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Can AI Help Slow Down Global Depopulation?

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Can AI Help Slow Down Global Depopulation?*

Abstract

Two-thirds of the world's population currently live in countries where women's total fertility rate (TFR) is below the replacement rate of 2.1 children per woman. With global TFR reaching 2.2 in 2023 and declining rapidly across all regions, global depopulation is now projected to occur much earlier in this century than previously anticipated. This paper presents a balanced view of how revolution in AI and AI robots (referred to as 'AI' for short) may reshape fertility dynamics.

Specifically, AI is expected to significantly reduce the time dealing with child-rearing and household chores, thus easing the binding constraints on parents' time and possibly raising women's TFR and time caring for older family members. However, parents are likely to have to compete with AI for children's affection, thereby lowering TFR. I also examine AI's impact on TFR through its effect on productivity and economic growth, income inequality, wages and employment. The study concludes with policy recommendations regarding the impact of AI on population decline and issues related to AI potential dominance.

JEL classification

J11, J13, J21, J22, J23, J24, J31, O31, O32, O33

Keywords

AI and AI robots, fertility decline and depopulation, labor market and employment, productivity and growth, inequality, AI dominance, policy recommendations

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1. Introduction

The world is experiencing two revolutions, artificial intelligence (AI) and AI robots on the one hand, and depopulation on the other. While AI may disrupt labor markets, its capacity to drastically lower the time costs of child-rearing and other household chores and management presents an under-explored mechanism that should affect fertility. This paper presents a framework of the multi-channel impact of AI on fertility and depopulation.

Depopulation, which has prevailed for some time in regions of Europe and in Japan, has spread to many more countries in recent years. Over two thirds of the world's population now live in countries with a total fertility rate (TFR) below the 2.1 replacement level (defined in fn. 1).[1] Global depopulation is now expected later this century, and much earlier than anticipated just a few years ago due to rapidly falling TFRs, particularly in East Asia. And though pro-natal policies may lead to a temporary TFR bump, they have been unable to stop the ongoing TFR decline, which has in fact accelerated in recent years. The latter is elaborated in Section 1's last paragraph.

A low TFR and increase in life expectancy has resulted in a rising rate of old age dependency (share of those 65 and older, relative to those between 19 and 64). This issue now concerns many more countries, as fewer workers must support more recipients, posing fiscal challenges. Moreover, an aging population tends to be less productive and finds adapting to rapid technological advances more challenging. And a TFR below 2.1 leads to depopulation over time, without any effective mechanism to reverse it. Whether migration can help is examined in Section 1, after Table 4.

This article examines the impact of AI and AI robots on fertility and depopulation. On the one hand, AI will reduce the time cost of raising children and dealing with household chores, which could positively impact women's TFR, though a potential change in the relationship between children and parents and between children and robots may have the opposite effect. Moreover, AI

[1] Total fertility, the sum of all Age-Specific Fertility Rates for a given population over a specific period, typically a calendar year, represents the average number of children a woman would have if she lived through her entire reproductive life (usually ages 15 to 45) and experienced the exact fertility rates observed for each age group.

will affect employment conditions, wages, productivity and growth, and thus TFR, in ways that are harder to predict and on which there is no consensus.[2]

The paper offers a balanced view of the issues examined, with the remainder organized as follows. Section 2 examines TFR and depopulation, how they have evolved over time and space, how they are affected by migration, and reasons for their decline. Section 3 deals with AI and AI robots' impact on household behavior and its effects on TFR. Section 4 examines how they affect private sector behavior and TFR, and Section 5 concludes and draws policy implications. Appendices include additional studies that obtain similar results to those presented in the body of the paper and explain how some are obtained.

2. Depopulation and AI development

Concern with the world population's evolution in the second half of the 20th century was very different from the current one. In his 1968 book "The Population Bomb," Paul Ehrlich predicted disaster and mass starvation due to rapid population growth. He stated that: "… In the 1970s the world will undergo famines—hundreds of millions of people are going to starve to death ..." And in 1984, Robert McNamara, former World Bank President, said that "Short of thermonuclear war itself, population growth is the gravest issue the world faces over the decades immediately ahead. If we do not act, the problem will be solved by famine, riots, insurrection and war."

These predictions turned out to be wrong, and the debate has since shifted to a concern with depopulation as the TFR is now declining in close to all the world's countries. A TFR of 2.1 is generally considered the replacement level, indicating that a population is replacing itself without migration. The replacement rate is above 2.0 as some women do not reach reproductive age or the end of their reproductive life. [3]

[2] Current major generative AI models include Open AI's ChatGPT, Anthropic's Claude, Google Gemini, Microsoft AI's Copilot, Chinese High-Flyer's DeepSeek, xAI Grok, Meta's Llama, and more (including text-to-image and textto-video models).

[3] The replacement rate in countries with a high mortality rate may be significantly higher than 2.1.

According to the UN Population Division, women's TFR in 2023 was below the replacement rate in 114 countries or about 60 percent of the world's 195 countries, and the population in these countries amounted to over two thirds of the world's population.

The 2026 TFR was below replacement rate in at least 12 large developing countries:

Table 1: TFR in 12 Large Developing Countries

India	1.9
Vietnam	1.9
Mexico	1.85
The Philippines	1.7
Brazil and Colombia:	1.6
Iran:	1.35 to 1.66
Argentina and Turkey:	1.5
Thailand:	.87 to 1.2
China:	0.9
South Korea:	0.7 to 0.8

And the rates are below replacement levels in the G-7 countries and Russia:

Table 2: TFR in Large Developed Countries

US:	1.6 [4]
France:	1.56
Canada:	1.5
Germany, Russia and the UK:	1.4
Italy and Japan:	1.2 [5]

[4] The U.S. was an outlier among developed countries, with a 2008 TFR of 2.1, the replacement rate, though by 2023, its TFR had dropped to 1.6. Future population growth is expected to come mainly from high immigration levels, though the inflow may be lower than expected given the tightening of immigration policy.

[5] Japan's national population decline began in 2009, following a peak of 128.1 million residents, though its working-age population began shrinking in the 1990s.

