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Supplement: Aging Well in an Aging Society: Italy at the Forefront of Population Aging: Research Article

Positive demography: changing the perspective on population aging from the Age-It Research Program

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Abstract

Objectives: The focus on the negative—at times depicted as catastrophic—consequences of population aging have overshadowed more optimistic stances. In this position article, we advance the notion of "positive demography," which—while acknowledging existing challenges—contends that since a new demographic phase is inevitable, high-income countries should focus on making the most of it. We discuss this view with reference to Italy, one of the fastest-aging countries in the world, drawing lessons from Spoke 1 (The Demography of Aging) of the Age-It Research Program.

Methods: We integrate different perspectives from social research on aging, informed by the most up-to-date literature in demography. This approach allows for a comprehensive understanding of demographic changes, highlighting their benefits while proposing forward-looking policy solutions.

Results: Longer life expectancy and improved health outcomes create opportunities for extended workforce participation and intergenerational contributions. Bridging the gap between desired and actual fertility is feasible through structural policies. Migration, at least in the short term, offers a means to mitigate aging-related challenges and accelerate demographic renewal.

Discussion: A positive demography agenda extends beyond addressing aging-related needs; it requires investments in younger generations to help them prepare for long and fulfilling lives. Achieving this vision necessitates interdisciplinary collaboration, innovation in data collection, and a methodological shift from *forecasting* to *backcasting*—identifying present actions necessary to shape a desirable demographic future.

Keywords: Longevity, Fertility, Migration, Data innovation, Italy

Population aging is a testament to our success in reproductive planning and extending life expectancy. The combination of low fertility (aging from the bottom) and low mortality (aging from the top) gradually results in smaller populations composed predominantly of older individuals. This process is slow and began long ago. The age profile of many populations—especially in high-income countries—no longer resembles a pyramid, the traditional shape used in demographic graphs. Instead, it now evokes other forms, such as cruise ships (Billari, 2023). The largest population shares have shifted from the base of the figure (i.e., among the youngest) to increasingly older ages. In this article, further to discussing the well-known negative consequences of population aging, we also advance an alternative notion, "positive demography," which we develop with special reference to Italy, one of the fastest aging societies in the world. Positive demography does not mean ignoring or downplaying challenges; rather, it signifies a shift in perspective, recognizing that Italy's demography is transitioning to a distinct, qualitatively new phase—neither better nor worse. Positive demography entails viewing demographic changes through a lens that highlights the positive aspects of contemporary population dynamics, while simultaneously proposing proactive solutions to their resultant challenges. In advancing this perspective, we acknowledge a growing body of literature—ranging from recent World Health Organization, United Nations, and European Commission reports to academic contributions (e.g., Leeson, 2017; Natale et al., 2024; United Nations, 2023; World Health Organization, 2015)—that has also advocated for a more balanced and constructive view of population aging.

The aging of population structures has emerged as a natural consequence of the so-called "Demographic Transition"—the shift from a demographic regime marked by high mortality and

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fertility to one characterized by low mortality and fertility, driven by major improvements in living conditions, social change, and medical progress. Italy is leading population aging in Europe and ranks among the oldest countries in the World, largely due to how decades of longevity growth and very low fertility rates have created an exceptional demographic scenario. As of 2024, a quarter of Italians are 65 years of age or older, and this proportion is still on the rise (Istat, 2024). By 2050, individuals over 50 will form the majority, and those over 75 will constitute roughly 20% of the total (Eurostat, 2025). This is an unprecedented scenario in human history: Never before have societies had at their core post-parenting and retirement-age individuals, with their evolving needs and increasingly complex family trajectories (Alderotti et al., 2022; Vignoli et al., 2025).

Population aging is often framed through a lens of alarm, primarily due to its perceived negative externalities—most notably, the growing fiscal pressures on health care and pension systems and the anticipated contraction of labor markets (Olshansky, 1997; Suzman, 2010). Concerns about the sustainability of welfare arrangements in the face of rising old-age dependency ratios have dominated public discourse, often reinforcing a zero-sum logic in intergenerational debates. These concerns, while not unfounded, are frequently amplified by demographic determinism and overlook the potential for institutional adaptation, policy reform, and shifts in behavior. The use of dramatic and strongly evocative terms—such as "demographic winter," epitomized by the alarmist 2008 documentary *Demographic winter: The decline of the human family*—along with media buzzwords like "demographic freeze," "demographic ice age," or "population boom," serves to reinforce an alarming narrative.

Nonetheless, the focus on the negative consequences has overshadowed a different perspective on demographic aging. From the individual's perspective, population aging represents an unequivocal success (Vignoli et al., 2024). With decreasing mortality, we can anticipate longer lifespans—adding up to the equivalent of an extra day each week over a lifetime—a prospect many would eagerly embrace (Scott, 2024). It is fascinating to consider the challenge of filling that additional day with meaning and fulfilling content. A significant proportion of people will spend their late years in better health than in the past. Recent research indicates that older adults today exhibit higher levels of physical and mental functioning compared to previous generations, suggesting a positive trend in aging health outcomes (Beard et al., 2025). These are remarkable and recent advances in the history of human societies.

Why, then, should these outcomes be viewed negatively? Media narratives tend to shift the focus from the achievement of exceptional longevity to concerns about the potential strain on the workforce, public finances, and health care systems. While these are legitimate challenges, they are frequently framed under overly conservative assumptions—typically of the "all-else-equal" kind—and overlook the fact that outcomes will largely depend on how effectively and promptly appropriate policy responses are implemented. Aging from the bottom is often viewed through a deficit lens, overlooking the potential opportunities it may present for younger generations (Kravdal, 2025). The shrinking size of younger cohorts may highlight the growing need to attract, support, and empower younger individuals by providing greater opportunities—even under constant resource constraints—given their declining demographic weight. Aging from the top similarly calls for a critical rethinking of how old age is conceptualized. It is often framed negatively, yet traditional indicators such as the old-age dependency ratio are based exclusively on chronological age. A 65-year-old—commonly used as the threshold for old age (e.g., OECD, 2019)—in 2024 can expect to live significantly longer than their counterparts in previous decades. Increasingly, this stage of life corresponds to a prolonged period of good physical and cognitive functioning, during which individuals may contribute through caregiving, civic engagement, or environmental stewardship. Moreover, with the right investments and life-long learning policies, outcomes might improve—particularly for individuals who accumulate greater cultural and social capital over the life course and who, in older age, may be seen not as a burden on society but as assets to families, communities, and the broader environment (see Boffo et al., 2025).

