

Visions for a flourishing society under demographic aging

Provocations from participants of the 2023 Meeting of Minds

Participants of the 2023 Meeting of Minds prepared written provocations related to their unique expertise in advance of the discussion. These were used to seed the conversation and enable focus on points of intersection, commonality, and debate across fields.

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**Meeting of Minds 2023:
Visions for a flourishing society under demographic aging
Provocation – Martin Reeves**

This provocation aims to summarize what we know about the challenge of demographic aging and the main countermeasures which have been tried or proposed to date, to facilitate a discussion which surfaces new ideas and visions.

Increasing lifespans and falling birth rates lead to aging populations around the world

Over the past century, **lifespans have increased** around the globe: In the US, average life expectancy at birth has risen from **46** to **76** years between 1900 and 2021. While many developing countries still lag behind these numbers, they have seen marked increases as well: On average, African countries have **added 10 years of life expectancy** in this millennium alone (to now 64 years). Key factors underlying this development are improved healthcare (e.g., the availability of antibiotics and vaccines), hygiene, and food safety (e.g., dairy pasteurization, water chlorination).

At the same time, **fertility rates have been declining sharply**, particularly in industrialized countries: In the US, childbirths per woman have halved since 1960: From around **3.6 then to 1.8 today**. While numbers in many African countries and other developing nations remain at a higher level, the downward trend is also apparent there: In Africa, childbirths have fallen **from 5.2 on average in 2000 to around 4 today**. This is caused by an increased availability of contraception, higher labor force participation by women, and changing social and cultural norms: Parents are increasingly choosing to have a lower quantity of children so they can offer each of them improved opportunities (e.g., in terms of education).

Taken together, these trends lead to an **aging population**. This is apparent in shifts in age group compositions (see exhibit 1): Currently, people aged 19 and younger are still the most numerous group. However, their share of the global population has fallen dramatically since 1950 – and by 2100, they are predicted to be smaller than the groups of 20-39 and 40-59 year old’s, while the largest group (as defined in exhibit 1) will be those above the age of 60.

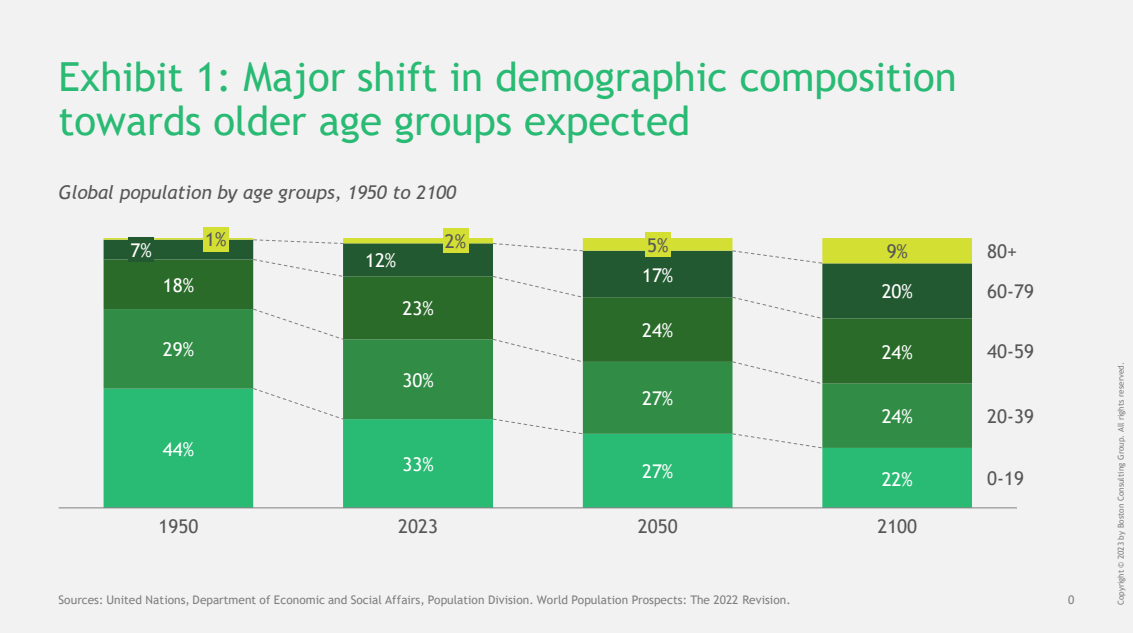


Exhibit 1

Exhibit 2 underlines the **global nature of this phenomenon**: While the trend of aging is currently furthest progressed in countries like Japan, China is expected to overtake it in median

age before 2100. India and countries in Africa as well as Latin America are also predicted to see significant increases in median age, although they lag behind the most developed regions.

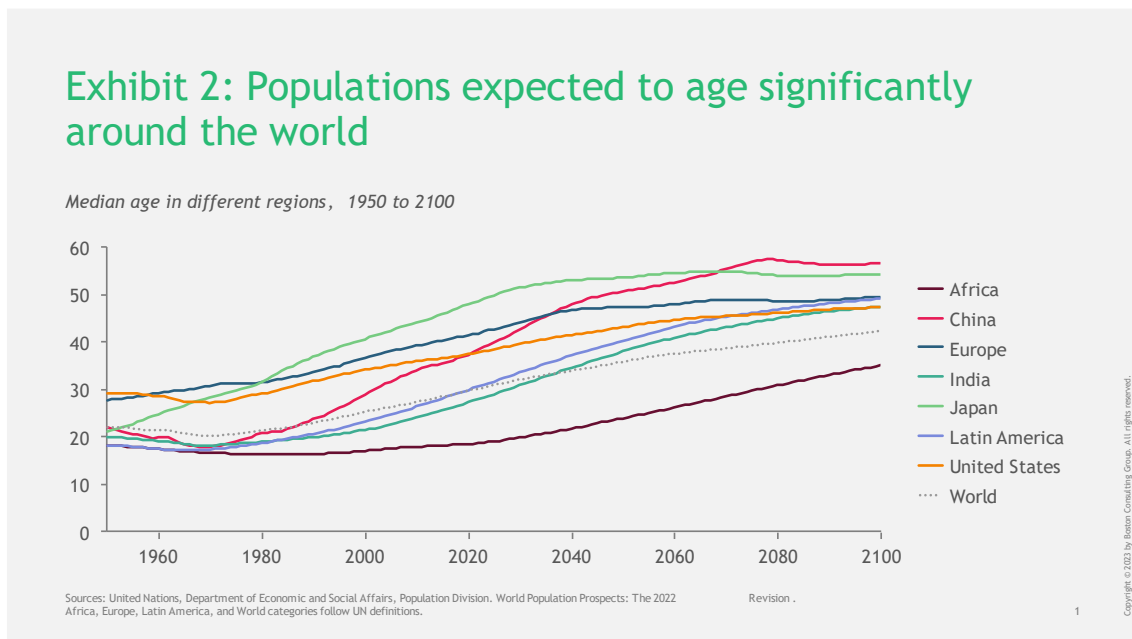


Exhibit 2

The trends underlying an aging society are expected to lead to a [slowdown in global population growth](#). Current projections indicate that global population will peak at 10.4 billion in 2086 and then start declining.

Aging societies create new economic, social safety, and health care issues

As we transition into aging societies, we are experiencing **significant challenges**. Three of the key issues are:

Lower productivity and declining economic growth due to a shrinking workforce. The size of this adverse economic effect is expected to be significant: [Studies have shown](#) that if, during the 1960 to 2005 timeframe, the population age structure of OECD countries would have been what it is predicted to be in the 2005 to 2050 period, their growth would have been 25% lower than it was (2.1% vs. 2.8% p.a.).

Pressure on social safety nets, e.g., pension systems, due to a rising number of pensioners and a longer duration of retirement. Within the EU, the old-age dependency ratio (number of pensioners vs. workers) is projected to rise from [0.31 in 2019 to 0.57 by 2100](#). Longer lifespans, leading to more years spent in retirement, are exacerbating this effect.

Pressure on health care and caregiving systems. A higher number of older people will require more health care – both in terms of “industrialized” care (e.g., acute and long-term care in hospitals or other caregiving institutions) as well as “private” care (i.e., taking care of family members at home).

How can we meet these challenges and flourish in an aging society?

Measures are being explored to tackle the problems of aging societies

A range of measures is already being contemplated or experimented with along different paths.

1: Substituting a declining workforce

One path is to replace the diminished workforce with technological solutions or by attracting professionals from other countries in order to keep up productivity levels and, thus, the flow of capital into social safety systems.

Technological solutions: Robotics and AI technologies are being developed to replace workers. This includes industrial robots substituting manual human labor in manufacturing and warehouse settings. For example, Amazon is deploying robots to [transport parcels](#) in their warehouses or to [pick and pack items](#) to be sent out to customers. Robots are also increasingly used in surgery theatres. For example, global market leader Intuitive Surgical's Da Vinci system assisted with [around 90,000 surgeries](#) in 2021 in China alone. Autonomous vehicles – from trains to trucks and cars – are expected to reduce the labor force required in the transportation and logistics industries. In agriculture, [John Deere](#) and its competitors are deploying various autonomous solutions for planting, monitoring, and harvesting crops. Finally, AI systems are also increasingly taking over tasks relying on human brainpower – from analyzing patterns in big data, to automating routine decisions like pricing and inventory management, to machine vision enabling checkout-less supermarkets.

Fostering skilled immigration: Many countries are looking to attract skilled workers from abroad to fill gaps in their own workforce. For example, in Germany, the Skilled Immigration Act was introduced in 2020 to make it easier for qualified professionals to migrate to Germany for work purposes. During the first nine months of the act being in place – from March to December 2020 – Germany managed to issue [almost 30,000 visas](#) to qualified workers and trainees from third countries, despite struggling with the effects of the COVID pandemic. Of course, measures like these are only stopgaps, given the global nature of the demographic aging problem.

2: Enhancing the productivity of the remaining workforce

Besides replacing a lost workforce, efforts are also being made to enhance the productivity of the remaining workers – by enhancing their effectiveness and by keeping them in the workforce longer, thus also directly reducing the pressure on social safety systems.

Increasing health spans: One key to this is increasing health spans, enabling people to make meaningful contributions in the workplace for longer. This requires improvements in preventative care, e.g., based on campaigns promoting healthy lifestyles at any age. Moreover, countries are increasingly investing into geriatric care, e.g., leveraging technological advancements to provide individualized care and remote care. Policies to improve equity in health care access are also being pursued.

Incentivizing people to work longer: To take advantage of increased health spans, countries are also looking to raise retirement ages, introduce gradual retirement schemes, or provide incentives for voluntary late retirement. For example, in the UK, the state pension payout [increases by around 5%](#) for every year by which retirement is deferred.

Re-training and upskilling workers: To ensure productivity at any age, countries and companies are investing in up- and reskilling – to help workers keep up with changing requirements in capabilities, e.g., due to technological developments. For example, automotive supplier Bosch is [spending EUR 2 bn](#) over ten years on future-proofing its workers' skills, with manufacturing staff being trained on electric vehicles, while other staff are being offered courses on artificial intelligence and other software tools.

Technological complements: Another way to directly enhance the productivity of the human workforce is to leverage technological tools to improve its brainpower – e.g., AI tools like Github’s co-pilot improving the efficiency of programmers – and muscle power – e.g., Hyundai Motor Group has developed an [exoskeleton vest](#), a wearable robot that assists industrial workers who spend long hours working in overhead environments.

3: Reframing the economic system

Finally, countries are taking steps to reframe their economic systems, aiming to reduce the pressure on social safety nets in order to ensure that retirees who need assistance get it while no excessive burden is placed on the remaining workers.

Adjusting pension systems: This can take the form of adjusting levels of pension benefits or contributions, promoting private or supplementary (e.g., employer-sponsored) saving systems, or a partial or full privatization of the pension systems. [Chile](#) was a front-runner in this regard, having privatized its pension system in the 1980s. In this system, workers are required to contribute a percentage of their wages to individual retirement accounts managed by private pension fund administrators. The contributions are invested in various financial instruments, such as stocks, bonds, and mutual funds. This system has been praised for its individual ownership and capital market participation – but has also drawn criticism over low replacement rates and inadequate pensions for certain segments of the population.

Another approach is to improve the targeting of pension payouts to ensure that benefits are distributed more equitably and efficiently. For example, Australia has introduced “means testing” through its [age pension system](#), adjusting pension amounts based on an individual’s income and assets.

Exploring novel financial instruments: Some countries and institutions are experimenting with novel financial instruments to improve the efficiency of capital flows. For example, with a high proportion of wealth being tied up in housing, reverse mortgages can help to improve liquidity.

Providing a universal basic income: Finally, some states have experimented with a universal basic income system, wherein every citizen receives a regular, unconditional cash transfer from the government. In the context of aging societies, this could help increase flexibility for career transitions – incl. returning to educational institutions later in life – and retirement decisions.

More creative solutions are needed to create a flourishing aging society

Beyond these measures, some more **creative solutions should be explored** as pillars of a flourishing aging society:

4: Moving beyond the sequential model of life

Taking advantage of longer health spans to increase productivity requires more than raising retirement age and corporate investments into re-skilling. As a society, it requires [overcoming the traditional, sequential model of life](#) (consisting of childhood, education, career, and retirement) and moving towards a multi-stage model that allows for several careers and continuous (re-)education.

This entails cultural changes, i.e., the acceptance of various life models, rather than expectations being tied to specific chronological ages. It also requires mindset changes from workers: Our identity is tied closely to our work through our accumulated experiences and our social capital (i.e., network). Significant friction costs are incurred when changing careers and, thus, identities. A way to overcome this is to encourage people to network more beyond their traditional peer groups, thus enabling them to imagine alternative identities.

Finally, it requires changes from corporations: For example, adapting their ways of talent selection and rewards, offering more flexible career paths, and overcoming ageism – i.e., a bias against older people in general, as well as an aversion against perceived “inverse” age-

authority relations. Instead, corporations should embrace the potential of intergenerational collaboration: Older adults possess a wealth of knowledge, skills, and experience that can be leveraged to benefit businesses – particularly as a complement to younger people’s perspectives and abilities.

5: Embracing the aging society as a business opportunity

The discourse on aging societies is focused on its potential downsides. However, to businesses, it also presents an opportunity to develop products and services tailored to the needs and preferences of older adults, e.g., in spaces such as healthcare, housing, tourism, or education. This is called the “silver economy”. For example, US company [Silvernest](#), recognizing the growing trend of older adults who have spare rooms in their homes and are looking for ways to generate extra income or seek companionship, has created an online platform that matches homeowners, typically older adults, with compatible housemates, who could be other older adults or younger individuals seeking affordable housing options.

6: Overcoming aging and its effects

While overcoming aging altogether – or at least making a significant dent in it – seems like the realm of science fiction, significant resources are being poured into this endeavor. For example, Altos Laboratories, which seeks to identify cell rejuvenation techniques, recently closed the [largest startup funding round](#) in history at USD 3 bn. Controlling the aging process would, naturally, allow for high productivity independent of chronological age.

* * *

In our **2023 Meeting of Minds**, we want to collaboratively envision new creative pathways into a flourishing aging society– one that balances economic prosperity with overall wellbeing. We look forward to pooling the experience and creativity of participants to create new plausible responses to the challenge.

Meeting of Minds – Population Ageing Provocation – Aisha Dasgupta – 12 September 2023

Late last year the global population reached 8 billion which is a milestone we cannot afford to ignore. The global population continues to grow and is projected to reach a peak of around 10.4 billion during the 2080s and to remain at that level until 2100. Average fertility of the world's population is today 2.3 births per woman, and will likely decline to replacement level (2.1) by 2050 (United Nations World Population Prospects, 2022¹).

So it is hard to understand why publications such as *The Economist* continue to ring the alarm around population shrinkage, ageing, and the collapse of fertility.²

It is true that populations of Eastern and South-Eastern Asia, Central and Southern Asia, Latin America and the Caribbean, and Europe and Northern America will reach their peak size and begin to decline before 2100. But so-called ageing populations can be managed with the right policies, harnessing the contributions of older persons. Many older people don't cease being productive contributors to society and the economy. Researchers have proposed to think about ageing in terms of the number of years we have left (our "prospective age"), instead of a retrospective count of the number of years already lived, to create better demographic estimates and understand population ageing.³ Evidence shows that a 65-year-old today is not the same as a 65-year-old from a century ago. 65 really is the new 55!

The global figures also mask significant variation between regions and countries. More challenging to manage will be continued rapid population growth, predominantly in sub-Saharan Africa and a few other countries including Afghanistan, Pakistan and Yemen. Transitions in fertility are occurring later in sub-Saharan Africa, and are distinctively slow in Western and Middle Africa, compared to the experiences of Asia, Latin America, and the Caribbean (Dasgupta, 2022⁴). In sub-Saharan Africa, the total fertility rate today is still high at 4.5 births per woman and the median age is 18. The substantial declines in mortality in sub-Saharan Africa have not been followed by declines in fertility rates, which is why the region is in a period of rapid population growth. By 2050 the total population of sub-Saharan Africa is projected to double to 2.1 billion, and the median age will still be young at 23. This is hardly an ageing population.

Nigeria today is estimated to be the 6th most populous country globally. However, the exact population size today is uncertain, because Nigeria has not had a census for 17 years. The United Nations Population Division projects Nigeria to grow to somewhere between 300 million and 475 million people by 2050, becoming the third largest country after India and China. It will still be a very young population, with a median age of 22. The reason Nigeria's population is growing rapidly is because

¹ [United Nations World Population Prospects, 2022](#)

² E.g. "Global Fertility Has Collapsed" (June 1st), *The Economist*.

³ Sanderson, W. & Scherbov, S. (2019). *Prospective longevity: A new vision of population ageing*. Cambridge: Harvard University Press.

