

Article

Life Extension Technologies and Pregnancy: Practical and Theological Considerations

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Abstract: As biotechnologies emerge that halt or slow aging, what significance will these have for pregnancy? I argue in favor of life extension technologies based on their benefit for cis-gendered women who wish to become pregnant. After age 27, fertility decreases, and risks associated with pregnancies increase. At the same time, women's twenties and thirties are often key years in their working life. If aging is stopped or slowed, women can delay pregnancy past those years. Though Martin Luther may seem an unlikely resource for theological reflection on this issue, his biblical commentaries on pregnancy lend support for these technologies. Luther emphasized how the pregnant Mary, though of lowly status, was essential to the embodiment of God and a testament to the blessings God may visit upon anyone. Luther also emphasized how Eve and other pregnant women help advance God's promise to sustain God's creation of humankind. I acknowledge that lengthening the window of fertility could exacerbate overpopulation on the Earth but show that solutions typically advanced, such as John K. Davis' "Forced Choice" proposal, almost always rely on controlling women's bodily autonomy and must be rejected. I also show that fears of a Malthusian crisis are likely not only overblown but incorrect given predicted declines in fertility rates.

Keywords: biotechnologies; extended life; pregnancy; constructive theology; malthusian crisis



Citation: Renaud, Myriam. 2022. Life Extension Technologies and Pregnancy: Practical and Theological Considerations. *Religions* 13: 713. <https://doi.org/10.3390/rel13080713>

Academic Editors: Calvin Mercer and Tracy J. Trothen

Received: 20 March 2022

Accepted: 25 July 2022

Published: 4 August 2022

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1. Introduction

Though extending human lives by decades or centuries has long been the stuff of fiction, recent groundbreaking research promises to make this a reality.¹ David Sinclair, a biologist and genetics professor at Harvard University who conducts scientific research on the process of aging, has predicted that, based on the current speed of scientific progress, the first person to reach the age of 150 has already been born (Sinclair 2022). By "extended life", I am referring to the life of someone whose rate of aging has been slowed, halted, or reversed with the help of biotechnologies. In this essay, I explore several perspectives that take a positive view of extending life, in particular with respect to pregnancy.

Technologies capable of extending life, I argue, will benefit working women who wish to become pregnant and take maternity leave or years-long child-rearing leaves without incurring penalties to their careers. After age 27, a woman's fertility decreases, and health risks to the fetus and to the pregnant woman increase. At the same time, a woman's twenties and thirties are key years in her working life. With greater control over the effects of aging on their bodies, women could delay their pregnancies until a lengthy absence is less likely to damage their career prospects.

I acknowledge the concerns of those who believe that increasing the window of fertility combined with increases in average lifespans could accelerate population growth and exacerbate pressures on the Earth's resources. With more children born and fewer adults dying, a catastrophic tipping point could be reached—the so-called Malthusian crisis—when food production can no longer meet demand, provoking a massive die-off due to war, famine, and disease.² However, I show that fears of unsustainable population growth are overblown.

Moreover, the solutions proposed to avert a Malthusian crisis usually rely on drastic measures to reduce births. I argue that such solutions—for example, John K. Davis’ “Forced Choice” proposal (Davis 2018, pp. 119–30)—must be rejected. Schemes to control the number of pregnancies, including Davis’, depend on restricting the autonomy of women over their bodies using measures that range from coercive to violent. Autonomy, in this essay, is defined as self-determination.

The prospect of life-extending biotechnologies is already an object of engagement by various religious traditions (Haker et al. 2021). I join this conversation by advancing a preliminary Protestant Christian theology of pregnancy that welcomes biotechnologies based on their ability to increase the age range during which women can become pregnant. Though the early Protestant reformer, Martin Luther, may seem an unlikely resource, his commentaries related to pregnancy prove helpful. Luther emphasized, for example, the blessings visited upon the Mary when God regarded her and chose her as the *theotokos*, or Mother of God. Luther also described and praised Eve, the First Mother, and all other childbearing women after her as key to sustaining and preserving God’s creation of humankind (Luther 1904).

