Economic Theories of Fertility Choice[*]

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Abstract

We review economic theories of fertility using simple benchmark models to high-light the central mechanisms shaping fertility choices. We first examine explanations for the fertility decline of the twentieth century, emphasizing rising female wages, technological progress in household production, improvements in survival and health, and the quantity–quality trade-off. We also discuss theories of the mid-century baby boom and subsequent fertility bust. The chapter then turns to explaining persistently low fertility rates in advanced economies and highlights mechanisms such as intra-household disagreement, intensive parenting norms, labor market institutions, family policies, delayed childbearing, rising childlessness and the effect of assisted reproductive technologies. We then consider fertility patterns in developing countries and their interaction with economic growth, focusing on the role of customary institutions, family-planning policies, and modern growth frameworks that endogenize fertility within the demographic transition. The chapter concludes by outlining several open questions that represent promising avenues for future research.

1 Introduction

There are few forces that shape the long-run trajectory of an economy as profoundly as fertility. Changes in fertility have far-reaching macroeconomic and welfare consequences because they determine the size, age structure, and growth rate of the population. During the demographic transition, declining fertility can initially boost economic growth by lowering the dependency ratio, that is, the share of children and retirees relative to the working-age population. Over time, however, persistently low fertility leads to population aging, rising dependency ratios, and increasing pressure on pension and healthcare systems. More broadly, fertility dynamics can influence human capital accumulation, labor supply, and the pace of economic growth. These consequences have motivated a large body of economic theories seeking to understand the forces that shape fertility behavior and the policies that may mitigate the economic challenges associated with sustained fertility decline.

The goal of this chapter is to provide an overview of economic theories of fertility. To this end, we organize the discussion around simplified and tractable benchmark models of fertility choice designed to isolate and highlight the key theoretical mechanisms proposed in the literature. The exposition focuses primarily on static frameworks, while also discussing selected simple dynamic extensions. This approach allows us to focus on the central economic channels underlying different theories while keeping the analysis transparent. Whenever possible, we refer to other chapters in this volume that examine these mechanisms in greater depth.

We begin with explanations for the persistent decline in fertility during the twentieth century. Broadly, these theories fall into two categories: those emphasizing economic forces within the household and those highlighting health changes that affect survival and longevity. On the household side, rising female wages increased the opportunity cost of childrearing, while technological progress in household production reduced the time required for domestic work and enabled greater female labor force participation. These changes altered both the incentives to have children and the allocation of resources across them, leading to a quantity–quality trade-off. A second set of explanations emphasizes improvements in survival and health. Declining mortality and rising life expectancy, together with medical innovations such as effective contraception and reductions in maternal health risks associated with childbirth, have played a central role in the persistent fertility decline over the course of the 20th century. Notably, both types of theories have also been used to explain the temporary reversal of fertility decline in many developed countries during the mid-twentieth century: the baby boom and the

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subsequent baby bust.

We then turn to a central challenge in the twenty-first century: persistently below-replacement fertility in advanced economies. In countries such as Japan, Italy, Spain, and South Korea, fertility rates have remained closer to one child per woman than to the replacement rate for several decades. We review theories that seek to explain why fertility can fall persistently below its replacement level. These explanations emphasize factors such as disagreement between spouses, the role of parenting norms, and the influence of family policies and labor market institutions on fertility decisions. We also discuss the rising prevalence of childlessness, as well as the effect of assisted reproductive technologies and the associated infertility risk when childbearing is increasingly postponed to older ages. These theories provide guidance for the design of family policies aimed at mitigating sustained fertility decline.

Finally, we broaden the scope of the chapter to examine how fertility interacts with long-run economic development and growth. Institutional differences between developed and developing economies are substantial, and the mechanisms that help explain fertility decline in the twentieth century are often less effective in accounting for fertility patterns in developing regions. In many settings, formal legal systems coexist with customary law, locally rooted rules and norms governing social and economic life. Because such institutions often operate at the level of ethnic groups rather than at the national level, fertility patterns can vary widely within countries, making aggregate fertility rates less informative about the underlying mechanisms that shape fertility behavior. We discuss two prominent examples from Sub-Saharan Africa: polygyny and impartible inheritance customs. We then review theories highlighting the role of contraception and family-planning policies in the context of developing countries. Finally, we discuss how demographic change interacts with economic growth. We compare classic and modern growth frameworks and highlighting recent work that endogenizes fertility within processes of structural transformation and the demographic transition.

A number of comprehensive surveys of fertility theories are available beyond the scope of this chapter. Doepke and Tertilt (2016) provide an overview of how fertility decisions affect macroeconomic outcomes such as labor supply, savings, human capital investment, and long-run growth. Greenwood et al. (2017) emphasize the role of changing gender wage gaps and technological progress in household production in shaping fertility. They also examine the influence of social norms and contraceptive technologies on premarital childbearing, as well as theories explaining the baby boom and fertility responses to wars. More recently, Doepke et al. (2023) highlight that several long-standing empirical relationships, such as the negative association between fertility and income,

no longer hold universally in developed countries and review theories explaining the evolving relationship between fertility, income, and female labor supply. Hotz et al. (1997) survey the economics of fertility in developing countries. Finally, fertility is not only a central topic in economics but also in related fields such as demography and sociology; Balbo et al. (2013) provide an overview of this broader literature.

2 Explaining Fertility Patterns in the 20th Century

The twentieth century witnessed one of the most profound demographic transformations in history: fertility declined steadily across much of the world as incomes and female labor force participation rose (Doepke et al., 2023). Explaining this pattern, fewer children in increasingly prosperous societies, has been a central challenge for economic theories of fertility. We begin with a baseline framework inspired by Becker (1960) that captures the negative relationship between fertility and income. We then extend this framework to account for other key features of twentieth-century fertility dynamics, including the quantity–quality trade-off in children, improvements in mortality and longevity, and the spread of contraceptive technologies. We also discuss theories that explain the mid-century baby boom, the only sustained reversal of the fertility decline in developed economies, as well as the changing relationship between fertility and the business cycle toward the end of the century.

2.1 Negative Fertility-Income Relationship

One of the most robust empirical regularities is the negative relationship between fertility and income in many countries.[1] Figure 1 illustrates this pattern for seven cohorts in the United States. Across cohorts, fertility declines as income rises. Within cohorts, richer households consistently have fewer children than poorer households, a pattern that has remained remarkably stable over time.

Becker (1960) introduced fertility into the standard economic framework by modeling children as a choice variable in parents' utility function. Parents derive utility from both consumption goods (c) and children (n). Consumption requires monetary resources, while children require parental time devoted to childrearing (ℓ). With standard log preferences, income and substitution effects offset each other, implying that fertility would be independent of income. To generate the negative fertility–income relationship ob-

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[1]There are exceptions. For example, fertility is positively related to family income in Korea (Kim et al., 2024).

Figure 1: Fertility–Income Relationship, United States
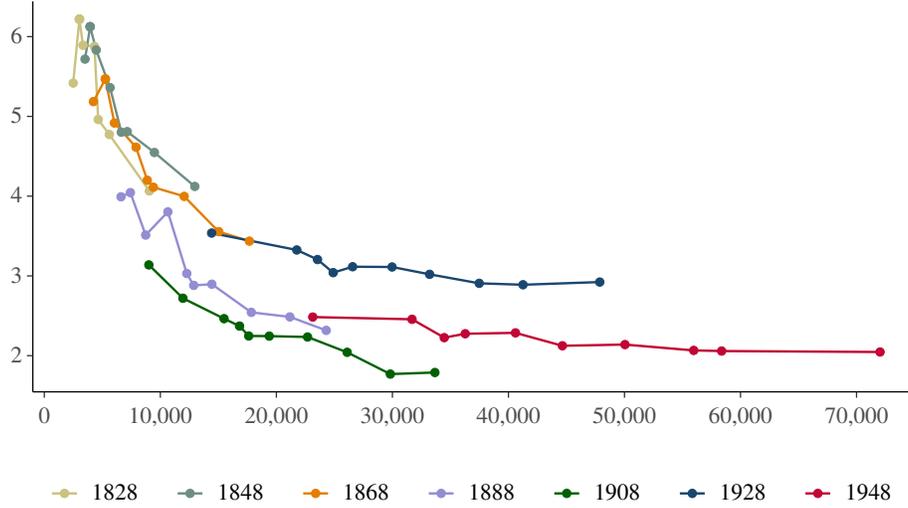
Notes: Reproduced from Jones and Tertilt (2008), Figure 4. Fertility is measured using children ever born in U.S. Census data. Income is proxied by occupational income scores (OIS).

served in the data, we introduce subsistence consumption.[2] This yields the following decision problem:[3]

$$\max_{c,n} \quad u(c,n) = \theta \ln(c + \bar{c}) + (1 - \theta) \ln n$$

$$\text{s.t.} \quad c = (1 - \ell)w$$

$$n = \phi\ell$$

$$0 \le \ell \le 1, \quad 0 < \theta < 1,$$

where w denotes the wage rate and ϕ captures productivity in childrearing. Solving for optimal fertility yields

$$n^* = (1 - \theta)\phi \left(1 + \frac{\bar{c}}{w}\right).$$

This simple decision problem generates a negative fertility–income relationship. When wages are low, market work yields little consumption above subsistence, making childrearing relatively inexpensive in terms of foregone consumption. As wages rise, the opportunity cost of time spent on childrearing increases, leading parents to allocate more time to market work and reduce fertility. Thus, higher wages reduce fertility even

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[2]See Jones et al. (2010) for a detailed discussion of various modeling mechanisms that can generate a negative fertility–income relationship.

[3]See also Greenwood et al. (2005) and Strulik (2008) for fertility models with subsistence consumption.

in this simple static framework.[4]

2.2 Quantity-Quality Tradeoff

A second key mechanism emphasizes parental investments in children. In this class of models, parents value both the number of children and the resources devoted to each child. Because higher child quality requires greater investment, parents face a trade-off between having more children and investing more in each child. This quantity-quality trade-off was first formalized in the seminal contributions of Becker (1960), Becker and Lewis (1973), Willis (1973), and Becker and Tomes (1976). It has since become a cornerstone of the demographic and macroeconomic literature and is widely used to study fertility behavior, human capital accumulation, and the demographic transition.

To capture this mechanism, we introduce child quality, q, into parental utility alongside consumption, c, and fertility, n. Child quality depends on an innate component $a \geq 0$ and parental investment s, commonly interpreted as schooling or other quality-enhancing inputs:

$$\max_{c,n,q,s} = \theta_c \ln c + \theta_n \ln n + \theta_q \ln q$$

$$\text{s.t.} \quad c + sn = (1 - \ell)w$$

$$n = \phi\ell$$

$$q = a + \delta s$$

$$0 \leq \ell \leq 1, \quad \theta_c + \theta_n + \theta_q = 1$$

Optimal parental investment s^*, child quality q^* and fertility n^* are given by:

$$s^* = \frac{1}{\theta_n - \theta_q}\left(\frac{\theta_q w}{\phi} - \frac{\theta_n a}{\delta}\right), \qquad q^* = \frac{\theta_q}{\theta_n - \theta_q}\left(\frac{\delta w}{\phi} - a\right)$$

$$n^* = \frac{\theta_n - \theta_q}{1 - \theta_q}\left(\frac{\delta\phi}{\delta - \frac{a\phi}{w}}\right)$$

For the problem to be well defined, it is required that $\theta_n > \theta_q$ and $\delta w > a\phi$. Under these conditions, optimal investment in child quality s^* increases with wages, implying that child quality q^* also rises with income. In contrast, the optimal number of children

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[4]The literature proposes alternative mechanisms that generate different income–fertility relationships. For example, Córdoba and Ripoll (2016) argue that intergenerational financial transfers are crucial for producing a negative income–fertility gradient. Bar et al. (2018) show that the ability to outsourced child-care leads to a positive fertility-income relationship among very high-income households in the U.S.

n^* declines with wages. The model therefore generates the canonical quantity-quality trade-off: higher-income parents choose fewer children but invest more in each child. Chapter 6 of this handbook provides a detailed overview of the quantity-quality theory of fertility and reviews the empirical literature testing its implications, including studies using twin births to identify the causal impact of fertility on children's education and health.

2.3   Longevity and Insurance from Children

Rising incomes over the past two centuries have been accompanied by substantial increases in life expectancy. Longer lifespans extend the expected retirement period and thus alter the incentives to save, invest in human capital, and have children. The effect of rising longevity on fertility, however, is theoretically ambiguous and depends on how individuals finance consumption in old age—through personal savings, support from children, or public pension systems.