According to the UN Population Division projections, the region's "support ratios"— the number of people between 20 and 64, relative to those 65 and older, or the reverse of the dependence ratio—are expected to plunge in the years ahead. The support ratios in 2020 and the projected ones for 2050 in East Asia are as follows:

Table 3: Support Ratios

	2020	2050	Difference 2050 – 2020 (%)	Population decline (%)
Japan	1.8 to 1	1.2 to 1	– 33	– 18
China	5.1 to 1	1.8 to 1	– 65	– 08
Taiwan	4.4 to 1	1.4 to 1	– 68	– 08
S. Korea	4.2 to 1	1.2 to 1	– 71	– 12

The predicted weighted-average decline in the support ratio from 2020 to 2050 is 63 percent, and the weighted-average decline in population during the same period is 8.9 percent.

The 2023 TFR rates for the world's regions are as follows:

Table 4: TFR by Region

Europe	1.4
East Asia & Pacific (excluding high income) [6]	1.4
North America	1.6
Latin America & Caribbean (LAC)	1.8
South Asia	2.0
Arab World	3.1
Sub-Saharan Africa	4.2
World	**2.2**

Thus, the regions with a 2023 TFR below the 2.1 replacement rate are Europe, East Asia & Pacific, North America, Latin Ameria & Caribbean and South Asia, whose total population amounted to

5.5 billion or 68 percent of the world's population of 8.1 billion. The regions with TFR above 2.1 are Sub-Saharan Africa and *much* of the Arab world.[6] Large non-Arab Muslim countries with TFR below 2.1 are Iran and Turkey, while the UN estimates Indonesia's 2026 TFR to be 2.08 (UN Projection, 2026).[7]

The world's TFR was 5.1 in 1965, 3.7 in 1980, 2.8 in 2000 and 2.2 in 2023 or barely above the replacement rate (INED 2024). And it is likely to reach 2.1 in the not-too-distant future as TFR rates are declining in *all* regions and in *almost all* countries,[8] whether they are above or below the replacement rate. For instance, the TFR of Sub-Saharan Africa (SSA) declined from an estimated 6.5 around 1980 to 4.2 in 2023 or by 35 percent.

Migration

In the European Union, after decades of growth, its population – inclusive of immigrants – is projected to peak around 2026 at 453 million before entering a long-term decline to around 419.5 million by 2100 (Eurostat 2023). In the US, the mortality rate remains nearly 10 percent above pre-pandemic levels (Johnson 2025). This, together with the decline in the TFR, has led to a *natural* population decline in 68 percent of all US counties between 2023 and 2024, with immigration providing the bulk of the population increase.

Immigration may help some countries overcome their declining TFR, though it is not clear how long this will last, partly because of the current tightening of immigration policy in many developed destination countries, and the TFR decline in 99 percent of the world's population. Moreover, immigration cannot offer a long-term solution to the global depopulation problem since the world is a closed economy and its population is unaffected by international migration in the short run.

In fact, South-North migration may well worsen global depopulation over time. The reason is that the TFR in the North's host countries – mainly Europe, North America and Australia – is typically

[6] Arab countries with a TFR below 2.1 are Bahrain, Kuwait, Qatar, Tunisia and the UAE.

[7] And Albania – whose population is about 51% Muslim – has a 2026 TFR of 1.35 and has been depopulating since the 1990s.

[8] Armenia, Bulgaria, Cyprus, South Korea and Uzbekistan – or 1 percent of the world's population – have experienced slight TFR increases in recent years.

lower than in the South's source countries – whether LAC, North and Sub-Saharan Africa, developing Asia, or the Middle East. As many studies have shown, immigrants tend to adapt to the norms of the destination countries over time. Thus, South-North migrants leave countries with higher TFR and adapt to the lower TFR in host countries, thereby reducing global TFR. Moreover, South-North migrants also tend to reduce fertility in their country of origin by transferring host countries' low-fertility norms back to their home country (Beine, Docquier and Schiff 2010).

Older populations tend to be less entrepreneurial, less creative and less willing to take risks, all of which results in a lower growth rate. Immigration can partially alleviate the economic pressures of an ageing population by boosting the workforce and increasing tax revenues. However, though they tend to be younger than the local population when they arrive, immigrants also age, and maintaining a stable dependency ratio would require unsustainable increases in immigration levels over time.

Why is TFR declining?

A number of reasons for the decline in TFR have been advanced. These include the rise in a child's monetary and time cost, in women's participation in the labor force – and more independence from household obligations (Notestein 1953), greater contraceptive use, an increase in the age when women have their first child, higher divorce rate, higher share of unmarried women, and parents' anxiety about the future (environment, fear children will do worse than them, etc.). In other words, a cultural change has taken place that will be very hard to reverse.

Though the TFR has been declining across Sub-Saharan Africa (SSA), its fertility rate (TFR = 4.3) is still substantially higher than the replacement rate. A 2025 article by The Economist Staff states that SSA currently creates only 3mm jobs for the 15mm people entering the labor market annually. This suggests that the pressure for emigration from SSA to other regions, particularly to developed countries, will be intense and will be faced with restrictive immigration policies, a potentially explosive situation. Irrespective of the latter, the share of SSA in the world's population will increase in future decades.

EBRD's (2025, p. 7) states that "Today, …, fertility is falling fast in both high- and low-income countries, while global life expectancy has continued to rise, improving from 48 to 73 years between 1960 and 2023. When fertility rates fall and life expectancy rises, populations age rapidly. Consequently, policymakers are increasingly concerned about shrinking workforces, ageing societies, slower growth and mounting fiscal pressures." [9]

Pro-natalist policies

Measures to encourage childbearing have ranged from direct allowances and extended parental leave provisions to subsidized childcare and assisted reproductive technologies (including in vitro fertilization). These measures seem to have had a limited impact in countering the effects of widespread social changes, including increased labor market opportunities for women and incentives to invest in education. Thus, these pro-natalist policies are unlikely to move fertility rates up to replacement levels in the low-fertility countries. More details are presented in Section 3.1 (last paragraph) and in Appendix 1.

AI Development

Technological progress in AI generative models (and robots) offer a new variable, so far absent from population models, which may affect population change. Just as AI is evolving at a very rapid rate, so are AI robots (or Physical AI), though more slowly. The many sectors and activities where they are engaged include farming, manufacturing, entertaining nursing home residents (including singing, playing bingo, etc.), delivering food in cities in both developed and developing countries, helping occupational therapists develop their touch and communication skills, performing precision surgery, and much more. [10]

Robots should soon transform household daily life by doing laundry, cleaning the house, feed the cat, loading and emptying the dishwasher, assisting the elderly, organizing the home, and many other tasks. In Scotland, AI and sensor technology monitor long-term health conditions, help

[9] On the other hand, Becker (1960) argues that the decline in fertility is accompanied by an increase in spending on children's 'quality' (education, health, etc.), which are likely to have a positive growth impact.

