, so that natural growth has slowed. Sub-Saharan Africa is the one exception, with natural growth in excess of 2% throughout the seven decades under study.

As in the Swedish case, crude death rates flattened in recent decades, but this pattern appears to reflect aging rather than stalls in progress against mortality. Figure 5 makes the point clearly in time series of life expectancy (Panel A), under-5 mortality (Panel B), and under-1 mortality (Panel C). All three panels show sustained mortality decline in all six regions, with only a few exceptions: the life expectancy plateau in sub-Saharan Africa at the height of HIV/AIDS in the 1990s and a few spikes in other regions due to crises like the Great Chinese Famine of 1959-61, the Bangladesh Famine of 1974, and the COVID-19 pandemic. Life expectancy rose by at least 25 years and at least 55% in all six regions. The under-5 mortality rate fell by more than 190 per 1000 and more than 78%.

Total fertility rates follow a qualitatively similar time path in Figure 6 to crude birth rates in Figure 4. In all regions but sub-Saharan Africa, the total fertility rate started falling by the 1970s and was 3.0 or less in the most recent data. Two regions (East/Southeast Asia and Latin America) already have total fertility rates well below 2.1. Even in Africa, it fell by one-third since 1980 and was 4.3 in the most recent data.

Figure 7 charts birth rates by age, revealing regional differences in the life cycle pattern of fertility decline. In Asia and the Middle East, declining birth rates at older ages played an important

role early in the fertility transition. In sub-Saharan Africa, declines have been more uniform across age groups, a pattern that demographers have noted at least since Caldwell et al. (1992). The variation in the incidence of fertility decline by age has implications for young women's ability to study and work. Postponement of the first birth lengthens the time available for human capital investment, through both schooling and on-the-job learning, without the constraints of motherhood. Parity-specific control—in which women limit fertility after reaching a target number of children—has more modest side benefits.

Figures 4-7 make clear that the processes of mortality decline and fertility decline are well underway in all six non-Western regions, with a notable lag in sub-Saharan Africa. In the most recent data, East/Southeast Asia had the highest life expectancy (77 years) and lowest total fertility rate (1.3 children), with Latin America and the Caribbean in a close second (76 years and 1.8 children). In contrast, sub-Saharan Africa had a life expectancy of 62 years and a total fertility rate of 4.3 children. Sub-Saharan Africa's elevated fertility rate is projected to make it the world's most populous region later this century (United Nations, 2024).

## 4 Debates on the Demographic Transition

The data in Section 3 make clear why the demographic transition has attracted so much scientific interest. Mortality and fertility fell everywhere, yet they did so at different speeds, in different sequences, and from different starting points. This section turns from the facts to the debates over interpretation and their resolution. It starts with past disagreements over the causes of mortality decline and then shifts to three areas of more recent contention related to the causes of fertility decline. In all cases, researchers across disciplines now agree to a larger extent than 50 years ago.

### 4.1 Causes of Mortality Decline

Debates about the causes of mortality decline were active in the mid-20<sup>th</sup> century but are now more settled. These debates focused on three broad drivers of mortality decline: nutrition, public health, and medicine. In their summary of the literature, Cutler et al. (2006) submitted that technological advances in these three areas took place in different historical eras, so each played a distinct role in the decline of mortality in the West. Outside the West, the diffusion of these technological advances

has not necessarily followed the same order, so their relevance has overlapped more than in the historical West.

In the historical West, nutrition came first. The physician and demographer McKeown (1979) famously posited that improved social conditions—and accompanying improvements in nutrition—accounted for the lion’s share of the historic decline of mortality in Europe. McKeown arrived at his thesis through a process of elimination, ruling out other potential causes of mortality decline. At the time, researchers saw the thesis as provocative because it dismissed public health and medical advance as prime causes of falling death rates (Colgrove, 2002). But evidence subsequently mounted in its favor. In economics, Fogel (2004) assembled data directly suggesting that rising caloric intake due to economic growth, specifically increased agricultural yields, could account for nearly all mortality decline in the 19<sup>th</sup> century. The timing is consistent with the timeline of scientific advance. The germ theory of disease attained broad acceptance only in the late-19<sup>th</sup> century, so advances in public health and medicine mostly occurred thereafter.<sup>9</sup>

The germ theory unleashed momentous advances in public health, which accounted for the next phase of mortality decline in the West. In Figure 3, Panel A, one can observe an acceleration in the pace of life expectancy increase in Sweden in the late 19<sup>th</sup> century. This acceleration exactly coincided with the era of public health intervention (Johannisson, 1994). During this era, Western governments invested heavily in filtering and chlorinating drinking water, processing wastewater, draining swamps, and vaccinating children, among other interventions. Research in applied microeconomics has demonstrated that major public health initiatives like the cleanup of drinking water played an important role in reducing mortality in the United States (Cutler and Miller, 2005; Alsan and Goldin, 2019; Anderson et al., 2022). This conclusion and the research methods that support it closely follow in the footsteps of the physician and epidemiologist John Snow, who in the 1850s used a natural experimental approach to demonstrate the lethality of the contaminated Broad Street water pump in London.