To keep this essay to a manageable length, I focus my remarks on cis-gendered women though I am well-aware that transgender men and non-gender-binary people may also become pregnant. I base my remarks on the assumption that, for many women, pregnancy and childbearing is a good. It is in no way my intention to diminish women who are unable to become pregnant, have miscarried, or do not want to be pregnant.

2. Pregnancy and Biotechnologies: What’s at Stake?

Pregnancy as a “good” is tied to at least two considerations: (1) it is a good in itself and, (2) it is a means to a desired end—an infant. I limit my remarks in this essay to the first consideration. For women who consider being pregnant as a good in itself, pregnancy is an embodied state that they desire and that they believe enhances their lives. These women wish to experience the bodily changes that accompany pregnancy, to feel the fetus grow and move, and to develop a bond with the proleptic child. Women who consider pregnancy a good in itself would likely choose to become pregnant even if surrogacy or other alternative childbearing options were available.

As biotechnologies that extend life by decades or more become available, they will no doubt have an impact on pregnancy. Research related to life extension is well underway, motivated in part by its most obvious benefit: to combat age-related diseases such as cancer, diabetes, heart disease, and Alzheimer’s by reversing or stopping the aging process itself. For women, aging leads to diminished fertility and eventually to the inability to become pregnant. It also leads to greater risks to their health if they get pregnant.

Scientists are already reporting groundbreaking achievements in reversing age-related declines. In 2020, for example, molecular biologist David Sinclair and his collaborators at Harvard Medical School successfully reprogrammed the damaged retinal cells of old mice, returning those cells to a younger state and improving the mice’s vision. These results alone constitute “a major landmark”, according to Juan Carlos Izpisua Belmonte, a developmental biologist at the Salk Institute for Biological Studies, because they “clearly show that tissue regeneration in mammals can be enhanced” (Ledford 2020). According to forecasts by a group of 60 demographers and scientists who study aging, life-extending technologies will make it possible for a child born in 2100 to live an average of 292 years (Richel 2003).

Though religious, theological, or ethical objections to life-extension may slow research in some regions of the world, countries such as the United States are ramping up their efforts. Scientific advances have become so promising that, in early 2022, a private company, Altos Labs, launched its own research into the prolongation of life after it managed to attract three billion U.S. dollars in financing and “a star-studded scientific cast” (The Economist 2022). Some worry that life-extending technologies may initially be affordable only for the wealthy. However, just as the costs of infertility treatments or medicines like insulin were initially

prohibitive for most people, life-extending technologies, though expensive at first, will likely become commercially viable and financially accessible to the less affluent.

I limit my remarks to life extension, which is not to be confused with immortality. Extended life and immortality—eternal life—are not equivalent. Extended lives are finite lives since people will still die from complications related to childbirth, or from accidents, killings, or incurable diseases.

3. A Benefit of Life Extension: Delayed Pregnancy

The familiar trope of the biological clock is a reminder that, physiologically, women have a limited window of opportunity to achieve pregnancy. Peak fertility occurs at the age of 27, an age that remains fixed. In contrast, according to 2020 data from the U.S. Census Bureau, the average age at which women marry in the United States is 28 ([United States Census Bureau 2021](#)). Hence, by the time many women marry, their best chance of getting pregnant is already past. While not all women seek marriage before having children, they tend to prefer to be in committed, stable relationships before starting a family.³

Fertility falls rapidly after the age of 35 so that, by age 40, a woman's chance of conceiving during a menstrual cycle is a mere 5%.⁴ Declining fertility can be mitigated if women bank their eggs until they are ready for pregnancy. At present, this is an expensive process; it also requires young women to think ahead and prepare for later pregnancies. In addition, banking eggs does not change the fact that, as women age, health risks associated with pregnancy increase. Pregnancy over age 35 is classified as high-risk because women are more likely to suffer from gestational diabetes, pre-eclampsia, high blood pressure, longer labor, and stillbirth ([University of Rochester Medical Center Health Encyclopedia 2022](#)). For women who wish to delay pregnancy until they have a partner and who wish to have more than one child, biotechnologies that can halt or reverse aging may be critical to realizing these plans.