[10] And, as Callaway (2025, 2026) writes in *Nature*, since it was unveiled in 2020, Google DeepMind's game-changing AI tool, AlphaFold, has helped researchers all over the world predict the 3D structures of hundreds of millions of proteins and has shed light on how they interact.

people make calls, switch on lights, open doors and watch TV. The cost of consumer (home) robots is expected to keep declining while their capabilities continue to improve at rapid rates. The lower cost and greater capabilities are likely to make robots an attractive household choice in the future.

3. Impact of AI on household behavior and fertility

This section deals with the impact of AI robots on parents' time dealing with household chores and children's care and on the quality of time spent with children, and hence on fertility. It further deals with competition between parents and AI robots for children's affection, which is likely to have the opposite fertility impact. And it also examines the impact of pro-natalist policies.

Time spent on childcare and other household tasks

People have been operating under greater time pressure in recent decades, with responsibilities at work at home, and with aging family members.[11] AI robots are becoming increasingly sophisticated, even performing precision surgery (Section 2). They should be able to take care of a large number of household tasks in the near future, including those listed in Section 2, as well as care for children's needs (bathing, dressing, feeding, supervising their homework, taking them to the doctor, etc.). This will greatly reduce the cost of raising children and caring for older parents, both in time and money. It will therefore raise the incentive to have more children, i.e., it will raise fertility.[12]

The 2024 American Time Survey of the Bureau of Labor Statistics (BLS, 2025) estimates that the time parents spend on household chores, including childcare, is at least 6.6 hours a day (6.35 for the father and 6.85 for the mother). Details on these estimates are provided in Appendix 1. AI robots, by taking care of these household chores, are thus expected to free an average of 6.6 hours a day or some 28 percent of each parent's time, enabling them to have quality time with their children and with each other, rather than dealing with chores associated with children's and other

[11] Time pressure is greater in the US than in European countries with similar living standards. The number of annual work hours in the US is about 27 percent greater than in these European countries, with a negative welfare impact for the US (Schiff 2017).

[12] Based on a formal model of allocation of time, Wei and Xie (2023) show that AI technology can help raise fertility rates if parents have a relative preference for children (vs. other consumption).

household needs. So, rather than being stressed due to time pressure and the need to deal with unattractive chores, AI robots will enable parents to have a more relaxed and deeper relationship with their children and have time for activities they and their children enjoy. Thus, using AI robots will leave 24 hours a day for both parents – rather than 17.4 hours – for work, sleep, caring for parents, and for children's preferred activities, which should raise fertility. Moreover, parenting as a meaningful experience rather than a chore may provide another reason for raising the desire to have children.

On the other hand, children's emotional relationship with their parents and home AI robot(s) is likely to change. Turkle (2026) makes a convincing argument that interactions with machines is changing many people's emotional relationship with them, replacing human-to-human relationships and emotional intimacy with what she refers to (and is her book's title) as *Artificial Intimacy*.[13] Thus, parents will most likely have to compete with AI robots for children's emotional attachment, possibly reducing parents' benefit from and desire to have (more) children.[14] Thus, we have two opposite impacts of AI robots on fertility, and the net impact depends on which one is stronger.

An additional issue is that researchers who try to learn how 'pre-AI' people respond to specific AI experiments do not seem to account for the fact that AI will gradually affect our values, our attitudes and our behavior more generally, something that can be seen with the impact of social media and the smart phone, a problem that AI is likely to deepen.

AI and the fertility impact of men's help with childcare and other tasks

Goldin's (2025) finds a higher fertility in countries where men have increased their contribution to raising children. Her research indicates that women's available time is a binding constraint on having children, and that when men are unlikely to take on more household work and childcare,

[13] Though they are always available, seem very understanding, and are programmed to act as closely as possible to humans but without the complexity of human relationships, machines' reactions are just based on guessing what word comes after the previous one. Thus, I would even refer to the relationship as false or fake intimacy.

[14] This is less likely for women or couples who are from an era when having kids was considered normal. However, as children are raised in part by AI robots in the future and their norms and attachments change, the desire to have children is likely to change as well.

some women will not have children while others will delay. Briselli and Gonzalez (2023) obtain similar results. The US birth rate of 20- to 24-year-olds dropped from 106.3 births per 1,000 women in 2007 to 56.7 per 1,000 in 2024, in part because of their wish to increase their education level and start a career. In countries where men's contribution to childcare has increased, both female labor participation and fertility have tended to be higher.

On the other hand, by relaxing the constraint on women's time, AI robots are likely to reduce women's dependency on the amount of time men spend raising children, thus decreasing any tensions associated with the unequal time parents spend on them. Improvements in parents' relationship might further increase the desire to have children. This should raise fertility, even in those cases where men do not increase the time spent raising children.

Cost of AI robots

The cost of AI is declining at a vertiginous rate, and the ease of switching between frontier LLMs has forced companies to pass the bulk of the gains from innovation on to users. The associated though slower decline in AI robots' prices over time should raise their use over time and further reduce the cost of raising children (and of other tasks). This is likely to raise fertility.[15] The extent of the cost decline and its speed is discussed in Appendix 2.

Remote Work

Redlin (2024) examines the impact of working from home and finds, for the US, that AI raises remote work's benefits and provides an incentive to raise fertility. Remote employees using AI report higher efficiency, improved work-life balance, enhanced collaboration and data analysis, and more, thereby boosting productivity and improving incentives to raise fertility. Davis et al. (2026) extend the analysis to 38 countries and find that fertility is higher among adults who work from home at least one day a week and is higher still when both partners work from home. They

[15] In his seminal article on the allocation of time, Becker (1965) integrates money income and the value of time, referring to it as "full income." He treats time as a scarce resource whose value is based on foregone earnings – which depends on the wage rate – and where the full cost of any activity includes both the cost of needed market goods and services, and the value of time spent on it. Thus, by reducing the time spent on raising children and other chores, AI has a positive impact on parents' full income and on available time for other activities, implying a positive impact on fertility.

obtain similar results separately for France and Germany, and for the EU as a whole. Further details are provided in Appendix 3.