The reflections that we here develop lie at the core of the Age-It Research Program (https://ageit.eu), particularly within its Spoke 1 on the Demography of Aging. This Spoke aims to advance understanding of the demographic dynamics—such as longevity, fertility, family life, and migration—that drive the ongoing aging process, leveraging new interdisciplinary collaborations and innovative integrations of population registers with social and health surveys. For full details about the overall Age-It Research Program, see Vignoli et al. (2025). First, we estimate the importance of demographic drivers of aging, such as fertility, mortality, and migration. Second, we illustrate how these demographic processes affect population aging and elaborate on the positive implications. Third, we discuss two foundational elements to promote a positive view on aging: new data requirements and the need to adopt an interdisciplinary approach. We conclude with a series of reflections to foster positive demography.

The demographics of population aging in Italy

Both population growth (or decline) and aging are driven by three main demographic phenomena: fertility, longevity (or mortality), and migration (e.g., Preston et al., 2000). The specific configuration and timing of these drivers affect a fourth influential factor—population (age) structure—which, in turn, has a crucial impact on future population growth.

The demographic trajectory of Italy since the mid-1900s offers a valuable case for examining the interplay of fertility, longevity, and migration in shaping population aging. There, prolonged low fertility and shrinking younger cohorts have largely eliminated positive momentum, intensifying aging trends in combination with limited migration inflows. Figure 1 reports the trends in a few key demographic indicators for Italy between 1950 and 2023. In this period, the Italian population grew from 47 million to 59 million (Panel A) despite the steady fertility decline, from more than two and a half children per woman in 1960 to roughly 1.20 in 2023 (Panel B). Mortality decline was remarkable: in 1950, a newborn could expect to live some 65.7 years, on average, but this prospective life span reached 83 years in 2023 (Panel C). International migration did not follow a clear trend, but, overall, during this period, Italy turned from an emigration to an immigration country, to the effect that the net migration rate became positive (Panel D). The highest immigration rates were observed in the 2000s; however, while immigration formerly sustained

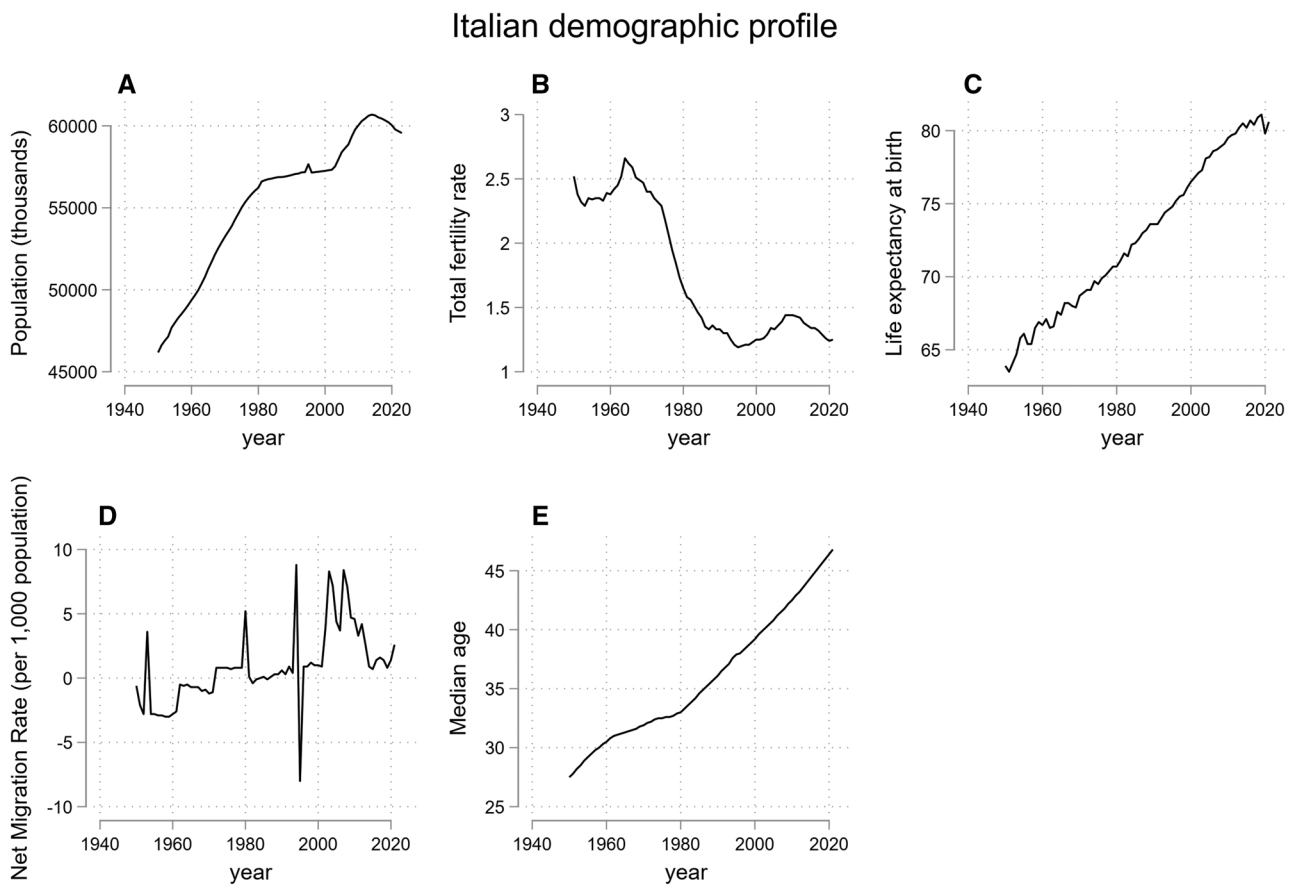

Figure 1. Trends of Italian demographic dynamics (1950–2023).
Source: Own elaboration of UN population estimates and projections 2024.

population growth, it now merely slows population decline, as the net inflow of immigrants is no longer sufficient to counterbalance the negative natural balance. As a result of these trends in fertility, longevity, and migration, the age structure changed over the years, and the median age, one of its possible synthetic indicators, passed from 27.5 years in 1950 to 47.5 years in 2023 (Panel E).