While a woman's twenties and thirties are optimal for pregnancy, these are also key years for a woman's career. Most studies into the costs of pregnancy-related work pauses have focused on highly educated women for whom data is more easily available. Research data shows that, within this demographic, taking time off for pregnancy and to raise children exact a long-term financial toll—part of the gender gap in earnings.⁵ It is not clear whether these studies are helpful when trying to understand the economic impact of pregnancy-related absences to gig workers or non-college-educated workers.

Economist Marianne Bertrand reports that career interruptions of 6 months or more have a negative impact on the future earnings of women with advanced business degrees. Bertrand found that ten years after earning a Master of Business Administration (MBA) degree, women are 22 percent more likely than men to have had at least one such interruption ([Bertrand et al. 2010](#), p. 236). Women with MBAs earn USD 115,000 on average at graduation, and USD 250,000 nine years later compared to men with MBAs who earn USD 130,000 on average at graduation, and USD 400,000 nine years later. Bertrand attributes this significant lag in women's earnings, at least in part, to women taking leaves from work. She also reports that, 10 to 16 years after graduation, a man in the ninetieth percentile of incomes for men with MBAs earns over one million dollars compared to USD 438,000 for his female counterpart ([Bertrand et al. 2010](#), p. 236).

The facts of their biology mean that women are compelled to weigh their career and earning prospects against the risks and reduced chances of becoming pregnant as they age. Women who can control their aging can postpone their pregnancies. The advantages of this kind of control for some working women is borne out by data. To return to the example of women with MBAs, the number of hours they work per week early in their careers ranges from 60–70 h per week but decreases over time as these women move into general management positions.⁶ By using life-extending technologies to pause aging by a decade or more, middle-aged women who remain biologically in their twenties or early thirties will have the option to wait to become pregnant until after they have moved into

management positions with more manageable workweeks. The ability to delay pregnancy enables women to optimize the arc of their careers.

4. A Protestant Theology of Pregnancy

Protestant Christians, among others, are already taking an interest in developing theological responses to life-extending technologies.⁷ In this vein, I offer a Protestant theology of pregnancy based on a selective reading of the works of the Protestant reformer, Martin Luther (1483–1546). I focus on Luther's writings about two key women in Christianity's narrative history whose importance is in part related to pregnancy—Eve, whom Luther called the First Mother, and Mary, whom Luther called *theotokos*, or Mother of God. As a source of Luther's views on Eve, I mostly rely on his commentary on the book of Genesis. For his views on Mary, I mainly turn to his commentary on Mary's hymn of praise, also called the Magnificat, in the gospel according to Luke (Lk 1:46b–55).

Ann Stensvold, a historian of religion and author of *A History of Pregnancy in Christianity*, writes that Eve's pregnancy along with Mary's "could have been conceptualized as a sacred event among Christians. But Christianity did not develop a cult of human pregnancy—or a veneration of motherhood for that matter" (Stensvold 2015, p. 2). Instead, Stensvold writes, Eve "represents everything that is alien to God—death, decay, and moral corruption—in spite of the very concrete function which women had—for everyone to see—in the actual creation and caring for new life". However, if Stensvold's overall assessment of Christianity's attitude toward Eve and pregnancy is correct, Luther is an exception.

The systematic theologian and author of *The Redeeming Act of Giving Birth: Martin Luther's Theology Concerning the Bodies of Mothers*, Amy Marga, acknowledges that Luther is "not an obvious resource", but like me, she finds his writings helpful in contemporary explorations of pregnant bodies as "locations of knowledge of the divine and of God's good creativity" (Marga 2020). Marga grants that, although Luther maintained essentialist views of women and was convinced that women's proper roles were limited to wife and mother, he also held, she argues, an "optimistic view" of the pregnant body. His ideas, according to her, subvert traditional attitudes about the curse of childbirth and affirm "the power that women have in God's activities of creation and new creation" (Marga 2020).

