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Policy Brief

The Senior Bulge

Anticipating and Addressing the Aging Boom

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Our world has entered uncharted territory. In 2018, the number of people on the planet age 65 and older exceeded those under four for the first time in history; by 2050, the 65+ cohort will surpass adolescents and youth (ages 15–24).[1] Following centuries of a growing population dominated by an increasing number of young people (a "youth bulge"), a stunning reversal in global population demographics has occurred: the onset of a "senior bulge." What will a world with an increasingly aging population be like? How should societies prepare to adapt? Can we specify how and to what extent the senior bulge will or has already begun to influence political, social, and economic trends? The answer to these questions is nuanced, as the senior bulge's impact will likely vary depending upon local demographic, technological, and policy contexts. Nonetheless, it is a critical global story, and one amenable to policy intervention.

THE USE OF HISTORY

History offers valuable lessons for the study of political demography. Not long ago, the idea of a world with an aging society would have provoked skepticism, and with good reason, as over the past several centuries, population growth has skyrocketed: In 1800, there were one billion people; today, estimates are 8.2 billion.[2] To many living in the twentieth century, demographic concerns therefore centered on how to respond to a world with a rapidly accelerating and seemingly endless world population growth. In 1968, biologist Paul Ehrlich released his now infamous *The Population Bomb*, a book that warned of an imminent Malthusian catastrophe in which the global order collapses due to its inability to manage its surplus of people. Now, more than fifty years later, his alarmist predictions look quaint. Yet although it is now easy to look back in ridicule at Ehrlich's dire predictions, we must not forget that at the time of its release, *The Population Bomb* was a sensation, selling more than two million copies worldwide.[3]

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The notable failure of the majority of *The Population Bomb*'s predictions provides a cautionary tale in projecting trends into the future. Annual population growth peaked during the very decade in which Ehrlich released his study.[4] What were the assumptions underlying Ehrlich's model, and why did they prove so misguided, such that we now find ourselves confronted with a demographic phenomenon the very opposite of the one he had predicted? How can our analysis avoid a similar fate?

It is tempting to embrace the opposite extreme. Consider Darrell Bricker and John Ibbitson's *Empty Planet: The Shock of Global Population Decline* (published in 2019), which argues that the global population is not on track for exponential growth as traditionally predicted but instead will peak mid-century at around nine billion before entering a steep and permanent decline.[5] We do not have a "population bomb," but do we really have an "empty planet"? To an extent, predictions about aging societies cannot be wrong; the seniors of the future have already been born.[6] And yet, there is a danger in assuming that trends observed today will inevitably continue into the future and, worse, that this is singularly alarming. Could changing social norms, such as increased flexibility in work-life balance or more equitable parental leave policies, encourage higher fertility rates? Might advancements in healthcare and assisted reproductive technologies make it easier for people to have children later in life?

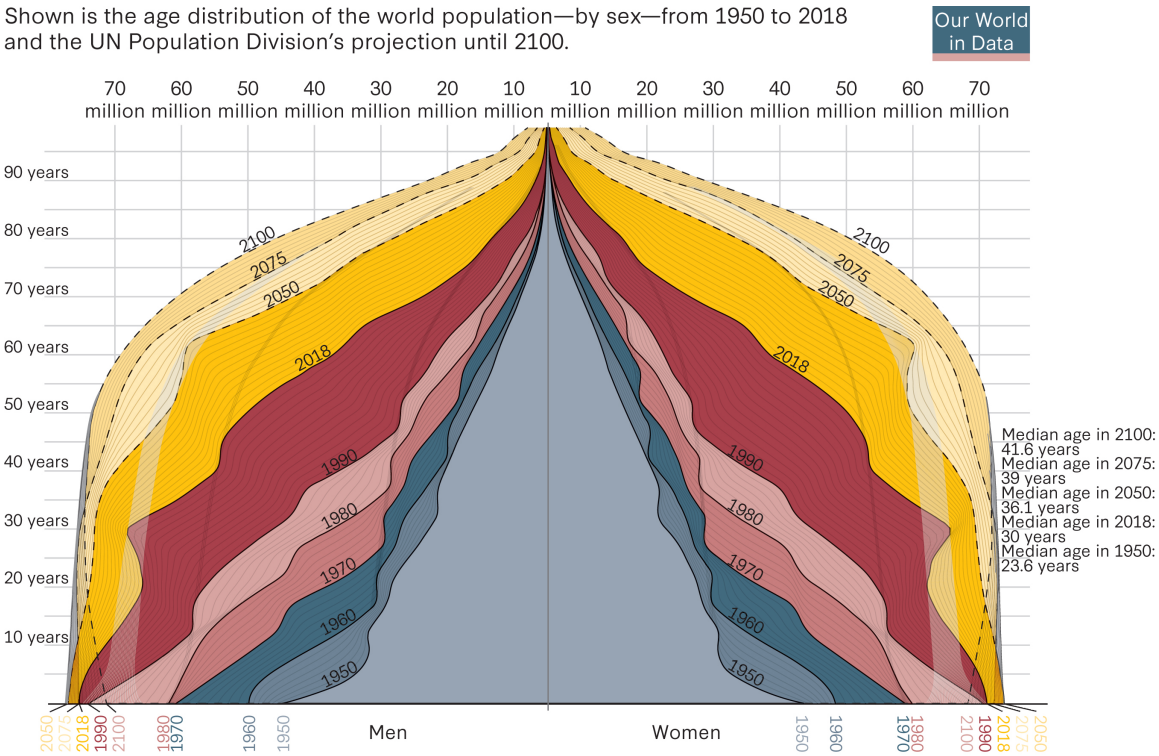
Global population statistics do show an aging world. Many of us already live in it. Over the last century, the changing age structure of the world's population has indeed led to a global turning point in population history, one in which our seniors represent a dominant component of the population. Hans Rosling, professor of global health, famously coined the phrase "peak child" to describe the period in global demographic history when the number of children under the age of five stopped increasing. According to statistics from the United Nations World Population Division, the world hit this peak in 2017.[7] Our contention is that this decisive, manifold trend can be managed, for the better.

THE SALIENCE OF THE SENIOR BULGE

Consider a population pyramid (figure 1), a graph that allows us to visualize the demographic makeup of a population. For much of the 1950s onward, an increase in the number of children fueled world population growth. Yet going forward, a "fill in" of the population above the base, as opposed to a widening of the base, will drive population increases.[8] As the number of children starts to decline, the number of people age 65 and older will grow significantly—and not just because so many more of their cohort were born. The world's current population will most likely live longer than any previous generation, as improvements in global health will allow the life expectancy of subsequent generations to increase still more.[9] Planetary success is now a problem. Better life management today requires even better life management tomorrow.