What factors primarily drive population decline? Figure 2 analyzes this question by decomposing population decline into its four key demographic components described above: fertility, mortality, migration, and age structure. The decomposition method—operationalized by Andreev et al. (2013)—involves constructing a series of population projection variants in which each component is selectively held constant to isolate its contribution to future population change. The difference between these variants quantifies the individual effect of each component, assuming independence and holding the others fixed in turn. The figure highlights the predicted change of the Italian population between 2020 and 2050 (left panel), and then between 2020 and 2100 (right panel), detailing the contribution of each of the four components. The expected declines are approximately 5.15% and 16.60% up to 2050 and 2100, respectively, implying a loss of roughly 3.2 million and 10 million in the two periods. Fertility is the demographic component with the largest impact. Indeed, without improvements in longevity and new immigration, the decline would be 12% up to 2050 and 32% up to 2100. The change in the age structure is expected to contribute to population decline by roughly 9% until 2050 and 16% until 2100. As fewer and fewer individuals are born every year, fewer individuals will be of reproductive age in the future (some 30 years later), which will further depress births—a phenomenon known as the "demographic trap" (Mencarini & Vignoli, 2018). This leads to a vicious circle, whereby fewer parents have fewer children, who will later form only a small group of potential parents.

To recap, the Italian population is already experiencing a period of profound transformations in its size and structure. However, this is only part of the story (Gietel-Basten, 2021; Gietel-Basten et al., 2024; Lutz, 2013). Lutz (2013) coined the expression "demographic metabolism" to denote the process by which societies evolve as successive birth cohorts—each characterized by distinct and measurable attributes such as education, health, and values—gradually replace older ones. This mechanism of cohort replacement helps explain how aging populations can simultaneously become more skilled, healthier, and socially dynamic. The concept provides a useful lens through which to interpret the double-sided nature of population aging, which is discussed in the following sections. Guiding these transformations, and thereby unlocking the full potential of human capital, is crucial for addressing the challenges associated with population aging and stagnation (or even decline), mitigating the negative consequences of the process, and making the most of the positive ones.

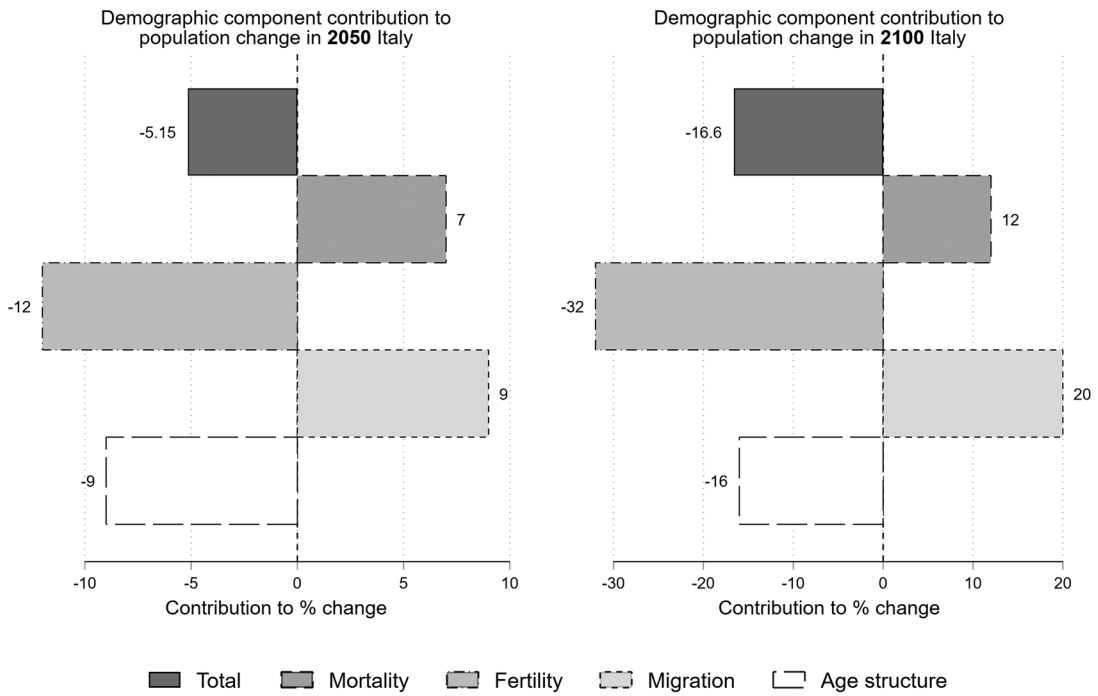

Figure 2. Contribution of demographic components to population change in Italy 2010 *vs* 2050 and 2100.
Source: Own elaboration of UN population estimates and projections 2022.

Aging from the bottom

Following the Second World War, Italy experienced nearly two decades of rising fertility. A large, young generation emerged from the devastation of the war and benefited from sustained economic growth. On average, women from that generation had two or more children over their reproductive years (Rosina & Impicciatore, 2022), resulting in the "baby boom," which peaked in 1964 with over a million births. Fertility began to decline in the 1970s and, since the early 1980s, has never again exceeded 1.5 children per woman on average. Italian society has thus experienced both a sharp fertility decline and prolonged stagnation at very low levels. In 2024, Italy recorded just 370,000 births—the lowest number in its history and approximately the size of a small Italian province. This aligns with a record-low total fertility rate—that is, the average number of children per woman—of 1.18.

This fertility decline may offer new opportunities for younger generations. Fewer children could represent a chance to invest more in their "quality." Just as families may prefer to have fewer children to provide them with better life opportunities (Becker & Tomes, 1976; Conley, 2008), the same concept can be applied on a national scale. Smaller cohorts of young Italians could be viewed as an opportunity to increase investment in their human capital, offering them greater chances to grow, develop, and access more opportunities in education and preparation for the labor market. Recent trends suggest a gradual improvement in the condition of young Italians, offering tentative support for the idea that demographic shifts—such as aging from the bottom—may create space for positive change (Ragozzini et al., 2025). While youth employment and tertiary education attainment remain below the EU average, there are signs of improvement. First, between 2018 and 2023, employment among 15–24-year-olds rose from 17.6% to 20.4%, and among 25–34-year-olds from 61.9% to 68.1%. The NEET (i.e., those not in education, employment, or training) rate has declined from 23.2 to 16.1 in the same period. Second, educational attainment is improving: in 2023, 80.1% of 25–34-year-olds held at least a secondary degree, and 30.6% were university graduates. Third, the share of young people living with their parents declined from 67% in 2021 to 63.2% in 2023, yet remains above the 58% recorded in 2010, reflecting persistent barriers to independence. These trends unfold against a backdrop of progressive shrinking of younger generations, as there is potential to help the newer generations surpass the achievements of their parents (Rosina, 2008). Nonetheless, without structural policies on education, employment, housing, and work–life balance, these demographic opportunities might remain unrealized (Vignoli & Paterno, 2025).