Longevity and Old-Age Consumption   We begin by examining how improvements in old-age survival affect fertility when individuals rely on personal savings to finance retirement. To capture this mechanism, we extend the baseline model to two periods. Parents allocate lifetime resources between current consumption, c, and old-age consumption, c_{old}. The parameter $\pi \in [0, 1]$ denotes the probability of surviving to old age and therefore captures life expectancy. The household's problem is

$$\max_{\ell, c, c_{\text{old}}} \quad \theta(\ln c + \pi \ln c_{\text{old}}) + (1 - \theta) \ln(n)$$
$$\text{s.t.} \quad c + \pi c_{\text{old}} = (1 - \ell)w$$
$$n = \phi\ell$$
$$0 \leq \ell \leq 1, \quad 0 < \theta < 1.$$

Optimal fertility is given by
$$n^* = \phi\frac{1 - \theta}{1 + \pi\theta}.$$

An increase in longevity raises the expected utility from future consumption, inducing parents to allocate more resources to old-age consumption. Because resources are limited, this reallocation reduces fertility, i.e., $\partial n^*/\partial\pi < 0$. In this framework, longer life expectancy lowers fertility by increasing the value of future consumption relative to childbearing. This mechanism features prominently in models linking the demo-

graphic transition to economic growth, including Zhang et al. (2003), Cervellati and Sunde (2005), and Soares (2005).[5]

Social Security and Old-Age Insurance from Children   A second strand of the literature emphasizes the role of social security. When formal financial markets or public pension systems are underdeveloped, as was the case historically in Western Europe and in many developing economies today, children serve as a primary source of old-age support (Boldrin and Jones, 2002; Boldrin et al., 2015). In this setting, fertility partly reflects an insurance motive. To illustrate this mechanism, suppose that parents receive a transfer $v > 0$ from each child in old age rather than financing retirement through savings:

$$\max_{\ell, c} \quad \theta(\ln c + \pi \ln c_{\text{old}}) + (1 - \theta) \ln(n)$$
$$\text{s.t.} \quad c = (1 - \ell)w$$
$$c_{\text{old}} = vn$$
$$n = \phi\ell$$
$$0 \leq \ell \leq 1, \quad 0 < \theta < 1$$

Optimal fertility is then
$$n^* = \phi \frac{1 - \theta + \theta\pi}{1 + \theta\pi}.$$

In contrast to the previous model, an increase in life expectancy now raises fertility, i.e., $\partial n^*/\partial \pi > 0$. When children provide old-age consumption, a longer expected retirement increases the value of having offspring. This mechanism also implies that the expansion of public pension systems can reduce fertility by substituting for the insurance role of children. To see this, suppose old-age consumption is supplemented by a public pension ψ,
$$c_{\text{old}} = vn + \psi.$$

Implicit differentiation yields $\partial n^*/\partial \psi < 0$: more generous pensions crowd out the insurance value of children and reduce fertility. Quantitative models built around this mechanism, such as Ehrlich and Kim (2007) and Boldrin et al. (2015), argue that the expansion of social security systems during the twentieth century contributed substantially to fertility decline.

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[5]Hwang and Kim (2023) distinguishes between expected and unexpected changes in life expectancy and shows how the timing and predictability of longevity gains affect fertility responses.

Taken together, these mechanisms highlight that the effect of rising longevity on fertility is not universal but depends critically on the institutional environment governing old-age support. More broadly, public policies beyond pension systems, such as cash transfers, housing programs, and childcare subsidies, can shape the economic incentives surrounding fertility decisions. Chapter 8 of this Handbook reviews the empirical evidence on how such social policies influence fertility and family formation.

2.4 Child Mortality

Declining mortality is one of the defining features of the demographic transition. Improvements in health, sanitation, and medical technology dramatically increased the survival chances of children over the past two centuries. A natural question is how these changes affected fertility decisions.

Demographers have long argued that declining child mortality reduces fertility because parents no longer need to have as many children to achieve a desired number of surviving offspring. Economists have formalized this intuition in models of fertility choice (Eckstein et al., 1999; Strulik, 2004; Doepke, 2005).

To illustrate this mechanism, consider a simple extension of the baseline model in Section 2.1 that introduces a survival probability for children. Parents make decisions based on the expected number of surviving children and solve

$$
\begin{aligned}
\max_{c,n,\ell} \quad & \theta \ln c + (1 - \theta) \ln sn \\
\text{s.t.} \quad & c = (1 - \ell)w \\
& sn = \phi\ell \\
& 0 \leq \ell \leq 1, \quad 0 < \theta < 1
\end{aligned}
$$

where $s \in (0, 1)$ denotes the exogenous probability that a child survives. Thus, sn represents the *net fertility rate*, that is, the expected number of surviving children. Solving the problem yields the optimal fertility choice

$$
n^* = \frac{\phi(1 - \theta)}{s},
$$

which implies $\partial n^*/\partial s < 0$. An increase in child survival (i.e., a decline in child mortality) therefore reduces the number of births required to achieve a given number of surviving children, leading to lower fertility.

However, this mechanism alone cannot account for the magnitude of fertility de-

cline observed during the demographic transition. In the simple model above, net fertility remains constant since $sn^* = \phi(1 - \theta)$ is independent of s. As emphasized by Doepke (2005), similar results arise in extended Barro–Becker frameworks (Barro and Becker, 1989). Mortality declines therefore cannot fully explain the large fertility reductions observed in industrialized economies. Additional mechanisms, such as the quantity–quality trade-off, child labor considerations, or old-age security motives, are required to generate the substantial declines in both gross and net fertility documented in the data.

2.5   Contraception, Premarital Sex and the Decline of Marriage

The twentieth century witnessed major changes in sexual behavior, contraceptive technology, and marriage patterns. These developments reshaped fertility decisions by altering both the risks associated with sexual activity and the social and economic consequences of childbearing.

Teenage Childbearing and Premarital Sex   In 1900, only about 6 percent of unmarried women engaged in premarital sex. By the 2000s, roughly three quarters of young women in the United States were sexually active before marriage (Greenwood and Guner, 2010). This shift, often referred to as the *sexual revolution*, occurred alongside major advances in contraception and rising educational attainment. Despite improved contraceptive technologies, the share of teenage births occurring out of wedlock increased over the century, rising from roughly 3 percent in 1920 to 7.5 percent in 2000 (Fernández-Villaverde et al., 2014).

Explaining why teenage childbearing rose despite safer contraception poses an important theoretical puzzle. Improved contraception has two opposing effects. On the one hand, it reduces the probability that sexual activity results in pregnancy. On the other hand, safer sex lowers the expected cost of premarital sexual activity and may therefore increase the number of teenagers who choose to become sexually active. As a result, improvements in contraception may initially increase out-of-wedlock births before eventually reducing them.

To illustrate this mechanism, consider a simple model inspired by Greenwood (2019). A teenage girl chooses whether to engage in premarital sex. Let V_0 denote lifetime utility if she does not experience an out-of-wedlock birth and V_b the utility if she does, with $V_0 > V_b$. Sexual activity yields enjoyment ℓ (libido) but may result in pregnancy. Let $\kappa \in (0, 1)$ denote the probability of safe sex, capturing the effectiveness of contraception

and knowledge about its use. If the girl abstains, she obtains utility $U_A = V_0$. If she engages in premarital sex, her expected utility is

$$U_S(\kappa) = \ell + \kappa V_0 + (1 - \kappa)V_b.$$

Therefore, the girl chooses sex if $U_S(\kappa) > U_A$. We can define a threshold libido level ℓ^*, where the girl is indifferent

$$\ell^* = (1 - \kappa)(V_0 - V_b).$$

As contraception becomes more effective (higher κ), the threshold ℓ^* falls, implying that more girls engage in premarital sex. Whether this leads to more or fewer out-of-wedlock births depends on the quantitative effects of safer sex and increased sexual activity. Suppose libido ℓ is uniformly distributed on $[0, \bar{\ell}]$. The share of girls engaging in premarital sex is

$$p(\kappa) \equiv \Pr(\ell \geq \ell^*(\kappa)) = \max\left\{0,\ 1 - \frac{(1 - \kappa)(V_0 - V_b)}{\bar{\ell}}\right\}.$$

The fraction of girls experiencing an out-of-wedlock birth equals the fraction who engage in premarital sex multiplied by the probability that pregnancy occurs:

$$b(\kappa) = (1 - \kappa)p(\kappa).$$

Out-of-wedlock births therefore depend on two opposing forces:

$$\frac{db(\kappa)}{d\kappa} = \underbrace{-p(\kappa)}_{\text{safer sex}} + \underbrace{(1 - \kappa)\frac{dp}{d\kappa}}_{\text{increased sexual activity}}.$$

Improved contraception reduces pregnancy risk but simultaneously encourages sexual activity. As a result, teenage births may initially increase before eventually declining.

Several studies formalize and test this mechanism. Greenwood and Guner (2010) develop a model explaining the joint rise in contraceptive effectiveness and out-of-wedlock births in the United States. Fernández-Villaverde et al. (2014) emphasize the role of changing social norms, showing how a shift from a regime of "shame" to a more permissive environment increased premarital sexual activity. Di Nola et al. (2025) study differences in teenage pregnancy rates between the United States and Norway and show that welfare-state institutions, including sexual education policies, play an important role. Chapter 13 of this Handbook reviews recent trends in teenage childbearing, its consequences, and the role of policy.

These mechanisms may also help explain why empirical evidence on the fertility ef-

fects of contraception is mixed. For example, Bailey (2010) finds that the pill accelerated the decline in marital fertility after 1960, whereas Myers (2017) shows that access to abortion enabled many women to delay marriage and motherhood. The debate around contraception and fertility in developed countries is discussed in Part IV of this Handbook.

Contraception and the Decline of Marriage   The ability to control fertility through modern contraception has also fundamentally altered incentives to marry. To illustrate this mechanism, we extend the premarital-sex model from the previous section by introducing a marriage choice. Match quality in the marriage market is summarized by a draw $w \sim W(\cdot)$.

If a woman marries, she receives utility $V_M(w)$ and, for simplicity, has a child with probability one. If she remains single, she receives utility $V_S(\kappa) = \max\{U_S(\kappa), U_A\}$, where $U_S(\kappa)$ and U_A denote the expected utility from premarital sex and the utility from abstaining, respectively, as defined above. Because U_S depends on contraceptive effectiveness $\kappa \in (0, 1)$, $V_S(\kappa)$ depends on κ as well.

A matched woman marries whenever marriage dominates single life, or $V_M(w) \geq V_S(\kappa)$. This condition defines a marriage cutoff $w^*(\kappa)$ such that marriage occurs if and only if $w \geq w^*(\kappa)$. Because safer contraception raises the value of remaining single, $V_S(\kappa)$ increases with κ, which raises the marriage threshold and reduces marriage rates:

$$\Pr(\text{marry}) = 1 - W(w^*(\kappa))$$

Finally, total nonmarital births equal the fraction of women who remain single times the probability of a premarital birth while single,

$$b(\kappa) = W(w^*(\kappa)) \left(1 - \kappa\right) p(\kappa).$$

Substituting the expression for $p(\kappa)$ yields

$$b(\kappa) = W(w^*(\kappa)) \left[(1 - \kappa) - \frac{V_0 - V_b}{\bar{\ell}} (1 - \kappa)^2 \right].$$

Nonmarital births therefore remain hump-shaped in κ: improved contraception mechanically lowers pregnancy risk but simultaneously increases premarital sexual activity. In addition, it raises the value of remaining single, reducing marriage rates through the cutoff $w^*(\kappa)$. Figure 2 illustrates these mechanisms. As contraceptive effectiveness increases, marriage declines while premarital sexual activity rises. Total births fall,

whereas the share of premarital births initially increases before eventually declining.

(a) Marriage Rate

(b) Share Women having Premarital Sex

(c) Total Births

(d) Share Premarital Births

Figure 2: The Effect of Contraceptive Effectiveness

Notes: We simulate the model with contraceptive effectiveness, κ, ranging from 0 to 1. The model is parameterized as follows: $n^d = 3$, $u = 1.75$, $\phi = 0.225$, and $A = 1.15$.

2.6   The Baby Boom and Baby Bust

During the mid-twentieth century, a striking reversal in the trend in fertility occurred. After decades of declining birth rates, many industrialized countries, including the United States, Canada, Australia, and parts of Western Europe, experienced a sharp rise in fertility known as the *baby boom*, followed by an equally pronounced *baby bust*. While often associated with the years following World War II, both the timing and magnitude of this surge varied across countries, prompting a large literature seeking to explain its causes.

Relative Income Hypothesis   A classic explanation is the *relative income hypothesis* proposed by Easterlin (1961). According to this view, fertility decisions depend not on absolute income but on income relative to material aspirations. These aspirations are

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shaped during childhood and reflect the standard of living experienced in the parental household. To capture this idea, consider the benchmark model augmented with a consumption benchmark c_{-1} representing parental consumption. Let $\chi > 0$ measure the strength of aspirational habits, yielding a reference level χc_{-1} (Abel, 1990; Campbell and Cochrane, 1999). The household's problem becomes

$$
\begin{aligned}
\max_{c,n} \quad & \theta \ln(c - \chi c_{-1}) + (1 - \theta) \ln n \\
\text{s.t.} \quad & c = (1 - \ell)w \\
& n = \phi \ell \\
& 0 \le \ell \le 1, \quad 0 < \theta < 1
\end{aligned}
$$

Optimal fertility is

$$
n^* = (1 - \theta)\phi \left[1 - \chi \left(\frac{w}{c_{-1}} \right)^{-1} \right].
$$

Fertility therefore depends on *relative income* $\frac{w}{c_{-1}}$. When wages are high relative to childhood living standards, fertility rises. Easterlin argued that the postwar baby boom emerged because relatively small cohorts born during the Great Depression entered a rapidly expanding labor market with modest consumption aspirations. High wages relative to these aspirations generated unusually high relative income and encouraged childbearing. As the large baby boom cohorts later entered the labor market, cohort crowding reduced wages relative to aspirations, contributing to the subsequent baby bust. Subsequent research has proposed alternative theories for the baby boom, which we discuss below. Chapter 7 of this Handbook, on the other hand, reviews evidence for earlier cohorts and presents new cohort-level data suggesting that relative income may also help explain today's low fertility rates.

Productivity in the Home   Greenwood et al. (2005) propose that the 20th-century evolution of women's labor supply and fertility, including the baby boom and the subsequent bust, was driven by what is now termed the *second industrial revolution* in the household. Rapid technological progress introduced labor-saving household appliances, such as running water, electricity, washing machines, and dishwashers. These innovations significantly lowered the time required for housework, thereby altering the fundamental trade-off between market work and childrearing and shaping the fertility dynamics of the mid-century.