It is true that Luther promoted and even insisted on married life, emphasizing the duties of women to the household. Above all, he preached, women were to attend to domestic duties and be responsible for housework, childbearing, and caring for their husbands and progeny. Less well known was the esteem he had for pregnancy. He considered it "a great miracle" and spoke of the awe he felt for women's ability to create new life. Commenting on Gen. 2:21, Luther writes:

... why is it not worthy of the highest admiration that a woman should receive human seed, which then grows, and as Job 10:11 so beautifully says, "Thou hast clothed me with skin and flesh, and knit me together with bones and sinews", that is, formed me and nourished me in my mother until I was matured to live in the air, separated from her ... All this is most wonderful and utterly incomprehensible, but lightly esteemed by us because we have truly become deaf to this most pleasant and lovely music of nature. (Luther 1904)

With respect to Gen. 2:18, Luther notes how God decides "it is not good that the man should be alone". Luther concludes, based on his exegesis, that "God is speaking of a common 'good,' or the good of the species; not of [Adam's] personal good". This common good is "that wonderful work of generation and the preservation of [the human] species". There was need of woman, Luther is convinced, for this wonderful work and "For the great and glorious ends of creation". To this end, he writes, Eve "was created with profound counsel and wisdom of design" (Luther 1904).

Paradoxically, Luther describes God's punishment of Eve after the Fall as "happy and joyful". Due to her sin, Eve is to bear children in pain, a "righteous" burden that Luther grants will be difficult for "the flesh to bear". Nonetheless, he emphasizes, before Eve sinned, God had promised her "that blessing of generation and fruitfulness". God elected

not to deprive her of this blessing and Eve retained “the glory of maternity”. For Luther, God’s punishment of Eve is happy and joyful because God allows her to continue having children. God permits her to retain “all these blessings of this present natural life”, as well as “that promised hope of life eternal” (Luther 1904).

Though God punishes Eve and all future women by decreeing pain in childbearing, God does not decree possible harm or death as additional burdens. After all, harm or death caused by pregnancy is counterproductive to God’s plans since Eve and other pregnant women are integral to preserving God’s creation of humankind. By extension, to pivot back to my earlier discussion of how pregnant women past age 35 are at greater risk of complications, Luther likely would have said that God wished them a healthy pregnancy. Anything less is a threat to women and their ability to sustain humanity. Luther’s keen compassion for pregnant women is evident in his “Consolation for Women Whose Pregnancies Have Not Gone Well”, written in 1542 (Luther 2016a).

Marga argues that, for Luther, due to their ability to bear children, women are “in a unique position to fight” for the perpetuation of the human species and “to fight for human life”. She praises him for preaching that “women *bless* the world by continuing to give birth despite the curse” (Marga 2020). After all, faced with the prospect of pain and suffering, women could find ways to avoid pregnancy, thereby putting an end to God’s creation. Luther held that childbearing shows respect for God and he lauds pregnant women because, although they experience hardships during pregnancy and childbirth, they fight for new life with courage and even joy.

Luther, Marga notes, is convinced that women participate “in God’s creative processes in a way that only pregnant and birthing women can” (Marga 2020). And similar to Eve, the perseverance of pregnant women in safeguarding God’s handiwork—despite God’s curse—deserves acknowledgment and gratitude.

Eve and Mary form something of a bookend in the biblical understanding of salvation, explains Beth Kreitzer, author of *Reforming Mary: Changing Images of the Virgin Mary in Lutheran Sermons of the Sixteenth Century*. Kreitzer writes: “it is in consenting to the conception of Jesus through the Holy Spirit that Mary reversed the action of Eve, causing life rather than death to come into the world” (Kreitzer 2004, p. 36).