Another characteristic of the fertility decline is the increase in maternal age at birth. While Italian women were having their first child at around the age of 26 in 1952, the mean age at childbirth increased to roughly 33 years by 2024. Postponing parenthood is not a negative phenomenon per se, as long as it is a conscious and free decision. However, postponement may turn into involuntary childlessness, and indeed the proportion of childless women has dramatically increased over time (it currently stands at roughly 45% of those aged 18–49). Among these childless women—interviewed in 2016 in the nationally-representative "Survey on families and social subjects" conducted by the Italian National Institute of Statistics—over three out of four stated that they would like to have children in the future, and only less than 25% said they would rather not have any (Castagnaro et al., 2025). This underscores the gap between desired and actual fertility, reinforced by recent data. A 2023 survey showed that roughly 73% of adolescents aged 17–19 wished to have at least one child. Of those, nearly 62% preferred to have two children, and 18% aimed for three or more. In contrast, among Italian women born in 1973, only 28% had two children, and just

8% had three or more. These figures reflect a strong preference for two children and highlight a significant fertility gap—one of the highest in Europe (Beaujouan & Berghammer, 2019).

The surge in average age at first birth—or, indeed, at any birth—has raised concerns that older parents may not be able to fulfill their fertility desires due to reduced fecundity. The diffusion of medically assisted reproduction (MAR) has partially mitigated those concerns. MAR encompasses a set of interventions, procedures, surgeries, and technologies aimed at treating subfecundity (Goisis et al., 2024; Zegers-Hochschild et al., 2017). Since the late 1970s, when the first MAR-conceived child was born, the proportion of children born via the treatment has substantially increased, up to almost 10% in the 2020s in such countries as Spain and Denmark (Cozzani et al., 2021; Goisis et al., 2024). Despite restrictive legislation, Italy is also following this trend, and the proportion of MAR-conceived children nearly doubled in the 2010s, reaching some 3%–4% of newborns in 2022 (Campo et al., 2023). In terms of fertility, the contribution of MAR to the total fertility rate for women aged 15–59 in Italy rose from 2.1% in 2013 to 3.7% in 2022 (Burgio et al., 2025). Among women aged 40 and over, MAR accounted for 16.2% of the total fertility rate in 2022, up from 8.6% in 2013. Notably, in 2022, nearly one in three first births after age 40 resulted from MAR. Overall, these techniques may alleviate the problem of fertility postponement, giving future parents more opportunities to fulfill their reproductive desires. However, success rates remain limited beyond age 35, and the procedures can entail financial and health costs. Indeed, these techniques should not be considered a safety net or a panacea for postponed parenthood, but merely an additional opportunity when infecundity or subfecundity conditions emerge at suboptimal (i.e., late) ages. There is an urgent need to strengthen health systems to support reproductive health for both men and women and informed reproductive choices over their life courses (Ferlin et al., 2022).

To fully understand and address the ongoing fertility changes from a positive demography perspective—in addition to recognizing the growing opportunities offered by smaller, younger cohorts and MAR—it is also crucial to identify and propose solutions to remove the structural barriers preventing individuals from planning and achieving their desired number of children. The barriers that separate desired from actual fertility have been well highlighted in the literature. We are now aware of what does not work: policies of a "pro-natalist" nature, especially those that offer financial incentives for having children, such as baby bonuses (see e.g., Gauthier, 2007; Economist Impact, 2024), are not perceived as important for parenthood and are therefore scarcely effective (Guetto et al., 2025). Although isolated cases—such as Hungary—suggest short-lived or tempo-related effects, the broader cross-national evidence indicates that such incentives generally yield only modest or transitory impacts on fertility (OECD, 2024). What matters, instead, are aspects of a more "structural" nature (e.g., childcare availability), particularly those concerning the entire life course. Female employment (which, in the country, remains relatively low compared to Northern and Western Europe) and more generally, the economic stability of couples (having two sources of income and decent standards of living) are considered essential for reproductive choices (Alderotti, 2022; Vignoli & Guetto, 2025). These findings align with recent research indicating that the economic instability faced by young adults in Italy has contributed not only to fertility postponement but ultimately to lower completed fertility (Alderotti et al., 2025).

In line with the notion of positive demography, we advocate for a more inclusive expansion of family policies. Policymakers and employers have an opportunity to enhance the quality of life for younger generations by improving work–life balance, not only for parents, but also in the broader context of partnership formation and the transition to adulthood, which may eventually lead to childbearing if desired by couples (Bignami et al., 2024; Kotowska et al., 2010). The spread of MAR exemplifies how policies must promptly adapt to societal changes rather than seek to maintain the status quo.

Aging from the top

Better and longer survival is good news in and of itself. It is paradoxical that, while humans try to postpone death and international agencies rank countries based on life expectancy, living longer has become a cause of concern due to its consequence—namely, population aging. In this section, we first argue that this apparent contradiction derives from the fact that aging is often measured incorrectly; then, we outline certain solutions that may make aging more comfortable in the future.

Italy, where the average life expectancy reached approximately 83 years in 2023 (81 years for males and 85 for females), ranks among the highest globally in terms of longevity—a significant achievement. To understand how this impacts population aging, we must examine two populations simultaneously: the observed population and the stationary population. The stationary population is a theoretical construct found in every life table—the tool demographers use to describe mortality. This construct is crucial because it has its own age structure, denoted by L_x also called years of life lived. It is much simpler, however, to think of these Lx as individuals aged x in a hypothetical stationary population, where the death rate is constant and equal to the birth rate. If these survival conditions are those of the observed population (e.g., Italy in 2023), these variables can be shown to represent the "shape" toward which the observed age structure tends to evolve (De Santis & Salinari, 2024; De Santis & Salinari, 2023). In other words, the stationary case serves as a projection of the future age distribution, assuming survival conditions remain unchanged, and also gives an idea of what is to be considered "standard" (or average), over a very long time span in that population. Of course, survival conditions will change in the future, but then a new life table can be constructed, with a new L_x series, which will simply replace the previous one, and play the same role.