Recall the baseline model from Section 2.1. Optimal fertility is

$$n^* = (1 - \theta)\phi \left(1 + \frac{\bar{c}}{w}\right).$$

Technological improvements in the household can be interpreted as an increase in childrearing productivity ϕ.[6] Over the twentieth century, both wages w and household productivity ϕ increased. These changes generated two opposing forces: higher wages reduced fertility by raising the opportunity cost of time, while higher household productivity increased fertility by lowering the effective cost of childrearing. During the mid-century diffusion of household technologies, productivity gains temporarily offset the negative wage effect, contributing to the baby boom. As these technologies matured and wages continued to rise, the wage channel regained dominance, leading to the baby bust.

Medical Progress   Another theory of the baby boom emphasizes medical advances that lowered the costs and health risks of childbearing (Albanesi and Olivetti, 2016). To capture this mechanism, consider a version of the baseline model that includes a fixed time cost of pregnancy and childbirth κ:

$$\max_{n,\ell} \quad \theta \ln(c + \bar{c}) + (1 - \theta) \ln n$$
$$\text{s.t. } c = w(1 - \ell - \kappa)$$
$$n = \phi\ell$$
$$h + \ell + \kappa = 1$$

Medical progress reduces κ by lowering the risk that childbirth permanently reduces a women's productivity. Albanesi and Olivetti (2016) quantify this burden using the WHO's DALY measure (years of life lost plus years lived with disability) and convert it into a per-period time cost for mothers.

Optimal fertility is

$$n^* = \phi(1 - \theta)\left((1 - \kappa) + \frac{\bar{c}}{w}\right)$$

A decline in κ relaxes the time constraint and increases fertility, providing a mechanism through which medical progress can generate a baby boom. Quantitative evidence from Albanesi and Olivetti (2016) shows that the dramatic reduction in maternal mortality

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[6]See Greenwood (2019) for a more general treatment using a CES home production function.
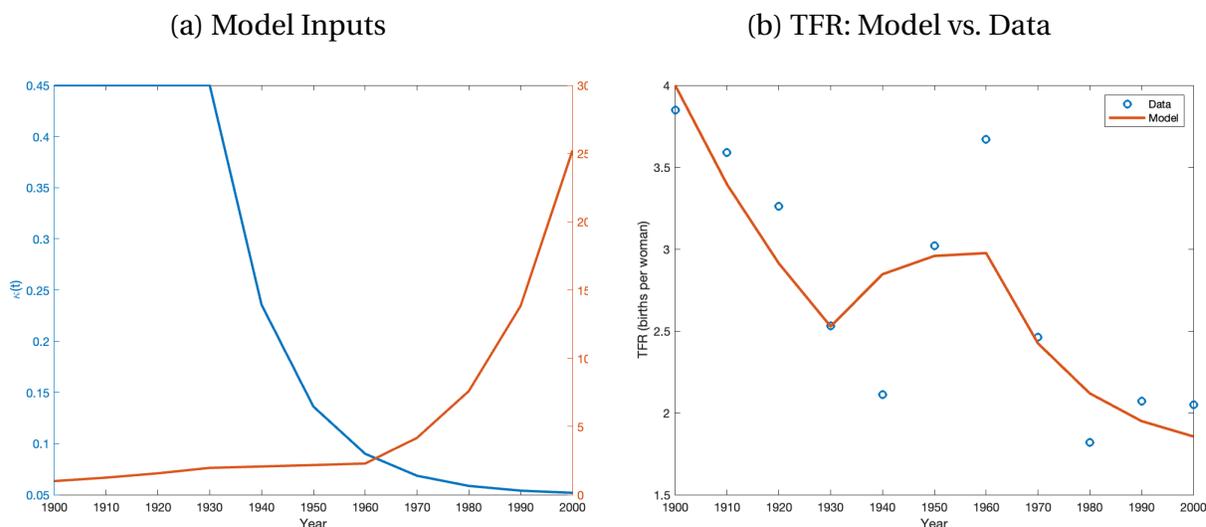
Figure 3: Baby Boom and Baby Bust

Notes: We create two time series for the increase in wages as well as the increase in home productivity (a decline in κ). We simulate the model using these series as inputs. The model is parameterized as follows:

and morbidity beginning in the 1930s played an important role in the mid-century fertility surge. As health improvements stabilized while wages continued to rise, fertility declined again, contributing to the baby bust. Figure 3 illustrates both mechanism numerically.

Part V of this Handbook reviews the economics of reproductive health in more detail. In particular, chapter 32 reviews the determinants and policy implications of maternal health in developed countries. It highlights persistent disparities in maternal mortality and morbidity and discusses how policies, from parental leave to nutrition programs and abortion access, shape maternal health outcomes.

Labor Market Competition Among Women   Doepke et al. (2015) emphasize the role of labor market dynamics. They argue that the surge in female labor demand during World War II permanently increased labor force participation among older women. As these women remained in the workforce after the war, younger cohorts faced stronger labor market competition. Reduced employment opportunities encouraged younger women to leave the labor force earlier and start families sooner, contributing to the postwar baby boom.

2.7 Income Risk and the Cyclicality of Fertility

Historically, severe downturns such as the Great Depression were accompanied by sharp fertility declines, while economic expansions often coincided with fertility increases. For example, Jones and Schoonbroodt (2016) develop a general equilibrium model with dynastic altruism, age-structured populations, and aggregate productivity shocks. In their framework, fluctuations in productivity translate into changes in household income, generating procyclical fertility.

Recent work suggests that the relationship between fertility and the business cycle has evolved over time. In particular, Coskun and Dalgic (2024) show that fertility has become increasingly procyclical as women's labor force participation has risen. As female earnings have become a larger component of household income, fertility has increasingly moved with the business cycle. This shift reflects the interaction between income volatility, the gender composition of earnings within households, and the opportunity cost of time.

To illustrate this mechanism, consider a model in which fertility decisions interact with uninsurable income risk and the gender composition of earnings. Women choose market hours, while men always work, but face income risk ε:

$$w_m = \mu_m(s) + \varepsilon_m, \qquad \mathbb{E}[\varepsilon_m] = 0, \quad Var(\varepsilon_m) = \sigma_m^2.$$

where $s \in \{B, R\}$ denotes the aggregate state (boom B or recession R). Female earnings w_f are acyclical and exogenous, while male income is procyclical, $\mu_m(B) > \mu_m(R)$, reflecting the empirical pattern that men tend to work in more cyclical occupations than women (Coskun and Dalgic, 2024). Consumption in state s is

$$c(s) = (1 - \ell)w_f + w_m = \left(1 - \frac{n}{\phi}\right) w_f + \mu_m(s) + \varepsilon_m,$$

so expected consumption conditional on s equals

$$\mathbb{E}[c|s] = \left(1 - \frac{n}{\phi}\right) w_f + \mu_m(s).$$

Households cannot fully insure against male income risk and become more exposed when women devote more time to childrearing. We capture this exposure as

$$Var(c|s) = \sigma_m^2 \left(\kappa_0 + \kappa_1 g(s)\frac{n}{\phi}\right), \qquad g(s) \equiv \frac{\mu_m(s)}{w_f} \qquad \kappa_0, \kappa_1 > 0.$$

Agents are risk averse. To retain tractability, preferences over consumption take a mean–variance form and households derive utility from consumption and children:

$$u(c(s), n) = \theta \ln \left(\mathbb{E}[c|s] - \frac{1}{2} Var(c|s) \right) + (1 - \theta) \ln n$$

$$= \theta \ln \left[\left(1 - \frac{n}{\phi} \right) w_f + \mu_m(s) - \frac{1}{2} \sigma_m^2 \left(\kappa_0 + \kappa_1 g(s) \frac{n}{\phi} \right) \right] + (1 - \theta) \ln n,$$

The optimal fertility choice is

$$n^* = \Omega \cdot \frac{w_f + \mu_m(s) - a}{w_f + b \frac{\mu_m(s)}{w_f}},$$

where $a \equiv \frac{1}{2} \sigma_m^2 \kappa_0$ and $b \equiv \frac{1}{2} \sigma_m^2 \kappa_1$ capture risk exposure, and $\Omega = (1 - \theta)\phi/\theta$ is a constant.

Two mechanisms determine fertility in this framework. First, children require maternal time, so their opportunity cost increases with the female wage w_f. Second, when women reduce market work to care for children, households become more exposed to uninsurable male income risk. This *risk-exposure channel* scales with income volatility σ_m^2 and with the gender earnings gap $g(s) = \mu_m(s)/w_f$.

Holding mean income fixed, higher income risk reduces fertility: $\partial n^*(s)/\partial \sigma_m^2 < 0$. Empirical evidence supports this prediction. For example, Chabé-Ferret and Gobbi (2025) show that declines in aggregate economic uncertainty can significantly increase fertility. They estimate that the lower uncertainty faced by women born in 1910 relative to those born in 1933 can account for an increase in completed fertility of 0.4–0.6 children.

The model also captures how the cyclical behavior of fertility depends on female wages. When w_f is low, households rely heavily on male earnings and the gender earnings gap is large. Because male income is higher in booms, exposure to income risk is also greater in booms, which can make fertility countercyclical (Butz and Ward, 1979; Buckles et al., 2021). As female wages rise over time, households become less dependent on male earnings and the gender earnings gap shrinks. The risk-exposure channel weakens and the standard income effect dominates: higher income in booms increases fertility. In this case fertility becomes procyclical.

Figure 4 illustrates this mechanism. For low female wages fertility is countercyclical, whereas for higher female wages fertility becomes procyclical. The model therefore provides a simple explanation for why fertility has become more procyclical over time as women's labor force participation and earnings have increased.
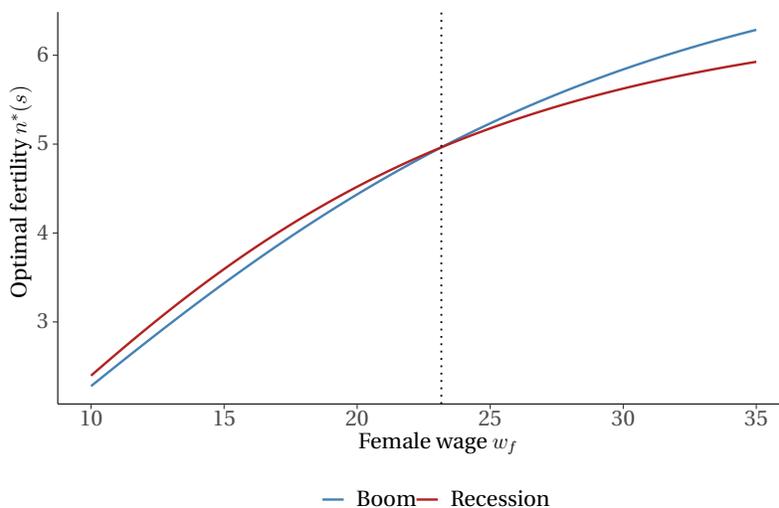
Figure 4: Fertility in Booms and Recessions as a function of w_f

Notes: Simulating optimal fertility choices in booms ($s = B$) and recessions ($s = R$). Male earnings are given by $\mu_m(B) = 35$ and $\mu_m(R) = 17$. The remaining parameters are set to $\theta = 0.2$, $\phi = 1.5$, $\sigma_m^2 = 1$, $\kappa_0 = 8$, $\kappa_1 = 56$.

3   Understanding Low Fertility in the 21st Century

While the central question of the nineteenth and twentieth centuries was how to explain the demographic transition and the decline of fertility from high to moderate levels, the challenge in the twenty-first century is different. In most advanced economies, fertility has fallen persistently below replacement and childlessness has become increasingly common. At the same time, women's educational attainment now matches or exceeds that of men in many countries, reshaping household dynamics and labor market opportunities. Competition over children's future prospects, for example in education and labor markets, has intensified, reinforcing quantity–quality trade-offs. New medical technologies, such as assisted reproductive technologies, have also altered the biological and economic constraints of childbearing. These developments call for new theoretical frameworks to explain the mechanisms that shape low-fertility environments.[7]

3.1   Bargaining Between Spouses

The models discussed so far treat fertility as a unified household decision. Another approach is to model reproductive choices as the outcome of bargaining between partners who face different costs and benefits. Doepke and Kindermann (2019) formalize this

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[7]Chapter 16 of this Handbook examines the economic consequences of persistently low fertility in advanced economies and discusses policies designed to address these challenges.

idea in a model where two parents bargain over the decision to have a child $b \in \{0, 1\}$. Each partner $g \in \{f, m\}$ obtains utility from consumption c_g and a utility gain from child-bearing v_g:

$$u_g(c_g, b) = c_g + bv_g.$$

Market wages are w_f and w_m, and having a child entails a consumption cost ϕ. If the couple cooperates, joint consumption exhibits economies of scale, captured by $\alpha > 0$, yielding the budget constraint:

$$c_f + c_m = (1 + \alpha)(w_f + w_m - \phi b).$$

Under *full commitment*, partners can commit ex ante to future transfers. The outside option is non-cooperation without a child, where each individual consumes their own income: $\bar{u}_f(b = 0) = w_f$ and $\bar{u}_m(b = 0) = w_m$. In this case, a child is born ($b = 1$) whenever the joint benefit exceeds the total cost:

$$v_f + v_m \geq \phi(1 + \alpha).$$

If this condition holds, transfers can be arranged such that both partners are better off and disagreement never arises.

The outcome changes under *limited commitment*. Suppose fertility is chosen in the first stage, while consumption is negotiated in a second stage once the child is born. Child care costs are distributed according to fixed shares λ_f and λ_m, with $\lambda_f + \lambda_m = 1$ and $\lambda_f > \lambda_m$, implying a larger domestic burden for the mother. Recent work emphasizes that such asymmetries may arise from persistent gender norms and mismatches in expectations about household roles.[8] Her outside option with a child then deteriorates relative to the man:

$$\bar{u}_f(b = 1) = w_f + v_f - \lambda_f \phi, \quad \bar{u}_m(b = 1) = w_m + v_m - \lambda_m \phi. \tag{1}$$

Because the mother's outside option falls, her bargaining position weakens. Anticipating this outcome, she evaluates fertility not only based on the utility gain v_f, but also on the expected loss in bargaining power. Since the father cannot commit ex ante to compensate her for this future loss, she may veto the birth.