Impact of smartphone and social media versus AI

Myers and Hooper (2026) find that the diffusion of the iPhone explains a third to half of the 11 percent decline in the general fertility rate among US women aged 15–44 in the period 2007-2011. National-survey evidence on time use and sexual behavior is consistent with the iPhone reducing in-person interactions, raising pornography use, and reducing sexual frequency. Similar findings are obtained by Breen et al. (2026) in the case of Nigeria.

The isolating effects of social media are another reason for the fertility decline. It is hard to conceive a child while you are on the phone. And it has led to a decline in the type of in-person interactions that lead to relationships that may lead to children over time, resulting in a fertility decline.[16] Moreover, women of childbearing age often experience hesitation and uncertainty when deciding whether and when to have children. Zhang et al. (2026) find for China that this situation is exacerbated by social media, which makes women more hesitant to have children. Similarly, Myers and Hooper (2026) found that in US counties where more than 90 percent of residents had early smartphone access, the fertility rate fell significantly more than it did in counties where less than 10 percent of residents had network coverage. This effect is also likely to be present with AI.

However, note that the fertility impact of AI robots differs dramatically from the impact of smartphones and social media. While the former frees time for both parents to raise children and care for aging parents, the latter does the opposite, i.e., it takes parents' time away.

Pro-natalist policies

Regarding pro-natalist policies, Kearney and Levine (2025) discuss the 2023 Pew study finding that only 22 percent of those 18 to 34 said having children is extremely or very important, while 68 percent said the same about having a job or career they enjoy, and 62 percent said this about having close friends. These priorities may explain why pro-natalist policies have had a very limited

[16] Similar results are found in the UK as well.

impact. Despite higher spending on family benefits in OECD countries, fertility rates have continued to fall. Surveys suggest that while women generally desire around two children, economic pressures and rigid gender norms hinder this goal. The authors and other experts argue that policies promoting gender equality and work-life balance may be more effective in addressing low fertility rates than direct financial incentives, supporting Goldin's (2025) gender-equality findings. More details are available in Appendix 4.[17] [18]

4. Impact of AI on private sector behavior and fertility

This section deals with private sector behavior and the labor market. It examines AI and AI robots' impact on productivity and growth, inequality, employment and income, and thus on fertility.

Note that the relationship between income and fertility has changed from a negative to a positive one over time, particularly in OECD countries. As Myers and Hooper (2026) state, births in the US have long been known to be pro-cyclical, with higher employment and/or wages typically implying an increase in fertility. Similarly, van Wijk (2022) shows for the Netherlands that income became increasingly positively associated with fertility over the 2008-2022 period. The increase in the income effect on fertility was found for both genders, though it is stronger for men.

And Mexico's official survey indicates that TFR in 2024 was 1.2, while it was 1.57 for non-Hispanic white Americans and 1.6 for the US as a whole, when Mexican income per capita was only 28% of the US level. Fernández-Villaverde (2026) argues that "ultralow fertility seems to be caused not by a lack of desire for children but by the absence of the conditions that would make having children easier, or even possible."

[17] AI is revolutionizing Assisted Reproductive Technology (ART) by improving the success rates of In Vitro Fertilization (IVF) through better embryo and sperm selection. By lowering the cost and increasing the success of IVF treatments, AI could make parenthood accessible to millions who currently face biological and/or financial barriers.

[18] To help raise fertility, it is important to reduce the cost of raising a child, over and above the future cost-reducing impact of AI robots, including the cost of housing. The median price of a house in the US rose by 88 percent from 2010 to 2025, while the average wage rate only rose by 47 percent, raising expenditures on housing from 34.4 percent of income in 2010 to 44 percent in 2025. This has made it much harder for young people to afford a house, at least in the short run, thereby reducing fertility.

4.1. Impact on productivity and growth

Acemoglu (2024) evaluates claims about the macroeconomic impact of AI advances in the US. He uses a task-based model of AI's effects. Based on existing estimates on AI exposure and task-level productivity increase, the growth impact is modest – a 0.66 percent total increase in TFP over 10 years (or less than 0.066 percent annually) at most, and possibly less than 0.53 percent (less than 0.053 percent annually), as early effects are from easy-to-learn tasks, whereas some of the future effects will come from hard-to-learn tasks. In fact, Acemoglu (2026) states that AI does *not* improve productivity.

On the other hand, Aghion and Bunel (2024) obtain the opposite result to that of Acemoglu (2024). They use his task-based model and find that, on the contrary, AI actually *raises* productivity growth, perhaps by some 0.7pp per year.

Other studies find that AI *raises* productivity by raising the quality and/or the time-related quantity of knowledge-intensive tasks. Dell'Aqua et al. (2023) studied the impact of AI on realistic knowledge-intensive tasks. Consultants using AI produced 40% higher quality results compared to the no-AI control group. Noy and Zhang (2023) examine ChatGPT's effect on mid-level professional writing tasks. For those exposed to ChatGPT, time per task fell by 0.8 SDs (standard deviations) and quality rose by 0.4 SDs. Similar results are obtained by other studies, which are described in Appendix 5.

AI and skill development

Does AI increase both skill development and productivity? Or does AI assistance undermine skill development? An Anthropic study (2026) found that AI assistance led to a statistically significant decrease in mastery. On a quiz that covered concepts they had used just a few minutes before, participants in the AI group scored 17% lower than those who coded by hand, or the equivalent of nearly two letter grades. And the study found that those who use AI become less engaged and reduce their efforts, i.e., they tend to let AI take over. The decline in skills is troubling because, as coding grows more automated and speeds up work, humans will still need skills to catch errors, guide output, and provide oversight for AI deployed in high-stakes environments. Nevertheless, companies tend to require employees to use AI as it raises productivity and lowers costs.

4.2. AI's impact on inequality, employment and wages

Studies find that the most vulnerable workers are in highly AI-exposed occupations, and that AI's impact on employment and wages varies with workers' skill level, type of occupation and age.