Given the plethora of demographic trends worth analyzing, from the surging youth populations of sub-Saharan Africa to the rapidly graying societies of East Asia, why have we chosen to focus on the "senior bulge"? As the world confronts demographic shifts such as growing urbanization, changing migration patterns, and absolute population decline in some extreme

FIGURE 1 The Demography of the World Population from 1950 to 2100



Source: Max Roser, *Our World in Data*, September 2019, updated February 2024, https://ourworldindata.org/global-population-pyramid.

cases (for example, Italy and Japan), why do we contend that the senior bulge warrants special attention? Firstly, in our studies of demographics thus far, only recently has the scholarly literature engaged with the implications of an aging world. Ample room therefore exists for continued examination of the senior bulge phenomenon. Secondly, whereas other demographic shifts affect only specific geographic regions or countries at certain stages of development, with the exception of sub-Saharan Africa, the entire world is currently experiencing or will soon experience the senior bulge.[10] Examining its drivers is therefore critical for all countries as well as for the regional and international organizations that can respond to its costs and consequences.

The senior bulge is furthermore a result of two sub-demographic shifts, as increasing life expectancy and decreasing fertility rates have combined to create this phenomenon. To understand the senior bulge therefore requires engaging with the drivers of each individual trend and analyzing the results of their interaction. More than that, the consequences of an aging world will have significant economic, political, and social implications: The senior bulge will demand changes to our welfare states, require a new perspective on how best to reap the benefits of migration, and influence when and how nations wage war. It will interact with technology, which could counteract or exacerbate its effects (or do both,

depending on the time and place), leading to new uses of existing technologies and potential increased investments in developing new ones. As such, understanding the senior bulge's context, identifying its emerging trends, and determining potential policy solutions are critical for navigating the planet's demographic transition. It can either be a crushing burden, or an opportunity.

THE SENIOR BULGE IN CONTEXT

The senior bulge is driven by several key trends: the post–World War II baby boom that produced unusually large cohorts of births, the expansion of the welfare state in mid-twentieth-century societies to support those cohorts, the continuously rising life expectancy rates due to medical and public health advances, the declining fertility rates as families have fewer children, and an evolving role of women that includes greater workforce participation and delayed childbearing. Collectively, these shifts mean that more people are living longer while fewer babies are born, causing older age groups to make up an unprecedented share of the population.

The senior bulge poses profound challenges to traditional economic, military, and social structures, as modern economies and social insurance systems were built around the assumptions of a large youthful workforce and a relatively small retired population. Those assumptions are now being upended. Many nations face looming labor shortages and slower economic growth as the workforce ages and shrinks. Military organizations worry about a dwindling pool of young recruits to sustain their forces. Socially, the weight of an aging electorate and the burden of caring for millions of seniors are testing intergenerational support systems. As societies age, they must adapt institutions that were designed for another era to a new reality of longevity and lower fertility.

THE POST-WORLD WAR II BABY BOOM AND ITS CONSEQUENCES

The first major driver of today's senior bulge was the post-World War II baby boom. In the aftermath of World War II, many countries—especially the United States, Canada, Australia, New Zealand, and much of Europe—experienced a surge in birth rates. Between 1946 and 1964, birth cohorts were larger than those immediately before or after that period. In the United States, annual births jumped from about 2.6 million in 1940 to over 4 million per year by the mid-1950s.[11] The total fertility rate in the US surged to over 3.5 children per woman at the peak of the boom, compared to around 2.1 (replacement level) in the 1930s. As noted above, similar baby boom patterns occurred in other countries, fueled by postwar economic optimism, the rates of youthful marriages, and a desire for normalcy after the disruptions of depression and war.[12] By the end of the 1940s, about thirty-two million babies had been born in the US (versus twenty-four million in the 1930s), and annual births topped four million from 1954 until 1964. This massive generation of "baby boomers" now forms the core of the senior bulge as they enter their 70s, 80s, and beyond. These boomers (around eighty-three million in the US) constituted about 28 percent of the US population in 2010, and their aging is a primary factor increasing the share of seniors today.

Governments did not ignore this demographic bonanza; in many countries the baby boom was accompanied by the rapid expansion of welfare-state programs to support the growing population. From the 1950s through the 1980s, social spending rose dramatically across advanced economies. In the United States, the Great Society initiatives of the 1960s introduced Medicare and Medicaid, complementing the preexisting Social Security pension system. Similarly, many western European nations built out comprehensive pension, healthcare, and social safety net programs during the postwar decades. As a result, public social expenditures in member countries of the Organisation for Economic Co-operation and Development (OECD) more than doubled from under 10 percent of GDP in 1960 to over 20 percent by recent years.[13] Two-thirds of this social spending goes toward pensions and health services, reflecting the heavy focus on supporting the seniors. These systems were, at the time of their design, financially supported by the demographic reality of the baby boom: a large base of young workers supporting a relatively smaller retired cohort. In the US, the 1965–1987 period saw especially rapid growth in welfare spending as the federal government entered new areas such as healthcare and education, anticipating the needs of a populous generation.[14] Crucially, these programs assumed that beneficiaries would draw on support for only a few years after retirement. Social Security, for example, set its initial retirement age at 65 in an era when life expectancy at birth was under 62 and only about half of those who reached adulthood would survive to 65.[15] A man who turned 65 in 1940 could expect to spend about 12.7 years in retirement on average, whereas a man turning 65 in 1990 could expect around 15.3 years of benefits. The welfare state was calibrated for a world of short retirements and high worker-to-retiree ratios. Those calibrations have been fundamentally altered by longer lifespans and lower birth rates, leaving social support systems strained.

INCREASING LIFE EXPECTANCY: A LONGER RETIREMENT PERIOD

One of the most significant demographic shifts leading to the senior bulge is the steady rise in life expectancy. People today live far longer on average than their counterparts of even a few generations ago, which means more years spent in older age. In the 1960s, life expectancy at birth in most developed countries ranged roughly from the mid-60s to low 70s. US life expectancy was about 70 years in 1960. By contrast, today life expectancy in the United States is about 79 to 80 years—slightly lower in recent years due to pandemic-related mortality, but roughly a decade longer than sixty years ago.[16] Many other developed nations have even higher life expectancy figures. Japan's life expectancy is about 84 years, and numerous western European countries have life expectancies in the 81 to 83 range.[17] Globally, the trend is the same: In 1960 the average human could expect to live around 52 years, whereas by 2021 the global average life expectancy exceeded 71 years, despite lower incomes and higher infant mortality in developing regions.[18] Public health improvements, medical advances (such as vaccines, antibiotics, and better treatments for chronic diseases), higher living standards, and safer work environments all contributed to this longevity revolution.