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[8]For example, Goldin (2025) argues that highly educated women increasingly prefer partners with more egalitarian views of childcare and household responsibilities, while many men continue to hold more traditional expectations. Anticipating an unequal distribution of childrearing costs within couples raises the effective burden borne by women and can reduce fertility.

Formally, each partner agrees to have a child only if

$$v_f \geq \left(\lambda_f + \frac{\alpha}{2}\right)\phi, \quad v_m \geq \left(\lambda_m + \frac{\alpha}{2}\right)\phi. \tag{2}$$

These participation constraints imply that fertility operates as a veto game: both partners must individually gain. The term $\frac{\alpha}{2}\phi$ captures each partner's share of the benefit from joint consumption that is forgone when resources are diverted to child costs. If childcare costs fall disproportionately on the mother (high λ_f), her threshold rises sharply. Even when the joint benefit $v_f + v_m$ exceeds the total cost, fertility may not occur because one partner's participation constraint is not satisfied. Lack of commitment therefore creates a disagreement in couples that can push fertility below the full-commitment benchmark.

Chapter 9 of the Handbook further discusses how differences in preferences, costs, bargaining power, and information within couples shape fertility outcomes.

3.2 Parenting Norms and Status Externalities

Rising expectations about childrearing have become a defining feature of low-fertility societies. In many developed countries, parenting has become increasingly intensive, with growing pressure to invest time and resources in children's education and development (Doepke and Zilibotti, 2019). Such social norms may reinforce the quantity–quality trade-off and contribute to persistently low fertility.

One way to formalize these norms is through status externalities or comparison motives (Kim et al., 2024). Parents evaluate their children's outcomes relative to those of others and derive utility from their child's quality compared to a social benchmark. To capture this mechanism, consider a standard quantity–quality model augmented with comparison motives:

$$
\begin{aligned}
\max_{c,n,q,\ell} \quad & \theta_c \ln c + \theta_n \ln n + \theta_q \ln\left(q - \chi\,\tilde{q}\right) \\
\text{s.t.} \quad & c + sn = (1-\ell)w \\
& n = \phi\ell \\
& q = \delta s \\
& 0 \leq \ell \leq 1, \quad \theta_c, \theta_n, \theta_q > 0, \quad \theta_c + \theta_n + \theta_q = 1, \\
& 0 \leq \chi < 1, \quad q - \chi\,\tilde{q} > 0.
\end{aligned}
$$

The term $\ln(q - \chi\tilde{q})$ captures status concerns: parents value their child's quality q rela-

tive to a benchmark $\tilde{q}$, determined by the behavior of other parents. The parameter χ measures the strength of comparison motives.[9]

Solving the household's problem yields optimal per-child investment s^* and fertility:

$$s^* = \frac{\theta_q \delta w + \theta_n \phi \chi \tilde{q}}{\delta \phi (\theta_n - \theta_q)}, \qquad n^* = \frac{\phi w \delta (\theta_n - \theta_q)}{(1 - \theta_q)(\delta w + \phi \chi \tilde{q})}.$$

A higher benchmark level $\tilde{q}$ induces parents to increase investment per child while reducing fertility. These responses are stronger when comparison motives χ are larger.

In equilibrium, the benchmark quality must be consistent with individual choices, implying $\tilde{q} = q$ under the simplifying assumption that all households are identical. The resulting equilibrium allocations are

$$q^{\mathrm{eq}} = \frac{\theta_q \delta w}{\phi (\theta_n (1 - \chi) - \theta_q)}, \qquad n^{\mathrm{eq}} = \frac{\phi (\theta_n (1 - \chi) - \theta_q)}{(1 - \theta_q)(1 - \chi)}.$$

Equilibrium fertility declines as comparison motives strengthen. Intuitively, status competition pushes parents to invest more in each child, raising the cost of childrearing and lowering fertility.

Such a comparison-driven equilibrium can be welfare-reducing for parents. Kim et al. (2024) and Mahler et al. (2025) show that taxes on status-oriented investments, when rebated through pro-natal transfers, can help restore the socially efficient allocation. In practice, such interventions could take the form of taxes or regulations on private education expenditures, tutoring, or other status-oriented investments. Ho and Wang (2024) evaluate the effects of a ban on private tutoring and a cap on education costs in a heterogeneous-agent model with endogenous marriage, fertility, and a quantity-quality trade-off, and find that these policies increase fertility.

Nakakuni et al. (2026) and Chapter 10 of this Handbook discuss a broader class of mechanisms in which fertility behavior is shaped by cultural transmission and the diffusion of norms across individuals, families, and regions. In Chapter 12, social norms appear through son preference and gender bias. Cultural institutions, such as dowry systems, patrilineal inheritance, and expectations about old-age support, can make sons more valuable than daughters. These norms influence fertility behavior by shaping stopping rules, birth spacing, and prenatal selection.

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[9]Assume that $\theta_n (1 - \chi) > \theta_q$, which ensures the existence of an interior equilibrium.

3.3 Family Policies and Labor Market Institutions

Persistently low fertility in many advanced economies has renewed interest in pro-natal family policies, such as childcare subsidies, tax benefits, cash transfers, and parental leave. While empirical evidence suggests that such policies can increase fertility, their effects vary widely across countries and policy designs (Olivetti and Petrongolo, 2017; Doepke et al., 2023; Hart et al., 2024). Their effectiveness depends critically on the broader institutional environment, particularly labor market structures and workplace practices.

Structural models provide a useful framework for studying these interactions. They allow researchers to distinguish between short-run responses, such as the timing of births, and long-run outcomes such as completed fertility and welfare effects (Erosa et al., 2010). A large literature studies cash transfers as a pro-natal instrument. In standard fertility models, transfers raise fertility because children are normal goods. Consistent with this prediction, Adda et al. (2017) find that German child benefits increase fertility in the short run, although long-run effects on completed fertility are smaller. Similar patterns are documented by Cruces and Rodríguez-Román (2025) for Spain. Using a heterogeneous-agent life-cycle model for the United States, Zhou (2022) show that transfers raise fertility mainly among low-income households, but may also reduce investment per child, increasing inequality.

Beyond financial incentives, labor market institutions play a crucial role in shaping fertility decisions. Following Goldin (2014), recent work emphasizes workplace flexibility as a key determinant of fertility outcomes. In many occupations, rigid schedules, long hours, or limited control over working time make it difficult to reconcile careers and childrearing (Guner et al., 2026). To illustrate this mechanism, consider a variant of the baseline model that includes leisure and an additional time cost of children arising from workplace inflexibility:

$$\max_{c,n,\ell,h} \quad \theta \ln c + \gamma \ln n + (1 - \theta - \gamma) \ln(1 - h - \ell - \eta w n)$$

$$\text{s.t.} \quad c = wh,$$

$$n = \phi \ell,$$

$$0 \leq h, \ell \leq 1.$$

The term $\eta w n$ represents the additional time burden of raising children in inflexible jobs, where $\eta > 0$ captures the severity of workplace frictions. These frictions may reflect institutional features such as rigid schedules, minimum-hours requirements, or expec-

tations of long working hours in high-paying occupations. Optimal fertility is given by

$$n^* = \frac{\gamma}{1/\phi + \eta w},$$

which shows that greater labor-market inflexibility (higher η) reduces fertility by increasing the effective time cost of children.

Quantitative models confirm the importance of such mechanisms. For example, Guner et al. (2024) study split-shift schedules in Spain that impose a fixed daily time cost of working. Eliminating this inflexibility in their life-cycle model raises fertility by about 6 percent. Kim and Yum (2025) show that inflexibility such as minimum-hours requirements in high-paying Korean jobs create strong career–family trade-offs, particularly for women. Expanding job-protected parental leave benefits in their model mitigates these frictions, increasing fertility while improving women's career outcomes.

Labor-market segmentation provides another important channel. In countries such as Spain, Korea, and Japan, workers are divided between stable permanent jobs and more precarious temporary positions, increasing employment uncertainty and reducing incentives to have children. Guner et al. (2024) show that reducing employment risk among temporary workers can increase fertility and female employment. Kim and Yum (2025) highlight the role of high entry costs into career-oriented jobs in Korea, which make it difficult to (re-)enter stable career tracks after interruptions. In their model, removing these barriers increases completed fertility and alters the effects of parental leave reforms, highlighting the interaction between family policies and labor-market institutions.[10]

3.4   Childlessness and the Extensive Margin of Fertility

A growing feature of low-fertility societies is the rise in childlessness. Much of the economic literature models fertility as a continuous choice, which is convenient in aggregate settings but abstracts from the discrete decision of whether to have children at all. We therefore present models that distinguish between two margins of fertility: the *extensive margin* (whether to have any children) and the *intensive margin* (how many children to have conditional on becoming a parent). This distinction has become increasingly important because childlessness accounts for a large share of fertility variation in many developed economies.

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[10]Yamaguchi (2019) builds a structural model incorporating dual labor markets in Japan and studies the effects of parental leave policies on fertility.
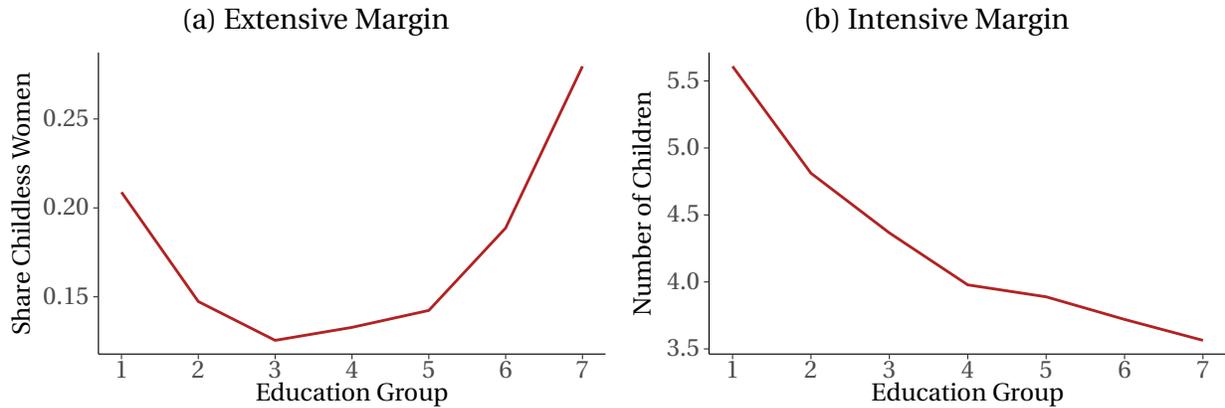
(a) Extensive Margin   (b) Intensive Margin

Figure 5: Intensive and Extensive Margin of Fertility

Notes: The data come from the 5% sample of the 1990 U.S. Census. The sample includes women aged 45 and older. Fertility is measured by children ever born. Education is grouped into seven categories: (1) No schooling; (2) Primary schooling; (3) Less than high school; (4) High school degree, (5) Some college; (6) Four-year bachelor's degree; (7) More than a four-year bachelor's degree.

Baudin et al. (2015) document two key empirical patterns. First, conditional on having children, fertility declines with education, the intensive margin. Second, childlessness follows a U-shaped pattern with respect to education: it is highest among the least and the most educated women. Figure 5 illustrates these patterns using data from the 1990 U.S. Census for women aged 45 and older, allowing us to measure completed fertility.

Baudin et al. (2015) refer to childlessness among the least educated women as "social sterility", meaning that these women are biologically capable of having children but cannot afford to do so. This mechanism generates higher levels of childlessness among the least educated. At the top of the education distribution, women earn higher wages and therefore face higher opportunity costs of childrearing, which leads to a larger share of childless women among the most educated. Conditional on having children, Figure 5b shows that the number of children declines with education.

To capture these mechanisms, we assume that female education operates through the wage rate w_f, which determines the opportunity cost of time. We introduce a small utility parameter $\nu > 0$ so that zero fertility is feasible, and assume that motherhood

requires a minimum level of consumption $\underline{c}_f$. The household solves

$$
\begin{aligned}
U_{int} = & \quad \theta \ln c + (1 - \theta) \ln(n + \nu) \\
\text{s.t.} & \quad c + \underline{c}_f \mathbb{I}(n > 0) = (1 - \ell)w_f + w_m - \tau w_f^2 n, \\
& \quad n = \phi \ell \\
& \quad 0 \le \ell \le 1, \quad 0 < \theta < 1, \quad \nu, \tau > 0
\end{aligned}
$$

The term $\tau w_f^2 n$ captures a wage penalty from combining careers and childrearing, which rises with female wages. This specification is motivated by evidence in Goldin (2014) that career penalties are particularly severe in high-paying occupations. For an interior solution, optimal fertility is

$$
n_{int}^* = \frac{(1 - \theta)(w_m + w_f - \underline{c}_f)}{\frac{w_f}{\phi} + \tau w_f^2} - \theta \nu.
$$

If parents choose not to have children, that is, if $n^* = 0$, utility and consumption are given by

$$
U_0 = \theta \ln c + (1 - \theta) \ln \nu \qquad \text{where} \quad c = w_m + w_f.
$$

Fertility at the extensive margin is therefore

$$
n^* = \begin{cases} 0, & \text{if} \quad U_0 > U_{int} \\ n_{int}^* & \text{otherwise}. \end{cases}
$$

Figure 6 illustrates the model's implications. At very low income levels, households cannot afford the fixed cost $\underline{c}_f$, leading to childlessness. As income rises, fertility becomes positive. However, when female wages become sufficiently high, the opportunity cost of time and the wage penalty associated with childrearing dominate, making childlessness optimal again. The model therefore generates a U-shaped relationship between income (or education) and childlessness, as in the data.