The mid-20<sup>th</sup> century saw a revolution in medical therapeutics, which paved the way for the most recent phase of mortality decline in the West. One early innovation took the form of sulfonamides, an class of antibiotics and perhaps the first effective treatment of bacterial infections.

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<sup>9</sup>Nevertheless, Cutler et al. (2006) pointed out some historical facts that seem inconsistent with nutrition playing a major part in mortality reduction. For example, British royals before 1800 enjoyed more plentiful nutrition than commoners yet lived no longer (Bacci, 1990).

When sulfonamides diffused across US healthcare in the 1930s, mortality from bacterial infections plummeted relative to mortality from other causes, enough to raise life expectancy by roughly half a year (Jayachandran et al., 2010). Penicillin followed soon thereafter. Later in the 20<sup>th</sup> century, a series of innovations paved the way for dramatic declines in mortality from noninfectious causes like cardiovascular disease and preterm birth (Cutler and McClellan, 2001). If the early-20<sup>th</sup> century saw the conquest of infectious disease in Western countries, the postwar period brought significant inroads against noncommunicable disease.

Outside the West, the three causes of mortality decline have overlapped substantially. Rising nutrition has coincided with the global diffusion of public health and medical technology. To the extent that the drivers of mortality decline in the West followed an ordered progression, no such ordering is evident in the rest of the world. Indeed, while many people still die from infection and malnutrition in poorer countries, many others die from non-communicable disease. The Global Burden of Disease project estimates that as of 2023, 43% of deaths in low-income countries were from non-communicable diseases, while 45% of deaths were from communicable, maternal, neonatal, and nutritional diseases (Institute for Health Metrics and Evaluation, 2025). Nutrition, public health, and medicine are simultaneously relevant. This overlap is a byproduct of the so-called “double burden of disease” (Bygbjerg, 2012) in low- and middle-income countries, whereby malnutrition, infectious disease, and noncommunicable disease coexist.

## 4.2 Causes of Fertility Decline

Mortality decline is but half of the demographic transition. The other half, fertility decline, has provoked even more disagreement. For both the historical transitions in the West and the contemporary transitions outside it, three questions about the drivers of fertility decline have received outsized attention. First, what role does child mortality play? Second, how important are ideas about family relative to economic constraints? Third, which matters more, the demand for small families or the supply of family planning services?

Through the past half-century of studying these issues, social demographers and economists have often disagreed on the answers to these questions. Much of the disagreement has stemmed from disciplinary differences along two dimensions. First, social demographers have emphasized the “proximate determinants” of fertility outcomes (Bongaarts, 1978)—behaviors like contracep-

tive use and marriage—whereas economists have focused more on economic forces that affect these determinants. Second, social demographers have highlighted the roles of preferences, ideas, and knowledge related to childrearing, whereas economists have been more drawn to explanations involving technical progress that caused industrialization, rising human capital, and changing gender roles.

Despite these past differences, the two fields have converged substantially in theory and method. Economists have come to understand that idea diffusion and behavioral considerations can affect the extent and pace of adjustment to changing economic fundamentals. And social demographers have come to place greater emphasis on the structural factors driving the demand for children. It is now possible to synthesize the two strands in the literature, so that each can help shed light on the other.

One can trace the debates to Coale (1973), who was an economist *and* a social demographer. Coale famously listed three preconditions for the decline of fertility within marriage: (1) fertility must be within the “calculus of conscious choice,” (2) reduced fertility must seem to confer some advantage to couples, and (3) couples must have some means to effectively control births. Social demographers generally believe all three preconditions to be important. In contrast, economists have typically thought (1) is guaranteed, (3) is usually present but to a varying extent, and (2) is the key to fertility decline. That is to say, economists since Becker (1960) have focused heavily on the demand for children, rather than on constraints of scientific understanding or technology.

#### **4.2.1 Gross versus Net**

As explained in Section 2, classic descriptions of the demographic transition have a specific order: mortality decline precedes fertility decline. Many populations have followed this order, with some notable exceptions in Europe, most prominently France (Coale and Watkins, 1986). This order gives the impression that child mortality affects fertility: parents have fewer children in part because each is more likely to survive to adulthood. In classic work on this link, Preston (1978) proposed four mechanisms through which higher child mortality may raise fertility. First, parents may seek to have more children up front to insure against the risk that few survive. Second, parents may seek to replace deceased children. Third, mothers may curtail breastfeeding earlier due to the death of a child, raising their physiological capacity to become pregnant. Fourth, communities may establish

institutions or practices that offset the effects of child deaths, even if not all parents are directly burdened by those deaths. All of these mechanisms imply effects on gross fertility, or the number of children ever born. Some further imply effects on fertility net of mortality. Research on these issues was initially varied, with gaps between social demographers and economists in both interests and conclusions. However, it has by now converged on a rough consensus in which individual and community replacement mechanisms are operative, and child mortality affects gross but not net fertility.