Another reason that stationary populations are useful is that they help us select threshold ages. To measure population aging, we need (at least) one indicator, and this, in turn, usually needs threshold ages, α and β, respectively, to separate the young (Y) and the older adults (S) from the rest of the population. This is the case, for instance, of the ratio S/A (or $OADI$, old-age dependency index), one of the most frequently used indicators, where A stands for the adults (no longer young, not yet older adults). There are two separate issues here. The former is the selection of these threshold ages (α and β) at some starting point, for example, 1980. This inevitably involves a degree of arbitrariness, and the choice may be guided by tradition, education, or labor market rules. Let us assume, for instance, that α and β are set at 15 and 65 years, respectively.

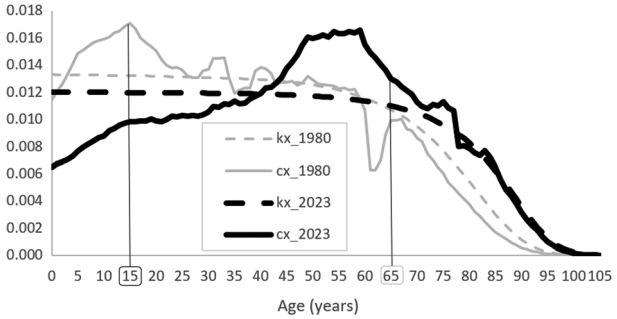

Figure 3. Reference and current population age pyramids (Italy, 1980 and 2023, both genders).
Note: c_x ($=P_x/\Sigma P_x$) and k_x ($=L_x/\Sigma L_x$) are population shares, actual and reference (stationary) case, respectively. $\alpha = 15$ and $\beta = 65$ are the (arbitrary) threshold ages in 1980, when $e_{0,1980} = 74.1$ (while $e_{0,2023} = 83.1$). A few of the corresponding threshold ages in 2023 are presented in Table 1.
Source: Human Mortality Database (2020) and Istat (2023).

The question that we need to focus on is what to do with these threshold ages when survival conditions change. How should they evolve, if at all, in a way that shows some kind of consistency with the initial choices? The most common procedure is to keep them constant (15 and 65 in this example), which implicitly foregrounds the number of years already lived. However, this traditional "backward looking" approach can be unsatisfactory due to its tendency to exaggerate the perceived aging consequences of improved survival and overlook the fact that, with lower mortality, individuals at any age have more years remaining, often in good health conditions. In the example of Figure 3 (Italy, 1980 and 2023), as the average length of life increases from 74.1 years to 83.1, the "reference" *OADI** (=*S**/*A**) passes from 26.4% to 39.3% (Table 1). The asterisk denotes measures calculated on the L_x series of a life table (or years of life lived), that is on the stationary population associated with that life table, or, in simpler words, on current survival conditions and their ultimate effect on the population age structure. The increase in the *OADI** index has two general implications. First, when mortality declines, surviving to higher ages becomes more likely. Second, if nothing is done, the aging indexes (and all others, for that matter) will signal a deterioration: the populations will *tend* to age, or at least will appear older.

Following insights from previous scholars who proposed defining old age based on remaining life expectancy rather than chronological age (e.g., Siegel & Davidson, 1984; Sanderson & Scherbov, 2008), a forward-looking, or prospective, approach can serve as an alternative. Here, threshold ages are adjusted in such a way that the *remaining* average length of life is held constant. This approach looks forward rather than backward and, like the other constant-age-threshold methods, retains something constant—but in this case, it is the years left to live rather than those already lived. However, the approach also has its shortcomings, which become evident when considering that the principle can be applied either solely to the retirement age (β) or to both thresholds, α and β. Table 1 presents both options. With the former (denoted "Prosp β," where α remains constant, while β increases to 71.8 years, so that $e_{71.8,2023} = e_{65,1980} \approx 15.5$ years), the reference share of adults A^* increases from 63.4% to 66.1%, to the detriment of all other shares. In the second case (denoted "Prosp $\alpha\beta$"), where both α and β increase—α to 23 years to ensure that $e_{16.5,2023} = e_{15,1980} \approx 60.5$ years—the share of the young increases substantially (from 19.9% to 27.6%), while apparent aging, as measured by OADI*, increases only to 28.0%. In both scenarios, the shifts in the "standard" shares of life lived across the three stages—youth, adulthood, and old age—are large.

Table 1. Threshold ages and population shares with various approaches (Italy, 1980, and 2023).

Type	1980	2023			
	Base	Const	Prosp β	Prosp $\alpha\beta$	Shares
alfa	15	15	15	**23.0**	**16.5**
beta	65	65	**71.8**	71.8	**70.0**
Y*	*0.199*	*0.180*	*0.180*	*0.276*	*0.199*
A*	*0.634*	*0.589*	*0.661*	*0.566*	*0.634*
S*	*0.167*	*0.231*	*0.159*	*0.158*	*0.167*
OADI*	*26.4%*	*39.3%*	*24.0%*	*28.0%*	*26.4%*
Y	0.222	0.122	0.122	0.201	0.132
A	0.644	0.635	0.717	0.629	0.698
S	0.134	0.243	0.162	0.170	0.170
OADI	*20.8%*	*38.3%*	*22.6%*	*27.0%*	*24.3%*

Note: Y, A, S = shares of young adults, adults, and older adults, respectively; *OADI* = old—age dependency index (*S*/*A*). An asterisk denotes values calculated on the corresponding stationary population. $e_{0,1980} = 74.1$ and $e_{0,2023} = 83.1$. Types: *Const*: constant α and β; *Prosp* β: constant α, while β increases so that $e\beta_{2023} = e_{65,1980} = 15.46$; *Prosp* $\alpha\beta$: β increases as before, while α increases so that $e\alpha_{2023} = e_{15,1980} = 60.50$; *Shares:* α and β increase so that Y^*, A^*, and S^* remain constant. Italics indicate the stationary population, while bold text highlights changes with respect to the previous scenario.
Source: Human Mortality Database (2020) and Istat (2023).