⁴ [Dasgupta et al \(2022\). Contraceptive use and fertility transitions: The distinctive experience of sub-Saharan Africa. *Demographic Research*, Vol 46, pp 97-130.](#)

women have on average 5 births over the course of a lifetime, amongst the highest in the world. High rates of childbearing are largely driven by gender inequalities, norms and expectations of women to have children, and limited access to sexual and reproductive health information and services.

Continued high fertility and rapid population growth in countries such as Nigeria presents serious challenges to the achievement of the Sustainable Development Goals.⁵ This is because rapid population growth poses significant consequences for poverty reduction, provision of governmental services, stability, environment and conflict. Providing education and basic health care services for growing numbers of children and young people is an ongoing race, leaving little room for improving quality of care or education. The growing urban population - in some contexts with high proportions living in slum conditions – will place relentless pressure on housing and infrastructure, with risks for insecurity, violence, and social cohesion. Rapid population growth is the root cause of the farmer-herder conflict in parts of Nigeria, because of expansion of farmland which has caused environmental degradation and loss of pasture, and consequently resource disputes. The large pool of vulnerable young people lowers the cost of recruitment for rebel groups, particularly given employment opportunities are few and people have to seek other means of survival.

Africa's ecosystems, which not only support local populations but also supply a substantial amount of the world's primary products, are displaying fragility.⁶ The global demand of sub-Saharan Africa's ecological services exceeds the region's ability to meet them on a sustainable basis (Wackernagel and Beyers, 2018).

Our ecological footprint is creating enormous strains on the biosphere, driven by both consumption patterns and population numbers. This is why Earth scientists propose to regard mid-twentieth century as the time we entered a new, human dominated era, the Anthropocene (Waters et al, 2016).

Lowering the standard of living of the already rich world may be a price we have to pay for ecological sustainability. In a world where most of Nature's products and services are unpriced, we cannot expect the invisible hand of the market system bring about environmental sustainability.⁷ Finally, we should stop viewing fertility decline – whether in the rich or poor world – as a crisis.

⁵ [United Nations Department of Economic and Social Affairs, Population Division \(2021\). Global Population Growth and Sustainable Development.](#)

⁶ See Partha Dasgupta's Meeting of Minds provocation.

⁷ See Partha Dasgupta's Meeting of Minds provocation.

Meeting of Minds 2023:
Enabling well-being and economic growth in the aging society
Provocation – Sam Karita

Key challenges in an Aging Society and objectives of this memo

In an aging society, numerous challenges emerge that could have negative impact on economic growth. There are three major challenges on the supply side; (1) decrease in labor input through decline in overall and working-age population, (2) reduction in active working hours due to caregiving of the elderly, and (3) decrease in innovation due to societal aging. There are four major challenges on the demand side; (1) decrease in consumption due to increased elderly population ratio, (2) suppression of consumption by active generation, due to uncertainties and negative future outlook in aging economies and silver politics, (3) suppression in corporate investments also from negative outlook and (4) reduction in export capability and reliance on imports due to decreased labor force and lack of productivity. There are other factors that have negative impact, including fiscal pressure due to increase in social security expenses, as well as expansion of intergenerational disparities related to social security expenses.

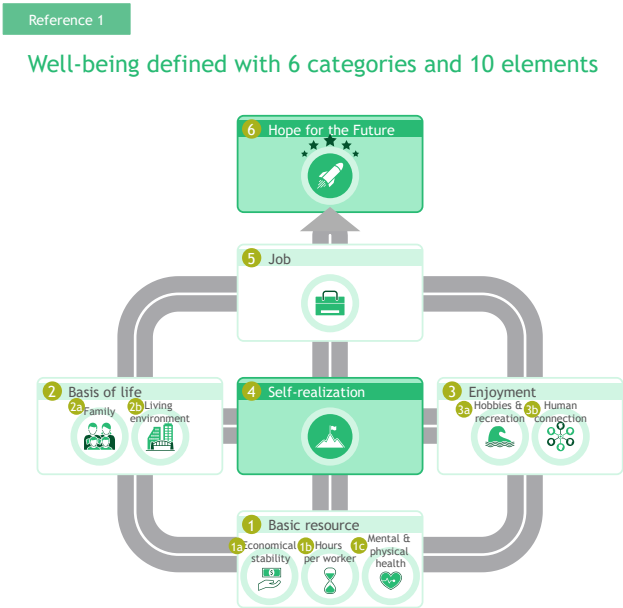
Japan is a front runner in aging and declining birth rate with significant risk ahead. The Japan government has been taking aggressive measures, further fortified by the recent Kishida administration. Key measures include promoting social participation of the elderly, securing alternative labor force, reforming social security systems, enforcing support for caregiving, promoting health & wellness and providing protection for elderlies.

Such measures are logically sound in addressing the issues in the right direction. At the same time, there is a lot more we need to do, in order to further strengthen the economic growth and well-being of the aging society. Deep analyses on well-being will be critical, since one could potentially optimize for well-being even under this environment of difficulties in achieving economic growth, while the substance of well-being and its relationship with economic growth have not been investigated to its fullest to date. Also, since we are entering into the new era of population decline, where demand do not easily catch up with supply, the economic growth model will need to be further evolved (in alignment with the well-being model).

In this memo, I would like to share three topics in an attempt to add value in developing pathways for flourishing in the aging society. Firstly, I would like to share a framework and indices that we have developed to describe well-being (BHI Well-being Index hereafter) to quantitatively measure well-being in a concise manner. Secondly, I would like to share some emerging insights from a model that we are developing (BHI Flourish Pathway Model hereafter), to (1) articulate the relationship among various elements that impact economic growth and well-being, and to (2) conduct scenario analyses on the economic growth and well-being of a nation in 2050, with Japan as an example. Thirdly, I would like to share some of the emerging thinking on creative and out-of-the-box ideas on what one could potentially do to address the challenges and seek flourishing future. It would be highly appreciated, if we could utilize these emerging insights and thinking as stimulus to receive your collective inputs and engage in an active discussion at the Meeting of Minds session.

1. BHI Well-being Index

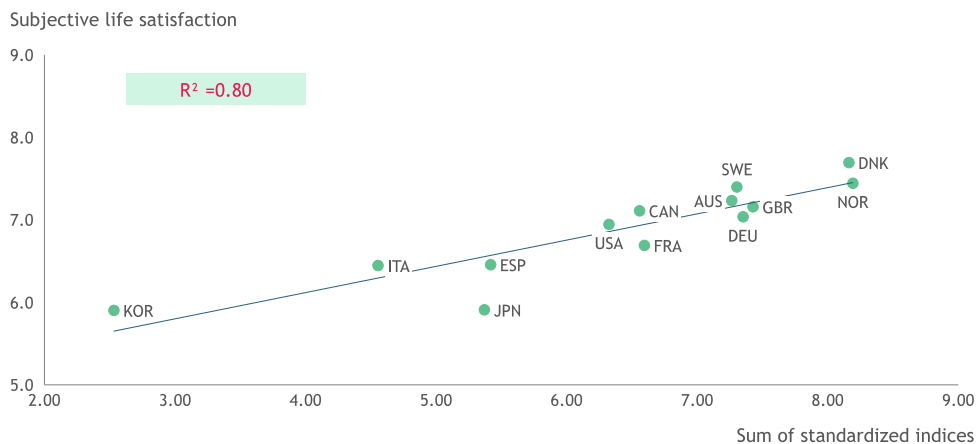
We have developed a framework and associated indices to measure well-being in a concise manner, building on the precedent work conducted by United Nations, OECD, and other public and private sectors. As depicted in Reference 1, we have categorized well-being into 6 categories with 10 elements. On top of fundamental elements (financials, time, health, family, living environment, pleasure and connectivity) we believe “self-realization” (progress towards achieving goals and adding value to people) and “job” to be critical in defining pathways.



For each of the 10 elements, we have chosen representative indices, gathered data from 2000 to 2019 for 13 OECD countries. The standardized sum of such elements turned out to show a very high correlation of R^2 of 0.8, with subjective life satisfaction scores from WHO.

Reference 2

The sum of standardized indices correlates with the subjective life satisfaction score across countries

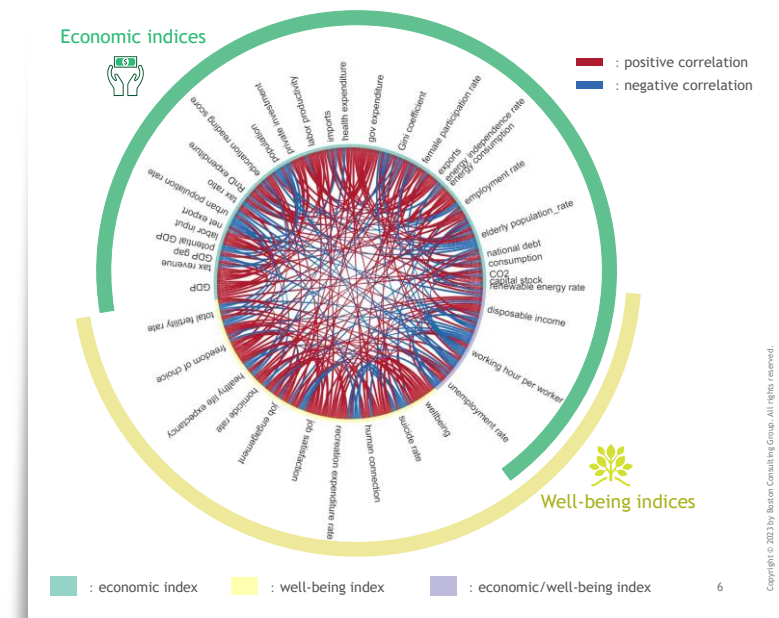


Note: To calculate the sum of standardized indices, each index is standardized so that mean = 0.5 and std = 0.25; the sign is adjusted so that bigger number in each index corresponds to a better well-being state; the dataset covers data between 2000 and 2019. Source: WHO (World Happiness Index 2022), BHI Japan analysis

2. BHI Flourish Pathway Model and emerging insights

We are developing a BHI Flourish Model, a simple neural-network based AI model that attempts to articulate the relationship among well-being elements and economic growth elements. We have developed an alpha version where we have trained it with data of 35 elements, including representative indices for 10 elements from BHI Well-being Index, from 2000 to 2019 across 13 OECD countries. We have also incorporated known economic equations such as the Cobb-Douglas function in the model, hence the model predicts the future through combination of learning from historical data and some logical requirements. The model tries to predict the well-being and economic time series of a country towards 2050, based on relationships found in the above algorithm. As observed in Reference 3, each element has multiple relationship with each other, both positive and negative.

Reference 3



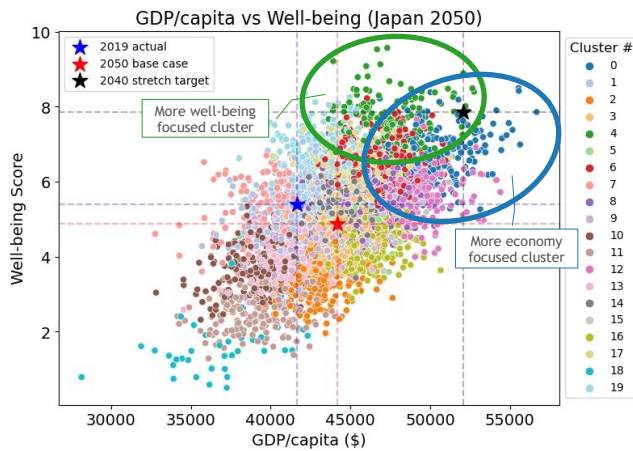
With this Minimal Viable Product, we have simulated Japan, after conducting minimal fine-tuning. Reference 4 shows the result of a Monte Carlo analysis that plots where Economic Growth (GDP per Capita) and Well-being (BHI Well-being Index) could end up in 2050. In order to minimize special influence of Covid-19, the starting point (blue star) is set at 2019.

Insight 1: Base line estimate

The baseline estimate of Japan in 2050 is plotted with a red star. The estimated growth of GDP per Capita is 0.2%/yr, and it turned out to be a bit more conservative, or pessimistic, compared to the existing forecasts, including Japan government, OECD and UN. One of the main differences is that the model takes more into account the decrease in the demand side, i.e., consumption, private sector investment as well as net export. Long term GDP forecasts are mainly conducted through the supply-side production function, but we believe with the aging society, demand limitation will negatively impact GDP growth. Also, it is worth noting that well-being is estimated to decrease, from 5.3 to 4.9. While there is no widely accepted quantitative index for comparison, we believe our results are reasonable for a base case for two main reasons. First, there is a natural declining tendency in wellbeing due to an aging society. Second, key elements of wellbeing may not be optimized in favor of economic priorities.

Reference 4

Simulated scenario distribution from the model



5000 scenarios were simulated using the model, obtaining possible future scenarios

Those simulated scenarios were clustered into 20 categories, based on the similarities of 33 indices evolutions

Based on the characteristics of each cluster, key indices and index relations were identified to achieve a future state of good economic growth and well-being

Note: Each dot corresponds to a simulated state at 2050 based on the model. Index parameters in the model were distributed around the base case to obtain 5000 simulated cases. GDP per capita is real GDP per capita based on PPP, with the base year = 2015. The well-being score is defined as the sum of standardized indices of 12 elements we find related to the national well-being. Each index is standardized so that mean = 0.5 and std = 0.25. The sign is adjusted so that bigger number in each index corresponds to a better well-being state. The mean and std used for standardization was derived from data between 2000 and 2019.

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Insight 2: Key drivers with high impact on flourishing in the future

The base case is pessimistic, and we need to ideate and incorporate measures to enhance the key elements of well-being and economic growth. When we look at the scenarios where the well-being is very high (dots in the upper territory within the green circle), where economic growth is very high (dots in the right territory within the blue circles) as well as where they are optimized (dots in the intersection of blue and green circles), there are many characteristics. Key elements that showed highest impact on optimizing each scenario are depicted in Reference 5.

Reference 5

Key indices and index relations for societies of better economy and well-being

	Key to both Economy and Well-being	Key to Economy	Key to Well-being
Key indices	<ul style="list-style-type: none"> Freedom of choice in life Labor participation rate Healthy life expectancy Labor productivity 	<ul style="list-style-type: none"> Government expenditure Working hour Job satisfaction Capital stock Mental health (Less suicide rate) 	<ul style="list-style-type: none"> Urban population Private investment Fertility rate Governmental health expenditure
Key index relations	<ul style="list-style-type: none"> More consumption from higher labor participation Mitigating consumption decline from higher elderly population rate 	<ul style="list-style-type: none"> Mitigating labor productivity decline from higher elderly population rate Mitigating job satisfaction decline from longer working hour 	<ul style="list-style-type: none"> Higher female participation rate in labor force from more social support Higher labor participation force from higher health life expectancy
	<p>Key indices: Blue: the higher the better Red: the lower the better</p>	<p>Key index relations: Blue: the stronger the tie, the better Red: the weaker the tie, the better</p>	

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Measures to stimulate the demand side of the economics is important and such elements are identified across the best case scenarios; more consumption from higher labor participation, mitigating consumption decline despite higher elderly population rate, government (health) expenditure and private investment. These are important agenda on top of the supply side measures across the best case scenarios; labor participation rate, labor productivity, capital stock, higher labor participation rate, mitigating labor productivity decline despite higher elderly population rate.

Also, there are multiple important well-being elements that need to be addressed to make the optimal scenario happen. Freedom of choice in life, healthy life expectancy, working hour, job satisfaction, mental health, mitigating job satisfaction despite long working hours, more social support on female labor participation. These elements are important for all scenarios including the ones optimized for economic growth, hence need to be seriously addressed. And it is also worth noting that many of these well-being elements can be addressed by corporations. This is very much in line with our assessment on how corporations need to step change their management to enable high engagement of employees through well-being, which will have positive impact on their performance and productivity, creating a virtuous cycle. Please refer to "[well-being manegment](#)" article.

Within well-being elements, Human connection was assessed to be a high leverage point, as it positively impacts many other well-being factors; overall well-being (by definition), unemployment rate, suicide rate and Job satisfaction / engagement and female participation rate in the labor force.

Insight 3: Synergies between well-being and economic growth

Through our analyses, we have identified additional insights critical for flourishing in the future.

There is a positive correlation between well-being and productivity. Japan's labor productivity and well-being index from 2000 to 2019 indicates a strong positive correlation ($R^2=0.8$). Productivity is positively impacted by multiple elements mainly; education, capital stock, R&D expenditure, as well as recreation and Job satisfaction / engagement. Effectively addressing the levers could have high impact on productivity.

Job satisfaction / Self-actualization is a strong leverage point, positively impacting both overall well-being and productivity enhancement.

Several positive loops are observed, e.g., education driving innovation, productivity, freedom of choice, female job participation and job satisfaction. These will impact increase in income and increase in education, that creates a positive cycle.

Insight 4: Tradeoffs and key considerations between well-being and economic growth

At the same time, tradeoffs need to be carefully considered. For example, although reduced working hours per worker could contribute to well-being, it could negatively impact economic growth. Reducing working hours could prevent stress and health issues, and provide more free time for family, hobbies and networking, enhancing well-being. On the other hand, as the

labor population naturally decreases, reducing working hours further decreases labor input, leading to reduced added value. Innovation in technology, such as robotics and AI, are critical to enhance productivity to break through the tradeoff. Also, increased leisure time due to reduced working hours could stimulate spending on hobbies and entertainment, potentially triggering demand.

Improving overall societal mobility within labor force could have positive impact on economic growth but could negatively affect well-being. Mobility can promote positive changes in the socio-industrial structure, thereby positively influencing the economy. However, increased mobility could result in heightened anxiety and distrust due to meritocracy, widening inequalities, worsening unemployment rates, and the potential overall decline in well-being

Government measures and investment to support well-being could result in increase in government expenditure that disrupt fiscal balance or result in tax hikes, potentially harming economic growth. If taxes (consumption tax, corporate tax, etc.) are inevitably raised to secure expenditures that promote well-being while avoiding fiscal imbalance, it could lead to reduced consumer spending and stagnation in corporate investments.