A longer life means a longer retirement. Whereas social insurance systems once planned for retirees spending around a decade receiving pensions, now it is common for people to live twenty or even thirty years beyond retirement age. In the United States, the average remaining life expectancy at 65 increased by roughly five years from 1940 to 1990, and it has continued

to rise. As of 2020, an American who reaches age 65 has roughly an eighteen- to twenty-year life expectancy ahead, meaning that many will live into their mid-80s or beyond.[19] Similar or greater gains have occurred in other countries. The implication is that public pension systems and healthcare programs for seniors must support each individual for much longer than originally anticipated, greatly increasing total outlays.

For example, paying a retiree's benefits for twenty to twenty-five years rather than ten to fifteen years multiplies the cost per person. Healthcare spending also skews heavily toward older age, so an expanding senior population with greater longevity drives up national healthcare expenditures. As a result, many countries have seen senior healthcare and long-term care become among the fastest-growing budget items. Systems designed when workers far outnumbered retirees are coming under stress as that ratio narrows. In the US, there were about 5.7 workers per Social Security beneficiary in 1960; today, that ratio has fallen to under 3 and is projected to drop close to 2 by 2035, as the last of the boomers retire. The costs of pensions, healthcare, and eldercare are rising accordingly, pressuring government budgets and younger taxpayers.[20] Another effect of increased life expectancy is the changing nature of work and retirement. It is important to note that with better health at older ages, more seniors are remaining economically active longer, whether by choice or necessity. It is not uncommon now to see people working into their late 60s and 70s, a trend encouraged by policies raising the official retirement age to reflect new longevity. The extension of life expectancy has effectively lengthened the period of "elderhood," amplifying the senior bulge and challenging societies to support a growing cohort of the long-lived seniors.

DECLINING FERTILITY RATES AND THEIR IMPACT

Counterbalancing that of longer lives, the other major demographic shift is declining fertility. The baby boom was followed by a "baby bust." Over the last half-century, birth rates have fallen sharply in most parts of the world, especially in developed economies. In the late 1950s, a woman in the United States had on average about 3.7 children in her lifetime.[21] Today, the US total fertility rate is around 1.7, the lowest level on record.[22] Following the postwar boom, fertility rates plummeted through the 1960s and 1970s. By the 2000s, many advanced societies had total fertility rates well below the replacement level of 2.1 (the rate needed to maintain a stable population in the absence of immigration). OECD countries' fertility averaged only about 1.5 in 2022, down from 3.3 in 1960. Some countries are even lower; for instance, South Korea's fertility rate has recently fallen below 0.8, and southern European nations such as Italy and Spain are around 1.2.[23] This means each generation is considerably smaller than the one before in these societies. Globally, the trend is similar. In the 1950s, the world fertility rate was about 5.0, whereas by 2021 it had more than halved to 2.2.[24] The decline from high birth rates to low birth rates is a defining feature of the demographic transition that accompanies economic and social development. The decline began in Western countries, but it has since spread to much of Asia and Latin America. Even many developing countries have seen substantial fertility declines in recent decades.

Several key drivers explain this broad decline in fertility: first, increased access to contraception and family planning. The twentieth century had widespread availability of effective

birth control (notably the Pill from the 1960s onward), allowing women to reliably control the number and timing of children. Contraceptive use rates rose dramatically in many regions—for example, the share of women using modern contraception in sub-Saharan Africa more than doubled from 13 percent in 1990 to 29 percent by 2019.[25] Additionally, as societies become more urbanized and education levels rise, large families are often less economically advantageous or desired. Couples tend to prioritize investing more resources in fewer children. Today, both young men and women increasingly find meaning in life outside of parenthood, a marked shift from the mid-twentieth century, when starting a family early was a near-universal expectation. Marriage is often postponed or forgone and childbearing delayed. The average age of first childbirth has climbed in many countries. Across the OECD, the average age of women at first birth is now around 30 (rising from 28.6 in 2000 to 30.9 in 2022). This delay inevitably compresses the childbearing years and often results in fewer children. Moreover, a growing share of women (and men) remain childless by choice. In some countries, the proportion of women born in 1975 who never had children is double that of women born in 1935.[26]

The economic calculus of raising children has become a deterrent in many developed societies. The direct and indirect costs of child-rearing (education, housing, childcare, lost income for stay-at-home parents, etc.) have surged. Meanwhile, careers have become more demanding. Especially in prosperous but high-cost societies, having many children can be seen as financially onerous. The OECD reports that financial uncertainty and the high cost of raising children are significantly influencing people's decisions to have fewer or no children.[27] When young adults face expensive housing, student debts, or insecure jobs, they often postpone family formation. The impact of declining fertility is directly linked to the senior bulge: With fewer young people being born, the age distribution of the population skews older over time. Smaller youth cohorts mean relatively fewer entrants to the labor force and, down the line, fewer taxpayers to support retirees. In effect, low fertility "hollows out" the base of the population pyramid. One immediate consequence has been the shrinking ratio of working-age adults to senior dependents. Many pay-as-you-go social security systems rely on current workers' contributions to pay current retirees' benefits. This support ratio has deteriorated markedly.

THE ROLE OF WOMEN: WORKFORCE PARTICIPATION AND SOCIAL CHANGE

The twentieth century had a profound transformation in the role of women. Expanded opportunities for women in education and the workforce have had a direct impact on fertility patterns, family structure, and the economy. In the postwar era, women increasingly pursued higher education and careers, delaying marriage and childbirth. For example, in the United States the female labor force participation rate climbed from roughly 34 percent in 1950 to nearly 60 percent by 1998, a doubling of the share of women (age 16 and over) who were working or seeking work.[28] By the early twenty-first century, women made up nearly half the labor force in many advanced economies. Women's educational attainment also rose. Today, women often outnumber men in tertiary education in North America and Europe. With greater career prospects, many women have chosen to establish themselves professionally before starting families. The effect on childbearing has been significant: The age of

first marriage and first birth have both risen throughout the developed world. As noted, the average age at which women have their first child now exceeds 30 in a number of countries, whereas it was in the early 20s during the baby boom years. Having children later typically correlates with having fewer children overall, contributing to the fertility decline. The empowerment of women in the workforce has therefore tended to reduce birth rates, at least in the absence of mitigating policies.