It was for Mary, not Eve, according to Stensvold, that early Christianity developed reverence. Mary was held in special favor because, as the embodied space in which God took on human flesh, her body served as the “door of salvation”. In this way, her body participated in God’s incarnation, the central event of Christian faith. However, Luther altered “certain aspects of Marian piety” with notable implications for a Protestant theological understanding of pregnancy (Stensvold 2015, p. 2).

From his perspective, Kreitzer argues, Mary should principally be recognized for her humility before God, and “praised for her great faith and for her willingness, despite the challenges to herself, to be the Mother of God” (Kreitzer 2016, p. 310). Nonetheless, Luther also emphasizes how God “regarded” Mary. Though she was “not the daughter of one of the chief rulers”, Luther writes, God regarded this “poor and plain citizen’s daughter, tending the cattle and doing the housework, and doubtless esteemed no more than any poor maidservant today, who does as she is told around the house” (Luther 2016b, p. 319). God’s regard, according to Luther, “is the greatest of his works”, since it is the work “on which all the rest depend and from which they all derive”. When “God turns his face”, and regards someone, Luther writes, “there is nothing but grace and salvation, and all gifts and works must follow” (Luther 2016b, p. 341).

Kreitzer points out how Luther “shifts the focus of [his commentary] from Mary (the one who was regarded) to God (the one who deigned to regard her, and likewise all of us)” (Kreitzer 2016, p. 310). Mary’s pregnancy serves, for Luther, as a proclamation that no one is too lowly or poor or insignificant for God to regard them. Indeed, Luther argues, when Mary exclaims, “Behold, since he has regarded me, all generations will call me blessed”, she is saying that “it is only because God regarded her” that people will call her blessed” (Luther 2016b, p. 341). By extension, just like Mary, pregnant women serve to remind

humanity how God may “make his face shine” upon any person, conferring grace and salvation regardless of station in life.

In addition, Luther holds that Mary’s pregnancy is a testament to the experience of God’s love. No one can love God, Luther writes,

unless he makes himself known to us in the most lovable and intimate fashion. And he can make himself known only through those works of his which he reveals in us, and which we feel and experience within ourselves. (Luther 2016b, p. 318)

Luther describes Mary as “the tender mother of Christ” who teaches by “the example of her experience” of God’s love within herself “to know, love, and praise God”. In line with Luther’s depiction of the tender mother of Christ, although other pregnant women are not pregnant with God, they may, like Mary, experience God’s love within. Like her, these women teach about this love with their words and by example.

Luther’s commentary on Eve and Mary depicts pregnancy as praiseworthy and as consequential to God’s project of creation. A Protestant theology of pregnancy informed by this commentary takes a favorable view of pregnant women because, like Eve, they participate in the work of preserving God’s creation. Pregnant women also participate, like Mary, in the work of communicating the love of God they may experience within as well as by serving as reminders that God may turn God’s face toward anyone—not just an elite few—and confer grace and salvation. By extension, such a theology of pregnancy takes a favorable view of technologies that can assist women to extend their childbearing years, especially if, by reversing or halting aging, these technologies reduce the risk to women of harm or death.

5. Extending Pregnancy and the Malthusian Threat

A common reaction to contemplating a future shaped by life-extending technologies is fear that, as people live longer, the planet will become overpopulated and its limited resources taxed beyond sustainable limits. In the section that follows, I focus on the possibility that these technologies will set off a Malthusian crisis. I argue that typically, solutions proposed to avert such a crisis involve untenable restrictions on pregnancy and women’s autonomy over their bodies.

Philosopher John K. Davis argues that most concerns about extended-life technologies do not outweigh the benefits promised by these biological interventions—however, he does consider the risk of overpopulation “a serious threat”. To address this threat, Davis proposes a reproductive policy that he calls Forced Choice (Davis 2018, p. 103). His proposal reflects genuine alarm based on empirical data. Using “medium” projections, the United Nations Population Division estimates that the earth’s population could reach 8.5 billion by 2030, 9.7 billion by 2050, and 11.2 billion by 2100 (Davis 2018, p. 104). Davis notes: “because the world’s population is so large and because economic development is happening all over the world, we are putting more and more pressure on the world’s resources and ecosystem. According to an estimate from the Global Footprint Network, the world is [already] consuming the equivalent of one and a half earths” (Davis 2018, p. 104).