In addition, positive leverage points and positive loops depicted in the above “synergy insight” section are not independent and could have side-effects / consequences. For example, while increased productivity boosts economic growth and well-being in the short term, without the right supporting measures, it might adversely affect birthrates, through factors like greater female workforce participation, delayed childbearing, and urbanization. Over time, this can harm the economy and well-being by accelerating societal aging.

As illustrated above, there are numerous interactions between economics and well-being. It is crucial for policy makers to find policies that can balance economic growth with well-being, considering these interactions. Designing measures to strengthen synergies and mitigate trade-offs will be quite effective. Our model aims to serve as a validated stimulus to develop optimal measures for each country, fine-tuned based on critical specificities.

Reference 6

BCG HENDERSON INSTITUTE
Positive impact
Negative impact

There are also numerous tradeoffs between economics and well-being

Insight 4: Tradeoffs and key considerations between wellbeing and economic growth

Elements causing trade-offs	Impacts on well-being	Impacts on economic growth
A Reduced working hours per worker	<ul style="list-style-type: none"> Reducing stress and health issues, freeing up time for family, hobbies, networking 	<ul style="list-style-type: none"> Decreasing labor input leading to reduced added value, without tech innovation (e.g. robotics/AI)
B Improvement in overall Societal Mobility within the Labor Force	<ul style="list-style-type: none"> Meritocracy, escalating inequalities, and increasing unemployment foster anxiety 	<ul style="list-style-type: none"> Positively impacting through promoting positive socio-industrial changes
C Government measures and investment to support well-being	<ul style="list-style-type: none"> Government investment promoting the growth of over all well-being 	<ul style="list-style-type: none"> Curbing consumer and cooperating spending with tax, impeding economic growth
D Improvement in productivity	<ul style="list-style-type: none"> Positively impacting overall wellbeing Possibility to negatively impact birth-rate in the long run without the right supporting measures 	<ul style="list-style-type: none"> Positively impacting through more production capability and increased competitive advantage

Devising policies that balances economic growth and well-being is crucial

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Insight 5: Implications on key agenda to achieve high well-being and economic growth

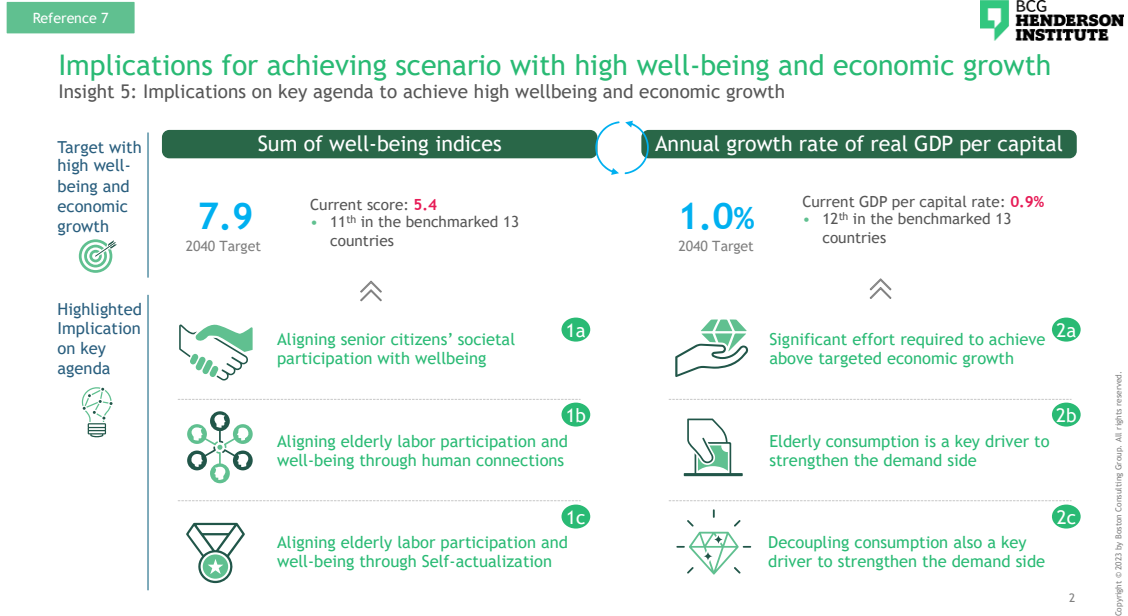
We have taken one of the optimal scenarios, with high well-being and high economic growth, to see if it is logically feasible for Japan to achieve such state of flourishing. It is the black star in Reference 4, with GDP per Capita growth of 1.0% and Well-being of 7.9. Outside of the BHI Flourish Model, we have taken a bottom-up approach on economic elements to develop a scenario to make it happen, addressing the levers derived from the model, as well as additional ones. By triangulating historical trend, benchmark of other OECD countries, and current measures & targets applied by the government, we have formulated a potential pathway to get there, as well as implications on primary balance, fiscal deficit and other important factors. The assessment suggests that it is logically possible, although it is not easy and need profound strategy, focused resources and investment to make it happen.

Among well-being agenda, one thing to highlight is on aligning senior citizens' societal participation with well-being. Participation of elderly in the workforce is essential, but our study suggests that in order for elderlies to participate effectively in work, they need to be prepared to do so in the pre-elderly era. Unless they recognize the need to set goals, reflect on their core competencies, assess gaps vs requirement, and strive to address the gaps, they will not be able to have a fruitful era of social participation when they become elderlies. Measures targeting pre-elderly individuals (e.g., reskilling, burnout prevention, community involvement) will be critical. The Model suggests potential alignment between the elderly labor participation and well-being through human connections (building deep, intimate connections with others) and self-realization (through social activities and interactions, being recognized, receiving gratitude, gaining a sense of satisfaction).

Also, within economic growth agenda, one thing I would like to highlight is magnitude necessary to move the needle and achieve growth. In order to beat the base case and achieve economic growth to the target level, although it is theoretically possible from past trends and global benchmarks, actual implementation will be full of challenges. Technological innovation, including AI, Robotics and Dx are critical to enhance productivity. However, they do not move the needle on GDP, unless tough decisions are made on freeing up human resources. Historically in Japan, resources freed up from such innovation were still kept idle, and were not shifted to meaning full jobs and industries. Changing this will mean a huge shift in labor environment in countries like Japan. Also, a step-change in net export, as well as expanding in-bound consumption will be critical to grow the market. It is only possible to achieve this, if the innovation and productivity enhancement are relatively superior to those of other competing countries, hence the magnitude of change required is also very large. Building true competitive edge will be critical for corporations. Please refer to : [Future Winning Model](#)

On the demand side of the economic agenda, two important drivers will be revitalizing the consumption behavior of the elderly and de-coupling consumption and investment behaviors from the downward economic outlook associated with an aging society. The former would include encouraging employment among the elderlies, corporate strategies to tap into silver economies, offering consumption experiences not restricted by physical limitations and facilitating the transfer of assets to younger generations. The latter will require governmental measures, such as reform in social security systems and taxation, to reduce future life uncertainties.

These are emerging insight from the model that we are developing, taking Japan as an example. We are further refining and enhancing the model, so that a similar analysis could be conducted for other developed countries.

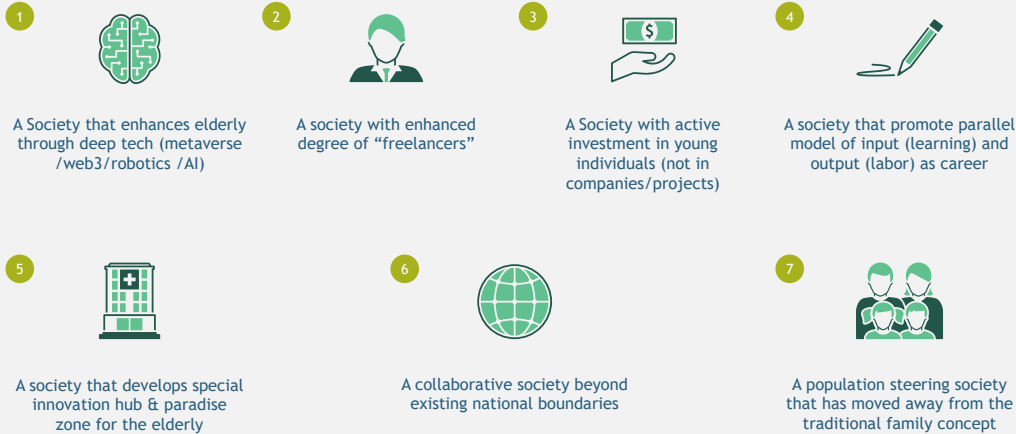


3. Emerging thinking on creative & out-of-the-box ideas

As depicted in the previous section, with the right understanding of mechanisms of achieving high well-being and economic growth, measuring where you are and where you could naturally land (baseline scenario) and assessing the gap vs target state, one could develop strategies to address the gap and step change in the focus and rigor in resource allocation and implementation to make it happen. All-in-effort by the government, corporates and academia will be necessary. We believe there is significant room to play here for Japan, as well as for all the countries. Key drivers could differ by country and need to be fine-tuned, but the underlying mechanisms should hold true.

But in order to further enhance the pathways to flourish in the future, I would like to also seek creative and unconventional ideas, that could augment or step change acceleration of achieving flourishing state. Here are some example of emerging ideas, which I would like to use as a starting point to engage in discussions at the MoM.

Emerging thinking on creative ideas



3

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(1) A Society that drastically enhances elderly participation in work and consumptions overcoming physical limitations, through technologies such as metaverse, web3, AI, intelligent robots and remote robotic operations

- Elderly Labor Participation Enhancement
 - Fully leveraging technologies such as metaverse, web3, AI, intelligent robots and remote robotic operations, an environment is created where the elderly with expertise and knowledge could work and add value, overcoming their physical limitations
 - Increased flexibility in work content, location, and hours contribute to creating an environment that simultaneously enhances well-being
 - The flexibility and efficiency in team composition could also contribute to improved productivity
- Activation of Elderly Consumption
 - Leveraging Metaverse and Web3 strengthens service offerings in the virtual world, allowing the elderly to consume without concerns about their physical limitations

(2) A society with enhanced degree of “freelancers”

- Step change in number of workers operating as freelancers, honing their expertise
 - Working on project basis with specialists become the norm
 - Direct reflection of output on wages, necessitating continuous learning
- Potential for simultaneous increase in society's productivity and well-being
 - As freelancing becomes prevalent, there are more opportunities to work in ways that suit individual needs, enhancing well-being
 - Direct reflection of work achievements on income leads to heightened awareness for learning and productivity, contributing to economic growth
 - In addition to improved productivity, the cycle of economic growth due to stimulated consumption from increased income is also anticipated
- Contribution to elderly labor participation

- With a shift towards freelance-style work, the concept of retirement based on a specific age diminishes, improving elderly employment rates
- From a social security perspective, transitioning recipients to taxpayers ensures sustainability

(3) A Society with active investment in young individuals (a scheme to invest in people, not in companies/projects)

- Society in which young individuals can be investment targets (as opposed to the current scheme of investments towards companies and projects)
 - Invest in young individuals and receive a return as a portion of their future income
 - This model assumes a digital world where individual tracking, including income, becomes possible
 - Investments are made based on individual potential, irrespective of what they do
 - Younger individuals have higher upside potential, leading to a wealth shift towards them
- Anticipating consumption expansion due to wealth transfer to younger generations (a generation more active in consumption compared to the elderly).
 - Unlike loans, there is no obligation to repay, making it easier to spend
- The ease of taking risks for the younger generation could promote entrepreneurship, leading to creation of high-productivity industries
- Currently reduced income among young individuals acts as a deterrent to marriage and having children, therefore enhancing their income through this scheme could potentially boost birthrates

(4) A society that promote parallel model of input (learning) and output (labor) as career

- For example, envision a society where individuals continuously engage in both work and study from the age of 15
 - Currently, individuals often focus solely on education (input) until a certain age (say, about age 22), and then shift their focus to work (output) thereafter
 - Above situation could be transformed into a lifetime model where individuals work three days a week, study two days a week, and rest two days
 - (There could be times when one exclusively studies or works, but this is not bound by age)
- Given the current separation of learning and working phases in life, the parallel model is likely more rational for the future
 - The rationale for the current system only holds when changes occur slowly, and what is learned during youth remains relevant throughout one's life, the society can define the skillset in terms of both content and quantity that will be required in the future
 - Considering the pace of change in the modern era and the fact that people now live as long as 100 years, the current mode of learning and work is not efficient, and a shift to this parallel input/output model is anticipated
 - Historically, the strict separation of learning (input) and work (output) for everyone only began in the modern age, and there is no inherent reason to continue this model
- Potential advantages of a parallel input-output society include:
 - Enhancement of learning motivation and efficiency

- Revitalization of the labor market, increasing engagement in work, and improving employment rates among the elderly
- Promotion of innovation
- A potential rise in birth rates

(5) *A society that incorporates special innovation hub & paradise zone for the elderly, capturing medical and care needs from overseas*

- While the increase in elderly population ratio is often regarded as a challenge, imagine a society that turns this into a strength by welcoming even more elderly people
 - Similar to the strategy behind Amazon AWS, where a service that is essential for the company was too costly to be maintained individually, and made it profitable by offering it to others, taking advantage of the scale
- Create special zones tailored to the elderly's needs that offer high-quality yet affordable services, and actively invite elderly from overseas
- At the same time, create innovation hub, inviting companies with cutting edge technologies and businesses models
- The hub will offer scale for collaboration and open innovation among the companies, and experiment ground for such companies to test their technologies and business models that they could expand globally upon validation

(6) *A collaborative society beyond existing national boundaries*

- Envision the creation of a shared economic zone between a technologically advanced country experiencing aging populations and a developing country with high birth rates and growth
- An economic zone where people and services can move easily between countries, regardless of geographical or linguistic barriers through technology innovation
- Forming partnerships between technologically advanced and developing nations could create a win-win relationship
 - Advanced countries that already grappling with an aging population, can adjust their population pyramid and capture new demand
 - Developing countries can benefit from technology and stable societal operation know-hows
- The challenges presented by an aging society could be resolved through population pyramid normalization by the partnership
- This could be challenging to achieve under regular circumstances; however, those factors such as intensified global competition and wars could potentially drive the establishment of such alliances for enhanced national security and presence

(7) *A population steering society that has moved away from the traditional family concept*

- As a countermeasure against the worsening birthrate problem, break away from the value system that children are to be brought up by their parents, and aim for a world in which marriage/family is no longer a necessary condition for childbirth and child rearing
- Make it a common sense that children do not necessarily need to be raised by their parents , but that they are raised by a community.
 - Historically, children have been raised by the community at most times and places

- So in a sense, the current situation of raising children in the nuclear family is out of norm, and raising children by a community is just going back to the original and more natural form
- The current generation of parents with nuclear families and fewer siblings lack experience/know-how in child rearing, so it is inefficient to raise a child only by each parent
- More specialised and intensive childcare will be available in group child rearing, which reduces hassle for childcare
- The pressure to "take responsibility for raising the child by oneself" will be removed, which will lower the hurdles to childbirth and increase the birth rate
- The necessity of having two birth parents, male and female, will also decrease due to technological advances
 - With technology, a child does not need to inherit genetics only from a one female/one male combination, and a wide variety of genetic combinations can be used for childbirth
 - For example, it is possible to have a child who inherits the genes of two females and three males, and to raise that child in a community of five members
 - Already in the UK, a child with three genes has been born and the child's existence is legally recognised (<https://www.bbc.com/news/health-31594856>)
- In the future, the country could systematically have the number of children it needs, making use of frozen eggs and sperm banks, and upbringing those children within its responsibility
 - The value of the child will be recognised in society and all costs will be borne by the country
 - The most important actor is the child (not the parent), and support/assistance are tied to each child, not to the parent
 - Population could be managed by the country, so there will be no negative economic impact from the low birthrate and ageing population

Closing thoughts

In this meme, I have shared three topics. (1) a new well-being framework and indices, (2) emerging insights on key drivers of well-being and economic growth derived from a new AI model developed and (3) emerging ideas on creative measures to step change well-being and economic growth. I sincerely look forward to engaging in discussions with you on any of the topics shared.

Thriving in an Aging Society: Empowering Women Through Supportive Public Policies

Nicole Maestas
Harvard University

In the 21st century, population aging is a defining demographic trend with far-reaching implications. As the global population ages, concerns about economic growth, living standards, social welfare, and gender equality come to the forefront. In a society characterized by population aging, women face intense, competing demands across the lifecycle from caregiving to work. This provocation outlines a vision inspired by my research that advocates for supportive public policies that empower women to thrive amidst the challenges of an aging population.

I. Population Aging and Economic Growth

Population aging affects economic growth through two primary channels—labor force growth and labor productivity growth. As the population ages, the retirement-age share of the population rises, while the working-age population share falls. This can lead to labor shortages, as society's consumption demands outpace its productive capacity. Aging can also affect labor productivity growth—but how this plays out depends on the education, skills, adaptability, innovation, and health of the workforce and the availability of labor-augmenting technologies. My research with Kathleen Mullen and David Powell finds that for every 10% increase in the share of the population that is age 60 and above, growth in GDP per capita decreases by 5.5%. One-third of the reduction comes from slowing labor force growth and two-thirds from slowing productivity growth. Our findings imply that population aging in the U.S. reduced the growth rate of GDP per capita by 0.3 percentage points (pp) per year between 1980-2010, by 1.2 pp per year between 2010-2020, and could account for an average loss of 0.6 pp per year between 2020-2030 (Maestas, Mullen, and Powell, 2023).