The changing role of women has also reshaped the labor market and the welfare state in important ways. On one hand, increased female workforce participation has been a boon to economies. It has expanded the labor supply, boosted GDP, and increased the number of contributors to social security systems. The influx of female workers has helped offset the aging of the male workforce to some degree. Yet it has also introduced new social policy needs: Working women have required support to balance employment and family, leading to the expansion of maternity leave, parental leave, and childcare programs in many countries. Nations have taken different policy approaches. Some, particularly in northern Europe, have adopted extensive family-friendly policies that enable women to participate in the labor force and raise children with the help of subsidized childcare, generous parental leave, and flexible work arrangements. In those societies, fertility rates, while low, have remained nearer to replacement level (for instance, France and Sweden maintain fertility rates around 1.7 to 1.9) than in societies with less support. In modern developed countries, the historical trade-off between female employment and fertility has softened: Since the mid-1980s, the correlation between women's workforce participation and fertility has turned positive in the OECD countries.[29] In other words, countries that facilitate women's employment and parenting tend to have higher birth rates than those where working mothers receive little support. By contrast, some countries facing ultralow fertility (such as Japan, South Korea, parts of southern Europe) are now experimenting with incentives like cash bonuses for babies or tax breaks, but these have had limited success so far.

For the welfare state, women's changing role presents both opportunities and challenges. With more women earning income, the tax base broadened and social security contributions increased, helping finance benefits, including those for the growing senior population. At the same time, because working women often have fewer children, the long-term demographic support ratio is weakened. This dynamic has forced policymakers to consider comprehensive approaches, namely, policies that support working mothers (childcare, flexible hours, parental leave) versus policies that directly incentivize larger families. The former aim to make it possible to have both a career and a family, whereas the latter (like onetime baby bonuses) try to encourage higher fertility outright.[30] The revolution in women's social and economic status has been a critical factor in the demographic equation. It has contributed to lower fertility and later births but also delivered a more gender-balanced workforce that bolsters economies and the financing of social programs. Any solutions to the challenges of the senior bulge will likely involve building on the gains of women's empowerment while finding new ways to support families in an aging society.

EMERGING TRENDS

The intersection of technological advancement, demographic shifts, and geopolitical realities is shaping new trends in robotics, labor mobility, and warfare. As aging populations put pressure on eldercare systems, robotics is emerging as an apparent solution to the high cost of healthcare labor—though cultural acceptance remains a potential bottleneck in its deployment. Simultaneously, global migration patterns are evolving, with labor mobility increasingly shaped by regional economic conditions and policy restrictions rather than open-market demand alone. Meanwhile, shifting demographics are also reshaping military capabilities, as aging populations limit the availability of personnel for prolonged conflicts, necessitating greater reliance on automation and precision warfare. These interconnected trends highlight the ways in which demographic pressures and technological advancements are redefining industries, labor markets, and global security strategies.

ROBOTICS

As aging populations strain eldercare systems worldwide, particularly in nations experiencing the "senior bulge," the high cost of robotics and challenges with cultural adaptation will lead to a dual-strategy approach. Governments and care providers will invest in both robotic assistance and low-skilled migrant labor to mitigate costs. However, the primary barrier to widespread adoption will not be financial but rather the cultural acceptance and practical integration of robotic technology into caregiving. Service robots—those designed to aid with physical tasks such as picking up items—are likely to find greater success than social robots, which aim to provide companionship.

Cultural Adoption Will Be a Higher Barrier Than Economics for Robotics in Eldercare

Japan has been a pioneer in developing eldercare robots for over two decades, with government and private sector investments accelerating in the 2010s. By 2018, the Japanese government had allocated over $300 million toward research and development in this sector. Robots in eldercare take on a variety of roles, from physical assistance—such as lifting, mobility support, and fall detection—to social engagement and cognitive stimulation. However, these robots remain costly to produce and maintain, limiting their accessibility to well-funded institutions and wealthy individuals.[31]

Despite the availability of this technology, its adoption has been slow. A national survey of over nine thousand eldercare institutions in Japan found that as of 2019, only about 10 percent had introduced any form of care robot. Among home caregivers, the adoption rate was even lower, with just 2 percent reporting experience using such robots. Many of the robots that are purchased end up being abandoned due to practical difficulties. Care robots often require significant maintenance and oversight, leading to increased workload for caregivers rather than reducing it.[32] Facility managers recognize the potential of these devices to alleviate labor shortages, but their implementation remains a challenge.[33]

The financial burden of robotics in eldercare remains high. Developing a single advanced robot, such as Ryan, has cost upward of $6 million. Care homes that wish to lease such a robot would face costs of around $1,200 per month for ten users, while base prices for purchase of some robotic models reach $37,000—excluding software, maintenance, and training.[34] Although this is less than the estimated $41,000 annual salary of a human caregiver, the up-front investment and ongoing operational costs create significant barriers to entry.[35]

Service Robots Will Be Utilized More than Social Robots

Service robots, which provide tangible assistance such as lifting, feeding, and monitoring, are more likely to gain acceptance in eldercare settings. In contrast, social robots designed for companionship face significant resistance. Surveys indicate that even tech-savvy adults view social robots as "creepy," "manipulative," and "unethical," doubting their ability to provide genuine companionship.[36] Moreover, older adults are among the least likely demographic to change their attitudes toward new technology, further hindering widespread adoption of social robots.

Given the persistent cultural and practical barriers to robotic caregiving, the most viable future model will likely involve a hybrid system, combining human caregivers with robotic assistance. To control costs, eldercare facilities may rely on low-skilled migrant labor while leveraging service robots in specific roles. Large, highly standardized facilities will be better positioned to absorb the costs and operational complexities of robotics, enabling economies of scale that could make these devices more viable.[37] However, without a shift in cultural attitudes toward robotic care, large-scale adoption will remain an uphill battle.

LABOR MOBILITY

As the global labor landscape evolves, migration trends and workforce needs are shifting in complex ways. While sub-Saharan Africa's rapidly growing population might suggest increased international migration, most movement remains within the continent due to regional opportunities and lower migration barriers. Meanwhile, the United States continues to receive the majority of its migrants from Latin America, where long-standing economic and geographic ties drive both low- and high-skilled migration. Despite the rise of remote work, the US labor market still faces persistent demand for in-person workers across key sectors, highlighting that virtual employment cannot fully substitute for physical labor. The following sections explore these dynamics in more detail.