Though more than 11 billion people may call Earth home by the end of this century, the global Total Fertility Rate (TFR) is falling. It is decreasing quickly enough that the Pew Research Center expects that the world’s population will nearly stop growing by the end of this century and begin to fall thereafter (Cilluffo and Ruiz 2019). Every adult woman must have 2.1 children to sustain a full replacement of the previous generation but, as Davis himself points out, about 46 percent of the world’s population lives in countries where women’s fertility rates have fallen below 2.1. Indeed, Europe’s fertility rate is a mere 1.5. Should a TFR of 1.5 become the norm world-wide, the global population will drop by half between 2100 and 2200, slipping to 3.5 billion people, a number not seen since sometime between 1960–1974. The International Institute for Applied Systems Analysis in Austria projects, based on this TFR, that the total human population will continue to freefall, sliding to 1 billion by 2300—a worldwide population comparable to that of the early 1800s—with numbers sliding still further afterwards (Davis 2018, pp. 112–13).

Davis develops a model to predict population growth once life-extending technologies become widely accessible. He starts from the premise that a life expectancy of 150 years will become the norm and all persons will want to extend their lives. He also assumes, quite reasonably, that the global TFR is 1.5. If these biotechnologies are commercially available starting in 2300 when the population is 1 billion, he predicts that the population will increase to 2.656 billion during the first 125 years due to a combination of births and people living longer. However, despite a longer lifespan of 150 years, the low fertility rate of 1.5 will cause the total population to fall back to 1 billion over the next 125 years. After three more decades, the population will drop to 100 million and continue dropping thereafter.

Though Davis is relying on prescriptive demographics, and his model can be critiqued, it demonstrates that fears of a Malthusian future may be overblown. Nonetheless, I want to explore his Forced Choice proposal further and explain why—just as any proposal that advocates controlling women's autonomy over their bodies—it must be rejected.

Davis engages in a thought experiment in which lives lasting up to 1000 years become possible. The resulting long-lived population would exert significantly more pressure on the planet than the population, previously described, with a 150-year life expectancy. To avert a Malthusian disaster, Davis recommends that persons who want to extend their lives up to 1000 years be required to adopt a "target birthrate" of 0.5 children. Anyone, regardless of gender, who opts for life extension but desires a child must consent to participating in a lottery. This impartial game of chance determines which one person out of every four (a 25% chance of winning) will be granted permission to have a child and extend their life.

If a man wins this lottery, his only option to have his "authorized" child is to partner with a woman who has lost the lottery and, by choosing to have, what is for her, an "unauthorized" child, is willing to forgo extending her life. If a woman loses the lottery and she has a partner who has also lost, she may opt for pregnancy anyway; however, by doing so, she forfeits her access to life-extending technologies. Or, if a woman has already been pregnant once, she may join the lottery; if she wins, she is granted access to life-extension technologies but is not authorized to have another child since she already has one. A woman who is using life-extending technologies but becomes pregnant loses access to those technologies unless she is among the 25% of winners when she participates in the lottery.

The carrot for cooperating with the 0.5 target birth rate is access to life-extending technologies. The stick for lack of cooperation is loss of access to those technologies. Davis realizes that some women will attempt to hide their children to avoid having to choose between them and an extended life. He suggests "policing" as the solution. Everyone will be required to submit to DNA testing. Parents who are discovered to have exceeded their child limit will be "penalized". This approach may appear humane on the surface, and averting a Malthusian crisis is clearly desirable. However, it relies on "policing" women's bodies and "penalizing" them should they become pregnant without winning the lottery. It transgresses the autonomy of women over their bodies by surveilling them and punishing them if they refuse, or fail, to cooperate with target pregnancy rates.