This suggests a possible alternative, and arguably preferable, approach: adjust threshold ages in such a way that reference (i.e., standard, average) shares of life (Y^*, A^*, and S^*—those of the stationary population) remain constant. If this is the objective, the necessary adjustments in the threshold ages are relatively small compared to the changes in life expectancy (see Table 1). For instance, when life expectancy at birth (e_0) passes from 74.1 to 83.1 years (an increase of 8 years), α needs to rise by only 1.5 years (from 15 to 16.5), while β must increase by 5 years (from 65 to 70). Remarkably, this straightforward adjustment of threshold ages is sufficient to completely counterbalance the effects of aging from the top, along with the associated concerns. However, even in the best-case scenario (constant life shares, dynamic adjustment of threshold ages), *current* aging indexes will not remain constant over time. For instance, in Table 1 (first and last column), *OADI* passes from 20.8% in 1980 to 24.3% in 2023. This happens as, while aging from the top can be totally neutralized, as we have just seen, other causes of aging "from the bottom" (low fertility) cannot and will continue to operate.

The central argument of the previous discussion is that how we define the boundaries of young and old ages necessarily influences measures of aging; therefore, updating threshold ages is essential for producing a less alarming and more realistic assessment of a population's aging status. Rethinking aging and redefining who we consider an "older adult" presents a valuable opportunity to dispel catastrophic perceptions of an aging society. Demographic studies show that not only has mortality been postponed to older ages, but also that individuals who survive to advanced old age would do so because they reach older ages in better health (Vaupel, 2010). On average, the morbidity onset has shifted to older ages, but the variation in the age at morbidity onset has increased (Seaman et al.,

2020). In other words, populations are aging in better health but are becoming more heterogeneous in terms of individual frailty. In addition, recent evidence (e.g., Gimeno et al., 2024) points to stagnation—or even worsening—in some cohort-specific health indicators in contexts like the United States and the United Kingdom, particularly regarding chronic conditions. Similarly, data for Italy indicate a situation that warrants attention, as healthy life expectancy has slightly declined over the past three years (Istat, 2025). Hence, as more people live longer, it is of pivotal importance to address their specific and evolving needs and propose solutions.

First, governments should make large investments in medical research. As longevity increases, health care systems may face mounting pressures due to the rise of chronic and degenerative diseases common in older age. The hope for the future is that innovative treatments such as tissue regeneration, stem cell treatments, the creation of artificial organs, and genetic therapies can slow the biological processes of aging, thereby enhancing health outcomes while curbing health care costs (Cordeiro & Wood, 2023). Moreover, increasing attention must be given to the specific needs of each generation. As new cohorts age, each has been exposed to different health challenges, particularly the rise of so-called "affluent diseases" (e.g., obesity, smoking, metabolic diseases) (Mackenbach, 2012; Thun et al., 2012). It is crucial to direct medical investments toward improving lifestyles as early as possible in order to most effectively address these evolving health risks. In fact, a recent simulation predicts that if the burden of certain diseases continues to decline, this trend could offset the increase in demand for health care services driven by population aging (Bernini et al., 2024).

Second, new technologies may play a key role in improving access to health care services. New housing models, evolving from the smart home concept, are already being developed to support well-being and health monitoring. These homes will offer personalized services tailored to individual health needs, incorporating digitalized health care options, such as telediagnosis, telemedicine, telemonitoring, and telerehabilitation (Li et al., 2020). Quality care, person-centered care, reducing isolation, and easy access to health services are all action areas aligning with World Health Organization's Healthy Ageing agenda. In sum, major advances in biomedical (Chiti et al. 2025) and technological (Sorrentino et al. 2025) fields are on the horizon, poised to support the challenges and opportunities of increasing longevity.

Aging and migration

When the natural change in a country fluctuates around or declines below zero, positive net migration emerges as a crucial factor to slow population decline and rejuvenate a population's age structure. These dynamics have attracted the interest of population scholars since their inception, but it was only with the publication of the United Nations (2001) report on "Replacement Migrations" that research on this topic intensified. Drawing an analogy from climate change research, migration can be seen as a "mitigation" factor to population aging (Gietel-Basten, 2021), as it may provide an immediate relief to its negative consequences. In this vein, migration renewal is a fast demographic process that contrasts the slow demography paradigm (Billari, 2022). Migration provides a stock of working-age individuals who can offer an immediate replacement to an aging and shrinking workforce. Migration may also have positive implications on fertility in the receiving country, as it increases the number of people of reproductive age, providing further support in unlocking the demographic trap.

A useful example from outside Italy shows how migration policy can rapidly reshape demographic trajectories. In 2005, the Spanish government implemented a large-scale regularization program that granted legal status to approximately 700,000 undocumented migrants, resulting in a substantial increase in the officially recorded foreign-born population and a marked rejuvenation of the workforce (González-Enríquez, 2009). While this case illustrates how policy interventions can alter the demographic impact of migration well beyond the gradual effect of annual flows, it should be noted that such an effect reflects the formal recognition of existing migrants rather than the creation of a younger workforce per se, and that as migrants age, the demographic impact may shift over time unless migration continues.

While not a cure for population aging, migration has helped mitigate its effects. In Italy, over the last two decades, the number of international immigrants increased by 3.6 million, rising from 1.3 million in 2002 to 5 million in 2022. Along with this growth, new cohorts of second-generation migrants have been born, with their own demographic behaviors. This has helped rejuvenate the population's age structure, as migrants are usually young adults. Without this influx, Italy would have had 54 million residents in 2022 instead of 59 million. Migrants also contributed to higher birth numbers—320,000 births would have been recorded in 2022 without migrants, compared to the observed 393,000. This mitigation is due to both the higher fertility rates of migrant women and their role in enhancing potential parents (García-Pereiro & Paterno, 2025). However, it should be noted that migrant women's fertility rate in Italy has declined from 2.78 to 1.87 between 2002 and 2022, primarily due to adaptation mechanisms and changes in the composition of migrants, particularly with the growing share of Eastern European women, who tend to have lower fertility rates.