People Are Not Likely to Leave Sub-Saharan Africa, Despite Its Large Working-Age Population

Migration patterns within sub-Saharan Africa suggest that potential migrants are more likely to move internally rather than leave the continent. Approximately 79 percent of sub-Saharan African migrants relocate within the region, with Côte d'Ivoire, South Africa, and Nigeria being primary destinations.[38] Several factors contribute to this trend, including economic opportunities in neighboring countries, cultural and linguistic similarities, and geographic proximity.

Additionally, migration within Africa often entails fewer legal and financial barriers compared to external migration, making it a more viable option for most individuals.

While some sub-Saharan Africans do move internationally, Europe tends to be a more common destination than the United States. Stricter immigration policies and geographic distance make migration to the US less feasible for many potential African migrants. This means that despite its rapidly growing working-age population, sub-Saharan Africa will likely remain a region of intraregional labor movement rather than a major source of US immigration.

The United States Will Continue to Receive Most Migrants from Latin America

Historical trends indicate that the majority of United States–bound immigrants will continue to come from Latin America, particularly Mexico and Central America. Over the years, the US has seen significant migration waves from these regions due to economic opportunities, geographic proximity, and established migrant networks.

While labor migration continues to be a significant driver, the composition of migrants is evolving. High-skilled professionals from Mexico, such as engineers, scientists, and entrepreneurs, are increasingly taking advantage of visa programs like TN visas under the US-Mexico-Canada Agreement (USMCA).[39] Additionally, Mexico's growing innovation hubs, particularly in Jalisco, are producing more technologically skilled workers, some of whom seek opportunities in US tech hubs like Silicon Valley.[40] Educational exchanges between the US and Mexico also contribute to a steady flow of students and researchers crossing borders for academic and research purposes.[41]

Despite these shifts, migration from Central America and Mexico is still largely driven by economic disparity and labor market demands in the US, particularly in industries requiring physical labor. This suggests that although the skill level of some migrants may be increasing, the overall labor-driven migration trend from Latin America will persist.

Remote Work Will Not Replace the Need for Physical Labor

Although online remote work has expanded opportunities for certain professionals, it will not significantly impact the demand for physical labor in the United States. Many of the jobs in highest demand require an in-person presence and cannot be performed remotely. For example, the healthcare sector continues to experience shortages of nurses, nurse practitioners, and other specialists due to an aging population and expanded healthcare access.[42] Similarly, the increasing demand for mental health services has heightened the need for therapists, counselors, and social workers, all of whom provide services that typically necessitate physical interaction.[43]

Beyond healthcare, the US economy also relies heavily on labor-intensive industries. The construction and skilled trades sectors, including welders and electricians, are experiencing worker shortages, which cannot be filled by remote workers.[44] The logistics industry faces similar challenges, particularly in trucking, where a nationwide shortage of certified truck

drivers is straining supply chains.[45] These labor shortages highlight the ongoing need for physical workers, particularly in blue-collar industries that cannot be replaced by automation or digital solutions.

Additionally, while remote work has increased in fields such as software development, artificial intelligence, and data analysis, the broader labor market trends suggest that the US economy will continue to require a steady influx of in-person workers. The demand for civil, electrical, and mechanical engineers, which are typically in-person roles, remains high due to aging infrastructure and skill mismatches.[46] In contrast, remote workers are unlikely to replace the physical workforce in sectors such as construction, transportation, and healthcare.

WAR

New war technologies, such as drones and advanced decision-making tools, can enhance military effectiveness by improving precision and reducing the risk to soldiers. However, these technologies primarily benefit operations that do not require extensive ground forces, such as drone strikes.[47] Although drones can be effective in counterterrorism and other specific scenarios, they do not fully replace the need for ground troops in many situations where boots on the ground are often necessary. This limitation underscores the continued importance of manpower in military operations, despite technological advancements.[48] The aging population and changing demographics necessitate new recruitment strategies. For instance, the US Army is adapting by targeting younger generations and exploring older recruits, who often have higher qualification scores and reenlistment rates.[49] However, these efforts may not fully offset the broader demographic challenges. The strain on military healthcare systems due to an aging veteran population further complicates resource allocation. Veterans increasingly depend on the Department of Veterans Affairs for long-term care, which may struggle to meet these demands.

While technology can enhance certain aspects of military operations, the demographic trend of an aging population will continue to challenge the ability of developed nations to maintain large armies and engage in prolonged conflicts. The shift toward smaller, more technologically advanced forces may become more prevalent, but the fundamental need for manpower in many military scenarios remains unchanged. This reality highlights the importance of adapting military strategies to address the constraints imposed by demographic trends.

SHIFTS IN EMERGING TRENDS

There is some comfort in making predictions about demographics. Namely, demographics lend themselves well to high credence claims about the future—for example, we can predict with accuracy the number of seniors in the United States around the year 2040. Not only are demographics relatively easier to predict than volatile political shifts, for example, but they also play an undeniably strong causal role in the issues discussed so far. For this reason, in thinking about the future, demographics are a tempting starting point when considering trends.

Yet, projections about the future that have been made by leveraging demographics have been dangerously false before. Not too long ago, the greatest fear was not depopulation but overpopulation and a quasi-apocalyptic overpopulation on the order of mass famine. Of course, with the benefit of time, it is clear these sorts of arguments were unsound: Technological revolutions in agriculture and resource extraction as well as declining fertility rates meant a menacing population bomb never materialized. Nonetheless, developing countries (e.g., Tibet and Thailand) adopted draconian family planning initiatives in part because of this alarmist narrative. Demographic projections make good substance for specious and effective alarmism.

Such a failure should cause some skepticism in making conjecture from demographics, though it is also constructive in showing us how we might better scrutinize the predictions outlined surrounding demographic shifts and their effects. Specifically, we consider the possibility of shifting demographic trends as well as possible technological effects. Perhaps, the alarmism of this present report is also unjustified.

CONSIDERING THE POSSIBILITY OF RISING FERTILITY RATES

While the focus of this paper is on the senior bulge, and therefore on people who are already alive, we ought to consider those unborn, as population cohorts should be viewed in absolute as well as relative terms. A bulge is a relative measure, and many of the issues discussed are similarly borne out of a relative imbalance in cohort sizes. Therefore, in considering the trajectory of the bulge, it is important to consider cohorts that do not yet exist. Even if these cohorts never reach a productive working age during the described senior bulge, their mere anticipation has fiscal implications for how one might finance senior bulge expenditures.