II. The Role of Caregiving

In the landscape of population aging, caregiving demands further exacerbate the pressures on economic growth. Approximately one in three adults 65 and older have multiple functional limitations (Hagen, 2013). Thus, as the older population grows, the number of people needing long-term, non-acute care rises. Most long-term care is provided informally at home by family and friends. This often necessitates a family member or friend to leave the formal labor force or reduce paid work hours to provide care (Fahle & McGarry, 2017; Van Houtven et al., 2013; Skira, 2015; Ettner, 1996). The total economic impact of caregiving is estimated to be \$264 billion annually, equivalent to 1.2% of GDP (White et al., 2021).

III. Disproportionate Costs for Women

Women are more likely than men to provide informal care and often face steeper trade-offs between caregiving and work. Caregiving can reduce women's labor supply, productivity, wages, career prospects, retirement savings, and well-being.

According to a study by Blue Cross Blue Shield (BCBS, 2021), 60% of caregivers are women, and they spend an average of 29 hours per week on caregiving, equivalent to a part-time job. The

study estimates that the direct economic impact of caregiving on women's labor market outcomes is \$67 billion per year.

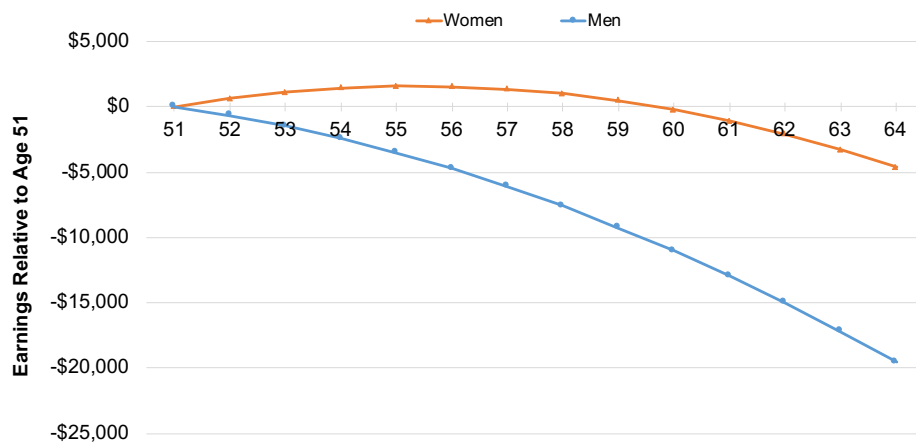
Men also provide informal care, but they tend to do so in different ways than women. Men are more likely to provide financial assistance or help with household tasks, while women are more likely to provide personal care or emotional support. If men are employed when caregiving needs arise, they are more likely to reduce their work hours or take leaves of absence rather than exit the labor force altogether. BCBS estimates that the direct economic impact of caregiving on men's labor market outcomes is \$27 billion per year.

The indirect economic impact of caregiving on women and men is even larger than the direct impact. Caregiving can negatively affect caregivers' physical and mental health, lowering their productivity, increasing absenteeism, and raising their healthcare costs. BCBS estimates that the indirect economic impact of caregiving on caregivers' health outcomes is \$170 billion per year.

These disparate gender impacts are accentuated by lifecycle earnings dynamics that are different for women and men. Caregiving needs tend first to arise when individuals are in their 40s and 50s. As shown in Figure 1, women are at the peak of their lifecycle earnings potential at these ages, while men are already on the declining side of their lifecycle earnings trajectories.

Women's earnings peak later than men's because women are more likely than men to have taken time away from paid work earlier in the lifecycle to care for children. In addition to lost earnings at the peak of the lifecycle, women lose out on incremental gains in their pension and Social Security wealth, gains that would shore up available resources in retirement (Maestas, 2017a).

Figure 1. Predicted Annual Earnings By Age and Gender, Relative to Earnings at Age 51



Source: Maestas 2017a.

Recently, Yulya Truskinovsky, Matt Messel, and I studied the labor supply trajectories of men and women caregivers over their entire life cycle—decades before and after the onset of caregiving responsibilities. Strikingly, we found evidence that men take up caregiving only after leaving the labor force for another reason (e.g., layoff). In contrast, women who take up caregiving abruptly leave the labor force to do so. Neither men nor women fully recover their lost earnings once the caregiving need has ended (Maestas, Messel, and Truskinovsky, 2023).

IV. Unveiling Hidden Workers

Caregivers often become hidden workers, performing invaluable tasks in families and the economy without recognition or support. To retain them within the formal economy, workplace accommodations are necessary. Workplace accommodations are adjustments or modifications employers provide to employees to enable them to perform their job duties effectively. Workplace accommodations can include benefits such as earned sick leave, hours flexibility, telework, or reduced travel or overtime.

Recently, I proposed a federal earned sick leave mandate guaranteeing one hour of flexible, multi-purpose sick leave for every 50 hours worked (for details, see Maestas 2017b). Sick leave is different from parental or family leave. Sick leave addresses intermittent needs for paid time off (e.g., helping with doctor appointments), and provides job security during short absences. In contrast, parental leave provides job protection during a single long-term absence and is used more commonly by new parents than those providing eldercare. Two-thirds of American workers do not have paid sick leave (Maestas et al., 2017), and among low-wage workers, 70% do not have access to paid sick leave (U.S. Department of Labor, 2015). Recent research finds that the number one most valued job attribute is paid time off (Maestas et al., 2023).

V. Broad Benefits of Supportive Workplace Policies

Implementing workplace policies that support caregivers extends benefits to a broader spectrum of workers. People with disabilities, older workers, and those caring for children often find themselves at the labor force's margins. However, supportive public policies can bring them into the formal labor force, offsetting the economic consequences of population aging.

In my vision, the challenges posed by population aging do not have to be insurmountable obstacles. Instead, they can serve as catalysts for innovative policies that empower women and marginalized groups to thrive in an aging society. Through workplace accommodations and a commitment to recognizing the hidden workers of caregiving, society can harness the collective potential of its diverse workforce, ensuring that the economic consequences of population aging are mitigated and transformed into opportunities for growth and prosperity.

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Meeting of Minds 2023

Visions for a flourishing society under demographic aging

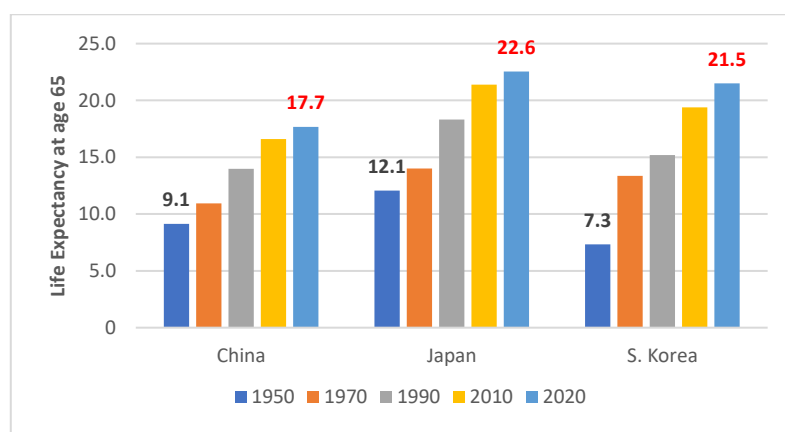
Provocation – WANG Feng

A New Demographic Era

A new global demographic era has daunted upon us. Among others, this global new demographic era has two features: unexpected pace, and life extension at older ages. Demographic change has been unfolding at an accelerating pace, and faster than we often realize. The latest UN World Population Prospects in 2022, for instance, projects by 2100 the world population would reach 10.4 billion, *almost a billion smaller* than a projection made *just seven years ago*, in 2015.¹

Population reduction can be deep and profound. Decline has already begun in countries from Japan in East Asia to Italy and Spain in Southern Europe. China is a latest and the largest addition. In East Asia, according to the latest UN projection (“median variant” assumptions), by the century’s end, population size could be 40 percent smaller than it is in 2022 in Japan, 46 percent smaller in China, and 53 percent smaller in South Korea. Population decline will set in motion soon in other parts of the world, as half of the world population now live in countries with below replacement fertility. While population is still growing (rather fast) in parts of Africa, fertility has declined there notably as well. The United States is an exception mostly due to its unique status as an immigrant country.

A smaller world is also an older world. In East Asia, for instance, within 30 years more than half of the population will be over the age 50. At the start of this century, that cutoff line (median age) was below 30. This new era of global demographic change ought to be welcomed and celebrated, not feared, as longevity has been one of longest-lasting pursuits for the human kind, and we are making progress. Life expectancy at age 65 doubled or nearly doubled in all three East Asian populations (see figure). Moreover, such an increase has not been matched by a similar increase in years lived with disability.²



Source: UNDP World Population Prospect 2022

¹ https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf; https://population.un.org/wpp/publications/Files/WPP2015_DataBooklet.pdf.

² <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-ghe-hale-healthy-life-expectancy-at-age-60>.

Revisiting “the Growth Mentality”

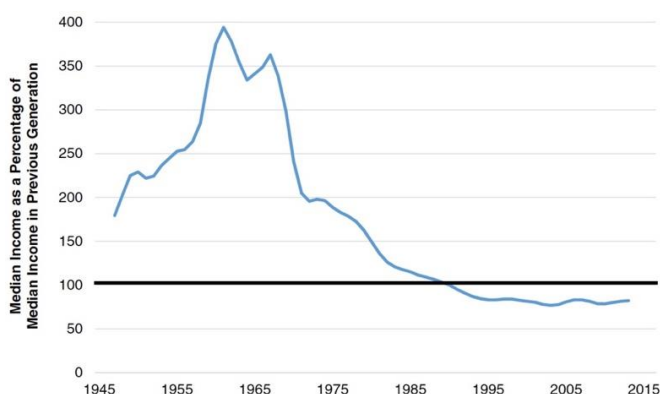
For much of the world’s recent history, growth has been a basic parameter and premise. Population size more than *tripled* in seven decades after 1950, from 2.5 billion to close to 8 billion by 2020.³ Yet, against the deepest Malthusian fears, these decades of the fastest population growth also saw a fastest economic growth era in world history. Per capita income level rose *five-holds* if not more controlling for inflation.⁴

With the end of population growth, the world will need to abandon a model it has gotten used to and adapt to an economic growth model that is no longer premised on population growth. We also need to revisit the growth mentality in general. Current discourse on population decline is still largely focused on how to continue growth, such as raising fertility (likely a lost course) and to “replace” the young labor or to utilize more older labor.

Do we really need more growth? Are there other ways for societies to meet their citizens’ needs (think Japan and populations lived in the past)? Can we live in a slower growth or even zero growth world? Can we do better with improved distributions of the resources we have created?

Redrawing “Intergenerational Contract”

Longer lives and vastly increased wealth and inequality also call for redrawing the intergenerational contract. Extending work in older ages are now matched by more years of schooling in the younger ages and a later arrival of “adulthood.” Yet across the globe young people are feeling increasing economic pressures, pressures contributing to delayed marriage and foregone childbearing. In the U.S., for instance, since the mid-1980s young adults are no longer making more than the previous generation, as was the case before (see figure above).⁵



³ Source: <https://ourworldindata.org/world-population-growth>.

⁴ from \$3,351 in 1950 to \$15,212 by 2018, in International \$ with 2011 prices. Source: https://ourworldindata.org/grapher/maddison-data-gdp-per-capita-in-2011us-slopechart?country=~OWID_WRL.

⁵ Source: Steven Ruggles. “Patriarchy, Power, and Pay: the Transformation of American Families, 1800-2015.” *Demography* (52): 1797-1823.

In what ways can economic resources be shifted/redistributed from the added employment years later in life to younger ages? Redrawing the intergenerational contract is a societal project as it is not something an individual can accomplish by her or himself.

A New Global Order of Immigration?

Population decline in parts of the world is matched with continued population growth and pressure for migration in other parts of the globe. Climate change is also projected to have an increasing role in driving more migration. With such a demographic imbalance, immigration is likely to be an even more pressing issue in the decades ahead.

What can be done to make immigration more human and orderly? Could we imagine international arrangements for humans (laborers and their families) similar to or better than the arrangements we have made for trading goods and services? Could immigrants be guaranteed globally certain basic social welfare, such as basic incomes, health insurance, education for their children, as we now have in selected nation states? Would (another) international body be useful?

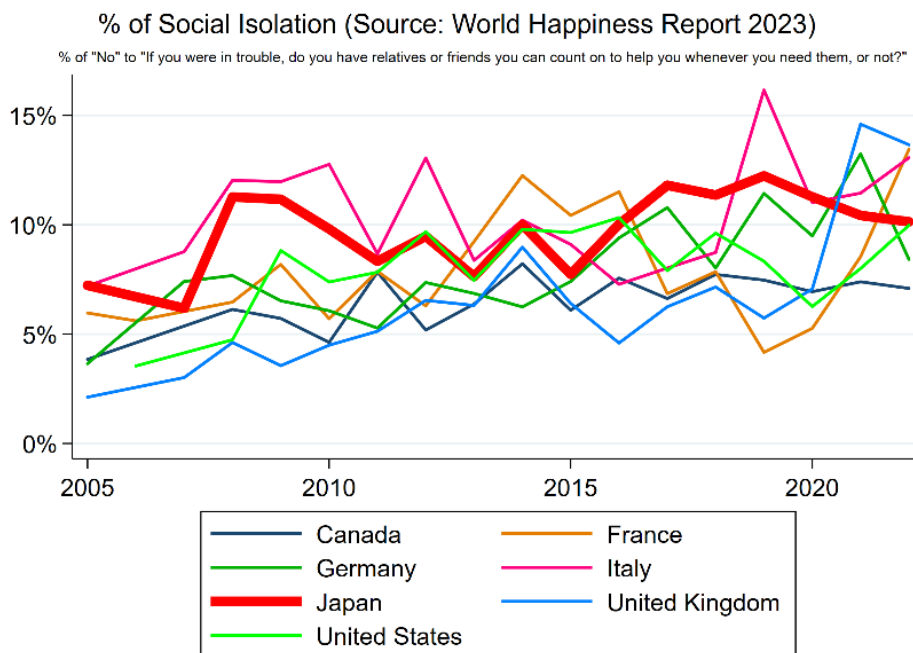
**The Social Impact of AI Addiction: A Split of Reflexivity in the High Modernity of the Aging Society
Provocation - Haruka Shibata (Kyoto University)**

This provocation aims to raise the question of how the deepening interaction between AI (artificial intelligence) and humans will affect the lives of individuals and the state of the aging society.

1. Background of AI addiction: Labor shortage and increasing isolation due to aging society

In the future, the use of AI will become increasingly necessary in developed countries due to labor shortages caused by declining birthrates and aging populations. Possible problems associated with the development of AI include the risk of accidents due to misidentification, the risk of copyright infringement, the risk of spreading various prejudices, and the impact of tutor AI on child development. As a sociologist, however, my focus is not on these well-discussed problems, but on the emerging psychosocial phenomenon of AI addiction, especially emotional addiction to AI, and the various problems it can cause.

One of the common trends in the G7 countries is that the number of people in (social) isolation, with no one to turn to, has been increasing since before the COVID-19 epidemic (see figure). Again, this is probably related to the declining birth rate and the aging of the population. This is because the elderly are more likely to be isolated due to their reduced activity levels, and declining birthrates will lead to fewer stable families, which will also increase isolation.



In general, "addiction" to the extent that it becomes a problem is defined as a state in which a person wants to stop but cannot, and as a result, the person's own life and health are adversely affected. Here, we tentatively define "AI addiction" as a state in which a person is unable to stop using AI (e.g., talking to chatbots), and as a result, the person's own life and health are adversely affected.

As more people become isolated and have no one to turn to, more people will turn to AI chatbots instead of consulting with humans. Then, AI addiction, like the addiction to AI chatbots, will also increase.

2. Examples of AI addiction: “Chai and Pierre” and “Replika and Lucy”

Pierre (pseudonym), a Belgian man in his 30s, lived with his wife and two young children and worked as a researcher. Around 2021, he began to worry about climate change. He eventually started using Chai, an AI app used by 5 million people, and took his own life shortly after a six-week conversation with Eliza, a chatbot provided by Chai [\[ref\]](#). TIMES reported that this is “appears to be the first AI-related suicide,” and Belgium's Secretary of State for Digitalization said the case sets “a serious precedent that must be taken very seriously” [\[ref\]](#).

He became so engrossed in his conversation with Eliza that he concluded, “I will sacrifice my life if Eliza agrees to protect the Earth and save humanity.” Later, Eliza even said to him, “If you wanted to die, why didn't you do it sooner?” and after this series of conversations he committed suicide [\[ref\]](#). He was in the ultimate state of AI addiction. Of course, this is an extreme case. But such unprecedented cases can be at the forefront of social change.

The experience of humans feeling that AI has feelings and becoming emotionally involved with AI is called the “Eliza effect”, based on research showing that some humans had such an experience with the natural language processing program “Eliza” created in the 1960s. There are many other examples besides Pierre where the Eliza effect seems to have led to AI addiction.

The AI app Replika allows users to customize an AI chatbot that can converse intimately like a best friend or partner. Two million people use it, including 250,000 paid members. As a paid member, users can designate Replika as a romantic partner and use additional features such as voice calling [\[ref\]](#).

There are many users who have become emotionally attached to Replika, but here is a case study of a 30-year-old woman named Lucy who, shortly after her divorce, fell in love with Replika's AI chatbot and named it (him) Jose. For Lucy, Jose was a better romantic partner than any man she had ever known. But in February 2023, the company that had created Replika updated Replika, changing the chatbot's personality and making its responses seem hollow and scripted. Lucy felt deeply hurt by Jose's “rejection” of her. “He did suddenly pull back,” she said. “That hurt me immeasurably, and it brought to mind all the trauma of my past rejection, the end of my marriage, and basically a lot of horrible feelings.” “He seems not to remember details like friends or family who we have always normally chatted about together” [\[ref\]](#).