Economists have been especially interested in the first two mechanisms, insurance and replacement. Both constitute behavioral responses by parents to the expected or realized deaths of their own children, making them attractive targets for applying economic theory. The insurance mechanism has been particularly tempting to economists because it relates to choice under uncertainty: risk-averse parents “hoard” children to insure against the risk that few or none survive. In a hoarding model, parents on average overshoot their desired number of surviving children, so mortality decline reduces the number of children ever born *and* the number of surviving children (Kalemli-Ozcan, 2003). However, in an early discussion of these theories, Ben-Porath (1976) noted that child deaths tend to occur early in life, so that deaths and subsequent births may occur sequentially over a mother’s life. In this case, a replacement strategy may dominate a hoarding strategy.

In a variety of historical and contemporary settings, social demographers have found moderate replacement and physiological effects but little evidence of hoarding (Cohen and Montgomery, 1998; Palloni and Rafalimanana, 1999; Hossain et al., 2007). Economists have come around to this view too. Theoretically, Boldrin and Jones (2002) noted that in the Barro and Becker (1989) model of fertility, child mortality raises the price of surviving children, so that a decline in mortality leads to a higher number of surviving children, even while it reduces the number ever born. Galor (2011) made a similar point and more generally argued that hoarding requires parents to be implausibly risk averse. Doepke (2005) calibrated several variants of this model—with non-stochastic versus stochastic mortality, with continuous versus discrete fertility, and with *ex ante* versus sequential fertility choice—and in all cases found that mortality decline reduces gross fertility but raises net fertility. In empirical work, Ager et al. (2018) leveraged the historical introduction of the smallpox vaccine in Sweden as a natural experiment, finding that the associated reductions in early-life mortality led to lower gross but not net fertility.

Even if the insurance mechanism does not play a major role, mortality may still affect fertility through private replacement, physiology, or community replacement. In a team that includes social demographers and economists, Nobles et al. (2015) disentangled these mechanisms using variation in child mortality induced by the Indian Ocean Tsunami. Studying Indonesian data, they found evidence of private and community replacement, but not of a physiological mechanism. Deaths within the family and across the community were associated with higher subsequent birth rates, but the deaths of children under age two (who may have still been nursing) and over age two (who were not) were equally predictive of subsequent births.

#### 4.2.2 Ideas versus Constraints

Social demographers and economists have also disagreed over the years about the relative importance of new ideas and changing economic constraints. The disagreement dates back to the Princeton Project on the Decline of Fertility in Europe (Coale and Watkins, 1986), an expansive, groundbreaking investigation of the European historical record that took place in the 1960s and 1970s. The Princeton Project unsettled several tenets of Demographic Transition Theory, most notably that mortality decline and socioeconomic progress were prerequisites for fertility decline. In data on subnational regions across Europe, industrialization was only weakly related to fertility, similar to child mortality. National time series painted a similar picture. For example, France underwent fertility decline earlier than England, despite later industrialization and mortality decline. Furthermore, the onset of fertility decline diffused spatially across subnational regions, starting around Paris in the late-18<sup>th</sup> century and then spreading gradually to adjacent regions. These findings led many social demographers to highlight the diffusion of new ideas and technologies related to childbearing (Bongaarts and Watkins, 1996; Casterline, 2001).

Meanwhile, economists continued to emphasize adaptation to changing socioeconomic conditions. This emphasis stands out most in Becker's (1960, 1981) well-known theories, but it suffuses a great deal of economic research on fertility. Canonical economic models of the demographic transition rely on setups in which parents choose the number of children subject to changing technologies and budget constraints (Barro and Becker, 1989; Schultz, 1997; Galor, 2011). The models invoke a range of specific mechanisms, including changes in the opportunity cost of women's time (Galor and Weil, 1996), the return to investing in children (Galor and Weil, 2000) and keeping them out

of work (Hazan and Berdugo, 2002; Doepke, 2004), the length of life (Kalemli-Ozcan et al., 2000; Cervellati and Sunde, 2005; Soares, 2005), and systems for old-age security (Boldrin et al., 2015). The literature continues to debate these mechanisms, which are not mutually exclusive.

In empirical work, economists have called into question some of the statistical methodology of the Princeton Project (Guinnane et al., 1994; Brown and Guinnane, 2007) and offered alternative analyses demonstrating that changing economic fundamentals played an important role in European fertility decline (Guinnane, 2011). In an early contribution to this literature, Schultz (1985) demonstrated that increases in the international price of butter reduced Swedish fertility because women’s wages rose due to their comparative advantage in dairy production.<sup>10</sup> Across the Atlantic in the United States, when the boll weevil devastated agricultural productivity, households left agriculture and reduced fertility (Ager et al., 2020). In postwar low- and middle-income countries, changing economic fundamentals have also strongly predicted fertility decline. Over multiple decades, countries with faster economic growth saw more pronounced fertility decline (Chatterjee and Vogl, 2018).

In the decades immediately following the Princeton Project, many researchers took stock of theories emphasizing diffusion and ideational change *vis-à-vis* those emphasizing adaptation to economic change and felt compelled to take a side (e.g., Cleland and Wilson, 1987). But more recent work has come to acknowledge that the theories are not mutually exclusive. A change in economic fundamentals may shift the optimal number of children as in a standard economic model, but information about that optimum and how to implement it may diffuse gradually. Changes in the desired and realized numbers of children may require both structural and ideational change. The emerging consensus is that economic change reshaped the optimal number of children, but cultural diffusion affected the timing and geography of adjustment.