Chapter 15 of this Handbook explores the economics of childlessness in greater depth, examining how economic constraints, delayed childbearing, partnership dynamics, and changing family norms jointly shape the extensive margin of fertility.

3.5 Delayed Childbirth and Infertility Risk

Rising female education and labor force participation have increased women's market wages and strengthened incentives to invest in careers before having children. Delay-
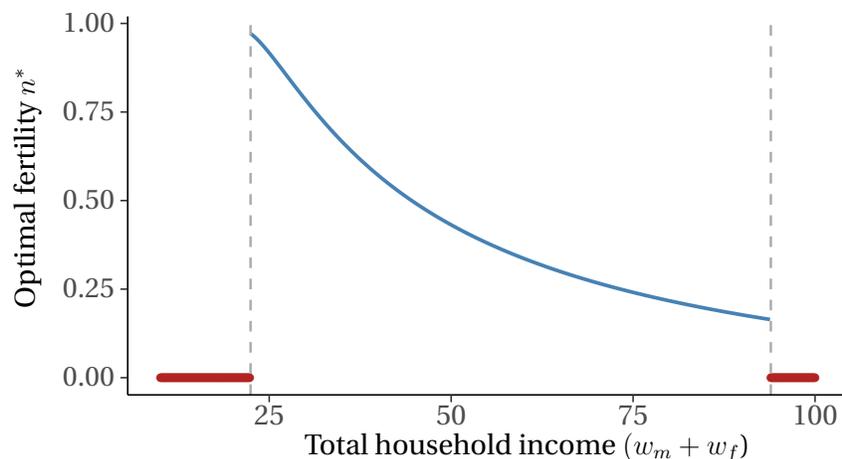
Figure 6: Childlessness and Fertility as a function of $w_f + w_m$

Notes: The figure plots the optimal fertility choices $n*$ for varying household incomes. Parameters of the decision problem are set as follows: $\theta = 0.45$, $\phi = 12$, $\nu = 0.4$, $\hat{c} = 15$ and $\tau = 0.065$. Female wages, w_f, vary between 0.05 and 50, while male wages, w_m vary between 10 and 50.

ing childbirth allows women to accumulate experience and earn higher wages over the life cycle, but postponement also increases the risk of infertility at older ages. Across countries, the average age at first birth has risen substantially (Figure 7a). To capture the trade-off between career investment and fertility risk, we consider a simple two-period framework in which women choose whether to have children early or postpone childbearing.

Women can either raise children in period 1 (early) or period 2 (late), but not in both periods. For simplicity, we abstract from quantity choices and focus on the timing decision. If a woman works full-time in period 1 ($\ell_1 = 0$), she accumulates experience and earns a higher wage $(1 + \kappa)w$ in period 2, where $\kappa > 0$ captures the return to early career investment. However, postponing childbirth involves infertility risk: in period 2,
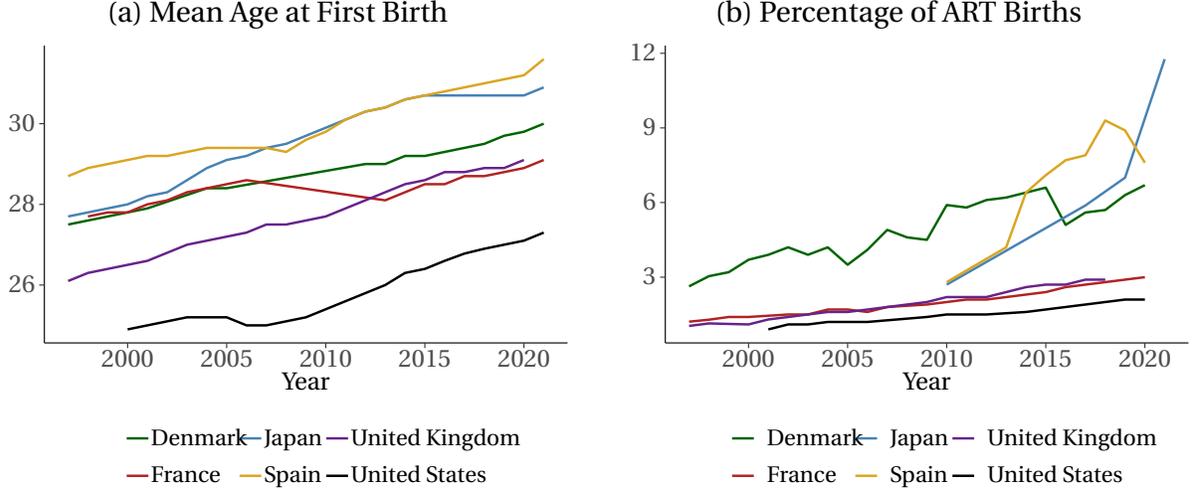
26

(a) Mean Age at First Birth (b) Percentage of ART Births

Figure 7: Delayed Childbearing and ART Technology

Notes: ART stands for assisted reproductive technology. Data for mean age at first birth comes from the OECD database. Data for the share of births using assisted reproductive technology is collected from ESHRE for European countries and the CDC for the United States.

conception occurs only with probability $p_n < 1$. The woman's decision problem is

$$\max_{c_1, c_2, n_1, n_2, \ell_1, \ell_2} \quad \theta_1 \ln(c_1) + \theta_2 \ln(c_2) + \theta_3 \ln(n_1 + \mathbb{E}(n_2))$$

$$\text{s.t.} \quad c_1 = w(1 - \ell_1)$$

$$n_1 = \phi \ell_1,$$

$$c_2 = w(1 + \kappa \mathbb{I}[n_1 = 0])(1 - \ell_2)$$

$$n_2 = \begin{cases} \phi \ell_2 & \text{with prob. } p_n \\ 0 & \text{with prob. } 1 - p_n \end{cases}$$

$$\ell_1 \ell_2 = 0, \quad \kappa > 0,$$

where $\mathbb{E}[n_2] = p_n \phi \ell_2$ and the constraint $\ell_1 \ell_2 = 0$ ensures that childbearing occurs in at most one period.

A woman postpones childbirth ($\ell_1 = 0$) if the utility from late childbearing exceeds that from having children early ($\ell_2 = 0$):

$$\theta_2 \ln(1 + \kappa) + \theta_3 \ln(p_n) > \theta_3 \ln\left(\frac{\theta_2 + \theta_3}{\theta_1 + \theta_3}\right)$$

The threshold probability p_n^* that makes women indifferent between early and late child-

bearing is

$$p_n^* = \frac{\theta_2 + \theta_3}{\theta_1 + \theta_3} \cdot \frac{1}{(1+\kappa)^{\theta_2/\theta_3}}.$$

Women delay childbirth whenever $p_n > p_n^*$. A higher return to career investment (κ) lowers the threshold p_n^*, making postponement more attractive. Conversely, improvements in fertility technology that raise the probability of conception at older ages (higher p_n), such as assisted reproductive technologies (ART), also increase the incentive to delay childbearing.[11].

This simple framework highlights how economic incentives to delay childbirth interact with biological fertility risk. Sommer (2016) embeds similar constraints in a life-cycle model with uninsurable earnings risk, showing that greater income risk induces precautionary postponement of childbirth. Because the probability of conception declines with age, this delay reduces completed fertility. While assisted reproductive technologies partially mitigate infertility risk, they do not fully offset this decline. Low (2024) show that infertility risk from delayed childbearing can also shape marriage-market outcomes: when women's human capital and reproductive capacity are negatively correlated, matching on both attributes generates non-monotonic sorting patterns.

Greater availability of these technologies has delayed the average age at first marriage and first birth and encouraged women to pursue higher education and professional careers. At the same time, access to ART increases fertility among older women and raises the incidence of multiple births. Chapter 29 of this Handbook discusses how access to ART has shaped women's behavior in both marriage and fertility decisions.

4 Fertility in Developing Countries and Economic Growth

While the demographic transition, the shift from high fertility and mortality rates to low levels of both, originated in Northern Europe in the late eighteenth century, it has since spread to nearly all countries (Delventhal et al., 2024), including those in the developing world. Most economic theories of declining fertility, however, were developed in the context of developed countries, either based on contemporary or historical transitions. Some of these mechanisms remain relevant for developing countries today. We now turn to economic theories of fertility that emphasize features specific to developing economies, including aspects of parents' fertility decisions and the interaction between the fertility transition and economic growth.

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[11]Figure 7 shows that while the mean age of births has increased over time, the prevalence of ART has been growing as well.

4.1 Fertility in Developing Countries

Across the world, the decline in fertility is typically associated with higher levels of human capital, higher GDP per capita, and lower child and maternal mortality rates, broadly consistent with the theories of the fertility transition discussed thus far. However, this relationship is much weaker when we focus on fertility transitions within countries over the past half century. For example, many countries in Sub-Saharan Africa have experienced fertility declines that are substantially smaller than what would be predicted by improvements in economic conditions and health outcomes. In contrast, countries in Latin America, similar to those in East Asia, have experienced fertility declines that are larger than predicted by economic and health factors alone.

Gobbi et al. (2026) argue that understanding these differences requires studying how institutions interact with economic incentives. In Sub-Saharan Africa, for example, formal legal institutions often coexist with customary law, a system of rules and norms that govern long-standing local traditions and practices historically developed within ethnic communities. Customary law regulates areas such as marriage and divorce (bride price and polygyny), inheritance and land rights, and dispute resolution within communities. In most Sub-Saharan African countries today, customary law coexists with statutory law within pluralistic legal systems.

We first analyze the role of customary law for fertility through two examples: polygyny and inheritance rules. We then discuss the impact of contraception and family planning policies in the context of developing countries.

Customary Law: Polygyny   Polygyny is a form of marriage in which one man is married to multiple women at the same time. It has historically been practiced in many societies, particularly in parts of Sub-Saharan Africa, the Middle East, and Asia, and is often governed by customary law. Today, polygyny remains prevalent in several Sub-Saharan African countries.

To understand the effect of polygyny on fertility, consider a man with income y who chooses consumption c, the number of wives f, and the total number of children n. Each wife requires the payment of a bride price p. Children are costly to raise, and the total cost is of childrearing assumed to be convex in the number of children and decreasing

in the number of wives, given by $\frac{n^2}{f}$. The man therefore solves:

$$\max_{c,n,f} \quad \theta \ln c + (1 - \theta) \ln n, \qquad 0 < \theta < 1$$

$$\text{s.t.} \quad c + pf + \frac{n^2}{f} = y,$$

$$c > 0, \ n > 0, \ f > 0.$$

Optimal choices are given by:

$$n^* = (1 - \theta) \frac{y}{2\sqrt{p}} \qquad\qquad f^* = (1 - \theta) \frac{y}{2p}.$$

Polygyny arises whenever $f^* > 1$, or $p < \frac{1-\theta}{2} y$. The model highlights a key trade-off: additional wives are costly because of the bride price, but they reduce the convex costs of childbearing by allowing births to be spread across multiple wives. When bride prices are sufficiently low relative to income, men optimally choose to marry multiple wives.

Tertilt (2005) develops a model in which polygyny affects fertility, savings and economic development. The idea is that bride prices ration women for men in polygynous societies. Since fathers receive these payments when daughters marry, children—especially daughters—become a profitable investment. This encourages men to marry multiple wives and have many children while relying on offspring rather than physical capital for old-age support. In contrast, when monogamy is enforced, bride prices typically become dowries (i.e., payments from the bride's family), making children financially costly and encouraging lower fertility and higher savings.[12] A calibrated version of the model predicts that banning polygyny would reduce fertility by around 40%, increase savings by about 70%, and more than double output per capita.

Customary Law: Impartible Inheritance   Inheritance customs likely emerged from a combination of economic, institutional, and cultural forces. *Partible inheritance* refers to systems in which land is divided among all heirs, whereas under *impartible inheritance* land is transferred to a single heir, typically the eldest son.

From an economic perspective, impartible inheritance tended to arise in settings where land was the primary source of wealth and where dividing land among heirs would reduce productivity (Fontenay et al., 2025). Under subsistence agriculture, farm

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[12]Marriage institutions may themselves evolve endogenously with economic development. For example, de la Croix and Mariani (2015) develop a theory in which political conflict among men and women of different socioeconomic groups leads societies to transition from polygyny to monogamy and eventually serial monogamy as income and human capital rise.

productivity typically increases with the size of the cultivated plot. As a result, inheritance institutions that determine how land is transmitted across generations can shape fertility incentives. Under partible inheritance, land is divided among children, creating incentives for households to limit the number of children in order to avoid fragmenting land into inefficiently small parcels. Consequently, fertility tends to be higher under impartible inheritance, where land is transmitted to a single heir, than under partible inheritance.

To illustrate this mechanism, consider a household with land endowment L that chooses consumption c and fertility n. The problem is given by:

$$\max_{c,n} \quad \theta \ln c + (1 - \theta) \ln(ny_i'), \qquad 0 < \theta < 1$$

$$\text{s.t.} \quad c = (1 - \ell)y$$

$$n = \phi\ell$$

where y denotes parental income and ℓ is the fraction of parental time devoted to childrearing. Children generate utility through their future income y_i', which depends on the inheritance system $i \in \{I, P\}$.

Households rely on subsistence agriculture. First consider what happens under *impartible inheritance* customs ($i = I$). Land is passed on to a single heir, but all children work collectively on the family farm. In this case, the children's future income grows proportionally with their number. Total future income is thus given by $ny_I' = A(L)n$, where $A(L)$ captures the productivity of land. The marginal benefit of having children is therefore constant. Optimal fertility, n_I^*, is given by

$$n_I^* = (1 - \theta)\phi.$$

Under *partible inheritance* ($i = P$), land is divided equally among all children. Since farming is more productive on large plots, the fragmentation of land reduces the productivity and the total output: $ny_P' = A(L)n^\alpha$, where $\alpha \in (0, 1)$ captures the extent to which land fragmentation reduces productivity.