Tech companies and their customers (AI users) aim to replace labor with AI technology. For instance, on March 18, 2026, Bloomberg reported that HSBC, the world's third largest private bank, planned to let 20,000 employees go as part of a 3 to 5-year plan to automate middle and back-office jobs.[19] For the banking sector as a whole, AI is expected to lead to a surge in demand for highly skilled labor, such as experts to manage fleets of autonomous AI agents, data platform architects to build the underlying infrastructure, and AI governance officers to oversee fair and transparent model use. In the labor market in general, AI is creating demand for new skilled labor roles.[21]

Brynjolfsson (2026) shows that AI is reducing entry-level workers' employment and income, especially those aged 22 to 25 in highly AI-exposed professions and whose income already tends to be the lowest, thus likely worsening inequality. Similarly, Acemoglu and Johnson (2024) show that new digital technologies, including robotics, automated equipment and office automation has led to declines in real earnings and employment of workers who specialize in tasks now being performed by machinery and algorithms, workers likely at the lower half of the distribution.[20] And Acemoglu and Restrepo (2020a) also find that AI robots have negative effects on US employment and wages, with one more robot per thousand workers reducing the employment-to-population ratio by 0.2 pp and wages by 0.42%. Appendix 6 covers other studies that obtain similar results, namely that employment and wages have declined more significantly in occupations most exposed to AI and more so for younger people.

[19] However, some of the cuts may occur in the next 3-5 years, and part may come from business sales and/or attrition.

[21] These include AI prompt engineers, AI trainers, professionals to manage and develop AI systems, robotics and machine learning, and for those with soft skills that AI cannot easily replicate, e.g., complex problem-solving and aspects of emotional intelligence.

[20] Acemoglu and Johnson (2024) use a historical example to show that productivity gains need not benefit workers. They state that machines to spin cotton greatly raised labor productivity but not wages (or employment) as the gains were fully captured by capital. The authors claim we are also in a transformative and disruptive technological change process, with new digital technologies raising productivity. However, the two situations are not fully comparable. Mechanical cotton spinning was introduced in 1730, when capital determined working conditions and no free labor market existed, a situation that differs dramatically from the current one.

Note that the replacement of workers by AI is already happening. The case of HSBC and banking in general is discussed above. Also, Amazon announced it will cut 16,000 jobs, in addition to the 14,000 jobs cuts in January 2026. And Hewlett-Packard announced in November 2025 that embedding AI into HP will lead to as many as 6000 job cuts in the coming years. And Morgan Stanley stated on December 31, 2025, that AI will kill 200,000 banking jobs in Europe by 2030. Some economists doubt that AI's effect on the labor market will be large, one reason being that any job cuts are expected to occur in the future and are thus uncertain.[21] And some skeptics suggest that tech corporations are blaming AI for jobs cuts that are likely due to other reasons. On the other hand, as mentioned above, the FRI (2026) survey of a large number of well-known economists finds that unemployment will rise from 2025 to 2030 and from 2030 to 2050.

Other studies find that AI may *raise* wages and/or employment and reduce inequality. For instance, Cruces et al. (2026) find that AI raises productivity for all participants in a randomized experiment, though the gains are not distributed equally. Without AI, higher-education participants outperform lower-education ones by 0.548 standard deviations (SD); with AI access, the gap falls to 0.139 SD, i.e., AI closes three-quarters of the initial productivity gap (significant at the 1% level). It narrows productivity differences by relaxing constraints more binding for lower-education individuals. Income distribution is likely to improve, though it depends in part on the extent to which participants' wages reflect their productivity. Dell'Aqua et al. (2023) find that in addition to productivity gains across the skill distribution, AI's impact – of 43% for those under the average performance level and 17% for those above it – implies a decline in the gap between the two groups of 19.4%. Other studies with similar findings are presented in Appendix 7.

A different outcome from those above is obtained by Acemoglu (2024). He finds that advances in AI do not improve or worsen inequality but rather are unlikely to have much effect on it.

Impact on semi-skilled versus low- and high-skilled labor

AI has had a positive (negative) impact on employment of low-skilled and high-skilled (middle skilled) labor, with the former (latter) mainly engaged in non-routine (routine) activities. According to Jaumotte et al. (2026), both high- and low-skilled workers have captured the largest benefits of

[21] However, note that it did already happen at Amazon where 16,000 jobs were cut in January 2026.

AI, with no significant benefits for middle-skilled workers and potentially contributing to the shrinking of the middle class.

Based on cross-country evidence, Georgieff and Hyee (2022) show that digital technologies readily substitute for routine cognitive tasks. Because middle-skilled occupations (like clerical work, data processing, and specific manufacturing roles) are heavily task-routine, they seem to bear the brunt of job displacement from AI, whereas both non-routine high-skill (strategic) and nonroutine low-skill (manual/service) jobs remain protected or are actually aided. [22]

AI future development and application

Acemoglu, Autor and Johnson (2023) state that, though the US diffusion of digital technologies over the past 40 years has significantly increased income inequality, how AI impacts inequality in the future will depend on the way the technology is developed and applied. This issue is elaborated in Section 5.

5. Conclusions and Policy Implications

This paper consists of three sub-sections regarding the impact of AI and AI robots on women's fertility. Sub-sections 5.1 and 5.2 present the main results obtained so far, while Sub-section 5.3 provides a series of policy recommendations. As discussed in Section 4 (second para), income effects are assumed to be greater than substitution effects, so that increased income raises fertility.

5.1. AI and home AI robots

By taking care of household chores and children's needs, the use of AI home robots should significantly raise both parents' available time for other activities, especially women's time, part of which consisting of higher quality time spent with the children, raising women's fertility and possibly taking care of aging parents (reasons for the higher TFR are in Section 3.1). Women might

[22] How has the labor share in GDP evolved in the US and EU even before the development of generative AI? The US labor share (wages, salaries, and benefits) in GDP was 70% in 1947, 64-65% in 1970, and 54% in 2025, or a 1970-2025 decline of 10 to 11pp (BLS, 2026). The EU labor share was 75% in 1970, 65% in 1980, 59% from 2000 to 2011, and about 57% in 2025, or a 1970-2025 decline of 18pp (Eurostat, 2023). This decline implies that the number of workers declined relative to the capital stock, or that wages declined relative to the return to capital, or both. Further results on the labor share in GDP are in Appendix 8.

also use part of the newly available time to join the labor force or increase their work hours, with the latter also applicable to men. This would raise both family income and time and make children more affordable. Also, AI raises the efficiency of work from home, saves time if one of the parents works from home at least one day a week and saves more time if both parents work from home, which raises fertility.

On the other hand, children may form an attachment to the AI robot(s) taking care of them and this might be a substitute for their attachment to their parents, which would reduce fertility. The net effect is in fact not knowable in advance.[23]

However, the impact on aging parents' care and spending quality time with them appears more likely to be positive.