The overpopulation alarmists such as Ehrlich erroneously assumed that future fertility rates would be in line with current rates and therefore future cohorts would continue to expand exponentially. The depopulation alarmists make a similar category of assumption, that sub-replacement rate fertility rates will persist. It is worth stress-testing the assumption that fertility rates will remain at sub-replacement levels.

Why Fertility Rates Have Fallen

It is helpful to understand why fertility rates dropped over the past seventy years from approximately 5 children per woman to 2 children and the key variables contributing to such a precipitous decline. Two variables have been singled out: educational opportunities and family planning technology in the form of contraception. Educational opportunities and, by extension, opportunities in the workplace have been shown to have a seemingly causal relationship with declining fertility. In fact, in long-run studies, women's education is the best determinant of fertility decline.[50] Modern family planning tools such as contraception facilitate a delayed onset of the first child and result in women having fewer children thereafter. These factors also have been attributed to declines in fertility rates and in some studies increasing contraceptive prevalence was shown to play a larger role than education (though of course the two variables are highly confounding).[51] In any event, it is helpful to consider how these variables might change.

Shifts in the Workplace

If putting women in the workforce decreases fertility rates, it is worth considering some version of the inverse. The average number of working hours in developed Western countries has been decreasing steadily over the past forty years.[52] So has the labor force participation rate. For those still working, we see hybrid and remote work as a permanent new fixture. With more time at home (for both parents), might this mean more children? There is some emerging research from the COVID-19 pandemic that women who worked remotely were more likely to be planning to have children than those who did not.[53] Survey data presented many possible confounding variables, making the result something we should receive with skepticism. Nevertheless, it raises an important question, and indicators of such an effect (fertility rates of women in households where both parents work at least partially remotely, remote work levels of new parents, etc.) ought to be watched.

Technology

While modern medical technology in the form of contraception reduced the fertility rate, new advancements might accomplish just the opposite: The freezing of eggs, synthetic wombs, improved in vitro fertilization (IVF)—all reduce barriers to having children. We are still in the nascent stages of such a trend (if it is ever to materialize). As of 2023, only twelve million babies have been born with assisted reproductive technologies.[54] Many technologies such as synthetic wombs are not yet market ready. However, this progress should be monitored. Indicators such as the number of births to women over 30 leveraging assisted reproductive technologies might provide a preview as to the nature of future trends around fertility rates.

There are potential synergies with government programs. Just as government support for contraception corresponds with dramatically decreasing fertility rates, it is not difficult to imagine similar synergies (e.g., government-subsidized IVF). These sorts of benefits have already begun being offered by employers (e.g., egg freezing).[55]

Government

While there are instances of governments reducing fertility rates, their ability to intervene in order to increase fertility rates has seen varying degrees of success. Pro-family policies including tax breaks, cash payments, subsidized and free childcare, and other social benefits have shown short-term success and potentially the ability to help prevent fertility rates from falling further. Nonetheless, long-term success in increasing rates has proven elusive (e.g., Japan and South Korea).

We observe transient fertility booms after the introduction of incentives. Following the introduction of Russia's 2007 "maternity capital" program, giving mothers of second and third children $12,000 cash payments, birth rates rose from 78 to 99 births per 1,000 women.[56] Five years later, the country's fertility rate proceeded to reach its highest point in over thirty years (though still far below replacement levels). This increase, however, leveled off and decreased despite the program being extended. Thus, it seems that the program provided a strong short-term boost (potentially bringing births forward) and marginal long-term benefits.

The potential for this program, like any government program, to be rescinded magnifies the temporary artifact. Singapore experienced a similar pattern of fertility rate, following its introduction of baby bonuses and tax rebates in 1987. The birth rate increased precipitously from 1.4 in 1986 to 1.96 in 1988.[57] Cultural artifacts are also attributed to this peak ('88 being the year of the dragon, and 8 being a lucky number), though the increase dissipated slowly, hovering around 1.6 to 1.8 for decades. A similar pattern emerges in Hungary.[58]

Such a pattern, while not necessarily the rule, indicates the difficulty countries have in implementing effective tactics to stimulate an increase in fertility rates. These examples demonstrate that we ought to be skeptical of a program's early success. None of the incentives entirely address the systemic factors previously mentioned; therefore, it should be unsurprising that they lack efficacy.

Programs in France and the Nordic countries have taken a slightly different approach. In an attempt to address key system factors such as the demands placed upon women by both the modern workplace and childcare, these programs have increased government support for childcare in addition to providing financial incentives. Notably, these programs date much further back in time—1919 for France and the 1970s for Sweden. Citizens can rely on their continued existence as they plan their families. Neither France nor Sweden has experienced the dramatic increases in population found in Russia or Singapore (due to their lack of such aggressive and immediate cash incentives), but nor have they experienced the demographic decline emblematic of other wealthy European nations. France maintains one of the highest fertility rates, hovering around 1.9, and Sweden's is just below 1.8, though there has been a decline in the past few years.[59] Thus, in attempting to increase fertility rates, it seems unlikely that government programs would lead to a dramatic and lasting shift.

TECHNOLOGICAL PROGRESS TO INCREASE PRODUCTIVITY

In the demographic expansion following World War II, technological innovation ameliorated issues of demand surrounding population increase. Modern farming techniques made food production for a growing population possible. Might the technologist ameliorate the challenges of a shrinking population? As we will see, there is a strong market pull to do so.

We contend that two types of technological progress can potentially provide significant innovations to cope with the senior bulge; the first focuses on reducing the cost of managing seniors, and the second aims at increasing productivity. This report has already addressed the first point and shown that technology appears to have only limited ability to meaningfully reduce the cost of senior care, although one ought to watch with anticipation the progress of generalized humanoid robots in the coming decade. Next, we consider the second type of innovation, technology to increase productivity.

A particularly menacing aspect of the senior bulge is its fiscal strain. One way to lessen the strain is to foster the growth of the economy to such a degree that it represents relatively less drag on the system. Another way is to optimize the productivity of smaller working segments of the population when they need to support larger, nonworking segments. In other words,

if the share of the population working is smaller, then can we just make that share super-productive? Both methods aim to solve the problem of increasing productivity, and therefore GDP per capita, with technology.