The optimal number of children under partible inheritance, n_P^* is thus

$$n_P^* = (1 - \theta)\phi\frac{\alpha}{\theta + (1 - \theta)\alpha}.$$

The two inheritance regimes generate different fertility incentives. Under partible inheritance, land fragmentation reduces the marginal benefit of additional children.

Since $\alpha < 1$, fertility is lower under partible inheritance than under impartible inheritance, $n_P^* < n_I^*$, as each additional child dilutes the land resources available to each heir. Consistent with this mechanism, Fontenay et al. (2025) show that belonging to an ethnic group with impartible inheritance in Sub-Saharan Africa increases fertility by roughly one child per woman. Similarly, Gay et al. (2025) document that regional variation in inheritance laws contributed to fertility differences across French regions, and that the adoption of partible inheritance after the French Revolution played a role in France's early fertility decline.

Contraception and Economic Growth Bhattacharya and Chakraborty (2017) and Strulik (2017) suggest that improvements in contraceptive technology influence long-run economic development. The key idea is that by making it easier to control the timing and number of births, contraception weakens the link between unwanted pregnancies and fertility. As a result, households can have fewer children and devote more time and resources to the education and development of each child. This shift from the quantity of children toward their quality increases human capital accumulation in the next generation. In this way, the diffusion of effective contraceptive technologies can contribute to the transition from a high-fertility regime with limited investment in children to a modern growth regime characterized by lower fertility, greater parental investment per child, and faster human capital accumulation.

To illustrate this mechanism, we distinguish between desired and realized fertility by allowing for unwanted births. Let n_t^d denote desired fertility and n_t denote realized fertility. Realized fertility exceeds desired fertility when fertility control is imperfect:

$$n_t = n_t^d + u_t(1 - \kappa_t),$$

where u_t denotes unwanted fertility and $\kappa_t \in [0, 1)$ measures the effectiveness of fertility control. Parents allocate one unit of time between childrearing and educational investment in children. Each realized child requires $\phi > 0$ units of parental time for rearing, the time constraint is $n_t(\phi + e_t) = 1$, where e_t denotes educational investment per child.

Assume that human capital evolves according to $h_{t+1} = A e_t h_t$, with $A > 0$. Then the growth rate of human capital g_t is given by:

$$g_t \equiv \frac{h_{t+1}}{h_t} = A \left(\frac{1}{n_t^d + u_t(1 - \kappa_t)} - \phi \right).$$

In the traditional regime, contraception is ineffective (κ is low), so families have no
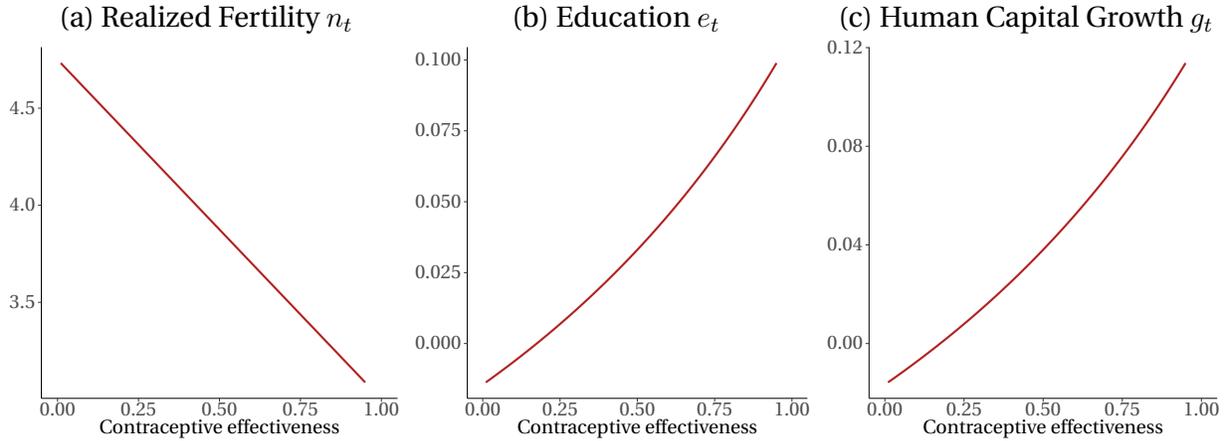
(a) Realized Fertility n_t   **(b) Education e_t**   **(c) Human Capital Growth g_t**

Figure 8: Economic Transition and Contraceptive Effectiveness κ

Notes: This graph plots fertility, education and human capital growth when the following parameter values are assumed: $n^d = 3.0$, $u = 1.75$, $\phi = 0.225$ $A = 1.15$. Contraceptive effectiveness varies between 0.01 and 0.95.

way of preventing unwanted births. Realized fertility is therefore high. Because raising children requires time, parents must devote most of their available time to childrearing rather than to investments in each child. As a result, educational investment per child is low and human capital grows slowly.

Figure 8 shows that as contraceptive technology improves, realized fertility becomes closer to desired fertility. The decline in realized fertility frees parental time that would otherwise be spent on raising additional children. Parents can therefore invest more time and resources in each child. This increase in per-child investment raises the accumulation of human capital in the next generation. As a result, the growth rate of human capital rises. The economy gradually shifts from a high-fertility, low-education regime to a low-fertility regime characterized by greater parental investment in children and human capital accumulation.

Cavalcanti et al. (2020) document that about 39% of pregnancies in the developing world are unplanned, and that the gap between realized and desired fertility is particularly large among poorer households. The authors develop an overlapping-generations model in which households choose desired fertility but face stochastic pregnancies. Families can reduce unwanted fertility using modern contraception or abortion, which increases fertility control (κ) and narrows the gap between desired and realized fertility. Calibrating the model to Kenyan data, the authors evaluate family-planning policies that reduce the monetary cost of contraception, lower non-monetary barriers to its use (such as stigma or lack of information), and increase the effectiveness of contraceptive technologies. Through these channels, such policies reduce unwanted fertility, increase

investment in children's human capital, and raise long-run income.

We return to discussing the role of fertility in models of economic growth in Section 4.2 of this chapter. The role of contraception for the fertility transition in low- and middle-income countries is more contested than the theory developed above may suggest. Chapter 20 provides evidence for the effect of expanding the supply of modern contraceptives in low- and middle income countries. While contraceptive use is often increased, the effect on fertility is often modest or insignificant, which potentially highlights the role of social norms, religion, or customary law in these settings. Similarly, Chapter 21 points out that access to abortion in low-income countries is largely determined by political, legal, and institutional factors beyond individual control. At the same time, empirical evidence suggests that access to abortion affects women's short- and long-run outcomes, including fertility, health, education, earnings.

Family Size Norms and Population Control Policies   Beyond economic incentives, a growing literature highlights the role of social conformity pressures in shaping fertility behavior. In these models, fertility choices depend not only by economic incentives but also by the desire to conform to prevailing family size norms. A common approach assumes that individuals incur a utility cost when their fertility choices deviate from those of a reference group. Existing studies differ primarily in how these reference norms are determined. Some emphasize contemporaneous peer effects or average fertility within a social group (Palivos, 2001; Manski and Mayshar, 2003; Ciliberto et al., 2016), while others focus on the intergenerational transmission of family-size norms (de Silva and Tenreyro, 2020; Guo et al., 2024).[13]

de Silva and Tenreyro (2020) study the fertility decline observed in many developing countries over the past several decades. They develop a quantitative model of endogenous fertility and human capital accumulation augmented with social norms regarding family size. In the model, parents value both the quantity and quality of children but experience disutility when their fertility choices deviate from prevailing social norms. These norms evolve over time as a weighted average of past fertility and the replacement fertility level. Calibrating the model to match developing countries in 1960, the authors show that human capital accumulation alone generates only a modest decline in fertility. By contrast, population-control policies that promote smaller family norms, through information campaigns and family-planning programs, substantially accelerate the fertility transition. Their results suggest that changes in social norms regarding

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[13]Nakakuni et al. (2026) review theories and empirical evidence on how social norms regarding family size influence fertility, as part of a broader set of social norms they examine.

family size played a crucial role in explaining the rapid fertility decline observed in many developing countries.

Part III of this handbook dives further in the determinants of family planning access, contraception and abortion in low- and middle income countries.

4.2 Fertility and Economic Growth

Fertility and population growth have always been an important determinant in theories of economic growth. Yet, most theories of modern growth, including endogenous and semi-endogenous growth models, take population growth as exogenously given. We briefly summarize the key ideas of these theories on economic growth and highlight the link between population growth and economic growth.

Economic Growth According to Malthus Malthus (1798) developed his theory of population at the end of the 18th century in Great Britain. At that time, Europe had not experienced sustained growth in living standards, typically measured as real GDP per capita. Motivated by this historical observation, Malthus proposed a theory in which long-run growth in living standards is impossible. Two key assumptions generate this result. First, land is assumed to be a fixed factor of production. As population grows, the amount of land available per worker declines, implying diminishing returns to labor and falling income per person. Second, fertility responds positively to income: when living standards rise, households choose to have more children.

To illustrate the mechanism, consider a representative household solving (adapted from Greenwood, 2019):

$$\max_{c,n} \quad \theta \ln c + (1 - \theta) \ln n \qquad 0 < \theta < 1$$
$$\text{s.t.} \quad n = \phi f$$
$$c + f = \frac{x}{P}$$

Here c denotes consumption of adults and n the number of children. Raising children requires food f, where $\phi > 0$ determines how much food is needed per child. Total household resources consist of the output generated by land. Suppose there are x units of land that are equally divided among a population of size P, so that income per household is x/P. Solving the household problem yields the fertility rate

$$n^* = (1 - \theta)\phi\frac{x}{P}$$

Fertility determines population dynamics. The population in the next period evolves according to $P' = nP$. In steady state the population size is constant, so $P' = P = P^*$. This requires the population growth rate to equal one, $n^* = 1$.[14] Substituting into the fertility equation gives the steady-state population size

$$P^* = (1 - \theta)\phi x.$$

Now suppose land productivity x increases due to a technological innovation. For a given population P at P^* (i.e., the initial steady state), the fertility rate increases because higher productivity raises income per capita. If x rises, then $n > 1$, implying population growth ($P' > P$). As population increases, however, the available land must be shared among more people, so income per capita x/P begins to fall. Because fertility depends positively on income, it gradually declines as population grows. The adjustment continues until fertility returns to the replacement level $n = 1$.

In the new steady state, income per capita is the same as before the technological improvement, but the population is larger. Technological progress therefore increases population rather than living standards. This mechanism is known as the *Malthusian trap*. Historical episodes illustrate these dynamics. For example, the Black Death in 14th-century Europe drastically reduced the population. The resulting increase in land per person temporarily raised living standards, but over time higher fertility restored the population and income per capita returned to its previous level. The model helps explain why sustained growth in income per capita is a relatively recent phenomenon. Prior to the Industrial Revolution, no country experienced persistent increases in living standards. Malthusian population dynamics provide a natural explanation for this pattern, consistent with empirical evidence of such dynamics prior to the 18th century (Ashraf and Galor, 2011).

Modern Growth Models with Exogenous Population   Modern growth theory provides several frameworks in which sustained improvements in living standards are possible. In contrast to the Malthusian model, these frameworks typically treat population growth as exogenous and independent of income.

The Solow model emphasizes capital accumulation as the main driver of economic development. In this framework, investment raises the stock of productive capital and

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[14]Following the standard convention in growth models, the decision-making unit is an adult (or equivalently a two-parent household normalized to one decision maker). Fertility n therefore denotes the number of surviving children per adult. Under this normalization, $n = 1$ corresponds to replacement fertility, meaning that a two-adult household has two surviving children.

increases output per worker, allowing economies to achieve permanently higher income per capita. Population growth nevertheless affects economic outcomes. Faster population growth lowers steady-state income per capita because more investment is required to equip a growing labor force with capital, while slower population growth raises income per person.

Later work emphasized technological progress as the fundamental engine of growth. In the model of Romer (1990), economic growth arises from the accumulation of ideas generated by research activity. Because ideas are nonrival, their discovery allows the same resources to be used more productively, leading to sustained increases in income per capita. Although population is exogenous in the model, it still influences economic growth because a larger population implies more researchers and therefore faster idea creation (Jones, 2022).[15]

Despite their differences, both the Solow and Romer models treat fertility and population as exogenous. As a result, they cannot capture the feedback between economic incentives and fertility decisions that is central to the Malthusian framework. The implications of population change also differ across models: in the Malthusian model productivity improvements raise population rather than living standards, in the Solow model faster population growth lowers income per capita, and in the Romer model a larger population can increase the rate of technological progress.

Modern Growth Models with Endogenous Population   Building on the basic quantity-quality framework outlined in Section 2.2, a subsequent literature placed fertility at the center of economic growth analysis. In contrast to standard growth models in which population is exogenous, these contributions model fertility as an endogenous outcome that shapes aggregate dynamics, including national wealth, long-run growth, and the demographic transition. Early contributions include Becker and Barro (1988) and Barro and Becker (1989), who develop a dynastic model in which fertility decisions are embedded within an intergenerational altruism framework. In these frameworks, fertility becomes a forward-looking investment decision that determines both the size and the human capital of future generations.