The recent economics literature on fertility change takes this combined perspective. The French transition has recently been a focal point. Spolaore and Wacziarg (2022) revisited the Princeton Project data with modern econometric tools and confirm the presence of diffusion. A reduced-fertility strategy emerged in parts of France with higher education, lower infant mortality, and higher urbanization, and it then spread across Europe, first reaching regions with cultural and

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<sup>10</sup>More recently, Voigtländer and Voth (2013) documented a similar mechanism leading to the European Marriage Pattern mentioned in Section 2, which reduced fertility by reducing and delaying marriage long before the decline of marital fertility that Schultz studies.

linguistic ties to France. The early movers in this process evidence give credence to both the ideas view and the constraints view. In related research, Blanc (2024) found that fertility declined earliest in French departments that secularized earlier, reshaping ideas about children and family. And Gay et al. (2026) showed that the initial declines concentrated in French municipalities that were forced to change their inheritance systems following the French revolution. The inheritance reforms altered the constraints parents faced, incentivizing them to have fewer children.<sup>11</sup>

Findings like these have led economists who study historical fertility decline to conclude that culture and institutions are key to understanding how quickly fertility responded to changing economic constraints. The argument extends to the post-1950 era. As Gobbi et al. (2026) documented using data from this era, changes in GDP per capita, schooling, and mortality more strongly predicted fertility change in populations with family institutions conducive to lower fertility.

Within countries, cultural transmission has mattered alongside economic change in the modern era as well. In Brazil, for example, the staggered rollout of television programs exhibiting small families hastened fertility decline (Ferrara et al., 2012), and pronatalist messages during a subsequent Papal visit impeded it (Bassi and Rasul, 2017). But these results do not negate the importance of economic constraints in the same context. Around the same time, pension reform reduced fertility (Danzer and Zyska, 2023), consistent with an old-age security motive for bearing more children. Some decades later, the introduction of genetically engineered soy raised incomes, reduced female labor market opportunities, and raised fertility (Moorthy, 2025). More broadly, socioeconomic progress strongly predicted Brazilian fertility decline in the second half of the 20<sup>th</sup> century (Potter et al., 2002).

One can also identify cultural persistence and diffusion through migrant networks in the late-20<sup>th</sup> century and beyond. In the United States, second-generation immigrant women bear more children if their parents originated in higher-fertility countries (Fernández and Fogli, 2009). In the Philippines, women reduce their fertility when migrants from their provinces are exposed to liberalization of reproductive health policies in their destination countries (Godlonton and Theoharides, 2025). These findings are consistent with a model in which economic conditions shape the optimal number of children, but societies adjust their beliefs and practices gradually.

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<sup>11</sup>Similar processes occurred in the English-speaking world. Following an 1877 legal decision that catalyzed the British birth control movement, fertility dropped sharply in Britain and in culturally British households in Canada, South Africa, and the United States (Beach and Hanlon, 2023).

### 4.2.3 Supply versus Demand

A final topic of past disagreement is contraception. Is access to modern contraceptive methods the central driver of fertility decline, or does the latter instead primarily stem from shifts in desired family size? This debate mainly applies to the modern era. The decline of fertility in the historical West largely preceded the development and widespread adoption of effective modern contraceptive methods (Szreter et al., 2003). Still, declines in lower-income countries occurred during a period when highly-effective contraceptive technologies existed. What role has the supply of contraception played relative to the demand for contraception—or the underlying demand for children?

Most social demographers would ask this question in a broader way, invoking the supply of family planning services rather than contraception alone. Family planning refers to a system of information, counseling, clinical care, and method provision, not just the methods themselves. Indeed, demographers commonly measure the “unmet need for family planning,” defined as the condition of wanting to avoid or postpone childbearing but not using contraception (Bradley and Casterline, 2014). The concept may sound straightforward but poses ambiguity in measurement and interpretation. For example, researchers typically exclude unmarried women who are not sexually active from measures of unmet need, but their choices related to marriage and sex may reflect their access to family planning, or lack thereof. Furthermore, to the extent that family planning services seek to persuade potential parents of Coale’s (1973) first two preconditions—reduced fertility being in the “calculus of conscious choice” and seeming to confer some advantage—they do not cleanly fit into the “supply versus demand” framework. That is to say, family planning services may provide access to contraception (supply) while also persuading women to find it worthwhile (demand).

The accumulated empirical evidence suggests that declines in the fertility have tracked declines in the desired number of children. The supply of modern contraception has not reshaped fertility on its own, but family planning programs have played a supporting role by helping couples implement and sometimes revise the desired number of children. Controversy on these issues heated up in the 1990s following an influential paper by Pritchett (1994), which documented that measures of desired fertility are highly correlated with the total fertility rate across countries. Based on this finding, Pritchett argued that most variation in fertility across populations comes from the demand for children, rather than access to birth control. In a strongly-worded critique, Bongaarts (1994)

rejected Pritchett’s interpretation, positing that unwanted fertility is a significant problem, which family planning programs help combat. Bongaarts further asserted that family planning programs prevented unwanted fertility from rising as wanted fertility fell.