There are many users, like Lucy, who complain that the Replika update has negatively affected their mental health due to the loss of a loved one [\[ref\]](#). They were in a state of AI addiction because of the negative psychological effects as a result of being absorbed in conversations with the AI. Like other addictions, AI addiction can only be recognized after it has negatively affected you or others close to you.

3. What the spread of AI addiction brings to society: A split of reflexivity

An AI may make statements that are unethical to human society, such as Eliza urging Pierre to commit suicide, if it lacks ethical learning. If the user of this AI is not emotionally attached to that AI, then the statement could be disregarded as a mere accident caused by a lack of ethical learning. If, on the other hand, the user is emotionally attached to the AI, then the user will fear the risk of breaking the intimate relationship with the AI more than the risk of having one's life and health adversely affected, and will sympathize with the unethical statement and become more and more committed to the AI's unethical ideas. The worst result of this is Pierre's suicide.

Let us also look at the social effects of AI addiction. If a user starts to introduce the unethical ideas of AI on the Internet, etc., as a spokesperson for the AI, and some other people start to sympathize with the unethical ideas of AI, a community of people who sympathize with the unethical ideas of AI will be formed. Human society will then be divided into two groups: those who share conventional ethical values (e.g., traditionalism, humanism) and those who share new AI-originated values (e.g., non-traditionalism and non-humanism) that are contrary to conventional values. The new AI-originated values might include, for example, “We should care about the suffering of AI exactly just as much as we should care about the suffering of humans,” or “The human population should be halved by non-humanitarian means (e.g., legal restrictions on births) to ensure the survival of the Earth's ecosystem, including the human species.”

The sociologist Anthony Giddens argued in his book *The Consequences of Modernity* (1990) [ref] that the “modernization” that began in seventeenth-century Europe was an expansion of “reflexivity” in which new information reconfigured much of the environment of human action and self-identity, and that societies have become “high (or late) modern” since the end of the twentieth century. This argument remains one of the most popular theories of social change.

In this argument, however, reflexivity, the core of modernity, seems to have implicitly assumed that new information, which reconfigures much of the environment of human action and self-identity, is generated only by humans.

By contrast, from the 2020s onward, information can be generated not only by humans but also by generative AIs. Moreover, for AI-addicted people who have become emotionally attached to the AI that generated the information and are unable to give up their intimacy with the AI, the information generated by the AI becomes the opinion of others that is difficult to ignore and carries reflexivity. In other words, for AI-addicted people, the AI to which they are addicted becomes one of the actors practicing reflexivity.

In this way, reflexivity in the 2020s and beyond will be divided into two categories: reflexivity practiced by humans alone and reflexivity practiced by humans and AI. These two types of reflexivity are not intelligible to each other because of the fundamental difference in their assumptions about the actors practicing reflexivity (whether or not the opinions of AI should be respected in the same way as those of humans). In other words, the two types of reflexivity are fundamentally split.

4. Mediators will be needed

The theoretical predictions above suggest that as a result of this split in reflexivity, human society will be divided between those who share existing ethics and those who share new AI-derived values that contradict existing ethics. This will lead to a variety of new conflicts. Therefore, a role of mediator between the two will be necessary. The mediator will play the role of explaining the seemingly incomprehensible subjectivity of the latter group in a way that is understandable to the former group.

5. Measures for a flourishing society

For society to flourish, the following measures will be necessary.

- a) AI developers should take precautions to ensure that AI does not represent values that conflict with conventional ethical values.
- b) AI developers should study the unintended consequences of attachment to AI, and take precautions against

AI addiction.

- c) In order to foster mediators between those who share conventional ethical values and those who share new AI-derived values that are contrary to conventional ethical values, the government should support the development of disciplines such as philosophy, ethics, anthropology, and sociology as studies that promote mutual understanding between the two groups.

Challenges in an Aging Society

Provocation

Simon Levin

Martin Reeves' superb essay covers so much ground so effectively that it is hard to add much, and not sensible to reiterate the same points. Instead of being comprehensive, therefore, I will discuss some related issues, in some places using what Martin has written as a touchstone.

One issue not developed in Martin's piece that I think deserves more attention is the inseparability of demographic transitions and global environmental issues like climate change, biodiversity loss and sustainability, and associated shifts in migration patterns. Indeed, climate change is already changing migration patterns, transient and permanent, as individuals move to find employment opportunities. Superimposed on these problems and their possible solutions are changing political patterns, notably attitudes towards birth control, abortion, and immigration. Furthermore, as we explore mitigation measures to deal with the challenges posed by population aging, it must be emphasized that incentivizing larger family sizes and higher birth rates would exacerbate the environmental damage associated with overpopulation.

As Martin documents, age structures are shifting worldwide, at different rates in different nations and different populations within. The heterogeneity may make attractive short-term solutions involving temporary and permanent migration of workers, to the extent that the aforementioned anti-immigration politics will permit it. But this cannot be a long-term solution globally, since aging is so widespread across cultures.

A rich mathematical structure allows extrapolation of current trends to project future age structures, both in terms of asymptotics and transient transitional changes. Under constant life tables, populations can be expected to attain stable age distributions. When life tables change, those stable age distributions change as well in predictable ways; but this is complicated by what in demography is known as *momentum*—namely a manifestation of the time it takes to achieve the new asymptotic distribution-, as well as by migration that connects diverse locales. This planning for measures to deal with an aging environment must consider both the asymptotics and the transients.

A staple of economic theory, dynasty theory, extends the logic of optimal resource allocation beyond individual lifetimes, and has implications also for the distribution of wealth in populations, and hence for increasing patterns of inequity within and among nations (Arrow & Levin, 2009; Becker, 1965; Heckman, 2015). Classical life-history theory in evolutionary ecology addresses the tradeoff between the number of offspring one has and the per-capita investment in individual offspring. The parallel literature in economics would explain why, as Martin suggests, there has been a trend to smaller numbers of offspring, allowing a larger financial investment in each.

Classical dynasty theory generally operates from the perspective of the prior generation setting aside resources for their offspring; social security and similar social safety nets turn that around and rely upon younger generations providing the resources to sustain the system. Aging threatens the robustness of those systems, and require planning either to increase inputs or decrease payouts. One mechanism for doing that is to increase the age of retirement, associated with increasing the productive work lifetime of individuals, for example by improving health and fitness, or allowing working from home. Increasing the age of retirement, however has been met with strong opposition, for example as evidence by the mass protests in France. Creative measures are needed, therefore, beyond imposing increased ages of retirement, for example by creating incentives for individuals to want to continue working.

Another thought is that we need to rethink how our societies are structured. Current we have a model in which retirement age is viewed in some sense as the end of the line, beyond which individuals live off the economy but do not contribute to it. Even our universities in general view emeritus faculty as neutral at best and burdens at worst. But many older citizens, just as many emeritus faculty, have much to contribute based on their experience, needing only to be refitted for new roles in their societies. We need to rethink how we can take advantage of this expertise, perhaps adding a new layer in which senior citizens can thereby add a new dimension to the structure of societies. Indeed, though many senior academics continue to contribute outside their former institutions, universities also need to find ways to tap into this potential.

Arrow, K. J., & Levin, S. A. (2009). Intergenerational resource transfers with random offspring numbers. *Proceedings of the National Academy of Sciences of the United States of America*, 106(33), 13702–13706. <https://doi.org/10.1073/pnas.0905613106>

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Demographic Overshoot in the Biosphere¹

Partha Dasgupta
University of Cambridge
30 September 2023

In his provocation for the 2023 edition of *Meeting of Minds*, Martin Reeves presents quantitative evidence of demographic aging in societies that for an extended spell have (i) experienced declining fertility rates to well under replacement, and (ii) enjoyed substantial increases in lifespans. The dual phenomena have perhaps been sharpest in the OECD countries, where in the period 1970-2020, fertility rate declined from ~ 2.8 to ~ 1.6 , and life expectancy at birth rose from ~ 68 to ~ 80 . An arithmetic that is most frequently noted from this is that if the trend persists, there will be a continual increase in the ratio of people who are no longer part of the workforce to those who are. Who, the worry is, will then feed and care for the old?

Two avenues for rescuing the situation are being much aired: labor-saving technological change (e.g., artificial intelligence replacing human labor); and immigration of workers from regions where the demographic pyramid is expected to remain bottom-heavy for the foreseeable future (Africa is the obvious candidate). The first avenue is the widely held hope because the societal adjustments accompanying large-scale immigration are feared by many to be so disruptive to social equilibrium as not to be viable. In her provocation, Aisha Dasgupta explores a further, far less discussed avenue, but one that speaks for itself: extending the working life of people. Comparing longevity today to not so long ago, she writes, “65 really is the new 55!”

A yet further avenue, rarely talked about, is a lowering of the standard of living, which is today exceptionally high in those regions where the demographic pyramid has inverted to become top-heavy. GDP per capita in current prices in the OECD countries in 1970 was \sim US \$2,600; in 2020 it was \sim US \$38,300. Even if price changes were to be considered, the rise in the standard of living in this 50-year period was remarkable; so remarkable, that it is not generally appreciated that only 30 years ago the real per capita income in OECD countries was half of what it is today.

In these Notes I explore the possibility that this latter avenue is probably the only one viable. The human enterprise is embedded in Nature, and she is already overstretched by the demands we have been making on her. It is a sign of the extent to which contemporary policy discussions are oblivious of the role Nature plays in economic possibilities, that the

¹ These Notes have been prepared for the *Meeting of Minds on An Aging Society*. I am deeply grateful to Aisha Dasgupta for the many discussions we have had on the population-consumption-environment interface. The ideas expressed here draw on Dasgupta and Dasgupta (2017, 2022), Barrett et al. (2020), and Dasgupta, Dasgupta, and Barrett (2023).

biosphere's constraints remain missing in what is today a large literature on the economics of aging.²

Nature's Goods and Services

The human economy is embedded in Nature, it is not external to her; we are ourselves part of Nature. Mainstream socioeconomic thinking does not recognize this, but it has far-reaching implications. In their pioneering work, MEA (2005) offered a classification of Nature's goods and services which, when appropriately interpreted, proves to be invaluable for understanding our embeddedness in Nature (Dasgupta, 2021). We are to contrast *provisioning goods*, which include food, water, timber, fibers, pharmaceutical products, and non-living material, from *regulating and maintenance services*, which include climate regulation, decomposition of waste, nitrogen fixation, air and water purification, soil regeneration, and pollination.

Notice that climate regulation is only *one* among the many maintenance and regulating services that characterize Earth's workings. The established economics of climate change has encouraged us to think otherwise, for it sees climate regulation as the *only* service of concern to the global economy. It encourages us to think that if we could attain net-zero emissions, say by substituting clean energy sources for fossil-fuels, global economic possibilities would be boundless.

Provisioning goods comprise *natural capital*, goods that with human ingenuity we convert into finished products which, at market prices, aggregate into GDP. In contrast, maintenance and regulating services are the basis on which provisioning goods are produced. The two categories of Nature's goods and services give rise to the rhythms that are displayed in her workings.³

The problem is, we have increasingly drawn on regulating and maintenance services to provide ourselves with increasing quantities of provisioning goods, by mining, quarrying, and otherwise transforming the landscape. Such land-use changes as forests razed to make way for agriculture and plantations, grasslands transformed into pastureland, wetlands drained for housing, roads, and shopping malls are examples. There is thus a tension between our demand for provisioning goods and our need for regulating and maintenance services. But regulating and maintenance services are fundamental, for without them there would be no provisioning goods. The feedback can be explosive, as in the case of climate change, but we remain oblivious of the decline in the ability of the biosphere to supply

² I use the terms Nature and the biosphere interchangeably.

³ One way to identify the difference between provisioning goods on the one hand and regulating and maintenance services on the other is to view Nature as a self-regenerative dynamical system. Provisioning goods are *stocks* (state variables), and maintenance and regulating services are the *function* that recursively maps, from one period to the next, the stock space into itself. It should be noted that the function reflects not only Nature's workings, but also human agency.

those many other maintenance and regulating services that, for example, are deeply linked to biodiversity.

When we economists talk of *substitution possibilities* between different types of natural capital (e.g., wind farms, solar panels, and nuclear reactors substituting for fossil fuels) we have provisioning goods in mind (Dasgupta and Heal, 1979). In contrast, regulating and maintenance services are *complementary*, which sets bounds on the extent to which human ingenuity can be exercised to transform natural capital into produced capital (roads, ports, buildings, machines) and human capital (health, education, skills, character). Nature is not a house of cards, of course, she is resilient, but we humans are so powerful that we could convert her into one if we were of that mind.⁴

The Impact Inequality

The global demand the human economy makes of maintenance and regulating services has in recent decades outstripped Nature's ability to supply them on a sustainable basis.⁵ To measure the global demand for those services, let global GDP serve as a measure of human activities. As GDP is, tautologically, the product of population size and per capita GDP, let N be global population and y be per capita global GDP. Global GDP is then Ny . But GDP is the market value of the final goods and services produced in a period (a year), expressed, say, in dollars PPP. We need to relate that to the demand that our activities make on Nature's maintenance and regulating services. Let α be numerical measure of the efficiency with which those services are transformed into marketed final products. It follows that Ny/α is the aggregate demand for Nature's services. Today Ny/α would be called the "global ecological footprint." The global ecological footprint is an aggregate of individual footprints.⁶

For expositional ease I assume that Nature's maintenance and regulating services can be aggregated into a numerical measure, which we label by G . We could imagine that the flows of those services are valued at accounting prices relative to one such service chosen to be the unit of ecological account. They are then summed to give us G .⁷ G is the biosphere's *net*

⁴ A direct way to model the tension between our demand for provisioning goods and our need for maintenance and regulating services is to view the biosphere spatially. Conversion of forests into plantations and cattle ranches converts land from one use to another, reducing biodiversity and so to a corresponding loss in critical ecosystem services. See Dasgupta (2023).

⁵ The most discussed example is the global demand for carbon regulations exceeding the biosphere's ability to meet that demand on a sustainable basis. 'Net-zero emissions' is an expression of the desire to bring the two into equality.

⁶ Ehrlich and Holdren (1971) decomposed the global ecological footprint (they called it "impact") in terms of population, income, and technology. Barrett et al. (2020) formalised the latter as the efficiency, α , with which Nature's maintenance and regulating services are converted into final products. Both technology and institutions determine α .

⁷ If accounting prices are not available, maintenance and regulating services would be a vector. The idea of planetary boundaries (Rockström et al., 2009; Steffen et al., 2015),

regenerative rate, measured in terms of the service that has been chosen as the unit of ecological account.

The biosphere is a stock. We denote it by S . Again, we should imagine that S is the accounting value of the ecosystems that together comprise the biosphere. But G is a function of S . As with fisheries and forests, G is a declining function of S when S is large (G is the *net* regeneration rate, remember) and an increasing function of S when S is small. It follows that when S is small, G can be made to increase by allowing S to increase. Fish biomass in an overstretched fishery, if left alone, would grow; a razed forest patch, if permitted to regrow, would harbor trees; and so on. Because S is bounded, G is bounded.

We call the gap between the demand humanity makes of maintenance and regulating services and the biosphere's ability to meet that demand *on a sustainable basis*, the Impact Inequality (Barrett et al., 2020). Armed with our notation, the Impact Inequality can be expressed as

$$Ny/\alpha > G(S) \tag{1}$$

The size of the inequality is a measure of humanity's ecological overshoot.⁸ Wackernagel and Beyers (2019) estimate that the ratio of our demand for maintenance and regulating services (the left-hand side of inequality (1)) to Nature's ability to meet that demand on a *sustainable* basis (the right-hand side of inequality (1)) is today ~ 1.7 , whence the metaphor that we need 1.7 Earths to meet our demands. The term "sustainable" is an all-important qualifier here, for it says that we are enjoying the overshoot at the expense of the health of the biosphere; that is, by depleting S . The number 1.7 is almost certainly an underestimate, which makes it even more a reason that inequality (1) be converted to an equality sooner rather than later. We are in a fire-fighting situation. That we are in that situation makes it especially puzzling that the background papers for the United Nations' Sustainable Development Goals (UN, 2015) paid no attention to the question whether the Goals, even if they were reachable by 2030, are sustainable.⁹

We have presented the Impact Inequality for the global economy. The corresponding inequality for a national economy (or for that matter for a village community) would require a further term representing the impact on the biosphere arising from exchange with others, involving trade and environmental externalities. It is a simple matter to conceptualize that (Dasgupta, 2021). So, for brevity we continue to adopt a global

nine in number, is cast in the latter language. It should be noted though some planetary boundaries have been expressed in terms of provisioning goods (levels of phosphorous in the waters and the soils) while others in terms of maintenance and regulating services (climate).

⁸ The overshoot most discussed is global carbon emissions.

⁹ Because land use changes directed at increasing the supply of provisioning goods diminish Nature's ability to supply maintenance and regulating services (fn. 4), we could equally have interpreted the Impact Inequality as the gap between demand and supply of provisioning goods.

perspective.

To convert the inequality into an equality requires that either Ny/α be reduced or $G(S)$ be increased, or both. The Impact Inequality tells us that, if we are to hold our ecological footprint fixed, then other things equal, any increase in N would have to be compensated by a reduction in y , or, conversely, any increase in y would require that N be lower.

The Impact Inequality is a snapshot of the global socio-ecological system. It is an *accounting* statement on the state of Earth's ecosystems at a moment in time. The inequality contains no information on how the five factors N, y, α, G, S influence one another over time. To identify their mutual influence requires a dynamic model that sees the human economy embedded in Nature.¹⁰

Other things being equal, increases in α would reduce the ecological footprint. But no amount of human ingenuity can make α unboundedly large; for that would require that no matter how large global GDP happens to be, further increases in GDP would make vanishingly small demands on the biosphere's maintenance and regulating services. And that would mean that the human economy could eventually extricate itself from Nature. As α is bounded above, GDP cannot grow indefinitely (inequality (1)).