Although migration alone cannot serve as a panacea for Italy's aging population (Billari & Dalla-Zuanna, 2011; De Santis, 2011; García-Pereiro, 2018; García-Pereiro & Paterno, 2022; Gesano & Strozza, 2019; Paterno, 2011), effectively integrating immigrants and maximizing the resources they bring should be viewed as a crucial investment for Italy for all three of the short, medium, and long term. This approach presents an opportunity to reaffirm Italy's position as an attractive destination for international migrants—a status that has weakened, as the number of migrants in the country has remained relatively stable over the past decade. Migration has a crucial role in promoting a positive and healthy demographic system in post-transitional societies—a role that, notwithstanding its well-known relevance, has received insufficient attention. Positive demography emphasizes this unique opportunity, which nevertheless requires identifying and removing the economic, labor, social, legal, and cultural barriers that hinder full integration, while also implementing targeted measures to address these challenges and actively promoting economic migration. One of the most significant barriers is employment. While migrants in Italy have relatively high employment rates (71% among men and 45% among women, respectively, 5% points higher and lower than those of native men and women; Istat, 2023), they are predominantly employed in the lower-skilled sectors of the labor market. It is well known that immigrants

fill labor niches, such as in construction, retail, hospitality, and caregiving (particularly for older adults): Sectors that primarily require medium-to-low specialization, and where the combined effect of low birth rates and the increasing average level of education among younger generations generates the greatest labor shortages (Reyneri, 2016). However, it is also important to acknowledge that many of these jobs are performed under precarious or irregular conditions, partly due to the challenges in formalizing these workers and the particularly disadvantaged status of women. Periodic amnesties and immigration flow decrees—though recently expanded—have proven insufficient for adequately regularizing the workforce. A comprehensive reform of citizenship laws could be crucial in facilitating faster and more effective integration. The integration of immigrants' descendants hinges on their full inclusion in the education system, which is essential for turning them into assets for the country and local communities rather than a collective social challenge (Strozza, 2015).

Foundations for a positive demography agenda: data and interdisciplinarity

Monitoring aging with data and anticipating its needs

A positive demography perspective requires a policy and research agenda built on concerted efforts in data gathering, monitoring, and forecasting. One of the key early findings of the Age-It Research Program is clear: there is an urgent need to create multiple large-scale datasets with harmonized health and socio-demographic variables (see, e.g., the Gateway to Global Aging Data in the United States and the UK's Longitudinal Linkage Collaboration, both of which integrate diverse datasets to support research on aging and health). Achieving such harmonization across multiple investigator-led studies has become a priority for continuing holistic, integrated, and interdisciplinary aging research in Italy. It is also becoming increasingly clear that large sample sizes—or even population registers—are needed to integrate insights from both the social and biomedical sciences. These are essential not only for identifying patterns but also for studies seeking to uncover causal relationships and create robust evidence that can be replicated across multiple studies. Positive demography highlights the new research opportunities emerging from these data sources and databases, whose availability could spark a revolution in various areas of demographic research, including aging, allowing for demographic phenomena to be understood and quantified at unprecedented scales and resolutions (Breen & Feehan, 2025). The key challenge lies in ensuring accessibility to these integrated, novel microdata from academia and research institutes, while simultaneously complying with the requirements set by privacy authorities. The good news is that promising solutions are emerging, such as the potential creation of synthetic microdata (Whitworth, 2022). In this regard, Spoke 1 of the Age-It Project is actively developing a prototype for the release of synthetic data in collaboration with the Italian National Institute of Statistics.

While the availability of high-quality data is crucial to understanding the current demographic situation and forecasting the future, it is not enough. Positive demography would also benefit from a change of perspective: from *forecasting* to *backcasting*. Further to exploiting the potential of advanced forecasting—that is, starting from the present situation and making assumptions about how certain actions will shape the future—backcasting allows for starting from the definition of a desired future and, by working backward, identifying the necessary actions to move from the present reality to the desirable future. Backcasting enables a more proactive approach to addressing the challenges of population aging, supports decision-makers in a rapidly aging world, facilitates the monitoring of aging trends, and helps anticipate future needs.

The opportunity to use big data for forecasting and backcasting models becomes especially key, as these tools offer a powerful means to understand, predict, and exploit the complex dynamics of demographic changes, thereby enabling stakeholders to prepare for future demands proactively. On one hand, big data analytics provides a granular view of the aging process by capturing and analyzing vast arrays of information from a multitude of sources, including health care records, socioeconomic data, and even real-monitoring devices. The insights gained from big data can highlight trends, reveal patterns, and identify risk factors associated with aging populations. On the other hand, AI-based forecasting models can now use and process big data to simulate the future implications of aging on various societal aspects, including household composition, care needs, and labor force participation. In doing so, they can provide a valuable framework for developing strategies to mitigate risks, optimize resource allocation, and improve the quality of life for older adults.

Unlocking the potential of such novel data sources as big population microdata, digital trace data, and geospatial data relies on our ability to create methods and establish disciplinary standards to tackle emerging challenges, such as understanding data access and assessing their representativeness and inferences. With new data sources becoming increasingly specialized, some scholars anticipate a shift toward interdisciplinary team-based science (Breen & Feehan, 2025), which could be the key to fueling academic innovation in aging research.

Understanding aging processes requires an interdisciplinary approach

Aging is not merely a biological process but is deeply intertwined with economic, social, and health-related dimensions. In this context, any research endeavor needs to explore various dimensions of aging, aiming to disentangle its complexities and implications for individuals and societies alike. Against this backdrop, positive demography requires the collaboration of diverse disciplines.

An exemplary case of interdisciplinary collaboration aimed to understand fertility dynamics in Italy can be found within Spoke 1 of the Age-It Research Program. We have previously highlighted the critical role that MAR can play in this context. Building on this foundation, Spoke 1 has fostered a robust collaboration between experts from both the social and biomedical sciences. Specifically, researchers in demography and law, representing the social science perspective, have worked closely with specialists in gynecology, obstetrics, endocrinology, and andrology (representing the biomedical perspective). This collaboration has allowed for an exploration of the intersection between fertility, fecundity, and male and female sexuality. The resulting synergy has led to key joint publications, including Cozzani et al. (2025) and Sparano et al. (2025a; 2025b). For instance, Cozzani et al. (2025) examined whether

the probability of a successful MAR cycle varied by the socioeconomic status of the patient, combining insights and methods from social demography with data and outcomes typical of medical research.

