SELF-INSURANCE AND POOLED SCHEMES AND THE NEED FOR REDISTRIBUTIVE MECHANISMS

BY **MARIA ARAGONA, LUCA REGIS** AND **ELENA VIGNA**

Longevity risk, captured by uncertainty in the evolution of mortality rates, continues to threaten the financial sustainability of traditional pension systems. As a consequence, insurers and plan sponsors are actively seeking alternative decumulation strategies that may transfer it to the pool of policyholders.

Among these alternatives, there are self-insurance solutions, such as Group Self-Annuitization (GSA) schemes, collective schemes and tontines. In theory, GSAs offer a highly efficient mechanism for mitigating longevity risk. A group of retirees pools capital; as members pass away, their remaining wealth (mortality credits) is distributed to the surviving members. Unlike in traditional annuities, where the insurer bears the longevity risk and has to set aside capital for that, a GSA scheme transfers the risk directly to the participants, who share it. Since policyholders are pooled together, their heterogeneity in mortality is a key factor. It is now a very well-documented demographic fact that mortality experiences vary drastically across socioeconomic classes. Individuals from more disadvantaged backgrounds generally face higher mortality risks due to environmental factors, income and education deprivation, riskier occupations, and barriers to healthcare. They are thus more exposed to mortality risk (High-Risk individuals) compared to those belonging to higher socio-economic classes (Low-Risk individuals), who instead live longer on average. In a standard GSA scheme, all members typically contribute the same initial premium and receive the same baseline benefit. When the members belong to different socio-economic classes, a GSA scheme triggers an implicit, regressive wealth transfer: the poorest members die earlier, leaving their mortality credits to subsidize the extended payouts of the wealthiest members. >

This article was published in the Astin Bulletin in September last year. It won the 2025 Chris Daykin award with the PBSS Section of IAA and it will be presented during the next International Congress of Actuaries in Tokyo, next November.

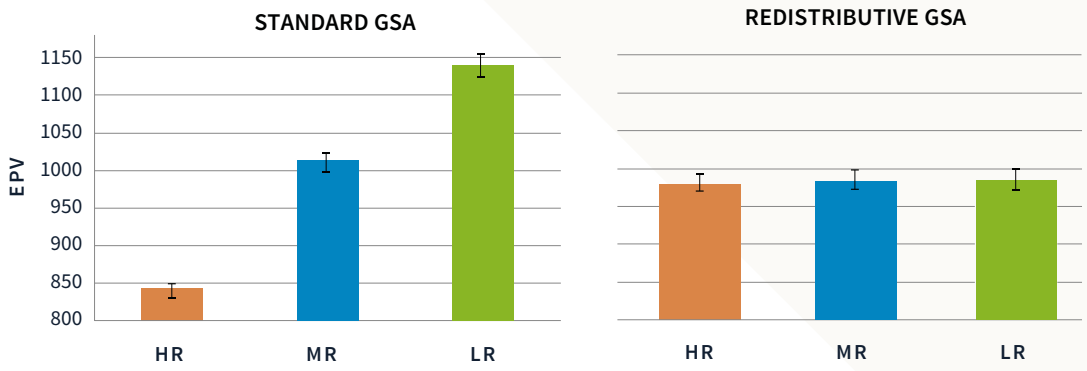
> ***In a standard GSA, the poorest may effectively subsidize the pensions of the wealthiest.***

Therefore, overall, longevity risk is mitigated, but there are implicit welfare transfers from more disadvantaged to wealthier individuals, worsening inequality among socio-economic classes. In our recent article 'A redistributive GSA scheme to cope with socioeconomic mortality differentials', appeared in the ASTIN Bulletin and recipient of the 2025 Chris Daykin prize, we have quantified the extent of this wealth transfer and proposed a modified redistribution rule to reduce inequality. We have used stochastic processes to model the force of mortality and have calibrated them using a British dataset on historical mortality data differentiated in ten socio-economic classes.

Considering three sub-populations of retirees: High-Risk (the most deprived class), Medium-Risk (the median class), and Low-Risk (the least deprived class), we calculate that, based on the Expected Present Value (EPV) of the cash flow streams calculated with each group's specific mortality experience, the poorest individuals implicitly transfer about 30% of their premium in favour of the lowest-risk individuals. This dynamic violates the fundamental principle of actuarial fairness and conflicts with global sustainability goals, such as the UN's 2030 Agenda aimed at reducing inequalities.

If standard pooling creates inequity, how can actuaries build a better decumulation product? The answer lies in replacing the 'equal benefit' rule with a redistributive rule which restores actuarial fairness at the individual level. In our article, we propose such a rule: a 'redistributive GSA' scheme, designed specifically to cope with these socio-economic mortality differentials. Instead of paying identical benefits to all members, the redistributive scheme optimizes benefit shares across different risk classes. In practice, policyholders are segmented. While all members contribute the same initial capital, the scheme assigns different redistributive >

FIGURE 1 – The figure reports the median simulated Expected Present Value (EPV) of the benefits for GSA scheme members belonging to the three socioeconomic classes. The bars on the left represent the EPVs in the standard GSA scheme, the bars on the right the EPVs of the redistributive GSA scheme. Whiskers display the 10th and 90th percentile of the distribution of EPVs.



> ***The people who die earlier can end up paying for those who live longer.***

shares and starting benefits based on the member's socio-economic profile. High-Risk members receive higher initial payouts to offset the effects of their shorter life expectancies, while Low-Risk members, who are expected to draw from the pool for a much longer period, start with a reduced initial benefit. Through Monte Carlo simulations, we show how actuaries can compute the redistributive shares to minimize the gap in Expected Present Value across classes. Our analysis shows that this mechanism is highly effective, restoring actuarial fairness to each member of the pool, as figure 1 shows.

Sensitivity analysis shows that effectiveness of the redistribution scheme is particularly relevant when interest rates are lower, because in the absence of redistribution high discount factors benefit disproportionately those who live the longest to the detriment of those who pass away earlier. Of course, the redistribution may serve as a tool to limit the possible adverse selection mechanism that may discourage the more disadvantaged and typically less insured people to take on insurance. However, practical challenges arise in correctly assigning members to the different classes and in the possible time-dependence of the individual characteristics.

As the industry is shifting away from traditional guaranteed annuities toward self-insurance schemes, it is necessary to guide these innovations responsibly, so that the newly designed products do not inadvertently penalize the vulnerable. Redistributive mechanisms are key to align financial sustainability and social equity. <

MARIA ARAGONA has a PhD in Economics at Universit à di Torino (Italy). She currently works in the Risk Management Unit at Reale Mutua Assicurazioni.

LUCA REGIS is Associate Professor of Financial and Actuarial Mathematics at Universit à di Torino (Italy), Affiliate at Collegio Carlo Alberto and Deputy Director of the LTI@UniTO Research Center.

ELENA VIGNA is Full Professor of Financial and Actuarial Mathematics at Universit à di Torino (Italy) and Fellow at Collegio Carlo Alberto.