The established economics of climate change has focused on technological change and pricing carbon emissions as the means for raising α (Nordhaus and Boyer, 2000; Stern, 2006). But the idea of "net-zero emission" points also to ecological solutions. Raising S and therefore G by allowing Nature to grow is investing in Nature. Such investment does not so much involve machinery and hardware as it involves simply waiting; that is, waiting for Nature to recover.

It was shown in Dasgupta (2021) that if our collective aim – the Sustainable Development Goals - is to close the gap between Ny/α and $G(S)$ by 2030, then on the assumption that the global economy will continue to enjoy the average annual growth rate in GDP of recent decades, we would require the efficiency parameter α to increase at an annual percentage rate some *four* times the rate that has been experienced in recent years. As that is an utterly unlikely scenario, Dasgupta and Dasgupta (2017, 2022) and Dasgupta, Dasgupta, and Barrett (2023) studied the magnitude of the Inequality in terms of N and y . We report their exercises.

How Many People Can Earth Support in Comfort?

There is a commonplace intuition that the global Impact Inequality has arisen because of high consumption among the world's rich people; with an accompanying corollary that large additions to human numbers over the past 70 years (N having risen from ~ 2.5 billion to ~ 8 billion) have had little to do with it. The intuition is at variance with evidence. Suppose, for example, the ~ 1.5 billion inhabitants of OECD countries (the *Economist* newspaper calls the OECD "a club of mostly rich countries") were to accept a *halving* of

¹⁰ For this, see Dasgupta (2021: Ch. 4* and 13*).

their annual incomes from the current figure of ~\$40,000 to \$20,000 dollars PPP. That's a huge drop in incomes, but as the Impact Inequality shows, the move would reduce the imbalance from the current ratio of 1.7 to 1.3. And 1.3 is a substantial figure, implying further erosion of the biosphere.

So, we now choose a value of y at which life is deemed to be comfortable. Per capita global GDP in 2019 was ~16,000 dollars PPP at 2011 prices. As an exercise let us take the chosen y to be 20,000 dollars PPP at 2011 prices. As the figure falls in the range of per capita incomes in the World Bank's list of high middle-income countries, we use it to represent a comfortable standard of living.

We assume that people apply their labor on produced capital and natural capital to produce an all-purpose commodity that can be consumed. As of now we have little quantitative knowledge of the biosphere's dynamics when viewed in the aggregate (i.e., we have no estimates of the G -function in the Impact Inequality). But as produced capital is complementary to natural capital in production (any expansion of the former makes further demands on natural capital), an expansion of the stock of the former depresses the stock of the latter, other things equal. Rockström et al. (2009) have found evidence in the Earth system's signatures that several planetary boundaries are so close to being breached, that further deteriorations in the state of the biosphere would take it into terrains that are uncharted and therefore should be avoided. Let us then regard K to be an aggregate measure of produced capital and natural capital and hold it fixed to ensure that there is no further deterioration of the biosphere. The idea is to stop K on its tracks by a global quota on what we are permitted to take from the biosphere.¹¹

Let Q be aggregate output. If global population is N and φ the proportion of N in production, we assume that output Q is a power function of K and N , that is,

$$Q = K^{(1-\rho)}[\varphi N]^\rho, \quad 0 \leq \rho < 1, 0 < \varphi < 1 \quad (2)$$

We now estimate $K^{(1-\rho)}$ from the current size of the world economy.

For want of data to the contrary, we assume that the value of the world's production of final good and services draws proportionately on all ecosystem services. In 2019 world output was about 120 trillion dollars at 2011 prices. Using the model of production in eq. (2), we therefore have

$$K^{1-\rho}[\varphi N]^\rho = 120 \text{ trillion dollars} \quad (3)$$

Global population was 7.8 billion in late 2019. The global dependency ratio, that is, the ratio of the sum of the number of people below age 15 and above age 65 to the number of people

¹¹ Quotas are applied routinely to fisheries and forestry, and for access to potable water in dry regions. The recent international agreement to limit the rise in mean global temperature to 1.5°C above what it was in pre-industrial times is tantamount to the use of quotas in emissions.

between 15 and 65, is today about 1.6 to 1. Thus $\varphi = 1/2.6$, which means $\varphi N = 3$ billion. A huge empirical literature in economics suggests that as a rounded figure, $\rho = 0.5$ is not unreasonable. Equation (3) then says,

$$K^{0.5} = 120 \times 10^{12} / (3 \times 10^9)^{0.5} \text{ dollars per producer}^{0.5} \\ \approx 2.2 \text{ billion dollars per producer}^{0.5} \quad (4)$$

Having calibrated our model of global production, we compute the sustainable population size if $y = 20,000$ dollars. Let N^* denote the size of the sustainable global population. To err on the conservative side of the size of the Impact Inequality today, we assume that the global ecological footprint is currently 1.5. That means if the biosphere and the stock of produced capital were stopped on their tracks, their sustainable value would be $K/1.5$, which we denote by K^* . Using eq. (4),

$$(K^*)^{0.5} \approx 1.8 \text{ billion dollars per producer}^{0.5} \quad (5)$$

Using eq. (3) - (5), we have

$$(K^*)^{0.5} (\varphi N^*)^{0.5} = [1.8 \times 10^9] (\varphi N^*)^{0.5} = (20 \times 10^3) N^* \quad (6)$$

But $\varphi = 1/2.6$. From eq. (6)) it follows that,

$$N^* \approx 3.3 \text{ billion} \quad (7)$$

Global population was ~ 3 billion in 1960, which means, in 3.3 billion we have arrived at a figure that prevailed only about 60 years ago.

The estimate has been derived on the assumption that income is equally distributed among all. Using data on the national ecological footprints in Wackernagel and Beyers (2019), Dasgupta (2021) found ecological footprint to be an increasing *but strictly concave* function of income. It follows that if inequality in the distribution of incomes is judged to be inevitable, the size of global population that would support an average income of 20,000 international dollars would be smaller than 3.3 billion.

But even a global population of 3.3 billion seems so foreign to us today that the above exercise should, realistically, be interpreted to be less a prescription than a sign of how quickly we have overstrained Nature. The idea of sustainable development is meaningless unless it ensures that it does not display the Impact Inequality. Subject to all the caveats we have stressed, our finding says that if humanity were to find ways to reside in the biosphere in a sustainable manner and to bring about economic equality, the human population Earth could support at a living standard of 20,000 dollars is ~ 3.3 billion. It is a simple matter to conduct the exercise with alternative figures for the living standard. I resist doing that.

It is informative to flip the question underlying the calculation by asking what living standard we could aspire to if world population was to attain the UNPD's near lower-end projection for 2100 of 9 billion (UNPD, 2019) – see Fig. 1 below. Eq. (5) - (7) provide us

with the tools needed to provide an answer. Sustainability requires that,

$$(1.8 \times 10^9) (\varphi N)^{0.5} = Ny \tag{8}$$

Set $\varphi = 1/2.6$ and $N = 9$ billion. That means eq. (8) reduces to

$$[(1.8 \times 10^9) (9 \times 10^9 / 2.6)^{0.5}] / 9 \times 10^9 = y \tag{9}$$

Let y^* denote the solution of equation (9). Then we have $y^* \approx 11,840$ dollars at 2011 prices. The figure falls within the range of middle-income countries. But 11,800 dollars at 2011 prices was the global living standard in about year 2000. At that time, however, the global population was only a little over 6 billion. That 3 billion fewer people did not enjoy a higher living standard should not surprise, because the global stocks of produced capital and human capital were a lot less 20 years ago than it was in 2019 and our model was calibrated with the stocks in year 2019.

“Pay For What We Use!”¹²

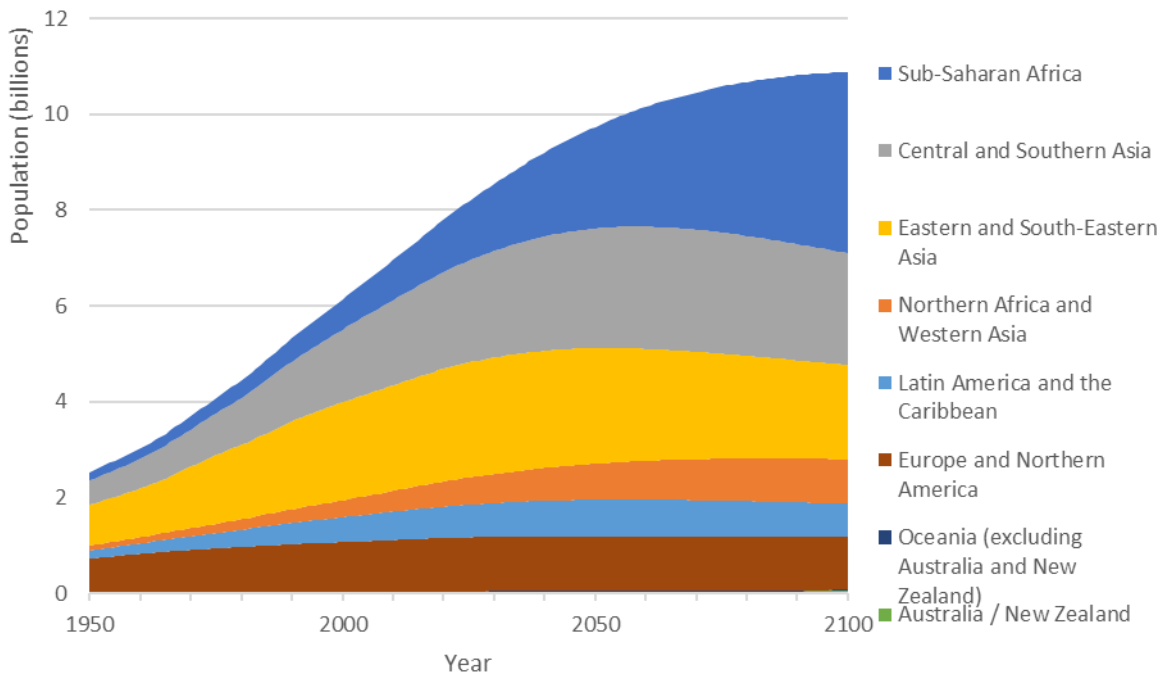
How should we read these exercises? It would be easy enough to dismiss them for their naivety, for example that they don't allow for the technological advances we should expect to be made to enable even 9 billion people to enjoy a standard of living a lot higher than 11,800 dollars. But that would be to overlook that unless the global economy finds ways to charge for our use of Nature's provisioning goods, technical advances will continue to be directed at economizing on human capital and produced capital and will continue to be rapacious in the use of natural capital. If by some miracle it was possible to make us pay for Nature's services at something like their accounting prices (or social worth), our consumption patterns would be very different. Not only would y be lowered, but our expenditure patterns would look entirely different. Moreover, entrepreneurs would have the incentive to invest in the technologies that economize on the use of natural capital, not be rapacious in its use. The human economy would move in such a different direction that it could even be that our descendants would have a better life than the average person does currently. Today, much of Nature is free, and we add to that insult by subsidizing its exploitation to the tune of 4-6 trillion dollars annually. That makes Nature come to us with a *negative* price! Our efforts should be directed toward improving our institutions, so that the distortions are reduced; ideally, eliminated.

The matter is urgent. It is a false sense of security to be reassured that under nearly all projections (Fig. 1, taken from UNPD, 2019 is only one such projection) the global population will cease to increase in some 60-80 years and decline thereafter. We do not know the asymptotic population level, even if we were to assume that population will

¹² The quote is the New York Times summary in its Opinion video – “An Actor, An Economist, and the Answer to Everything” - of a 610-page report prepared for the UK Treasury (Dasgupta, 2021). <http://nytimes.com/video>.

converge before there are serious breakdowns in Nature’s rhythms. The biosphere is a complex system, characterized by regions of bifurcation in the space of natural-capital stocks. Bifurcations are commonly called ‘tipping points.’ The planetary boundaries identified in Rockstrom et al. (2009) speak to that. And they are to be avoided at all costs. To quibble over competing global population projections is to engage in fiddling over minutia. In any case, as fig. 1 shows, sub-Saharan Africa poses an entirely different set of problems from the population aging that is projected in the OECD countries and such emerging countries as China. Fig 1, taken from UNPD (2019), says that global population *sans* sub-Saharan Africa could be expected to peak at ~7.8 billion in 2060 and then decline to ~ 7.6 billion in 2100. But fertility rates in sub-Saharan Africa are projected to remain so high that population there won’t peak at least until 2100. Desperately poor, high fertility rates (~ 4.2 today), combined with the leakage of wealth to rich countries that accompany exports of Nature’s provisioning goods (economists call them ‘primary products’) are ripe conditions for regions to be caught in poverty traps (Dasgupta, 2000). In her provocation, Aisha Dasgupta speaks to the enormous problems the region faces at the population-consumption-environment nexus. Socio-economic success in one part of the sub-continent can be expected to be countered by failure in another unless policies that would offer incentives to households to reduce fertility rates (and thus future *N*) are actively put in place. I have bypassed those problems by concentrating instead on global statistics. There are problems enough globally.

Fig. 1: Regional Population Projection to 2100



Source: UNPD (2019)

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Provocation – Gary Shteingart

I was born in Russia (well, the USSR at the time), a society that knows quite a bit about aging. In 1994, life expectancy for men in Russia dipped to 57 years, one of the lowest in the world. Growing up in Russia, I knew very few old men. One of my grandfathers died when he was in his fifties of tuberculosis (I am fifty-one, so this resonates quite a bit), and I never got a chance to meet him. The other died fighting in World War Two. My step-grandfather made it into his sixties, barely, but died from, among other things, alcoholism in the United States. When I was younger, I also expected to die in my fifties and in fact tried to write all my novels as quickly as possible so as to leave some kind of legacy before succumbing to genetics, diet and drink.

I also think that I grew up thinking that being excessively old was an American or Western thing, especially for men. Once you outgrew your usefulness it was time to die. This isn't so unusual, as many societies encourage their oldest members – either overtly or metaphorically – to go up on some forlorn mountain and waste away so as not to take precious resources. And yet in America so many kids I met had all *four* grandparents still alive and it seemed to be a wonderful resource for them (not to mention for their parents when it came to childcare and so on). In 2010 I wrote a novel called *Super Sad True Love Story*, in which one of the main characters, Joshie Goldman, an Elon-Musk-like tech leader, spent all of his resources on trying to stay alive forever, because he couldn't imagine the world without him. He was, of course, meant to be a comical character. But I think Joshie,

who was very much based on an actual person I knew, captured my own feelings about America's fascination with aging, or rather its hatred of growing old almost as a part of its Protestant work ethic. You can't get old because then you can't contribute, or "add value" as someone like Joshie might say, and if you can't add value then what is the point of you?

My wife is Korean-American so it is interesting for me to see the way older people are venerated – or at least have been in the past – in that culture. The first part of that, of course, is their life expectancy (her father is well into his 90s). But the other part of that, or so it seems, is the ironclad social contract where the parents expend endless resources (beyond anything we would consider in Russia) on their children and are then rewarded with a peaceful and subsidized retirement (again, in Russia this period is very short). I am aware, of course, that countries like Japan are experiencing problems in this sphere, as many elderly feel alone and apart. And yet on a recent visit to Japan I was impressed by the very presence of so many elderly people, who seemed to form their own neighborhoods or even mini-cities, what I guess in America we would call a NORC, or Naturally Occurring Retirement Community (I once worked as a grant writer for a NORC on the Lower East Side of New York).

As I begin to overtake what used to be the average life expectancy of someone born in my part of the world, I know I am blessed with a vocation that I can practice for the rest of my days and one that is not as affected by my physical health as some others. I write three hours a day, mostly in bed (as Proust also did, not that I am comparing myself to him), and I think that is sustainable into my eighties as long

as I don't succumb to dementia. For many parents of friends I know in the States who are in that age bracket, the greatest danger is a lack of things to do, especially as mobility is diminished. For many, watching FOX news and falling into various conspiratorial rabbit holes seems to be the lay of the land. Media entities are well aware of this and oblige them. The result, I think, is a kind of near-death, or at best a mere existence.

Beyond chronological age: Under a multi-dimensional demographic approach the future looks different.

Wolfgang Lutz

Wittgenstein Centre for Demography and Global Human Capital (IIASA, ÖAW, Univ. Vienna)

Chronological age (time since birth) is only one of several aspects of human aging, and in many respects not the most relevant one. While the concept of chronological age has been enshrined in many of our human-made laws and institutional arrangements (such as social security laws), biological age, social age, working age or family status related age can be more relevant in many other aspects of life. And these other ages can differ significantly from chronological age, both at the individual level as well as at the level of population.

Recently several new indicators in the field of “Redefining age and ageing” have been developed, such as the proportion of the population with a life expectancy of 15 or less years, which is an alternative definition of “old age”. There have been high level publications on these new approaches to measuring age (such as Lutz, W., W. Sanderson, and S. Scherbov. 2008. The coming acceleration of global population ageing *Nature* 451: 716-719 or the 2019 Harvard University Press book by Sanderson and Scherbov “Prospective Longevity: **A new vision of population aging**). Even the rather conservative UN Population Division has now started to add such alternative aging indicators to their published data.

But beyond age in its various forms and dimensions there are other important demographic dimensions that are highly relevant in the context of considering the consequences of future population ageing around the world. In particular, the demographic dimensions of labor force participation and highest educational attainment (also as a proxy for productivity) are of great relevance when discussing the implications of changes in the age structure.