Given the recent advances in artificial intelligence and the impending advancements in robotics, it is easy to become enthused about the possibility of increasing productivity. But should we moderate our expectations? US GDP growth per capita has been mostly consistent over the past eighty years, hovering around 2 percent.[60] That means through the Internet revolution, or the Third Green Revolution, or even nontechnological shifts, such as globalization and political shifts, this value seems to be bounded or at least at stable equilibrium. Scholars disagree as to the reasons for this stability. Robert Solow's productivity paradox posits that productivity-enhancing changes (particularly technological ones) take time to percolate, and therefore we do not observe dramatic increases in GDP growth.[61] Furthermore, some innovations are concentrated in sectors, so there is not a widespread increase in productivity. It is tempting to make the claim that advances in AI or generalized humanoid robotics have significantly broad applications that would drive enough value to generate an uptick in GDP growth per capita even despite the typical implementation lag. In fact, it is now not uncommon in Silicon Valley for people to claim that we can measure whether we have achieved artificial general intelligence (AGI) by looking at GDP growth. However, given the historical context of steady 2 percent GDP growth per capita, it seems unlikely that we can rely upon the latest technological wave to increase that rate significantly.

An example from Japan nicely illustrates this fact. In an attempt to manage their relatively large older population alongside negative population growth, Japan saw the wide proliferation of automation and robotics. Yet that country's GDP growth per capita has been modest, hovering around 0.25 percent over the past thirty-five years.[62] Such an outcome should lead us only to increase our skepticism of productivity gains from AI and robotics. The techno-optimist stance, which happened to be the correct response in the time of *The Population Bomb*, might not be the panacea for our present senior bulge.

POLICY RECOMMENDATIONS

The aging of the global population will have profound effects on societies around the world. As the senior bulge is a product of several demographic shifts (rising life expectancy, falling fertility rates) and is responsible for the onset of several emerging trends (increased robotics investment, redistribution of military spending, etc.), its consequences will necessitate a coordinated, active response from the public and private sectors alike. The following policy recommendations, specific to US policymakers and firms but with potentially wider applications, will enable the United States to better adapt to the senior bulge's effects.

MIGRATION AND LABOR

Concerning migration and labor markets, American policymakers should execute the following three actions.

1. Create More Legal Avenues for STEM Workers to Enter the United States

Although the United States is aging, it is doing so at a slower rate than other developed countries. In 2020, about 16.8 percent of the US population was age 65 or older, ranking the country thirty-fourth globally in terms of the proportion of older residents.[63] Migration is key to mitigating the effects of population aging in the United States through maintaining stable levels of economic growth and productivity gains. One of the greatest strengths is the United States' ability to attract global talent to support its technological and entrepreneurial competitiveness. Immigrants have historically made up an increasing percentage of the US high-tech workforce, with foreign workers accounting for more than a quarter of the United States' STEM workers in 2021.[64] Recently, however, the US has experienced a shortage of STEM workers due to its low and outdated H-1B caps, international travel restrictions, inability to retain international students, and the absence of a specific entrepreneurial visa.[65]

Beyond expanding H-1B visa caps and reevaluating current foreign travel restrictions, the US could also consider signing migration agreements with countries that can offer a high number of qualified potential migrants—similar to what India did with its Migration and Mobility Partnership Agreements (MMPAs). Signed with more than seventeen countries, including Germany, France, Australia, and the UK, these agreements enhance legal migration pathways for Indian migrants through provisions that offer visas and residence permits to students, skilled workers, researchers, and businesspeople.[66] Such agreements also include "return cooperation" clauses to facilitate the return of Indian nationals required to leave the host country by providing clear procedures for their identification and return. Beyond allowing the United States to maintain a sufficient level of legal migration, such policies would also enable migrants to benefit from these agreements. As Lant Pritchett put it, "The phenomenon of global poverty today is not one of 'poor people' but of people trapped in 'poor places.'"[67] Increasing the legal avenues for STEM workers to work in the United States to counter the effects of an aging population on the workforce would not only help the US maintain its relatively strong demographic position but would also enable the continued movement of highly skilled people to regions that can best maximize their human capital.

2. Invest in Skills Training in Potential Migrants' Home Countries

The United States, along with other high-income countries, should direct development funds toward vocational training and skills development in the home countries of potential migrants, since such a proactive investment in human capital could help create job-ready workers in sectors where demand is increasing, such as healthcare, construction, and green energy. As cited by the US Bureau of Labor Statistics, healthcare support occupations are projected to grow by 17 percent between 2021 and 2031, even as the domestic labor supply is shrinking due to the onset of the senior bulge.[68] This model addresses domestic labor gaps in the United States while also supporting economic development in the migrants' countries of origin, thereby reducing the pressures that often drive irregular migration.

A good example of effective skills training can be found in the Philippines, where the government's Technical Education and Skills Development Authority (TESDA) provides vocational training programs tailored for overseas employment that are often developed in collaboration

with destination countries, such as Canada, Saudi Arabia, and the UAE.[69] The US should consider engaging in similar partnerships with potential migrants' home countries to ensure that at least a selection of migrant workers are arriving with the needed skills and qualifications.

3. Align Visa Quotas with Labor Market Demands

Because labor shortages prevail in particular industries, a phenomenon that is expected to continue as the workforce ages due to the senior bulge, the United States should reform its visa allocation system through directly linking quotas to real-time labor market gaps. As the current visa system fails to consider which industries have the strongest demand for labor, sectors such as healthcare and medicine, food, and agriculture have experienced significant deficits. For instance, the agricultural labor deficit in the United States hit record-high levels in 2021 while, according to the Association of American Medical Colleges, the demand for physicians will increase faster than supply, resulting in an expected shortage between 54,100 and 139,000 physicians by 2033.[70] Due to these persistent labor force shortages, Congress should increase the annual cap of temporary H-2B visas, which allow US employers to hire foreign workers for temporary, nonagricultural jobs. Although the cap is currently set at 66,000, under supplemental authority granted by Congress through annual appropriations bills, the Department of Homeland Security (DHS) can release additional visas; this number stood at 64,716 in 2023.[71] Reevaluating the annual cap would relieve Congress from having to pass annual appropriations granting the DHS this specific right. As for the H-2A visa program, although it does not possess a numerical cap, it currently only applies to seasonal agricultural jobs lasting less than a year. Due to this time restriction, many dairy workers, meat packers, and most animal farmworkers are unable to apply to the program.[72]

Rendering H-2A visas available to year-round industries would further allow current labor shortages to be addressed. Through these two proposed reforms to the US visa system, industries that have recently suffered from lack of labor supply would be better equipped with the workers necessary to ensure maximum employment and production.

PRODUCTIVITY AND INVESTMENT

Policymakers should encourage economic engagement among seniors, particularly: 1) in the healthcare sector where they face employment barriers; and 2) in new consumer markets catering to seniors.

