

Reframing Policy Responses to Population Ageing: A Multi-Indicator Framework Based on Dynamic Measures

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1. Background and objectives

Population ageing—the increasing proportion of older individuals relative to the total population—is a fundamental and enduring demographic transformation. Recognized as one of the most significant global trends of the 21st century (United Nations, 2023), it is driven by sustained declines in fertility and remarkable increases in life expectancy. The scale is unprecedented: the global population aged 65 or over is projected to nearly double from 857 million in 2025 to approximately 1.6 billion (or 16% of the total population) by 2050. This global demographic shift places significant pressure on policymaking across domains, including fiscal sustainability, social protection systems (pensions, healthcare), and labour markets.

However, central to understanding the consequences of population ageing is the notion of who constitutes an “older person”. The use of dominant indicators based on a fixed chronological age threshold, like age 65, is increasingly arbitrary and anachronistic. For example, the Old-Age Dependency Ratio (OADR), a simple static chronological measure calculating the ratio of the population aged 65 and over to the population considered 'working age' (e.g., 15-64 or 20-64), implicitly assumes that the characteristics of a 65-year-old—in terms of health, productivity, capability, and dependency—remain constant over time (Lutz et al., 2008; Sanderson & Scherbov, 2010). This assumption is overly simplistic, as it ignores decades of improvement in longevity, health, and functional capacity. By ignoring these dynamic changes in the *characteristics* of the ageing population, the OADR paints an overly pessimistic and potentially misleading picture (Sanderson & Scherbov, 2010). It tends to exaggerate the 'burden' of ageing and serves as a poor proxy for actual economic dependency (Spijker, 2015). This misrepresentation can lead to flawed policy design and a failure to harness the potential opportunities associated with longer, healthier lives.

This paper addresses the gap between the static measurement of ageing and its dynamic reality, with a focus on its policy implications. The central research question is *how alternative, dynamic measures of population ageing—which systematically incorporate changing characteristics such as longevity, economic behaviour, and health status— can provide a more accurate, nuanced, and useful basis for policy formulation compared to traditional chronological indicators*. To answer this, the research investigates the conceptual foundations, methodological differences, and different policy implications of four distinct approaches to measuring population ageing. The main contribution of this paper to the literature is to propose a multi-indicator policy framework to inform adaptive policies on pensions, healthcare, and labour markets that reflect the evolving human capital of ageing populations across different economic and social contexts.

2. A Comparative Analysis of Ageing Indicators

Four major approaches for measuring population ageing are compared, based on their underlying definitions, calculation methods, key strengths, limitations, and primary policy relevance.

- *Chronological measures*, which serve as the baseline for comparison. As noted, the OADR is the traditional ratio of those above a fixed chronological age (e.g., 65+) to those of 'working age' (e.g., 20-64). Its primary strength is its simplicity and widespread historical use, linking directly to age-based eligibility for social programs like pensions.
- *Prospective measures*, an approach pioneered by Sanderson and Scherbov (2019). This framework redefines ageing based on a *forward-looking* perspective. Instead of chronological age (years lived), it uses 'prospective age', which is defined by Remaining Life Expectancy (RLE). The Prospective Old-Age Threshold (POAT) is set not at a fixed age, but at a fixed RLE—commonly 15 years, corresponding to the RLE at age 65 in many developed countries in the 1970s. The Prospective Old-Age Dependency Ratio (POADR) is then the ratio of the population above this dynamic POAT to the population between age 20 and the POAT. As longevity increases, the chronological age at which RLE equals 15 also rises, making the measure dynamic.
- *Economic measures*, which use the National Transfer Accounts (NTA) framework to measure the 'generational economy' (Lee & Mason, 2011). NTA moves beyond demographic counts to measure *actual* age-specific economic flows. Using national accounts and survey data, it estimates average consumption and labour income by age. This identifies the Lifecycle Deficit (LCD)—periods in youth and old age where average consumption exceeds labour income—and the Lifecycle Surplus (LCS) during the primary working ages. The NTA Dependency Ratio measures the total LCD relative to total labour income, providing a direct, economically-grounded measure of dependency (Prskawetz & Sambt, 2014).
- *Health-based measures* (HLE/HLY), which focus on the *quality* of life, not just its quantity. Healthy Life Expectancy (HLE) measures the average number of years an individual can expect to live in 'good health' (Robine & Jagger, 2003). It is typically calculated using the Sullivan method, which integrates mortality data with morbidity or disability prevalence data from surveys (Jagger et al., 2007). This indicator is essential for tracking whether increased longevity is accompanied by a 'compression of morbidity' (healthier years) or an 'expansion of morbidity' (more years lived with disability).

Table 1 summarizes the key strengths, limitations and policy relevance of each of these approaches.