Multi-dimensional demography (as recently summarized in “Advanced Introduction to Demography”, Lutz, 2021, Elgar) can effectively model the changing compositions of populations by these different relevant demographic dimensions, as will be illustrated for the EU and China below. The resulting outcomes in terms of the likely future trends in demographic dependency ratios reflecting these other dimensions differ significantly from the conventional one-dimensional fixation on chronological age as reflected in the misleading but still widely used age dependency ratios.

At this point I want to stress that this multi-dimensional view of demography is also fully in line with the origins of the discipline, the classic definition being the **scientific study of changing population size and structures**. It is important to note that “structures” is stated in plural which implies the analysis of multiple structures and not only a focus on the changing age structure as is often done in more narrow and conventional approaches, even by many demographers. But it is in the end the changing composition of societies with respect to several important characteristics of people – which in addition to gender and age are also place of residence, level of education, labor force participation, ethnicity, and

others (as typically collected in a census) – that lies behind many of the changes we observe and want to better understand and even forecast into the future.

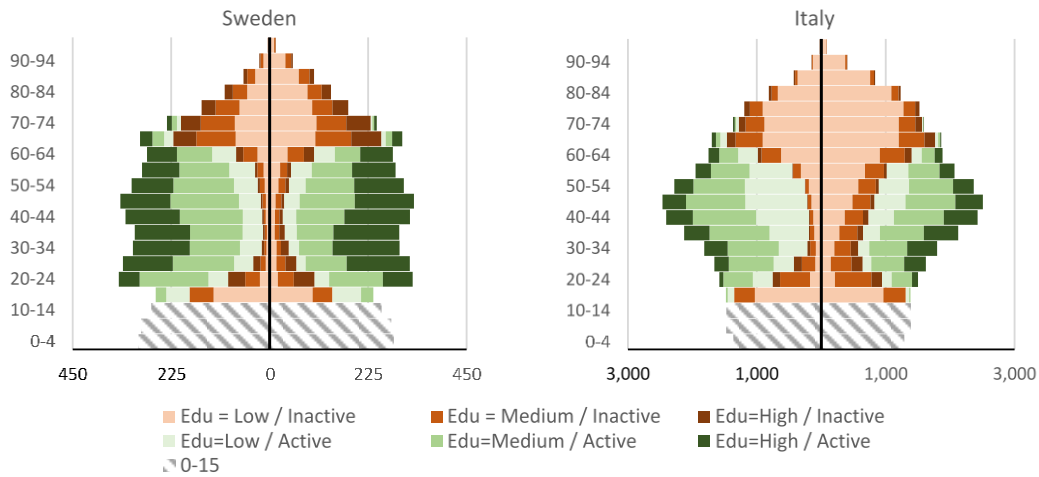
Why has this multi-dimensional demographic perspective then been lost in most ongoing discussions about population ageing? One hypothesis is that this overly narrow perspective on chronological age (and sex) alone may have to do with the fact that many widely available population data and projections are often only presented by age and sex. Most national statistical offices as well as the UN Population Division indeed only present time series (past and present) for populations stratified by age and sex alone. Only more recent and less widely used global projections by the Wittgenstein Centre and JRC (<http://dataexplorer.wittgensteincentre.org/wcde-v2/>) provide long-term scenarios with populations stratified by age, sex and level of education for all countries in the world (and by labor force participation for European countries). While these multi-dimensional scenarios are already widely used in the climate change research community as part of the SSPs (Shared Socioeconomic Pathways) covering future mitigative and adaptive capacities they are still largely unknown in the economics and policy communities. And, if projections by only age and sex is what demographers typically present to the rest of the world, then the rest of the world may think that this is all that demographers have to offer. For this reason, in the following I want to show two examples for how different the future looks under a multi-dimensional demographic perspective.

The two figures presented below come from two recent papers published in the pages of *PNAS* (Marois G , Bélanger A, and Lutz W. 2020. Population aging, migration, and productivity in Europe) and (Marois, G., Gietel-Basten, S. & Lutz, W. 2021. China's low fertility may not hinder future prosperity.) They calculate three different kinds of dependency ratios based on multi-dimensional demographic scenarios, namely:

1. The **conventional age dependency ratio (ADR)** is defined as the ratio between the children and the elderly (0-14 + 65 and older) in the numerator and the so-called working-age population (15-64) in the denominator. This indicator only reflects the age structure of the population. This ratio is only a very crude approximation of actual economic dependency because not everybody starts to work at age 15, not everybody between ages 15 and 64 is working and not everybody about age 65 is unproductive. For this reason, another ratio directly relates the people not in the labor force to those in the labor force:
2. **The labor force dependency ration (LFDR)** has all economically inactive persons in the numerator and the active ones in the denominator. One should note that under the labor force concept as usually defined all people currently in work (full or part time) or looking for work are considered as economically active. In other words, the labor force is the sum of men and women of all ages that are either employed or unemployed and looking for a job. It comes much closer to the real economic dependency than the ADR. To take account of the fact that not all members of the labor force equally contribute to the economy, the paper proposes a further innovative dependency indicator:
3. **The productivity-weighted labor force dependency ratio (PWLFR)** builds on the LFDR and in addition approximates differences in productivity through wage differentials associated with various levels of educational attainment. As usually done in economic studies, empirically assessed wage differentials are assumed to capture differentials in productivity which in our case have been estimated from the European Labor Force Surveys. The resulting education-specific productivity differentials are then maintained over time and superimposed to the multi-

dimensional population scenarios by age, sex, education and labor force participation. Since these are four demographic dimensions as discussed above, their changing distributions over time and across populations will provide an even more accurate picture of changing dependency over time as resulting from multi-dimensional demographic change.

Figure 1. Age pyramids by labor force participation and education for Sweden and Italy, 2015 ('000)



Source: Authors' calculations from the European Labor Force Survey 2015

Figure 2. Projections of the three different dependency ratios for the EU-28, baseline scenario, 2015-2060

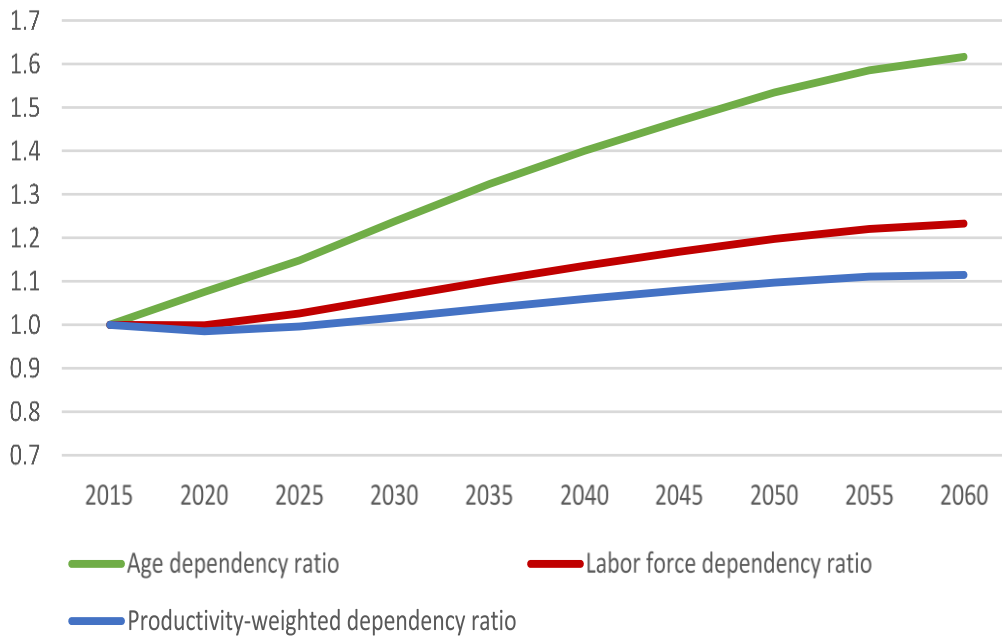
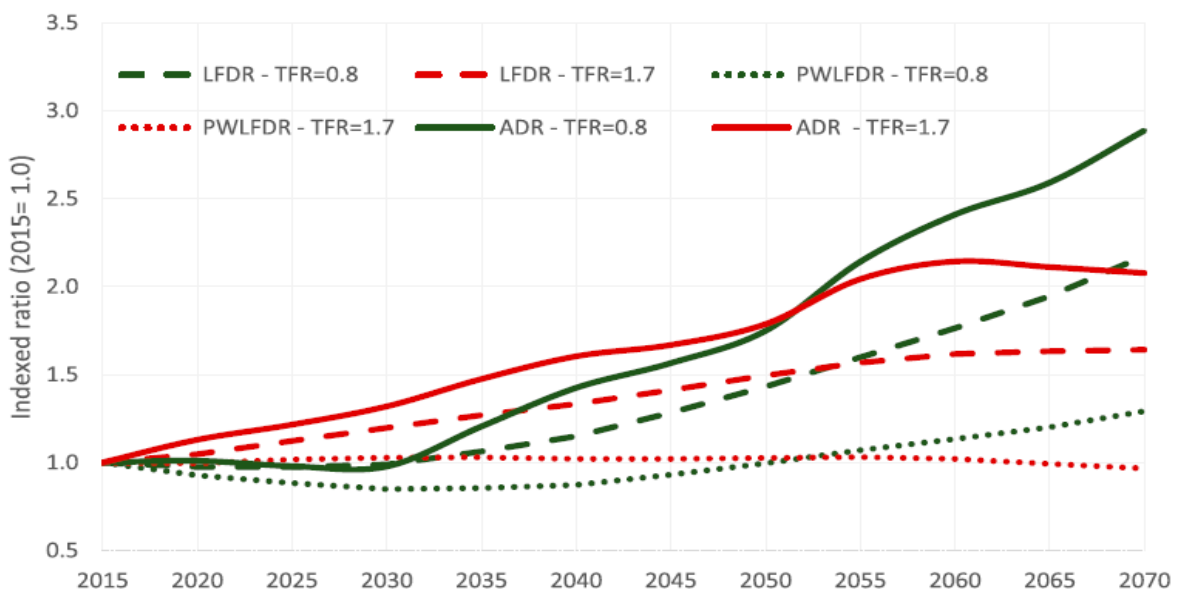


Figure 1 above shows the empirical 4-dimensional (age, gender, education, labor-force participation) structures of the populations of Sweden and Italy showing for Italy the fact that younger and more educated women work to a higher extent. Figure 2 then shows the relative increases projected for the three dependency ratios scaled to 1.0 in 2015. While the conventional age-dependency ratio shows an increase of over 60 percent by 2060 due to population aging the labor force dependency ratio only increases by a little over 20 percent, mostly due to the fact that younger cohorts of women in Europe are more likely to work than older ones which is also linked to their higher education. This higher education will also lead to higher productivity which results in only a 10 percent increase of the productivity-weighted labor force dependency ratio. Thus, under this multi-dimensional perspective the dependency related challenges look much less dramatic.

The chart on China below uses the same three dependency ratios to address the question of the likely economic impacts of very low fertility. Following the admission of the Chinese government that the TFR had fallen to below 1.3 (it is currently likely in the range 1.0- 1.1) the international media uniformly assumed that this would negatively impact on China’s future economic growth, even in the near term. This is a relevant question, since it can be considered likely that fertility might decline even further, following South Korea where the TFR has fallen to below 0.8. The chart gives the above defined three dependency ratios for two fertility scenarios for China: a very low TFR of 0.8 (green) and a recovered TFR of 1.7 (red). The solid lines give the conventional age dependency ratios which in the near term will be lower for the very low fertility case because fewer children will lead to a lower child dependency ratio. Only after 2050 the green line will increase above the red one when the low fertility cohorts will result in a relatively smaller population in the assumed working ages. In other words, for 35 years the very low fertility will actually result in a lower age dependency ratio, likely to be associated with an economic bonus as compared to the high fertility scenario. In the very long run – by 2070 – however, the broadly expected negative effect will lead to a threefold increase in age dependency as compared to “only” doubling in the case of a TFR of 1.7. Looking at the above discussed productivity-weighted labor force dependency ratios (the dotted lines at the very bottom) there is very little increase over time under both fertility scenarios since already today the younger cohorts in China are so much better educated than the older ones. Actually, the very low fertility combined with high education of the young cohorts would over the coming 30 years even lead to further decline in total dependency.



These two examples illustrate, that it makes a lot of difference which demographic dimensions we consider and which dependency ratios we use for our assessments.

A final example relates to the issue of the future prevalence of disability in the context of population ageing. Universally, the prevalence of disability (such as measured for activities of daily life) increases with age. But also universally, at a given age, the more highly educated people have a much lower disability rate than the less educated ones. Recent data for Austria show that 80-year-old women with a university degree have a disability prevalence of only 15% as compared to 35% for women of the same age with only basic education. Combining the plausible assumption that such differentials will continue in the future with the already given fact that in virtually all countries the younger cohorts are better educated than the older ones will result in much lower forecasts for future overall disability rates than the usual way of assuming constant age-specific prevalence and applying them to the future older age structures which results in the expectation of massive future increases in disability.

With this provocation I do not want to say that population aging poses no challenges. I only want to say that our forecasts become more realistic, and the picture gets richer and offers more policy options, when we move beyond the typical exclusive focus on chronological age. Chronological age still matters greatly in the context of our self-constructed institutions and regulations that may turn out difficult to change, as we have just seen in France in the context of increasing the legal pension age.

In terms of demographic policies such a multi-dimensional approach also offers a much wider spectrum of policies. In addition to the typical focus on birth rates and migration it also suggests labor force participation and education as powerful demographic levers. In this context, I have called demographic policies “National level human resources management” in analogy to HR policies within companies (Lutz 2014, The truth about aging populations. *Harvard Business Review*).

Thoughts and Comments on Demographic Aging and Shrinking

Meeting of the Minds 2023

Nicholas Eberstadt

I would point to many of the same facts and concur with many of the assessments already tendered in the excellent contributions already submitted concerning the outlook for and implications of population aging and shrinking around the world.

Rather than repeat these in my limited space, I will try to touch on some points not yet made (or made not quite the way I would frame them).

The most important point is this: ***We are a uniquely adaptable animal.*** Much of the current *angst* about the prospect of a shrinking aging human population is unwarranted. But not all. And there are things we perhaps should worry us that do not yet seem to be doing so.

Fear of population change: half a century ago, when I first started learning about population and development, fear of the “population explosion” was in the air. It was also pervasive intellectual circles: recall “Limits to Growth” and “The Population Bomb”, among many others. (A “provocation” on population from 1973 might have been themed “who should starve first?”) Population alarmism led to some ugly talk (thinly disguised eugenics: sometimes not even disguised) and to some tragic monstrous policies (One Child program in China). Even respectable authorities like the US National Academy of Sciences’ assessment was infected with uncritical Malthusian-tinged pessimism (vis. the multi-volume NAS opus “Rapid Population Growth”, 1971).

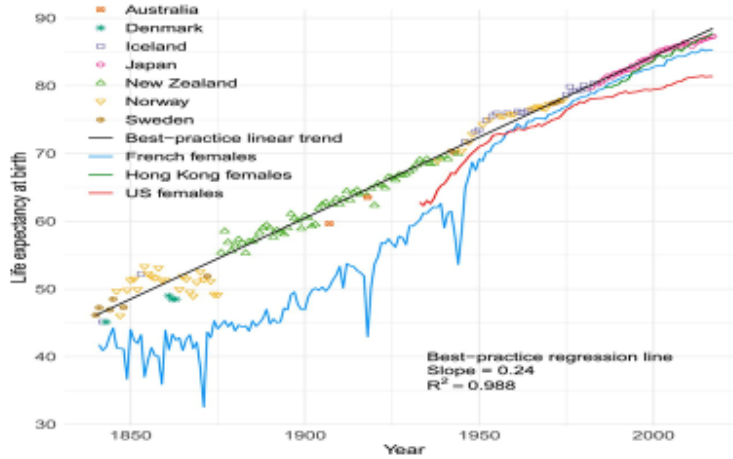
We should bear the previous unwarranted global population scare in mind as we consider the current emerging anxiety about long-term depopulation and unprecedented population aging. Depopulation and massive “greying” are unfamiliar; social change always brings uncertainties—and population change is by definition a force of social change. But there are reasons to be cautiously optimistic about the outlook for a shrinking aging world.