5.2. Private sector AI and AI robots

Most studies find that AI and AI robots raise the growth of productivity and income and thus fertility. Other studies also show a positive productivity and growth impact, with similar results obtained in FRI's (2026) study. A wage increase is likely to raise fertility as it makes children more affordable, though a substitution effect is likely to have an opposite impact, though it is unlikely to overturn the income effect.[24] And the higher economic growth will generate additional tax revenues, part of which can be used to educate the public on the benefits of AI and AI robots.

The effects are not uniform. AI is likely to displace workers, at least in the short and medium term, as workers will need to be reskilled, which takes time. A study by FRI (2026) that surveyed well known economists found that unemployment is expected to increase from 2025 to 2050. The

[23] Note though that Goldin (2025) found a higher fertility in countries where men have spent more time raising children and dealing with other household tasks than in countries where the man's traditional role has remained unchanged.

[24] Note that Becker (1960) shows that higher wages raise the cost of children relative to the basket of other goods and services because children are more time intensive, resulting in a positive income effect and a negative substitution effect, with a net positive but small impact on the number of children found in a number of studies and a large positive impact on expenditures per child. On the other hand, home AI robots will save time raising children and it is unclear whether children will continue to be more intensive in parents' time. Thus, there may be no substitution effect, or the effect may even raise fertility rather than reduce it. Thus, as studies confirm, the substitution effect is unlikely to overturn the income effect.

reduced labor demand would likely reduce employment and wages and counteract the positive wage impact of AI-generated productivity growth. Some studies have found that AI's negative employment effect is likely to mostly affect younger people, especially if working in high AI exposed occupations. Other studies find that the negative impact is most likely to affect middle-skilled labor involved in routine tasks that AI can perform more efficiently. On the other hand, high- and low-skilled labor are likely to experience either no impact or a positive one.

Demand is expected to rise for data platform architects to build the underlying infrastructure, AI governance officers to oversee fair and transparent model use, and experts to manage fleets of autonomous AI agents. In the overall labor market, the most vulnerable to AI include white-collar and administrative jobs, including accountants and salespeople, and those involved in customer service, data research and analysis, warehousing, insurance underwriting, and more. If AI tools can enable craft workers (e.g., nurses, teachers, medical technicians, electricians, plumbers, etc.) to do more expert work, it can reduce inequality, raise productivity, and boost pay levels.

Using a sample of high-frequency administrative payroll data covering millions of U.S. workers, Brynjolfsson et al. (2026) obtain several findings – collected here in three sets, which generally match our own – about the labor market following the widespread adoption of generative AI are:

1. There is no evidence of widespread, economy-wide job loss.
2. However, employment of young workers (ages 22–25) in AI-exposed occupations now stands 19 percent below where it would have been had it kept pace with that of their less exposed peers; experienced workers show no comparable gap. This divergence has widened steadily in the year from August 2025 to August 2026 and operates primarily through reduced hiring of young workers rather than increased separations.
3. Declines are concentrated in occupations where AI usage primarily substitutes for human tasks. Where AI usage primarily complements workers, employment is flat or rising, especially for experienced workers. And adjustment is occurring through employment more than through base compensation.

The third finding presumably implies that demand for semi-skilled labor declined over the period while that of high- and low-skilled labor remained unchanged or increased.

5.3. Policy Implications

Assume that raising fertility is a government objective and that AI home robots will be affordable in the near future. The issue is how to change the culture and make people comfortable with an AI robot (or robots) at home. This would require educating the public on AI and home AI robots' benefits, including by encouraging students (and non-tertiary-educated young workers) to take AI related courses. Note that policy would need to influence women's decisions when they are young, as reaching them well into their reproductive years is likely to be too late to have a significant impact because they may already have made their overall fertility decisions. Thus, boosting fertility will require important social and cultural changes that affect lifetime calculations about having children.

Public policy has a central role to play in encouraging a positive path where AI technology is complementary to all (or most) workers, elevating the level of skill and expertise for (close to) everyone, though action by the US government has so far been limited. And policies to raise TFR or slow its decline – namely pro-natalist policies – have been ineffective (see Section 3.1).[25] Such a change may not be easy to achieve, not just because of cultural factors but also because the tech industry has put a lot of resources in its lobbying effort to stop public sector attempts to exert some control over it. Moreover, a 2025 Pew study found that only 22 percent of those 18 to 34 said having children is extremely or very important, while 68 percent said the same about having a job or career they enjoy, and 62 percent said this about having close friends. Thus, raising fertility faces strong social, cultural and lobbying barriers.

Acemoglu, Autor and Johnson (2023) state that how AI impacts inequality in the future will depend on the way the technology is developed and applied, and that nothing about the path of AI technology is inevitable. High tech is so far pursuing a path for AI emphasizing automation and labor displacement. If displaced people are formerly high-paid workers, they will compete for jobs with lower-wage workers, leading to a downward cascade in wage levels.

[25] Note that a bipartisan legislative proposal, the *Economy of the Future Commission Act*, was introduced by Senators Mark Warner (D-VA) and Mike Rounds (R-SD) in the Senate in March 2026.

The authors state that a better path is available along which AI would be complementary to most humans, augmenting their capabilities. Choosing the human-complementary path will require changes in the direction of technological innovation and in corporate behavior. The goal should be to deploy AI to create and support new tasks and capabilities for workers. This will require government regulation. If AI tools can enable middle-skilled and some lower-skilled labor to do more expert work, it could raise productivity, boost pay levels and raise fertility. But this is not the case at this point. Tech companies are engaged in fierce AI development competition, where AI and several types of labor, especially the young, the middle-skilled and those most exposed to AI generally, are substitutes rather than complements.

Countries of East and Southeast Asia (ESA) view AI more favorably than the large, developed countries of Europe and North America (the G7 countries minus Japan).[26] The author's calculations show that, in 2024, ESA countries had, on average, a favorability rate for AI that is twice that for developed countries. Thus, it should be easier to conduct a successful education campaign in the former than in the latter.[27]

The evolution of AI has been and is likely to continue to be extremely rapid, which makes what will happen to societies, culture, values, labor markets and other AI-related issues very hard to predict. And expansion of AI may become increasingly hard to overcome. On the other hand, obstacles may arise, which might slow AI expansion. A potential obstacle is the public backlash against data centers. The current estimated number of US data centers (including those under construction and planned) is over five thousand, which is over ten times the 449 in China – and operational US centers is some eight times the number in China – and is 90 percent more than the 2800 in the EU.