To illustrate the core mechanism in a tractable way, we consider a simplified macroeconomic framework in which households choose consumption, the number of children, and investment in each child, while firms produce output using labor in competitive markets. Parents derive utility from their own consumption, the number of children,

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[15]Jones (2022) also studies versions of the endogenous growth model in which fertility is endogenous.

and the human capital of their offspring:

$$\max_{c_t, n_t, e_t} \quad \ln(c_t - \underline{c}) + \theta_n \ln n_t + \theta_h \ln h_{t+1}, \qquad \theta_n, \theta_h > 0$$

$$\text{s.t.} \quad c_t + w_t n_t (\phi + e_t) = w_t$$

$$h_{t+1} = \psi_t e_t^{\eta}, \qquad 0 < \eta < 1.$$

Here subscript t denotes the current period. c_t denotes parental consumption, n_t fertility, e_t investment per child, and $\underline{c} > 0$ subsistence consumption.[16] Each child requires a fixed time cost $\phi > 0$ and an educational investment e_t. Since childrearing uses parental time, the cost of children rises with the wage rate w_t. Human capital next period depends on educational investment and the productivity of education ψ_t.

Solving the household problem yields

$$e_t^* = \frac{\theta_h \psi_t}{\theta_n - \theta_h \psi_t} \phi,$$

so that investment per child rises with the productivity of education ψ_t. Fertility is given by

$$n_t^* = \frac{\theta_n - \theta_h \psi_t}{1 + \theta_n} \cdot \frac{1 - \underline{c}/w_t}{\phi}.$$

These expressions highlight the central quantity-quality trade-off. An increase in the productivity of education ψ_t raises the return to investing in children, leading households to increase educational investment per child while reducing fertility. By contrast, higher wages w_t raise income net of subsistence and, when subsistence consumption is covered, tend to increase fertility through an income effect.

Aggregate output is produced by competitive firms using total effective labor H_t, which depends on both the number of children and their human capital:

$$Y_t = A_t H_t \qquad H_t = n_t h_t$$

where A_t denotes total factor productivity. With linear production in effective labor, wages equal productivity. Improvements in productivity therefore raise wages, affecting both household income and the opportunity cost of childrearing. Output per worker in the next period is given by

$$y_{t+1} = \frac{Y_{t+1}}{n_{t+1}} = A_{t+1} h_{t+1},$$

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[16]The subsistence term ensures that fertility rises with income once subsistence consumption is covered.
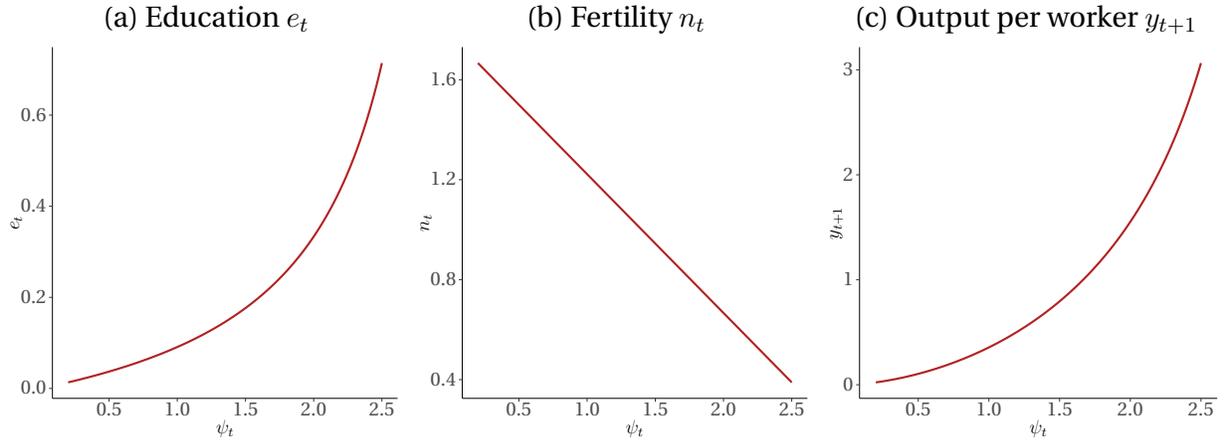
Figure 9: The Quality and Quantity of Children and Economic Growth

Notes: We simulate the model when the productivity of education ψ ranges from 0 to 2.5. The model os parameterized as follows: $\theta_n = 0.8$, $\theta_h = 0.25$, $\phi = 0.2$, $\bar{c} = 0.3$, $\eta = 0.6$ and $h_t = 1$.

so that improvements in human capital translate into higher future income.

This framework delivers a simple growth-fertility mechanism. Improvements in productivity A_t raise wages and household income, while increases in the productivity of education ψ_t strengthen incentives to invest in child quality. As the return to education rises, households substitute from child quantity to child quality: fertility declines, educational investment per child increases, and human capital accumulation accelerates. In this way, economic development can generate both rising income and a fertility transition.

Figure 9 illustrates the impact of changes in the productivity of education ψ_t. Panels (a)–(c) show that a higher ψ_t increases investment in child quality and reduces fertility, reflecting the quantity–quality trade-off. The resulting increase in human capital raises next-period output per worker, y_{t+1}, implying that improvements in the productivity of education translate into economic growth.

Related mechanisms are developed in richer dynamic frameworks. Becker et al. (1990) analyze poverty traps arising from the interaction between fertility and human capital accumulation. He shows how economies may remain trapped in a high-fertility, low–human-capital equilibrium or transition to a low-fertility, high-growth path as incentives to invest in child quality strengthen. Galor and Weil (1996) emphasize how technological progress can increase the relative demand for female labor, raising the opportunity cost of childbearing and thereby reducing fertility while increasing investment in human capital per child.

Subsequent work has incorporated these mechanisms into broader theories of long-

run development. For example, Galor and Weil (2000) integrate the human capital channel into a unified growth framework that explains the joint evolution of population dynamics and economic growth over several centuries. de La Croix and Doepke (2003) show that greater income inequality can slow economic growth by widening fertility differentials across households, leading poorer families to have more children but invest less in education, thereby reducing average human capital in the next generation. Manuelli and Seshadri (2009) extend the quantity–quality framework to include health capital, helping explain the negative relationship between fertility and income observed across countries.

The Demographic Transition Around the World   Building on models that endogenize fertility within the process of economic development, recent work has developed quantitative frameworks to explain the timing and speed of demographic transitions across countries. Delventhal et al. (2024) provide one such model. In their framework, households choose both the number of children and investment in their education, which introduces a standard quantity-quality trade-off. The economy features two production technologies, an ancient sector which uses land, skilled labor, and unskilled labor, with the modern sector relying more intensively on skilled labor. Improvements in production and medical technologies increase the returns to education and gradually reduce mortality. These technological advances originate in a frontier country, calibrated to Great Britain, and diffuse across countries over time, with the speed of diffusion depending on geographic proximity.

The model generates the demographic transition through three stages. In the first stage, the economy is in a Malthusian regime characterized by high fertility and high mortality. Productivity and medical knowledge are stagnant, and parents have many children but invest little in their education. In the second stage, improvements in medical technology reduce mortality, increasing life expectancy while fertility remains initially high. This leads to a temporary surge in population growth. In the third stage, continued technological progress raises the demand for skilled labor and the skill premium, increasing the returns to human capital. Parents respond by reducing fertility and increasing educational investment per child, leading to a sustained decline in birth rates and a transition to a low-fertility, but high-human-capital regime. The model replicates the observed timing of fertility declines across countries, the increasing speed of demographic transitions over time, and the strong correlation between declining fertility and rising educational attainment.

Despite a vast literature on the determinants of fertility transitions and the link to eco-

nomic growth (Chatterjee and Vogl, 2018), important questions remain about the mechanisms through which demographic change contributes to economic development and how these mechanisms vary across countries. For example, while most historical demographic transitions were accompanied by rising GDP per capita, many countries in Sub-Saharan Africa experienced declines in fertility without sustained increases in per-capita income or human capital. Gobbi and Hannusch (2026) investigate the absence of economic growth during the fertility transition in Sub-Saharan Africa.

5   Avenues for Future Research

Over the past century, the economic analysis of fertility has evolved from explaining the demographic transition to understanding the persistence of very low fertility and its macroeconomic consequences. This chapter synthesized these developments, beginning with the foundational negative relationship between income and fertility and the quantity–quality trade-off that helped explain the long-run decline in births. We showed how extensions of this framework, incorporating rising longevity, declining child mortality, and technological change in household production, can generate richer dynamics such as the mid-century baby boom and shifts in fertility cyclicality. In today's low-fertility environments, new mechanisms become central: bargaining frictions within couples, status competition in parental investment, and labor market institutions that shape the compatibility of careers and family life. At the same time, evidence from developing economies highlights that fertility transitions remain deeply shaped by cultural norms, customary institutions, and the uneven diffusion of technology. Taken together, these perspectives underscore that fertility is determined by the interaction of economic incentives, institutions, and social norms, leaving important open questions about how demographic change will evolve and how policy can respond.

Marriage Markets and Fertility   Marriage markets play a central role in shaping fertility behavior, as the decision to have children typically arises within a partnership. Yet relatively few economic models analyze marriage formation and fertility choices jointly. Recent work has begun to bridge this gap by endogenizing marriage and fertility decisions.[17] Despite these advances, the interaction between marriage and fertil-

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[17]For example, Kitao and Nakakuni (2026), building on Greenwood et al. (2021), incorporate gender differences to study the joint decline in marriage and fertility in Japan. Myong et al. (2020) extend the model of Baudin et al. (2015) by introducing social norms governing marriage and childbearing, while Ho and Wang (2024) incorporate a quality-of-children margin.

ity remains understudied.[18] Methodologically, many models that analyze marriage and fertility together remain static, largely because of computational complexity. Developing richer dynamic life-cycle models therefore remains a useful direction for future research. Early quantitative contributions such as Caucutt et al. (2002) and Greenwood et al. (2003) point the way, but further work could deepen our understanding of how marriage-market institutions and policies shape fertility in modern low-fertility environments.

Economics of Fatherhood   Most theories discussed in this chapter model fertility either as a woman's decision problem or as a joint choice within couples. Yet the economics of fatherhood remains largely underexplored. Over recent decades, fatherhood has become increasingly selective and unequal. Male childlessness is strongly concentrated among low-socioeconomic-status (SES) men, and rising union instability has increased the prevalence of non-resident fathers. At the same time, fatherhood has become more polarized: high-SES men are increasingly involved in childrearing, while low-SES men are more likely to remain childless or become non-resident fathers. Explaining these growing asymmetries between motherhood and fatherhood is an important direction for future research and may shed light on how changing patterns of male family formation shape fertility outcomes. Chapter 14 of this Handbook discusses the economics of fatherhood in greater depth.

Fertility Determinants in Developing Countries   Despite a growing empirical literature on fertility in developing countries, economic theories explaining fertility patterns, and especially the timing and speed of fertility transitions, remain limited (Gobbi et al., 2026; Gobbi and Hannusch, 2026). Most existing frameworks link sustained fertility decline to falling dependency ratios and rising income per capita. While this pattern describes many historical transitions, several countries in Sub-Saharan Africa have experienced fertility declines without sustained increases in income per capita. Mechanisms that may be particularly important in these contexts, such as customary law, social institutions, and family planning policies, remain only weakly integrated into economic models of fertility. Bridging this gap between empirical evidence and theoretical frameworks therefore remains an important direction for future research.

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[18]An exception is Kennes and Knowles (2024), who develop an equilibrium matching model to explain the rise in births to unmarried women in the United States. Their results suggest that changes in divorce risk, access to abortion, and improved contraception can jointly account for much of the increase in nonmarital births through equilibrium responses in the marriage market.

Economic Growth with Endogenous Fertility   The timing and speed of the demographic transition vary widely across countries (Delventhal et al., 2024). In particular, the relationship between fertility decline and economic growth is far from uniform. Most models of growth with endogenous fertility assume that technological progress triggers the fertility transition. Yet historical evidence shows that fertility began declining in countries such as France and the United States before the onset of sustained economic growth. Thus, more theories are needed to understand the complex interactions between fertility and economic growth across time and space.

References

Abel, A. B. (1990). Asset Prices under Habit Formation and Catching up with the Joneses. *American Economic Review 80*(2), 38–42.

Adda, J., C. Dustmann, and K. Stevens (2017). The Career Costs of Children. *Journal of Political Economy 125*(2), 293–337.

Albanesi, S. and C. Olivetti (2016). Gender Roles and Medical Progress. *Journal of Political Economy 124*(3), 650–95.

Ashraf, Q. and O. Galor (2011). Dynamics and Stagnation in the Malthusian Epoch. *American Economic Review 101*(5), 2003–2041.

Bailey, M. J. (2010). "Momma's Got the Pill": How Anthony Comstock and Griswold v. Connecticut Shaped US Childbearing. *American Economic Review 100*(1), 98–129.

Balbo, N., F. C. Billari, and M. Mills (2013). Fertility in Advanced Societies: A Review of Research. *European Journal of Population 29*(1), 1–38.

Bar, M., M. Hazan, O. Leukhina, D. Weiss, and H. Zoabi (2018). Why did rich families increase their fertility? inequality and marketization of child care. *Journal of Economic Growth 23*(4), 427–463.

Barro, R. and G. Becker (1989). Fertility Choice in a Model of Economic Growth. *Econometrica 57*(2), 481–501.

Baudin, T., D. de la Croix, and P. E. Gobbi (2015). Fertility and Childlessness in the United States. *American Economic Review 105*(6), 1852–1882.

Becker, G. S. (1960). *An Economic Analysis of Fertility*. Princeton University Press.

Becker, G. S. and R. J. Barro (1988). A Reformulation of the Economic Theory of Fertility. *Quarterly Journal of Economics 103*(1), 1–25.

Becker, G. S. and H. G. Lewis (1973). On the Interaction between the Quantity and Quality of Children. *Journal of Political Economy 81*(2), S279–S288.