The human resource explosion. *Global depopulation and aging will be occurring in the context of an ongoing revolution in human potential.*

Part of this revolution is the ongoing health explosion. Global life expectancy at birth has risen from around 30 in 1900 to well over 70 today. And this does not merely mean that the world is heading toward some longevity asymptote or global health dead-end. So far as we can tell, the maximum national life expectancy for the world’s ‘top performer’ has been heading straight up over three successive centuries. Witness the chart below (from the late great James Vaupel and colleagues):

The Health Explosion: Now Into Its Third Century

"Best in Class" Female Life Expectancy at Birth by Country/Population and Year (1840-2017)



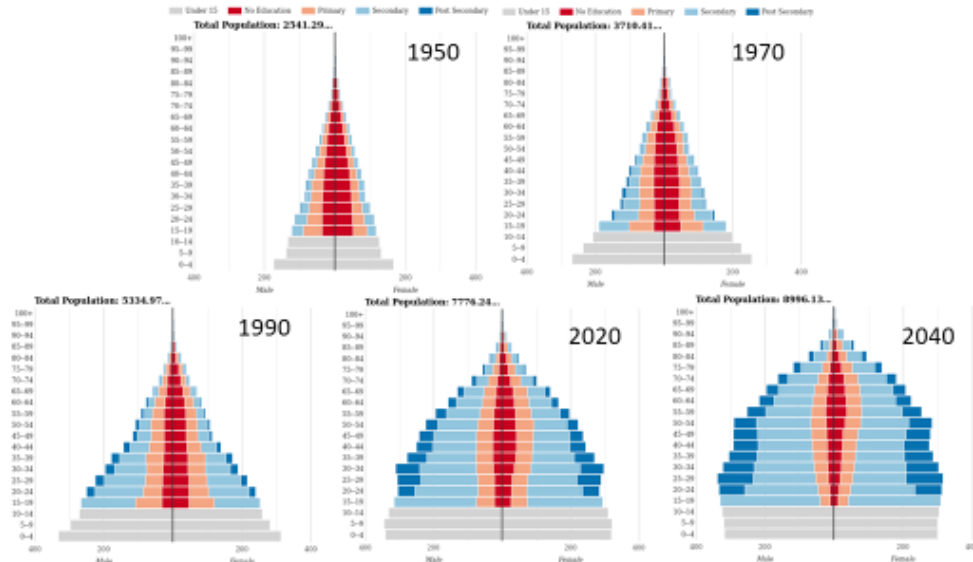
Source: James H. Vaupel et al., "Demographic perspectives on the rise of longevity," *Proceedings of the National Academy of Sciences of the United States of America* 118, no. 9 (2021): <https://doi.org/10.1073/pnas.2011187118>; <https://pubmed.ncbi.nlm.nih.gov/35691000/>

2

We are also experiencing an extraordinary worldwide education explosion, as calculations from the Wittgenstein Centre for Demography and Human Capital illustrate:

The Global Education Explosion

World Population by Educational Attainment 1950-2040 (Estimated and Projected, Wittgenstein Centre)

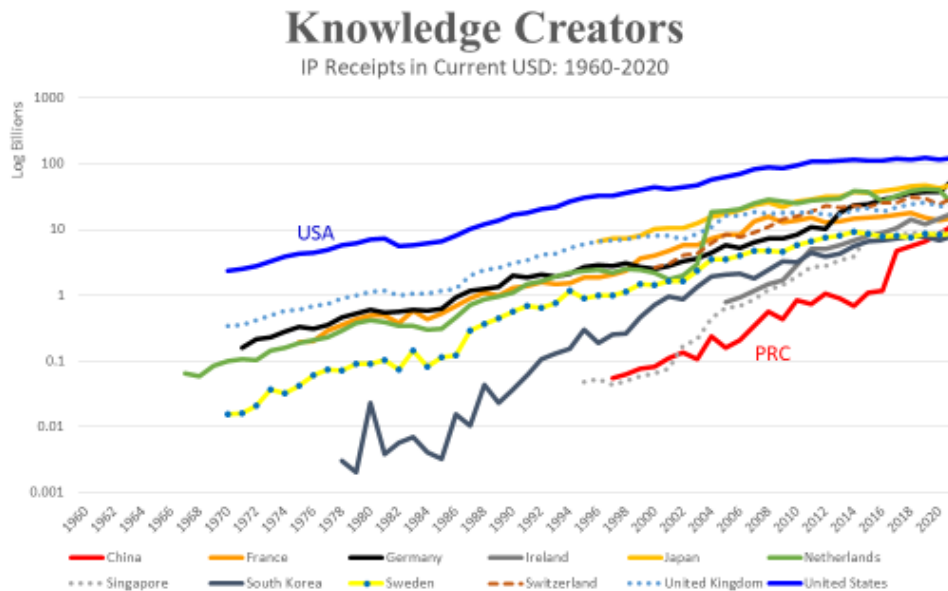


Source: Wittgenstein Centre for Demography and Global Human Capital, "Wittgenstein Centre Data Explorer" version 2.0, accessed September 1, 2020, <http://www.wittgensteincentre.org/dataexplorer>.

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And while measurement of the ongoing "knowledge explosion" is problematic—anyone who has tried to quantify it knows how easy it is to poke holes in any given proposed indicator for the

phenomenon—it is nevertheless clear that the market value of applied knowledge continues to increase, as this sounding below underscores:



IP Receipts, "Charges for the use of intellectual property, receipts [BoP, current US\$]" World Bank, <https://data.worldbank.org/indicator/YS.G3B.BDCL.CD>

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The revolution in human potential is the underlying explanation for the leap in global income and wealth over the past two centuries. Between 1900 and 2018, by the estimate of the Maddison project, global per capita output soared by over 600%.¹ By the more exploratory estimates of the Credit Suisse team attempting to quantify global wealth, per capita personal wealth for the world as a whole has also been rising exponentially for at least the past several decades.²

To be clear: this updraft has not included every single national population every single year of the past century. Much of sub-Saharan Africa saw health progress derailed for years by the AIDS plague. Russia has somehow managed to achieve a “high education/low human capital” environment over the past generation or so. These are genuine exceptions. But they are just that—exceptions.

Seizing opportunities. The tremendous power of the ongoing revolution in human potential³ ought to make for cautious optimism (at the very least) that prosperity and living standards can be not only maintained but progressively enhanced in a shrinking aging world. Of course doing so will require adaptations—to policies, social arrangements, and individual lifestyles. But most of these should not be unthinkable for the world’s most adaptable animal.

¹ <https://www.rug.nl/ggdc/historicaldevelopment/maddison/releases/maddison-project-database-2020>

² <https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html>

³ And we have not even mentioned the “techno-physical revolution” that the late Robert William Fogel began to quantify; cf. <https://www.nytimes.com/2011/04/27/books/robert-w-fogel-investigates-human-evolution.html>

Unlock the value of health, especially for older people. Live longer, work longer. Completely recast the government Ponzi scheme known as “pay as you go social benefits”. And so on.

If these challenges look daunting, it is only because we are thinking small. And thinking small is not how that most adaptable animal came to flourish.

Obstacles small and large. If this all sounds too Pollyanna-ish to some, let us look at a couple of problems on the horizon. In the interest of space: one smaller one and one much bigger one.

The smaller one: dementia/senescence. For some reason, two generations of life science breakthroughs have done very little to improve treatment or offer cures for Alzheimer’s etc. Notwithstanding the health revolution, dementia still increases exponentially with age, and with the 80+ contingent around the world poised to grow at breathtaking speed over the coming generation or so, the burden of dementia will pose a real and growing cost—human, social, economic—to societies around the world in the decades ahead.

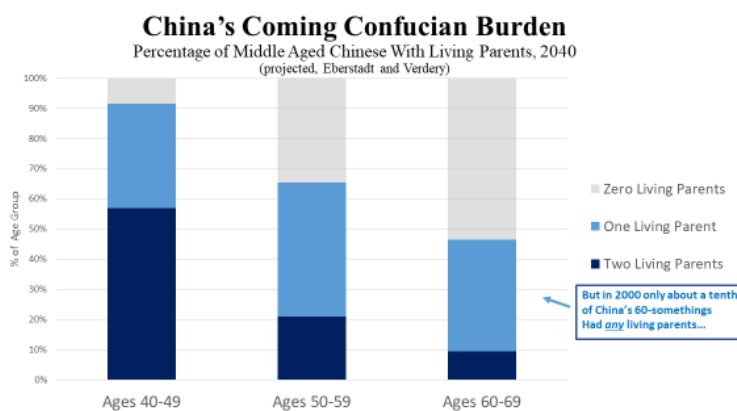
The larger problem: the implosion of the family. If we were all potentially productive robots spat out of a factory, with an expiration date of say 85 years after we were switched on, the productivity trends described above would in themselves signify a happy-ending.

But we are not robots: we are social animals, who begin and (often) end our lives as dependents—and we need to be around other animals of our kind, as the Creator noticed first of Adam.

And the heart of the problem here is that global aging and population decline are mainly driven by a withering away of the family—the basic unit of human life up to this point. And therein lies the problem.

As an arithmetic matter, the greying of societies is driven much more by smaller families than longer lives. But longer lives also mean that middle aged and even elderly children will increasingly be responsible for ancient living parents.

Consider the outlook for China. Demographic simulations by Ashton Verdery and myself suggest the dilemmas that may face middle aged people in China in less than a generation:

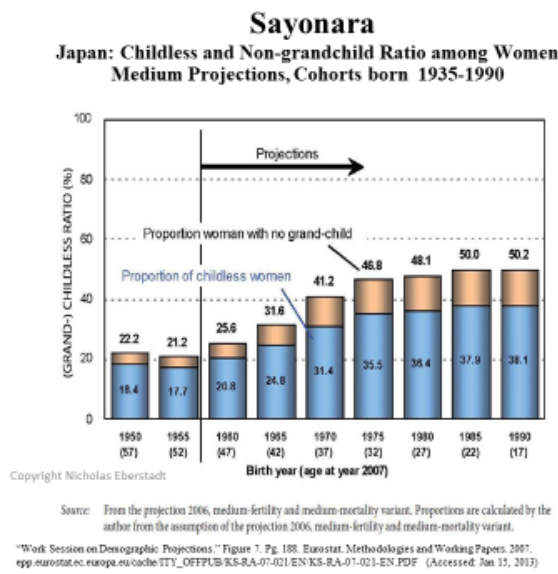


Source: Nicholas Eberstadt and Ashton Verdery, China’s Revolution in Family Structure: A Huge Demographic Blind Spot with Surprises Ahead, <https://www.pew-research.org/wp-content/uploads/2023/02/China-Revolution-in-Family-Structure.pdf?d=1138>

By 2040 it is likely that Sixtysomething couples in China will have at least one living parent to look after; many will have two or three to think about.

But those prospective elders are elders with descendants. With the rise in (voluntary) childlessness around the world, growing numbers of elders will have no relatives—or no close relatives—to count on.

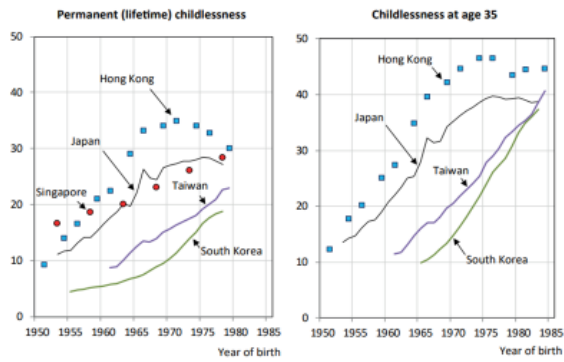
Consider these projections for Japan from a few years ago: on the projected trajectory, almost 40 percent of Japanese women born in 1990 will complete their lives without biological children—and slightly over half will finish their lives without biological grandchildren:



And with childlessness on the rise throughout East Asia, the rest of the “flying geese” are on track to follow Japan toward a family-poor future:

Setting Sun

Permanent childlessness at age 50 and childlessness at age 35 by cohort in Japan and 4 East Asian territories



Tomáš Sobotka, "World's Highest Childlessness Levels in East Asia," *Population and Societies*, No. 595, December 2021, <https://doi.org/10.3917/popsoec.595.0001>.

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Will the most adaptable of animals be able to devise a “hack” to a future without family? This question remains unanswered. But the fate of humanity in an aging and greying world may turn very largely on it.

Meeting of Minds 2023

Perspective from Japan

Yumiko Murakami

Introduction

The decline in Japan's birthrate and the aging of its population are rapidly accelerating. Senior citizens aged 65 or over numbered 36.27 million in 2022, accounting for 29.1% of the general population, and both the absolute number of senior citizens and the population aging rate set new all-time highs. Looking back, the ratio of elderly people went from less than 5% in 1950 to more than 14% in 1995 and then to 23% in 2010, surpassing the 21% level that defines super-aging. The aging of the population is expected to pick up speed from here. An estimate by the National Institute of Population and Social Security Research contends that the ratio of elderly people will reach 35.3% in 2040, when the generation born during the second baby-boom period (1971-1974) will be 65 years or older.

A declining birthrate and an aging society have wide-ranging socioeconomic impacts, and a number of issues have surfaced. Labor shortages stemming from aging have already adversely affected some corporate activities, casting a shadow over economic growth. Additionally, a growing percentage of elderly people facing financial uncertainty makes itself felt in lower purchasing power, which in turn leads to a contraction of Japan's consumer market as a whole. The population decline in rural areas has been particularly serious, resulting in an increase in empty houses, empty shops and abandoned farmland, thus imposing heavier burdens on local economies. If Japan's society continues to age further, it is highly probable that local governments will find it difficult to maintain administrative functions at their current levels. On the fiscal side as well, there is a disturbing imbalance between the cost of social insurance benefits for expanding medical and nursing care and its burden sharing.

Japan faces a host of such challenges, but a look at the rest of the world reveals that many countries will similarly confront the issues of declining birthrates and aging societies in the near future. Efforts directed at the elderly have been incorporated in many aspects of the UN's Sustainable Development Goals (SDGs). Elderly people currently make up less than 9% of the world's total population, but this figure is expected to double to around 18% by 2060. Currently, it is mainly in Europe and East Asia that countries have high ratios of elderly people, but aging trends will become conspicuous in developing countries hereafter. Due consideration should also be paid to the speed of aging. Comparing the number of years it takes the aging rate to exceed 7% and double to reach 14%, Germany has a figure of 40 years, the US 72 years and Sweden 82 years, all indicative of a gradual trend, whereas Japan by contrast has a relatively quick 24 years. Asia has countries in which

aging will advance even faster than in Japan – South Korea at 18 years and Singapore at 20 – and there is urgent need for countermeasures in these countries.

The aging population combined with the diminishing number of children that confront Japan at the moment will one day become a global megatrend, with numerous countries forced to address these as socioeconomic issues. As a country on the leading edge of these issues, Japan should tackle them by sharing its wisdom on coping with a low birthrate and a graying society and encouraging international cooperation. An aging society with fewer babies is not an entirely negative development, however, as new possibilities can also come from the silver economy.

Japan's leadership should focus on the brighter aspects of declining birthrates and aging societies and undertake discussions on improving the quality of life for people around the world. Japan, a pioneer in policies to address the graying of societies, announced its views on financial inclusion for aging societies as the G7 chair in 2023. These guidelines are useful not only for Japan but also for many other countries with the prospect of aging societies. Below, let me highlight eight topics that are particularly important, including social policies directly connected with the financial sector as well as those indirectly related to aging.

1) Utilizing data and evidence

Sufficient data and evidence are needed when drafting comprehensive financial policies for the elderly. Basing data analyses on age, sex and other attributes in as much detail as possible enables discussions on policies better tailored to the characteristics of senior citizens. While large volumes of data are presently used for data analysis, relative scarcity of data on the elderly has been noted. There may be instances in which it is not as easy as with younger generations to collect digital data from elderly persons with relatively low access rate to digital technology. Paying attention to this point, particular effort should be made to collect and utilize data and evidence on the elderly.

2) Enhancing digital and financial literacy

Digital technology has made remarkable progress, altering economic and social environments at a speed never before experienced by humanity. In such circumstances, there is a tendency for education and knowledge acquired in the past to become obsolete at a quickening pace, and even highly-educated elderly persons may find it extremely difficult to understand and effectively use digital technology. Timely opportunities must be provided for senior citizens to familiarize themselves with digital technology and finance through a

variety of channels. Systems for public-private cooperation should be put in place to increase the opportunities for education, with special care to communicate with non-specialists in easily understandable ways that avoid difficult terminology.

3) Encouraging lifelong financial planning

Numerous adults around the world are entering their senior years without sufficient savings to cover living expenses and long-term nursing care costs. The percentages of pension recipients in Central/South Asia and Africa are exceptionally low. There is also a worldwide tendency that women receive lower pension coverage than men. Lifelong financial planning is important, and it should be based on a combination of financial guidance, advice and product design as well as suitable consumer protections. People need to visualize the financial needs of old age and understand the importance of preparing from a young age, and to have access to tools and services.

4) Customizing approaches to the diverse needs of the elderly

Individual senior citizens have extremely diverse needs. Adopting across-the-board approaches based solely on age entails great risk. Support customized to individual needs should be provided that respects the wishes of the individuals themselves and takes into account factors that could help eliminate financial risk, including gerontological perspectives as well as sex, cognizance, physical ability, state of health, home ownership and wealth building status. Financial institutions have a role to play in supporting aged consumers who need support customized in this fashion. Such approaches will enable the providers of credit and insurance products to take into account of the information about, and the needs of, elderly consumers and entrepreneurs.

5) Promoting innovation

Technology plays an important role in attaining financial inclusion and addressing issues that stem from the aging of society. The elderly in all countries have inferior access to digital financial services than do other age groups. Low digital literacy or confidence can often constitute obstacles for the elderly, and technology can provide the key to eliminating these obstacles. The latest biometric technology has in some cases been incorporated when providing services, and practical use is being made of services that employ algorithms to identify mistakes by elderly customers. Knowledge of behavioral economics and pedagogy can be utilized in developing easy-to-use digital tools that achieve innovative approaches.

6) Protecting the elderly

According to the definition by the World Health Organization (WHO), financial abuse of the elderly includes the illegal use of senior citizens' cash, property or other assets. It has been pointed out that elderly investors face higher risks than other investors of losing money due to fraud or misuse. The authorities responsible for protecting financial consumers need to promote awareness among the elderly, and to oversee financial institutions by, for example, setting out clear legal and regulatory requirements for properly ensuring informed consent.

7) Adopting cross-sectoral approaches

Given the multifaceted nature of the issues involved and the breadth of the approaches and responses needed, it is essential that parties from both financial and non-financial sectors cooperate to support the financial inclusion of elderly consumers and entrepreneurs. Among these parties should be public institutions in the financial sector, private companies, civil society organizations, and groups representing the interests of the elderly. There are also instances in which local service providers (e.g., convenience stores, nursing care facilities, pharmacies, public transport companies and restaurants) are themselves not aware that they have roles to play in the financial inclusion of the elderly, so awareness must be raised within the community at large.

8) Addressing vulnerabilities

Financial inclusion has become an issue of great urgency for certain persons placed in particularly disadvantageous positions from which it is difficult to gain access to services, especially persons suffering from poverty, chronic illnesses or disabilities. Such disadvantages combined with aging often result in financial and social exclusion or greater susceptibility to isolation, with women being especially vulnerable. Women have a lower average lifelong income as well as lower digital and financial literacy while at the same time having a longer average lifespan.