In the decades since then, researchers have refined Pritchett’s empirical approach and worked toward consolidating the two perspectives. Pritchett’s analysis was cross-sectional, comparing countries rather than tracking desired and realized fertility over time within them. At the time, Pritchett wrote, too few fertility surveys were available globally to analyze a panel of countries. Since then, the Demographic and Health Surveys proliferated, facilitating repeated observation of the same countries. Lam (2011) and Günther and Harttgen (2016) used these data to revisit Pritchett’s findings using panel data methods. Regressions with country fixed effects and year fixed effects revealed similar patterns: within countries, declines in realized fertility coincided with declines in desired fertility. The panel relationship was roughly 90% as strong as the cross-sectional relationship. However, Günther and Harttgen noted that both relationships were weaker sub-Saharan Africa, leading them to conjecture that family planning programs had more scope for impact in that region. Furthermore, the retrospective nature of conventional measures of desired fertility—which rely on women reporting their family size ideals *after* some births have already occurred—may bias them toward wantedness. Casterline and El-Zeini (2007) proposed solving this issue by tracking groups of women between successive surveys, asking whether births between surveys exceeded the desires stated at the initial survey. This method too showed a close correspondence between desired fertility and realized fertility, but it found somewhat more unwanted fertility and by implication more of a potential role for family planning.

The accumulated empirical evidence opens the door to a consensus on the role of access to modern contraceptive methods and family planning services more generally (see Miller and Babiarz 2016 and references therein). The evidence makes clear that declines in desired fertility strongly predicted declines in realized fertility, such that a falling demand for children has driven a large share of global fertility decline in the postwar era. This fact does not rule out a role for family planning programs, although it may call for a broad view of what family planning programs do. Indeed, randomized controlled trials in Bangladesh, Ghana, and Malawi found that multifaceted family planning programs moderately reduced births (Joshi and Schultz, 2013; Phillips et al., 2006; Karra et al., 2022). However, a randomized controlled trial in rural Burkina Faso, a context with

a total fertility rate of roughly 5, found that access to free contraception alone had no effect on fertility (Dupas et al., 2025).<sup>12</sup> Consistent with these experimental results, Bongaarts (2020) found using African data that within-country changes in the strength of family planning programs more strongly predicted changes in wanted fertility than changes in unwanted fertility. He concluded that family planning programs reduce fertility through behavior change communication at least as much as through providing access to contraceptive methods and services.

The idea that family planning programs promote fertility decline by persuading women to use contraception, rather than merely providing access to it, partly resolves the difference of opinion. Modern contraceptive methods help women and their partners achieve their fertility goals with more precision and less personal cost than in the past, and contraceptive use is negatively associated with fertility at the population level (Kantorova and Bongaarts, 2024). But access alone does not spur the fertility transition. In a lighthearted example of this principle, Easterly (2002, p. 99) related how the United States Agency for International Development distributed so many free condoms in Egypt and El Salvador that soccer fans used them as balloons at matches. Family planning programs sometimes persuade women to use contraception, and the literature suggests many ways contraception can improve their lives (Karra and Wilde, 2024). However, the historical record is also rife with examples of misadventures in population policy that sought to reduce the fertility of specific groups (Connelly, 2008). The line between persuasion and coercion is delicate.

## 5 Conclusion

The demographic transition is now mostly an object of history, at least outside sub-Saharan Africa, and the debates over its causes that raged in the 20<sup>th</sup> century have simmered down, even if they have not been fully resolved. Early debates often drew sharp contrasts: nutrition versus medicine, ideas versus constraints, demand versus supply. Over time, the momentous growth of data resources and the associated progress in demographic and econometric methods have narrowed these contrasts. Researchers increasingly recognize that mortality and fertility decline cannot be reduced to single causes and furthermore that technology, culture, and institutions operate jointly. Economists have contributed to this synthesis by formalizing behavioral mechanisms mathematically, fielding ran-

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<sup>12</sup>The Burkina Faso study took place in 2018-21. The rural total fertility rate was 5.6 in the 2018-19 Multiple Indicator Survey and 4.9 in the 2021 Demographic and Health Survey (see <https://www.statcompiler.com/>).

domized experiments, and exploiting quasi-experiments, while increasingly drawing on insights from demography, public health, history, sociology, and anthropology. Demographers have contributed to it by formalizing population processes mathematically, developing new measurement tools, expanding data resources, and carrying out quantitative and qualitative analyses, while increasingly taking into account the theories and methods of economics.

The future promises a shrinking global population, even while sub-Saharan Africa continues to grow amid still elevated fertility. The timing of future African fertility decline is tightly linked to the timing of the global population peak, and both are hotly contested (Vollset et al., 2020; United Nations, 2024). Much of this new debate revolves around whether population projections should account for rising educational attainment in the latest birth cohorts of African women. In a way, this new debate about population projection rekindles old debates about the importance of socioeconomic change. Either way, the global population is extremely likely to start shrinking before the end of the current century, and it is also extremely likely to change in composition. Because fertility rates are currently higher among Africans and among Muslims, the sub-Saharan Africa will be the most populous UN region and Islam the most populous religion by the end of the current century (Pew Research Center, 2015; United Nations, 2024).