Davis dismisses comparison of his "Forced Choice" approach to China's one child policy, but his approach relies on "policing" and "penalizing" women. In the mid-twentieth century, China's government decided to implement a nationwide campaign of population control for reasons described by news anchor Tom Brokaw: "There are more than 1 billion Chinese. That one big statistic right there, more than anything else, is at the heart of this nation's economic problems. By the middle of the next century, if China's families have an average of 3 children, there will be starvation. However, with one child per family, the standard of living doubles". Brokaw also reported, "So now there's a desperate effort under way to control the population, to limit families to just one child".⁸

To enforce the one child policy, Chinese officials ordered women to be sterilized after they gave birth to their first child. Women who refused were kidnapped and forced to go undergo this procedure even if they were already pregnant again. Without regard to the good that women attach to pregnancy and without regard for their bodily autonomy,

local officials were rewarded if their assigned region did not exceed its quota of births. Filmmaker Nanfu Wang's documentary "One Child Nation", describes China as a nation that considered itself to be fighting "a population war, a war against population growth". However, this war "turned into a war against its own people" (Wang 2020).

How is Davis' Forced Choice approach different from China's one-child policy? Women, Davis acknowledges, may try to hide their unauthorized children—hence the need for mandatory DNA testing to identify them. What happens to these women if they become pregnant again? Will their children be taken from them? Will they be forced to have abortions? Will they be sterilized over their objections? Davis writes:

... banning life extension altogether may be politically more controversial and unpopular than *controlling* the reproduction of those who extend their lives. Prohibiting life extension denies decades or centuries of life to people who want it, while Forced Choice *merely limits* how many children they have. There really is *no better alternative* to limiting the reproduction of those who extend their lives, at least for a few generations. (Davis 2018, pp. 123–24) (Italics mine)

Though China forced women to have abortions and to be sterilized, it is not clear how much these attacks on women's bodily autonomy contributed to the reduction in TFR reported by this country's government. Would non-violent approaches have proven nearly or equally as effective? This seems possible. China's TFR dropped from 5.99 in 1969, the year it implemented its one child policy, to 2.56 fourteen years later (World Bank 2021). Economist Junsen Zhang writes that prior to 1969, fertility rates in China were already showing signs of a sharp drop-off. According to the World Bank, this rate fell, in the four years between 1965 and 1969, from its peak of 6.38 to 5.99 (World Bank 2021). Moreover, the one child policy was implemented, Zhang argues, at nearly the same time that China's market-oriented economic reforms "triggered several decades of market growth, which tend to reduce fertility rates" (Zhang 2017, p. 141).

In addition, Zhang points out, during the same period "a number of other developing countries in East Asia and around the world ... experienced sharp declines in fertility" (Zhang 2017, p. 141). Drawing on data from 16 countries with birth rates akin to China's in 1970, sociologist Feng Wang and his colleagues determined that these countries' birth rates declined more rapidly than the decline predicted by the Chinese government had it not enforced its one-child policy. Wang concludes that China exaggerated the effectiveness of this policy (Wang et al. 2013, pp. 115–29). Factors tied to increasing prosperity led some women of childbearing age to choose for themselves to have fewer children.

Indeed, China's rapid economic growth and brisk improvements in living standard may explain why its birth rate currently stands at about 1.6. Perhaps a harbinger of the future when the world's population begins to decline sharply, China's low fertility rate has created labor shortages that threaten the country's economic prospects. To address this threat, the Chinese government reversed course in 2015 and implemented a policy encouraging families to have two children (Attané 2016, p. 519). When the desired increase failed to materialize, China shifted course yet again and, in 2021, implemented a three-child policy.