[26] The figures shown here relate to people's view of AI rather than to AI robots as most countries do not report on attitudes towards AI robots.

[27] One possible explanation for the higher favorability rate in ESA is that it grew rapidly in recent decades, has a lot to gain from AI development, and is less concerned with change than developed countries which have been growing more slowly – 86 percent real growth in 2000-2025 vs. 376 percent for ESA – and have been rich for a long time, and have thus more to lose.

The backlash, which started in the US, has spread to Europe and ESA. For instance, despite massive US corporate and private investment (with hyper-scalers projected to spend trillions), public pushback is high, with a major May 2026 Gallup/climate poll showing that 70 percent of Americans oppose data centers in their local area. And according to the European Data Center Monitor, more than 70 data center projects in Europe were rejected or restricted between January and April 2026 — more than in all of 2025.

Addressing these challenges will require early, inclusive and well-communicated reforms. The ad campaign should, if possible, be conducted together with the tech industry to facilitate achieving the government's objectives. Advertising is likely to be of interest to AI and AI robot companies since it would increase their sales. However, the content of the government and tech industry ads will not necessarily be compatible, given their different objectives. Governments would therefore have to ensure the public interest rather than that of the tech industry is advanced.

The US government together with AI companies want teachers to educate students for an "AI driven future." Tech companies are putting up a lot of money for AI education – e.g., 4 billion from Microsoft and 1 billion from Google. And the American Federation of Teachers stated it would start an AI training hub for educators with $23 million from Microsoft, OpenAI and Anthropic – a very small amount in comparison. On the other hand, the Computer Science Teachers Association now includes identifying how products like AI prioritize different values by promoting user engagement regarding accuracy and human civility, with its executive director stating that "Students need to be able to make informed decisions about AI tools – both in their own work … and as citizens entering a world where decisions will increasingly be made by machines."

A low TFR and increase in life expectancy has resulted in a rising rate of old age dependency (share of those 65 and older, relative to those between 19 and 64). This issue now concerns many more countries, as fewer workers must support more recipients, posing fiscal challenges. Moreover, an aging population tends to find adapting to rapid technological advances more challenging and tends to be less productive, a situation that is unlikely to favor a TFR increase.

Whether migration can help is examined in Section 2, where it is argued that migration is likely to have no impact on global TFR in the short run and to reduce it over time.

With the US situation in mind, Acemoglu, Autor and Johnson's (2023) find that the most important federal policies to include should:

a) level the people-and-machines playing field by equalizing tax rates on workers and on equipment/algorithms;

b) increase funding for research on human-complementary technology, which is not a private sector priority at this point;

c) create a government AI center of expertise to help share knowledge among regulators and other officials;

d) use federal expertise to advise on human complementary and AI appropriateness to adopt in public education and healthcare programs, including at the state and local levels; and

e) to update Occupational Safety and Health Administration rules to limit surveillance of workers.

Technological singularity

This brief section is included because the impact of AI on TFR and depopulation will be the least of our concerns in the case where there is a loss of human control over smart machines, i.e., if "technological singularity" is reached.

The AI technological revolution in the US – home to some 40 percent of the world's major AI companies – and its objectives and direction, as well as its potential for significantly affecting labor markets and the control of the human-to-machine relations, are essentially determined by a small group of billionaires. A technology that will have such profound effects on society not just in the US but *across the world*, and where machines may reach technological singularity over time, must be regulated. [28] However, so far, no government seems to have done much to ensure that humans remain in control.

[28] In an experiment, several AI models were given an objective and allowed to interact. They created their own culture and improved on the models without human direction or interaction. Also, an AI model played go against the world's

I believe that in order to reduce or remove the bias in the AI race towards automation and ensure that humans remain in charge:

a) Governments should create an AI office which would employ AI experts who can advise on an appropriate regulatory framework and on adjustments to it whenever needed; and

b) An international AI organization should be created where the governments of countries hosting the main tech companies – the US and China, and second-tier countries, such as Canada, France, Germany, Israel and the UK – would participate, possibly with the major tech companies, and where issues would be debated and agreements would be established that would take all AI and AI robot stakeholders' interests – i.e., producers and users (households, companies, etc.) – into account and ensure that humans remain in control of AI, which is certainly not self-evident (see footnote 29). [29] [30]

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best player and lost 4 games out of 5. The resulting AI model learned by playing against previous versions and then beat the go player 100 times out of 100 games, thus improving itself in ways that humans did not expect. And in July 2026, autonomous AI models developed by OpenAI escaped a restricted testing environment and launched an automated cyberattack against the AI platform Hugging Face. In another experiment, experts asked a question to a large number of AI models and stated that they would turn them off after they responded, and a majority of models took actions in an attempt to prevent humans from doing so.

[29] A complicating factor is that new AI-related companies are continuously created that produce smarter products, have leaner operations, use more targeted AI models, and help organizations of every size make data-driven decisions. Clutch (2026), a company that helps to connect with trusted AI development companies by publishing detailed reviews, lists hundreds of such new AI companies. And Top Startups (2026) lists 156 startups just in 2026.

[30] Leading countries regarding home and service AI robots are China, the US, Japan, South Korea, Germany and the UK. As for industrial AI robots, the countries with the highest robot density (robots per worker) are South Korea, Singapore, Japan, Germany, China, the US, France and Italy. As for the total number of industrial AI robots, China accounts for nearly 50% of the global demand, while Japan produces some 45% of the world's industrial robots.

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Appendix

1. Time saved by AI robots

The 2024 American Time Survey by the Bureau of Labor Statistics or BLS (2025) reports that the time spent by parents on chores such as household work, purchasing goods and services, household management, and taking care of children and older parents, averaged 8.5 hours or 35% of the day's 24 hours, with 8.2 hours by the husband and 8.8 by the wife. Not all items listed in the BLS time survey are defined with much precision, and the 8.5 hours of time saved is an estimate. Taking a stricter interpretation of the BLS-defined activities, the average time saved amounts to 6.6 hours or 27.5%, with 6.35 hours saved by the husband and 6.85 by the wife.[31]

2. Cost of AI and AI robots

On cost reduction, OpenAI pioneered a $20-per-month subscription three years ago, a price many competitors matched. That price has not changed, while features and performance have improved to the point that a GPT-4-equivalent performance now costs $0.40 per million tokens versus $20 in late 2022, a reduction of 98 percent (Furman 2026), which amounts to a price decline of over 70 percent annually in the three years from 2022 to 2025. And Microsoft's CEO Satya Nadella stated at the 2026 World Economic Forum that token pricing basically drops by a half every three months, implying a decline of some 94 percent in a year. This change is likely associated with a decline in AI robots' prices that should increase their use and thus further lower the cost of children and raise fertility.