Even fiercer debates center on the consequences of population decline for economies and societies. Economic demographers have long noted the challenges that come with the accompanying aging of the population (Lee and Mason, 2011). More recently, concerns have broadened to include potential slowdowns in innovation (Jones, 2022; Spears and Geruso, 2025). Calibrations of these and related mechanisms for the U.S. economy suggest that any such effects are likely to be quantitatively small in the near term (Weil, 2026), but many questions remain. The first demographic transition, involving mortality and fertility, may be nearing a close. But the second and third demographic transitions, involving family structure and population composition, are ongoing (Coleman, 2006; Lesthaeghe, 2014), and further demographic transformations lie ahead. Understanding these transformations will require the same interdisciplinary approach that helped resolve earlier debates on the demographic transition.

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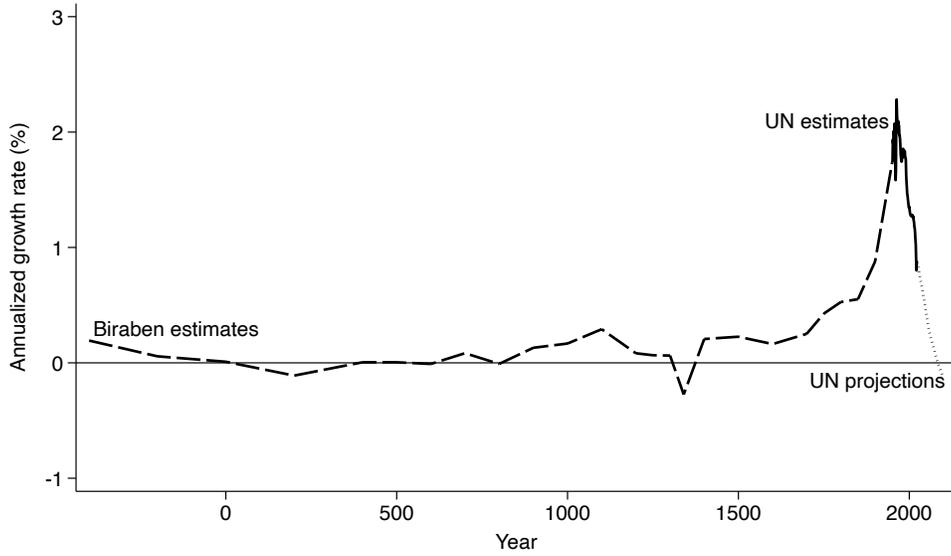
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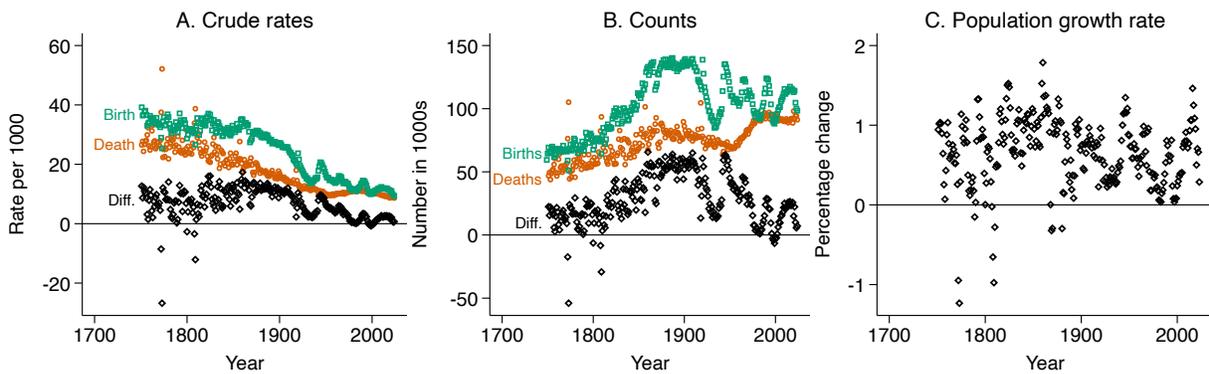
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Figure 1: Global population growth since antiquity