Another example of interdisciplinary collaboration involves the analysis of the cognitive processes affecting aging. In this context, Parkinson's disease warrants particular attention as it is a neurological condition associated with impulse-control disorders and gambling. A team of economists, psychologists, neurologists, computational neuroscientists, and neuroengineers investigated financial risk propensity in older individuals. Their study examined how dopaminergic therapy administered to Parkinson's patients with impulsive-compulsive disorders might disrupt financial decision-making. They found that dopaminergic drug intake does not significantly alter the behavior of patients without impulse-control syndrome, but selectively affects those already exhibiting the syndrome, acutely inducing risk-seeking behavior in economic decisions (Taddeini et al., 2025).

These examples from Age-It mobilize proactive research actions beyond standard discipline-centered approaches and collectively contribute to a deeper understanding of aging-related phenomena, spanning biological, economic, social, and health dimensions. This has implications for policy and practice in addressing the challenges of an aging population. By acknowledging the interconnectedness of these domains, a positive demography perspective moves closer to a holistic understanding of aging.

Fostering positive demography

This article advances the notion of positive demography, which does not imply avoiding or denying problems; rather, it acknowledges that we are entering a new, qualitatively different demographic phase. We are likely to live longer and in better health; the gap between desired and actual fertility can be bridged with appropriate policy interventions and by leveraging the potential of MAR technologies; and migration can serve—at least in the short term—as a solution to accelerate demographic renewal. Further to addressing the needs of a growing number of older adults, positive demography means that we must also support the young in preparing adequately for the long future ahead of them. Positive demography means exploiting the unprecedented research opportunities provided by new and powerful data sources, while also changing the perspective from forecasting to backcasting—that is, by working backward, identifying the necessary actions to move from the present reality to the desirable future.

Analyzing today's demographic landscape through the lens of outdated 19th or 20th-century perspectives may lead us astray. The discontinuous future ahead promises substantial transformations at all levels—individuals, families, regions, and nations. Italy, as one of the fastest-aging countries in the world, is particularly well-suited as a case study for exploring this shift. Its demographic trajectory makes it an early forerunner in a transition many other high-income countries will face in the coming decades. The "Global demography expert survey on the drivers and consequences of demographic change" launched by the Joint Research Center, the International Institute for Applied Systems Analysis, and the UN Population Division offers interesting insights into the perception of the future. The survey asked experts to assess the validity and relevance of alternative arguments about the forces that could shape future fertility, mortality, and migration trends in the country of their choice (Icardi et al., 2023). The results highlight the highest share of agreement among population experts on the statements expressing the need to seek stabilization of welfare and health care systems to counter the effects of aging, as well as pointing to the challenges for the younger generations. The highest disagreement was expressed on the statement that gave a pessimistic position on the impact of population growth on development. In the policy section, the strongest agreement was with the statement that stressed the need to target population policy on the goals of sustainable development and reinforcement of human resource bases rather than pursuing specific demographic targets.

Demographic research plays a crucial role, serving as a guide to understanding the challenges and opportunities arising from fertility, mortality, and migration dynamics (Bignami et al., 2024; Gietel-Basten et al., 2022; Strozza et al., 2024a; Strozza et al., 2024b). Furthermore, demographic research may be on the verge of a revolution, as new data sources (despite presenting challenges) open up innovative possibilities for advances in both demographic theory and applications. However, it is then up to policymakers to do their part: Managing demographic change requires a forward-looking approach from decision-makers. Concerns are natural, as we acknowledge that old age inevitably brings illness, limitations, loss, and loneliness; however, the analyses and reflections presented in this paper aim to emphasize a new, positive outlook on demography.

First, declining fertility—one of the main drivers of population aging and stagnation—is often seen as a threat to welfare systems and the economy due to fewer economically active individuals. Yet, it can also create opportunities to invest more in the quality of education, helping to address educational poverty and reduce inequalities (Billari, 2023). The real challenge lies not in low fertility per se, but in the persistent gap between desired and realized fertility. While many governments have pursued top-down policies to raise birth rates, these often lack strong justification, have limited impact, and may undermine reproductive health, human rights, and gender equality (Gietel-Basten et al., 2022). Rather than pro-natalist measures, what is needed are structural policies that support a smooth transition to adulthood and enable individuals to achieve their fertility intentions. In contemporary Italy, the decision to have children is strongly shaped by access to dual incomes and stable resources, especially in the context of labor market instability, rising costs, and declining real wages (Vignoli & Guetto, 2025; Vignoli et al., 2022). Unlocking the demographic trap caused by decades of low fertility requires substantial investment in younger generations.

Second, increased longevity deserves greater political attention alongside its already well-established scientific importance. Aging is not simply about chronological age, but about fostering a "longevous society" that enhances well-being across the life course. This means embracing new technologies to improve access to health care and prevention, and redefining aging itself (Strozza et al., 2024b). A shift in cultural attitudes is also needed—one that values all life stages, promotes intergenerational collaboration, and rejects the framing of generational conflict. Ensuring quality of life in older age requires reassessing the meaning of life stages and investing in medical innovation and home-based care to meet the needs of an aging population.

Third, population policy must consider the role of migration more explicitly, especially in countries like Italy. Migration operates on a faster demographic timeline than fertility and can immediately influence population structure. Even a 10%–20% increase in fertility today would take decades to expand the working-age population. In contrast, young migrants can contribute as workers and parents in the present. While migration is not a silver bullet for aging, it is a vital tool for maintaining demographic balance (Billari, 2022).

To conclude, pessimistic approaches to demographic change offer little value. The demographic future often evokes apprehension and doubt due to societal structures being simply unprepared for these changes. The prevailing negative view on demography, not limited to the Italian press and media, is perhaps a consequence of being in the midst of the great demographic shift toward global aging. A positive approach to demographic change requires a proactive response from academia, research centers, and civil society, focused on seeking solutions for the future rather than merely criticizing the present. Instead of concentrating solely on the needs of an aging population, emphasizing "pro-natalist" fertility policies while neglecting the crucial role of migration, we must support young people and adults to better prepare for their future. Policies are not necessarily the driving force behind demographic change; they must adapt to it, reflecting the new realities of society as a whole. Only if policies embrace this change can we effectively address the ongoing demographic challenges. This new society demands transformations in the structure of families, the economy, health care systems, and technology. These changes will foster positive demography in the coming years, characterized by healthier, happier individuals and more cohesive and productive populations.

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Author contributions

Giammarco Alderotti, Marco Cozzani, and Daniele Vignoli contributed equally to this study.

Data availability

Data and replication code are available upon request.

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