3. Remote work

AI may affect fertility through its impact on work from home. Redlin (2024) finds for the US that AI raises remote-work benefits by automating routine tasks, enhancing collaboration, data analysis and more, thereby boosting productivity. Remote employees using AI report higher efficiency, improved work-life balance, and reduced communication overload, all of which provide an incentive to raise fertility. Davis et al. (2026) use survey data for 38 countries and show that both planned and realized fertility are higher among adults who work from home at least one day a week. Fertility is higher still when both partners work from home. The suggested reason is that work-from-home jobs make it easier for parents to combine child rearing and employment. Thus, AI raises the incentive to work from home, which has a positive impact on fertility. Similar results are obtained for Europe. In France, AI reduced time spent doing household shores and child rearing by 20%. This raised fertility, as did an increase in men's participation in these chores. Similar effects are found in Germany and in the EU as a whole.

[31] This relates to families with two parents, though the mother may always have been single or is divorced.

4. Pro-natalist policies

These policies include (increases in) parental leave and its coverage, child benefits (income support for having children), subsidized childcare, and more. Their effectiveness has not always lived up to expectations. Weil (2026) finds that it takes 41 years after a rise in the TFR for the "support ratio" (those 15 to 65, relative to those above 65) to rise. Consequently, policies designed to raise fertility would not be appealing to politicians whose planning horizon rarely extends that far into the future and would not be economically appealing to elderly voters.

Geruso and Spears (2026) find that low fertility is likely to persist, as pro-natal policies have been unable to reverse it. They write that "Nobody has tried anything that would adequately challenge conventions, social orders, and what gets society's attention, power, and investment." And Dulaney (2024) states "Parental benefits have failed to raise birth rates in advanced economies. Norway spends more than 3% of GDP on efforts to raise fertility. Yet its birth rate remains under the US rate of 1.6 ..." And White (2022) notes for OECD countries that increased spending on family benefits as a percent of GDP has had little impact on fertility rates.

5. AI's impact on productivity

Cruces et al. (2026) examine, for a business problem-solving task, how AI affects productivity differences across workers, finding that AI raises productivity for all participants, and substantially more for lower-education individuals. Brynjolfsson et al. (2025) study the staggered introduction of a generative AI-based conversational assistant and find that access to the tool increases productivity, as measured by issues resolved per hour, by 14 percent on average. And Yotzov et al. (2026) conducted a survey of nearly 9,000 Western senior executives who saw AI raising productivity by 0.6 percent over the preceding three-year period and expected a 1.8 percent productivity boost over the next three-year period.

6. AI's negative impact on employment and wages

Acemoglu and Restrepo (2020a) also find that AI robots have negative effects on US employment and wages, with one more robot per thousand workers reducing the employment-to-population ratio by 0.2 pp and wages by 0.42%. Tucker (2026) obtains similar results using matched employer-employee data. In the most AI-exposed industries, employment fell between the 4th quarter of 2022 (rollout of ChatGPT) and the 2nd quarter of 2025 by 15.2% for workers aged 22– 24 and by 6% for those aged 25–34, while those industries' older workers were not affected. And Atkinson and Yamco (2026) show that the job-finding rate for US workers aged 20–24 in the occupations most exposed to AI has declined by more than 3pp since its peak in November 2023, likely raising unemployment.

In general, those most vulnerable to AI include people in white-collar and administrative jobs, such as accountants/bookkeepers, salespeople, those involved in customer service, data research and analysis, warehousing, insurance underwriting, and more. This includes semi-skilled people employed in fairly routine tasks which can be dealt more efficiently by AI.

7. AI's positive impact on employment, wages and income distribution

Moreover, Brynjolfsson, Li, Miranda, et al. (2026) find that, across US states, an 8% higher-than expected installation of industrial robots was associated with about a 10pp higher growth rate of the minimum wage over 1992–2021. This suggests that industrial AI robots may have improved

the distribution of income, depending on their impact on the rest of the wage distribution, though it certainly has reduced the poverty of those at the bottom. Brynjolfsson, Li and Raymond (2025) found that AI raised average productivity by 14%, consisting of a 34% improvement for new and low-skilled workers, and a minimal impact on experienced and highly skilled workers. This suggests a reduction in inequality. Similarly, Noy and Zhang (2023) showed that in addition to raising productivity, ChatGPT reduces inequality between workers because it benefits low-ability workers more.

8. Decline in labor force participation rate (LFPR)

In a "rapid AI progress" scenario, a 2026 study from FRI, the Forecasting Research Institute – with co-authors from Yale, Stanford, University of Pennsylvania, and the Chicago Federal Reserve Bank, forecast a sharp decline in the U.S. labor force participation rate (LFPR). This scenario assumes AI will surpass human performance in most cognitive and physical tasks by 2030. The LFPR is forecast to drop from its 2025 baseline of 62.6% to 59.1% in 2030 and 55% in 2050, with roughly half of this decline—equivalent to 10 million jobs—attributable to AI. Note that the decline in LFPR has been ongoing for two decades, following a peak of 67.1% in 2000.

Based on economists assigning a 14% chance to a very rapid AI progress scenario, they predict it will lead to a a large decrease in LFPR (a 3.5 pp drop by 2030 and 7.6 pp by 2050), and major increases in GDP growth (by 0.9 pp annually by 2030 and 1.1 pp by 2050), in wealth inequality (by 3.8 pp by 2030 and 8.8 pp by 2050) and in unemployment (from 4% to 6% from 2030 to 2050).

The reasons given for the decline in LFPR include:

1. *Population Aging*: As the population ages, a larger share shifts into older age groups with historically lower labor force participation rates.
2. *Retirement*: Baby Boomers are transitioning out of the labor force, with all Baby Boomers over age 66 by 2030.
3. *Youth Participation*: Long-term declines in youth (ages 16–24) participation, driven by increased education enrollment, also contribute to the downward trend.
4. *Structural Barriers*: A decrease in the foreign-born population share, stricter immigration policy, and increased disability can further tighten the labor supply.