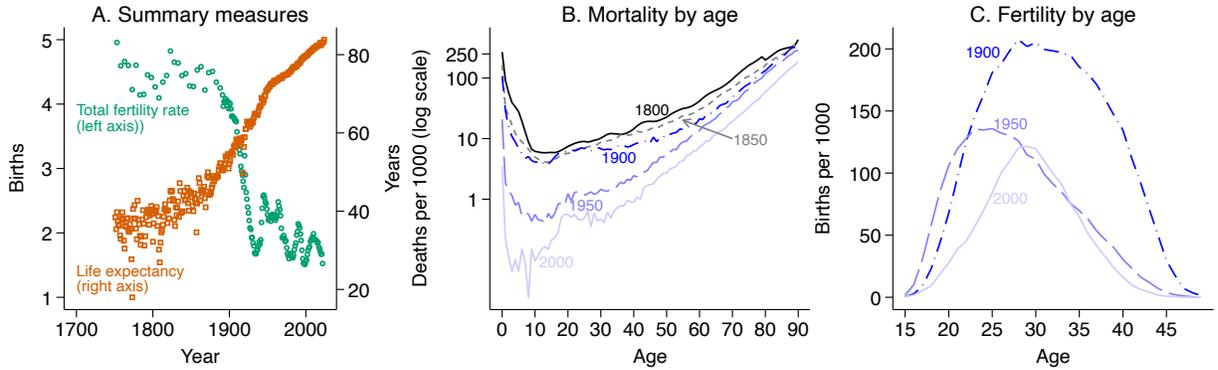
Notes: Biraben’s (1979) historical estimates have a frequency of 50-200 years. The United Nations (2024) estimates and projections have an annual frequency. The projections are the UN’s “medium” variant.

Figure 2: Population change in Sweden since 1751



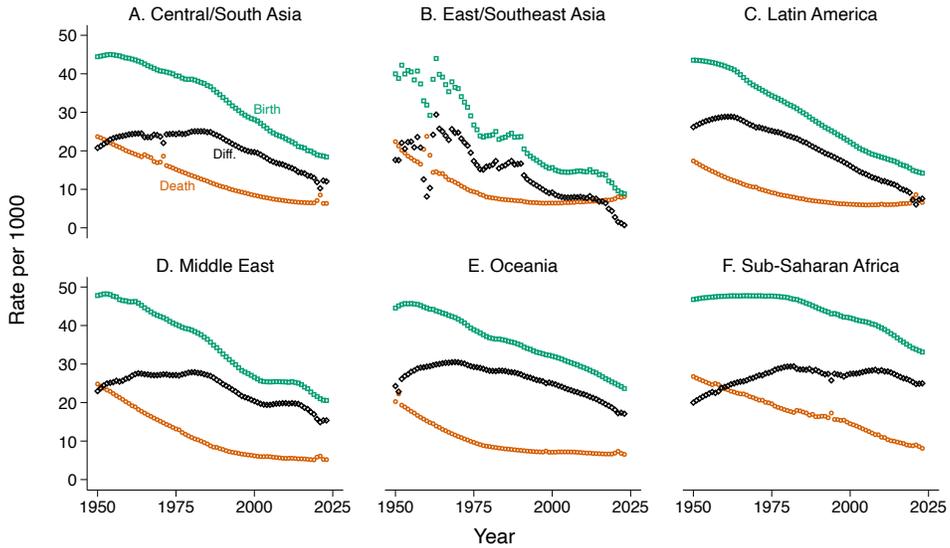
Note: In Panel A, the difference between the crude birth rate and the crude death rate is the rate of natural population change. In Panel B, the difference between the number of births and the number of deaths is the increment of natural population change. In Panel C, the population growth rate accounts for net migration in addition to births and deaths. Data are from the Human Mortality Database (2025).

Figure 3: Mortality and fertility in Sweden since 1751



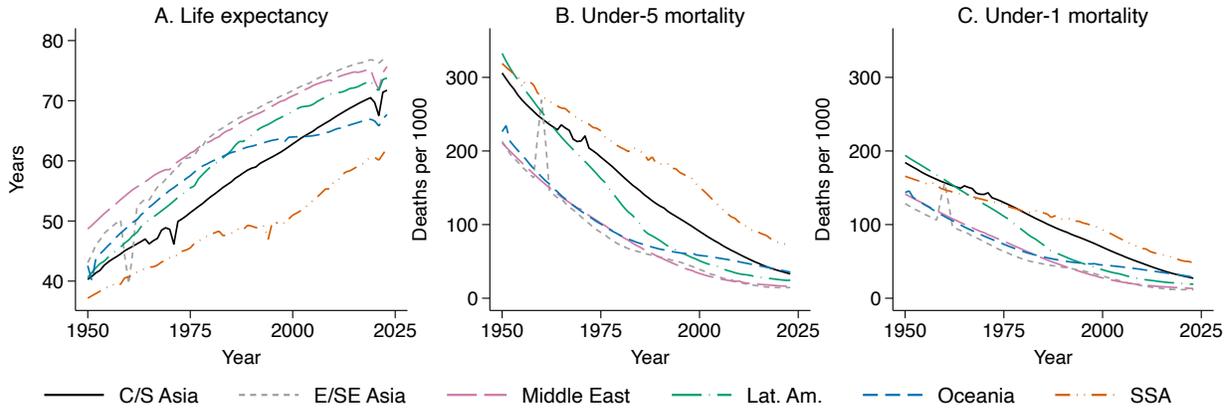
Note: “Life expectancy” refers to period life expectancy at birth. Mortality data are from the Human Mortality Database (2025). Fertility data are from the Human Fertility Collection (2025), with 1751-1890 from Statistics Sweden (1969) and 1891-present from the Human Fertility Database (2025).