3. Towards a multi-indicator policy framework

The comparative review of different approaches to measuring population ageing demonstrates that the choice of indicator is not merely technical; it fundamentally frames the ageing 'problem' and dictates the perceived policy solutions. The OADR (chronological) consistently shows a rapid, alarming increase in dependency, as it is inflated by the very longevity gains that represent a public health success. In contrast, the POADR (prospective) paints a different picture. By accounting for longevity, it shows a slower, less dramatic pace of 'effective' population ageing, suggesting that the chronological age of 'old' is effectively being postponed. The NTA (economic) framework shifts the focus from demographic ratios to economic behaviour, revealing that the true economic dependency burden is determined not by age counts but by the age profiles of labour income and consumption. Finally, HLE (health) adds a crucial warning. Even if POADR suggests we are 'prospectively younger', HLE trends are mixed. In many countries, gains in HLE

have not kept pace with gains in total life expectancy (Crimmins & Beltrán-Sánchez, 2011), suggesting an expansion of morbidity that carries significant implications for healthcare and long-term care systems.

Furthermore, ageing cannot be understood without considering the dynamic interplay of longevity, health, and education. These factors create a positive feedback loop. Rising educational attainment, a key trend in newer cohorts of older adults, is a powerful mitigating factor (Loichinger, 2015). Higher education is strongly correlated with better health, higher life expectancy, higher productivity, and higher labour force participation at older ages. Good health, in turn, is a prerequisite for extending working lives, while longer life expectancies incentivize greater investment in education. Viewing the population through this *human capital* lens presents a far more optimistic and dynamic scenario than the one suggested by OADR alone.

The policy implications of these different perspectives are profound. A policy discussion dominated by the OADR view leads to blunt policies like raising the statutory retirement age to a new fixed number to control costs. The POADR view, however, supports *dynamically linking* the retirement age to gains in life expectancy (Sanderson & Scherbov, 2019), aiming to maintain a stable retirement duration and ensure intergenerational fairness. The HLE view adds a crucial caveat: any such increases must be aligned with *healthy* life expectancy trends to prevent simply shifting burdens from pension systems to disability and healthcare systems.

In healthcare, an OADR focus projects runaway costs based on the rising *number* of chronological elderly. The HLE view, by contrast, shifts the policy priority to *prevention* and *healthy ageing* initiatives designed to *compress morbidity* (WHO, 2015) and manage the demand for care. For labour markets, the NTA and human capital perspective reframes the solution away from the "problem" of a shrinking workforce. It instead implies policies to *boost productivity* and the *effective support base* by increasing labour force participation (especially for women and older workers) and investing heavily in *lifelong learning, reskilling, and upskilling*. Finally, for fiscal sustainability, the NTA framework provides the analytical tools to *quantify* intergenerational transfers (Lee & Mason, 2011), assess the true fiscal balance, and design policies that ensure long-term sustainability and equity.

Further analysis of the implications of different approaches to the measurement of ageing for sectoral policies are illustrated in Table 2.

4. Conclusion

This research concludes that population ageing is a complex, multifaceted process that cannot be captured by any single, static indicator. Reliance on the OADR is insufficient and risks policy failure. We recommend that researchers and policymakers adopt a multi-indicator framework to gain a holistic understanding. This framework must integrate chronological measures for ease of calculation and historical continuity, prospective measures to reframe the dependency narrative, economic measures (NTA) to analyze fiscal sustainability, and health measures (HLE) to guide investments in healthy ageing. Ultimately, policy must shift from a reactive stance based on chronological age to a proactive strategy focused on investing in human capital. By fostering healthy ageing, promoting lifelong learning, and creating adaptable, age-friendly labour markets, societies can successfully navigate the challenges and harness the opportunities of an ageing world.

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Table 1: Comparison of Key Population Ageing Indicators

Indicator	Definition	Calculation Basis	Key Strengths	Key Limitations	Primary Policy Relevance
Old-Age Dependency Ratio (OADR)	Ratio of older population to working-age population.	Fixed chronological age thresholds (e.g., 65+ / 15-64 or 20-64). Based on population counts.	Simple, widely used, historically comparable, linked to age-based policy eligibility (pensions).	Static (ignores changing health/longevity), exaggerates burden, poor proxy for actual economic dependency, inconsistent thresholds used.	Assessing potential fiscal pressure on age-based entitlements (pensions, healthcare), broad demographic trend monitoring.
Prospective Old-Age Dependency Ratio (POADR)	Ratio of population above a prospective old-age threshold (POAT) to population between 20 and POAT.	POAT defined by fixed Remaining Life Expectancy (RLE), typically RLE=15 years. Based on population counts and life tables.	Dynamic (accounts for longevity gains), shows slower ageing pace than OADR, better meets 'equivalency criterion', reduces projection uncertainty.	Relies on life expectancy forecasts, RLE threshold somewhat arbitrary, less intuitive than OADR, doesn't directly capture health/economic status.	Informing adjustments to retirement ages, long-term strategic planning considering longevity, reframing the ageing narrative.
National Transfer Accounts Dependency Ratio (NTA-DR)	Ratio of total Lifecycle Deficit (LCD: Consumption > Labour Income for young & old) to total Labour Income.	Age-specific profiles of consumption and labour income from NTA framework (integrating national accounts & surveys).	Economically grounded measure of dependency, captures actual production/consumption patterns, distinguishes public/private transfers, allows policy simulation.	Cross-sectional (not longitudinal), data-intensive, requires assumptions (e.g., intra-household allocation), standard NTA is descriptive (needs models for behaviour).	Assessing fiscal sustainability, intergenerational equity, economic impacts of ageing, effectiveness of transfer systems, policy analysis (pensions, health, education).