1. Leverage Senior Workers in Healthcare

To address both the rising demand for healthcare and the growing population of older Americans, policymakers should support initiatives that remove age-related employment barriers and raise wages for healthcare workers—particularly older adults. Seniors are uniquely positioned to support one another; in 2023 alone, nearly 1.6 million workers age 65 or older were employed in healthcare and social assistance roles, according to the Bureau of Labor Statistics. Expanding healthcare investments not only benefits the aging population but also enables seniors to contribute meaningfully to the sector—whether through caregiving, advising, or administrative support. Encouraging older adults to reenter or remain in the workforce,

especially in caregiving roles, allows society to capitalize on their experience and empathy while addressing a growing service need.[73]

2. Promote Private Investment in Senior-Oriented Hospitality, Apparel, and Housing

As older Americans wield increasing purchasing power, public policy should encourage private sector investment in sectors aligned with their evolving needs—especially affordable hospitality, resort wear, and housing. Consumer data reveals that whereas spending on clothing and transportation decreases with age, healthcare costs rise, and housing remains the largest expense for households with a reference person age 55 or older.[74] These shifting patterns present a timely opportunity: Businesses can meet the demands of senior consumers through expanded housing options and senior-friendly travel and lifestyle services. Public-private partnerships and targeted incentives could drive infrastructure growth in hotels, retirement travel, and age-adaptive living, creating jobs while aligning the economy with demographic trends.

SYSTEMS THINKING

PERVERSE AND UNINTENDED CONSEQUENCES

Since the effect of demographic changes will go beyond the trends we have examined, the proposed policy recommendations will fail to capture many of the senior bulge's consequences. Furthermore, although we identified several emergent trends of the senior bulge, each is not independent, given that the world functions as an interconnected political and economic system. When discussing how best to intervene to mitigate the costs that will accompany the senior bulge through policy implementation, it is therefore neither wise nor efficient to react to the consequences of each trend in isolation. Systems thinking's emphasis on examining the interactions of individual elements renders it a useful framework for understanding how the senior bulge's various trends will merge to shape future political, cultural, economic, and military developments. Similarly, its focus on the unpredictable outcomes that can emerge when one attempts to intervene within a system is helpful when considering the ramifications of any policy recommendations. The following section will therefore draw upon key systems thinking frameworks to highlight the perverse and unintended consequences that might arise from the interventions listed above.

SYSTEMS THINKING AND DEMOGRAPHICS

As defined by political scientist Robert Jervis, a system exists when the following conditions prevail:

1. Units or elements are interconnected such that changes in one element, or in its relations, generate changes in other components of the system.
2. The system as a whole displays properties and behaviors that differ from those of its parts.[75]

Applying systems thinking to the study of demographics, we see that changes in one demographic component, such as a population's age structure or gender ratio, will not produce a linear result in one siloed political or economic sphere (e.g., aging leads to X) but will rather affect a myriad of factors within a society. A shrinking workforce, for instance, may affect not only economic productivity but also national security readiness and geopolitical influence.

The second portion of Jervis's definition reveals how, within a demographic system, the outcomes that emerge when different population groups interact with institutions, technologies, and one another can be unexpected and unpredictable. Political or economic outcomes cannot be forecasted, for instance, by simply examining fertility rates, life expectancy, or migration flows in isolation. Two countries with similar demographic diversity (e.g., Canada and France) may have vastly different political dynamics due to different histories or institutions. Policymakers should consider the following properties of systems when devising measures to respond to the senior bulge.

1. Results Cannot Be Predicted from Separate Actions

Within systems, interactions cause elements to no longer behave as discrete parts because the elements interacting with one other do not behave as they would alone.[76] This property is essentially an extension of the first half of Jervis's definition of systems and highlights how policies cannot afford to react to trends in isolation. Productivity, migration, war, family structures, and so on are all interconnected. Understanding how the senior bulge will influence such trends requires us to look beyond the effect of the senior bulge on each trend alone.

2. Behavior Changes the Environment

Systems can create circular effects whereby actors, when reacting to the new environments their actions have produced, change themselves in the process.[77] In other words, current actions within a system can alter the context in which future actions take place. When applied to demography and the senior bulge, trends such as decreasing fertility rates or increasing life expectancy are not merely reflections of the demographic system but rather actively reshape it over time. Any intervention within the demographic environment must take into account how such actions will alter the very same environment, thereby potentially leading to unintended consequences.

3. Strategies of Elements or Players in a System Depend on the Strategies of Others

Due to the interconnected relationship of the strategies of different players, the success or failure of any given strategy is often primarily driven by the actions of other players, as opposed to the actor's own skills or resources. If we assume that each state possesses its own "senior bulge strategy," then this system's property underlines how the efficacy of any individual nation's policy will depend upon the actions other nations have implemented. The steps the United States might take to respond to its senior bulge, for instance, may therefore affect whether France's internal demographic policies achieve their desired outcomes.

4. Ceteris Paribus ("Holding Everything Else Constant") Does Not Exist

Within a system, one cannot intervene at a single leverage point and assume that all remaining elements and interactions will stay constant. An understanding of this property is essential for policymakers, as it highlights the many unintended and unpredictable consequences that might result from one specific action. An attempt to increase the labor productivity of an aging population, for instance, may inadvertently affect migration patterns or how technology is wielded in the workforce.

5. Probability Theory Requires That the Improbable Sometimes Occurs

Within a mathematical framework, probability theory determines the likelihood of chance events occurring, whereby 0 indicates impossibility and 1 indicates certainty. Yet although events assigned probabilities closer to 0 might not be expected to occur, they are, at times, realized. From a policy standpoint, a trade-off exists between preparing for high-impact, low-probability events versus low-impact, high-probability events. Before the onset of COVID-19, for instance, many healthcare systems prioritized low-impact, high-probability events (seasonal flu or routine care), leaving them underprepared for the high-impact, low-probability event of a global pandemic. The same trade-off is applicable to the senior bulge: Should policies focus on devising strategies to counter low-impact, high-probability events (such as increased demand for routine healthcare procedures) or a possible collapse of the current pension or healthcare system?

CONCLUSION

Demographics play a key structural role in economic growth, social spending, and national power on the global stage. Coupled with our aging population are the latest wave of technological innovation and a harsher stance toward immigration in the United States. These components will both be key pieces in navigating this demographic transition.

We should try to use technology to decrease the costs of senior care and spur economic growth, but we cannot rely on either of these occurring. Instead, as the world's population is redistributed, we need to create policies that enable the efficient allocation of human capital. The senior bulge is an opportunity for the United States to do what it does best. Let it be a global center for innovation and a destination for immigrants.

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