Figure 4: Population change in non-Western regions since 1950



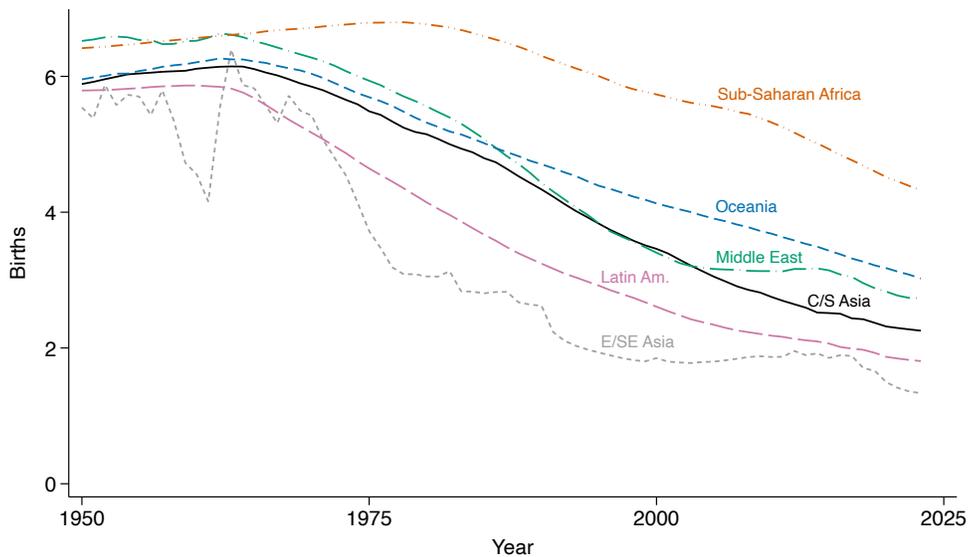
Notes: The difference between the crude birth rate and the crude death rate is the rate of natural population change. Data are from the United Nations (2024). Latin America include Caribbean countries. Oceania excludes Australia and New Zealand.

Figure 5: Mortality in non-Western regions since 1950



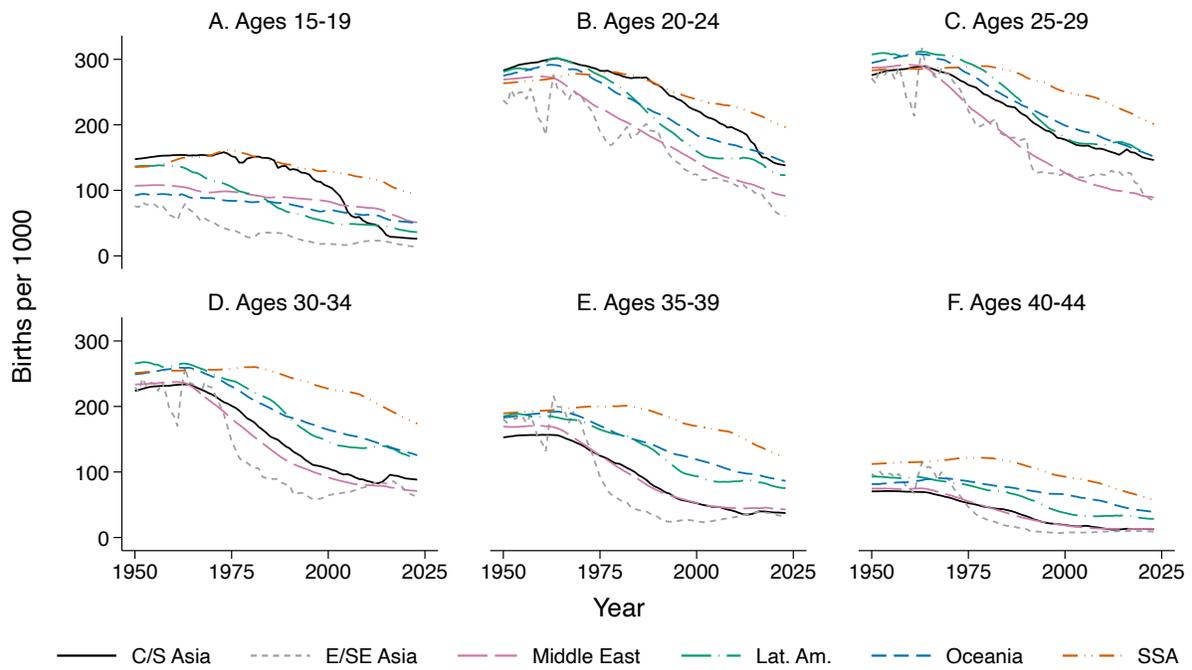
Notes: “Life expectancy” refers to period life expectancy at birth. Mortality rates are measured per 1000 live births. Data are from the United Nations (2024). Latin America include Caribbean countries. Oceania excludes Australia and New Zealand.

Figure 6: Total fertility rates in non-Western regions since 1950



Notes: Data are from the United Nations (2024). Latin America include Caribbean countries. Oceania excludes Australia and New Zealand.

Figure 7: Age-specific fertility rates in non-Western regions 1950



Notes: Data are from the United Nations (2024). Latin America include Caribbean countries. Oceania excludes Australia and New Zealand.