Becker, G. S., K. M. Murphy, and R. Tamura (1990). Human Capital, Fertility, and Economic Growth. *Journal of Political Economy 98*(5, Part 2), S12–S37.

Becker, G. S. and N. Tomes (1976). Child Endowments and the Quantity and Quality of Children. *Journal of Political Economy 84*(4), S143–S162.

Bhattacharya, J. and S. Chakraborty (2017). Contraception and the Demographic Transition. *Economic Journal 127*(606), 2263–2301.

Boldrin, M., M. De Nardi, and L. E. Jones (2015). Fertility and Social Security. *Journal of Demographic Economics 81*(3), 261–299.

Boldrin, M. and L. E. Jones (2002). Mortality, Fertility, and Saving in a Malthusian Economy. *Review of Economic Dynamics 5*(4), 775–814.

Buckles, K., D. Hungerman, and S. Lugauer (2021). Is Fertility a Leading Economic Indicator? *Economic Journal 131*(634), 541–565.

Butz, W. P. and M. P. Ward (1979). The Emergence of Countercyclical U.S. Fertility. *American Economic Review 69*(3), 318–328.

Campbell, J. Y. and J. H. Cochrane (1999). By Force of Habit: A Consumption-based Explanation of Aggregate Stock Market Behavior. *Journal of Political Economy 107*(2), 205–251.

Caucutt, E. M., N. Guner, and J. Knowles (2002). Why Do Women Wait? Matching, Wage Inequality, and the Incentives for Fertility Delay. *Review of Economic Dynamics 5*(4), 815–855.

Cavalcanti, T., G. Kocharkov, and C. Santos (2020). Family planning and development: Aggregate effects of contraceptive use. *Economic Journal 131*(634), 624–657.

Cervellati, M. and U. Sunde (2005). Human Capital Formation, Life Expectancy, and the Process of Development. *American Economic Review 95*(5), 1653–1672.

Chabé-Ferret, B. and P. E. Gobbi (2025). Economic Uncertainty and Fertility Cycles: Baby Boom and Busts in Twentieth Century America. Unpublished.

Chatterjee, S. and T. Vogl (2018). Escaping Malthus: Economic Growth and Fertility Change in the Developing World. *American Economic Review 108*(6), 1440–1467.

Ciliberto, F., A. R. Miller, H. S. Nielsen, and M. Simonsen (2016). Playing the fertility game at work: An equilibrium model of peer effects. *International Economic Review 57*(3), 827–856.

Córdoba, J. C. and M. Ripoll (2016). Intergenerational Transfers and the Fertility–Income Relationship. *Economic Journal 126*(593), 949–977.

Coskun, S. and H. C. Dalgic (2024). The Emergence of Procyclical Fertility: The Role of Breadwinner Women. *Journal of Monetary Economics 142*, 103523.

Cruces, L. and F. J. Rodríguez-Román (2025). Financial Incentives to Fertility: From Short to Long Run. Working Paper, Goethe University Frankfurt.

de La Croix, D. and M. Doepke (2003). Inequality and Growth: Why Differential Fertility Matters. *American Economic Review 93*(4), 1091–1113.

de la Croix, D. and F. Mariani (2015). From Polygyny to Serial Monogamy: A Unified Theory of Marriage Institutions. *Review of Economic Studies 82*(2), 565–607.

de Silva, T. and S. Tenreyro (2020). The Fall in Global Fertility: A Quantitative Model. *American Economic Journal: Macroeconomics 12*(3), 77–109.

Delventhal, M. J., J. Fernández-Villaverde, and N. Guner (2024). Demographic Transitions Across Time and Space. NBER Working Paper No. 29480.

Di Nola, A., G. Kocharkov, J. Mellert, and H. Wang (2025). Teenage Childbearing and the Welfare State. *Macroeconomic Dynamics 29*, e31.

Doepke, M. (2005). Child Mortality and Fertility Decline: Does the Barro-Becker Model Fit the Facts? *Journal of Population Economics 18*(2), 337–366.

Doepke, M., A. Hannusch, F. Kindermann, and M. Tertilt (2023). The Economics of Fertility: a New Era. In *Handbook of the Economics of the Family, Vol. 1*, Chapter 4. Elsevier.

Doepke, M., M. Hazan, and Y. D. Maoz (2015). The Baby Boom and World War II: A Macroeconomic Analysis. *Review of Economic Studies 82*(3), 1031–1073.

Doepke, M. and F. Kindermann (2019). Bargaining over Babies: Theory, Evidence, and Policy Implications. *American Economic Review 109*(9), 3264–3306.

Doepke, M. and M. Tertilt (2016). Families in Macroeconomics. In *Handbook of Macroeconomics, Vol. 2*, Chapter 23. North Holland.

Doepke, M. and F. Zilibotti (2019). *Love, Money, and Parenting: How Economics Explains the Way We Raise Our Kids*. Princeton and Oxford: Princeton University Press.

Easterlin, R. A. (1961). The American Baby Boom in Historical Perspective. *American Economic Review 51*(5), 869–911.

Eckstein, Z., P. Mira, and K. I. Wolpin (1999). A Quantitative Analysis of Swedish Fertility Dynamics: 1751–1990. *Review of Economic Dynamics 2*(1), 137–165.

Ehrlich, I. and J. Kim (2007). Social Security and Demographic Trends: Theory and Evidence from the International Experience. *Review of Economic Dynamics 10*(1), 55–77.

Erosa, A., L. Fuster, and D. Restuccia (2010). A General Equilibrium Analysis of Parental Leave Policies. *Review of Economic Dynamics 13*(4), 742–758.

Fernández-Villaverde, J., J. Greenwood, and N. Guner (2014). From Shame to Game in one Hundred Years: An Economic Model of the Rise in Premarital Sex and its Destigmatization. *Journal of the European Economic Association 12*(1), 25–61.

Fontenay, S., P. E. Gobbi, and M. Goñi (2025). Fertility in Sub-Saharan Africa: The Role of Inheritance. CEPR Discussion Paper 20275.

Galor, O. and D. N. Weil (1996). The Gender Gap, Fertility and Growth. *The American Economic Review 86*(3), 374–387.

Galor, O. and D. N. Weil (2000). Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond. *American Economic Review 90*(4), 806–828.

Gay, V., P. E. Gobbi, and M. Goñi (2025). Revolutionary Transition: Inheritance Change and Fertility Decline. *Journal of Political Economy*. Forthcoming.

Gobbi, P. E. and A. Hannusch (2026). The Missing Demographic Dividend. Working Paper.

Gobbi, P. E., A. Hannusch, and P. Rossi (2026). Family Institutions and the Global Fertility Transition. *Journal of Economic Perspectives 40*(1), 47–70.

Goldin, C. (2014). A Grand Gender Convergence: Its Last Chapter. *American Economic Review 104*(4), 1091–1119.

Goldin, C. (2025). The Downside of Fertility. NBER Working Paper No. 34268.

Greenwood, J. (2019). *Evolving Households: The Imprint of Technology on Life*. Mit Press.

Greenwood, J. and N. Guner (2010). Social Change: The Sexual Revolution. *International Economic Review 51*(4), 893–923.

Greenwood, J., N. Guner, and J. A. Knowles (2003). More on Marriage, Fertility, and the Distribution of Income. *International Economic Review 44*(3), 827–862.

Greenwood, J., N. Guner, and R. Marto (2021). The Great Transition: Kuznets Facts for Family-Economists. In S. Lundberg and A. Voena (Eds.), *Handbook of Family Economics*. Elsevier North-Holland.

Greenwood, J., N. Guner, and G. Vandenbroucke (2017). Family Economics Writ Large. *Journal of Economic Literature 55*(4), 1346–1434.

Greenwood, J., A. Seshadri, and G. Vandenbroucke (2005). The Baby Boom and Baby Bust. *American Economic Review 95*(1), 183–207.

Guner, N., E. Kaya, A. Ruggieri, and V. Sánchez-Marcos (2026). Firms, Flexibility, and Fertility. CEPR Discussion Paper No. 21120.

Guner, N., E. Kaya, and V. Sánchez-Marcos (2024). Labor Market Institutions and Fertility. *International Economic Review 65*(3), 1551–1587.

Guo, R., L. Lin, J. Yi, and H. Zhu (2024). Intergenerational Impact of Birth-Control Policies on Fertility: The Role of Norms. Exploring Population Change: Individual Resources and Socioeconomic, Cultural, and Biological Conditions, University of Chicago 2025.

Hart, R. K., J. Bergsvik, A. Fauske, and W. Kim (2024). Causal Analysis of Policy Effects on Fertility. *Handbook of Labor, Human Resources and Population Economics*, 1–25.

Ho, C. and Y. Wang (2024). Social Institutions and Low Birth Rates. Working Paper, Singapore Management University.

Hotz, V. J., J. A. Klerman, and R. J. Willis (1997). The Economics of Fertility in Developed Countries. In M. Rosenzweig and O. Stark (Eds.), *Handbook of Population and Family Economics*, Volume 1A, Chapter 7, pp. 275–347. Elsevier.

Hwang, J. and S. K. Kim (2023). Unexpected Longevity, Intergenerational Policies, and Fertility. *Journal of Population Economics 36*(3), 1607–1640.

Jones, C. I. (2022). The End of Economic Growth? Unintended Consequences of a Declining Population. *American Economic Review 112*(11), 3489–3527.

Jones, L. E. and A. Schoonbroodt (2016). Baby Busts and Baby Booms: The Fertility Response to Shocks in Dynastic Models. *Review of Economic Dynamics 22*, 157–178.

Jones, L. E., A. Schoonbroodt, and M. Tertilt (2010). Fertility Theories: Can They Explain the Negative Fertility-Income Relationship? In J. Shoven (Ed.), *Demography and the Economy*, pp. 43–100.

Jones, L. E. and M. Tertilt (2008). An Economic History of Fertility in the U.S.: 1826-1960. In P. Rupert (Ed.), *Frontiers of Family Economics*, Volume 1. Emerald Press.

Kennes, J. and J. Knowles (2024). Unmarried Births: Accounting and Equilibrium Analysis, 1960-1995. *Review of Economic Dynamics 52*, 84–109.

Kim, D. and M. Yum (2025). Parental Leave Policies, Fertility, and Labor Supply. CEPR Discussion Paper No. 19951.

Kim, S., M. Tertilt, and M. Yum (2024). Status Externalities in Education and Low Birth Rates in Korea. *American Economic Review 114*(6), 1576–1611.

Kitao, S. and K. Nakakuni (2026). On the Trends of Technology, Family Formation, and Women's Time Allocation. CRC-TR-224 Discussion Paper Series No. 735.

Low, C. (2024). The Human Capital-Reproductive Capital Trade-off in Marriage Market Matching. *Journal of Political Economy 132*(2), 552–576.

Mahler, L., M. Tertilt, and M. Yum (2025). Policy Concerns in an Era of Low Fertility: The Role of Social Comparisons and Intensive Parenting. *Brookings Papers on Economic Activity*. Forthcoming.

Malthus, T. R. (1798). An Essay on the Principle of Population. Chapter V. *Oxford World's Methods. Econometrica 37*(3), 424–438.

Manski, C. F. and J. Mayshar (2003, 03). Private Incentives and Social Interactions: Fertility Puzzles in Israel. *Journal of the European Economic Association 1*(1), 181–211.

Manuelli, R. and A. Seshadri (2009). Explaining International Fertility Differences. *Quarterly Journal of Economics 124*(2), 771–807.

Myers, C. K. (2017). The Power of Abortion Policy: Reexamining the Effects of Young Women's Access to Reproductive Control. *Journal of Political Economy 125*(6), 2178–2224.

Myong, S., J. Park, and J. Yi (2020). Social Norms and Fertility. *Journal of the European Economic Association.* jvaa048.

Nakakuni, K., M. Tertilt, and M. Yum (2026). Low Fertility Around the World: The Role of Social Norms. Prepared for New Frontiers in Fertility, edited by James J. Heckman.

Olivetti, C. and B. Petrongolo (2017). The economic consequences of family policies: Lessons from a century of legislation in high-income countries. *Journal of Economic Perspectives 31*(1), 205–230.

Palivos, T. (2001). Social norms, fertility and economic development. *Journal of Economic Dynamics and Control 25*(12), 1919–1934.

Romer, P. M. (1990). Endogenous Technological Change. *Journal of Political Economy 98*(5, Part 2), S71–S102.

Soares, R. (2005). Mortality Reductions, Educational Attainment, and Fertility Choice. *American Economic Review 95*(3), 580–601.

Sommer, K. (2016). Fertility Choice in a Life Cycle Model with Idiosyncratic Uninsurable Earnings Risk. *Journal of Monetary Economics 83*, 27–38.

Strulik, H. (2004). Child Mortality, Child Labour and Economic Development. *Economic Journal 114*(497), 547–568.

Strulik, H. (2008). Geography, Health, and the Pace of Demo-Economic Development. *Journal of Development Economics 86*(1), 61–75.

Strulik, H. (2017). Contraception and Development: A Unified Growth Theory. *International Economic Review 58*(2), 561–584.

Tertilt, M. (2005). Polygyny, Fertility, and Savings. *Journal of Political Economy 113*(6), 1341–1371.

Willis, R. J. (1973). A New Approach to the Economic Theory of Fertility Behavior. *Journal of Political Economy 81*(2), S14–S64.

Yamaguchi, S. (2019). Effects of Parental Leave Policies on Female Career and Fertility Choices. *Quantitative Economics 10*(3), 1195–1232.

Zhang, J., J. Zhang, and R. Lee (2003). Rising Longevity, Education, Savings, and Growth. *Journal of Development Economics 70*(1), 83–101.

Zhou, A. (2022). The Macroeconomic Consequences of Family Policies. Unpublished Manuscript.