6. Conclusions

Women who consider pregnancy a good in itself may well embrace life-extending technologies if these technologies offer them the option of maintaining a biological age optimal for pregnancy. Women tend to prefer starting families while in committed relationships but they choose to marry, on average, past the age of peak fertility. Life-extending technologies will free them from bondage to their biological clocks so that they neither feel pressured to find a long-term partner nor pressured to start a family. Such biotechnologies promise women the ability to exercise more control over the age at which they become pregnant, enabling them to plan better the arc of their careers. Because extended-life technologies will obviate concerns about taking early-career maternity leaves and minimize the impact of such leaves on future earnings, women and their families stand to benefit.

I have sketched the outline of a Protestant theology of pregnancy based on some of the writings of Martin Luther. His views about the good of pregnancy offer theological support for the development of extended-life biotechnologies since they promise to make pregnancy possible longer. Luther's exegesis of the biblical narrative of Eve depicts pregnancy as key to preserving and sustaining God's creation. It also honors the courage and fortitude of women who bear children in cooperation with God's project though they must endure pain during pregnancy and childbirth. Protestant women who understand themselves, theologically, as assisting God to sustain God's creation will have the option of prolonging their childbearing years. Luther's exegesis of the biblical narrative of Mary lauds her pregnancy as a testament to the blessings of God's regard—a regard not reserved only for the high-born and wealthy since God chose a poor servant as the *theotokos*. Mary's pregnancy also serves as a testament to the workings of God's love since Mary, who experiences this love within herself, learns to know and love God. Like Mary, pregnant women are reminders of the possibility of experiencing God's love and of the power of this experience.

Extending-life technologies could result in outsized population growth due to reduced deaths and increased births. However, I have argued that fears of a Malthusian future are exaggerated and may incorrectly reflect expectations of a logarithmic boom rather than reflect the reality of shrinking populations post-2100 due to decreasing fertility rates. An international team of scientists, who published their birth projections in a 2020 issue of *The Lancet*, anticipate that the fertility rate in 183 out of 195 countries and territories (94%) will fall below 2.1 by 2100 (Volsett et al. 2020). If this demographic decline proves accurate, especially since it will accelerate over time, the ability of women to become pregnant longer in life could become key to moderating some of the resulting negative effects. China, already an object lesson with respect to these ill effects, is experiencing rising economic pressures on the small number of workers who are supporting many retirees, pension systems running out of money, and urban contraction. By increasing women's window of safe pregnancy, life-extending biotechnologies offer the prospect of a higher birth rate which could dampen the impact on humanity of a predicted, rapid slide in global population.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

Notes

- ¹ I wish to thank the two blind reviewers who read earlier versions of this essay. Their thoughtful comments and insightful suggestions were of enormous help to me during the revision process.
- ² (Davis 2018, p. 94). The Malthusian crisis receives its name from the British economist and cleric, Rev. Thomas Malthus (1766–1834), who argued in his 1798 book *An Essay on the Principle of Population* that abundance in food supplies did not improve standards of living but rather led to increases in population and greater suffering among the lower classes due to disease and famine.
- ³ (Dommermuth et al. 2014). The research reported in this paper shows that individuals with a partner are more likely to realize positive fertility intentions than singles, and union stability has a similar positive effect. https://www.ssb.no/en/forskning/discussion-papers/_attachment/182990?_ts=146a3818d38 (accessed on 15 March 2022).
- ⁴ <https://www.reproductivefacts.org/news-and-publications/patient-fact-sheets-and-booklets/documents/fact-sheets-and-info-booklets/age-and-fertility/> (accessed on 15 March 2022).
- ⁵ (Bertrand et al. 2010, p. 230). See also <https://www.census.gov/library/stories/2020/06/cost-of-motherhood-on-womens-employment-and-earnings.html> (accessed on 15 March 2022).
- ⁶ (Ibid., p. 235). According to Bertrand, “Hours decline with time since MBA for both men and women, in part reflecting a move out of investment banking and consulting and towards general management positions in corporations”.
- ⁷ See for example (Mercer and Trothen 2014), (Mercer and Trothen 2021), (Haker et al. 2021), and, most recently (Gouw et al. 2022).
- ⁸ Tom Brokaw news report in (Wang 2020).

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