Healthy Life Expectancy / Years (HLE/HLY)	Average years expected to live in 'good health' from a specific age.	Combines mortality data (life tables) with morbidity/disability prevalence data (surveys, e.g., GALI via Sullivan method).	Measures quality vs. quantity of life, intuitive, monitors health trends & inequalities, informs morbidity compression debate.	Sensitive to health definition, relies on subjective self-reports (cultural bias), data availability/comparability issues, Sullivan method limitations.	Health policy planning, healthcare/LTC resource allocation, evaluating public health interventions, monitoring quality of life in ageing populations.
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Table 2: Implications of Different Approaches to the Measurement of Ageing, by Policy Domain

Policy Domain	Implications/Actions based on chronological measures	Implications/Actions based on prospective measures	Implications/Actions based on economic measures (NTA)	Implications/Actions based on health-based measures
Pensions/ Retirement	Raise statutory retirement age based on fixed age thresholds; Focus on fiscal burden due to high numbers of 65+; Parametric reforms (benefits, contributions) to maintain solvency.	Link retirement age dynamically to gains in life expectancy (RLE) to maintain constant retirement duration; Redefine 'old age' for pension eligibility based on prospective age; Focus on intergenerational equity in pension duration.	Analyse fiscal sustainability based on lifecycle deficits/surpluses; Assess impact of pension generosity on savings (2nd dividend); Model impact of retirement age changes on labour income & consumption profiles; Consider role of assets vs. transfers in funding retirement.	Consider HLE alongside LE when setting retirement ages; Promote policies enabling work capacity for those below retirement age but with health issues; Focus on pension adequacy for those retiring early due to poor health.
Healthcare/ Long Term Care (LTC)	Project costs based on rising numbers of 65+; Focus on expanding capacity to meet demand	Recognize that 'old age' healthcare needs occur at later chronological ages as LE increases; Use	Analyse age-specific healthcare consumption profiles (NTA); Identify drivers of high late-life	Prioritize investments in healthy ageing & prevention to compress morbidity & reduce

	from chronologically old; Address fiscal sustainability challenge of rising age-related spending.	prospective measures to anticipate shifts in the timing of peak healthcare demand; Adjust long-term planning based on RLE trends.	costs; Assess fiscal impact of different health financing models (public vs. private); Evaluate cost-effectiveness of interventions across the lifecycle.	demand; Use HLE to monitor population health quality & target interventions; Develop integrated care models for multimorbidity; Invest in LTC workforce & infrastructure based on projected HLE/disability trends.
Labour Market/ Education	Focus on potential labour shortages due to shrinking working-age (15/20-64) population; Policies to increase Labour Force Participation within traditional working ages.	Recognize that 'working age' can extend as people live longer & healthier; Promote policies enabling longer working lives consistent with prospective age; Adjust human capital planning for longer careers.	Analyse impact of education/skills on labour income profiles (NTA); Promote Labour Force Participation among women & older workers to boost aggregate labour income (support base); Invest in education/training to enhance productivity across the lifecycle.	Invest in lifelong learning for health & employability; Adapt workplaces for older workers' health needs; Address health barriers to Labour Force Participation; Use HLE data to understand work capacity.
Fiscal Sustainability/ Equity	Highlight rising OADR as primary fiscal threat; Focus on cost containment in age-related spending (pensions, health); Potential for intergenerational conflict over resources.	Use prospective measures to reframe fiscal debate (potentially less alarming burden increase than OADR suggests); Inform debates on intergenerationally equitable pension ages based on RLE.	Use NTA/Generational Accounting to quantify intergenerational fiscal flows & imbalances; Analyse impact of ageing on tax base & public spending structure; Assess role of public vs. private transfers & asset income in generational economy.	Promote healthy ageing to reduce long-term fiscal pressures from healthcare/Long Term Care; Address health inequalities that impact economic participation & dependency; Ensure fiscal policies support both longevity & quality of life.