Pension reforms in inheritance societies

Sylvain Catherine*

July 31, 2026

Abstract

This paper studies how pay-as-you-go pension systems shape the distribution of wealth across cohorts and amplify the role of inheritance when economic growth declines. A growth slowdown opens a budgetary gap, and when governments close it by raising contribution rates rather than cutting benefits, the net wages of workers fall while the resources of retirees are preserved. Slow growth therefore tilts wealth toward the elderly, the more so the more generous the pension system. Household data from twenty European countries confirm these predictions: the elderly are wealthiest relative to the working-age population where pensions are generous, especially where productivity growth has been slow. Furthermore, retiring cohorts accumulated wealth fastest in generous, slow-growth countries during the 2010–2023 slowdown. These trends shift national wealth shares from late-career households to those above seventy.

Keywords: Pension systems, wealth inequality, bequests, overlapping-generation model.
JEL codes: D15, E21, H55.

*University of Pennsylvania, Wharton. Email: scath@wharton.upenn.edu.

1 Introduction

Between 2010 and 2023, as economic growth in Europe stalled, wealth shifted up the age ladder. The median wealth of households aged 70–85 rose from 1.50 to 1.67 times that of the working-age population.[1] Across European countries, the elderly are wealthiest, relative to the young, where pensions also happen to be most generous. To illustrate this relationship, Figure 1 reports the strong and rising cross-country correlation between retirement benefits, measured relative to the average salary, and the relative wealth of the elderly. In France and Spain, which offer among the highest benefits in Europe, individuals above 70 own 60% to 100% more wealth than the working-age population.

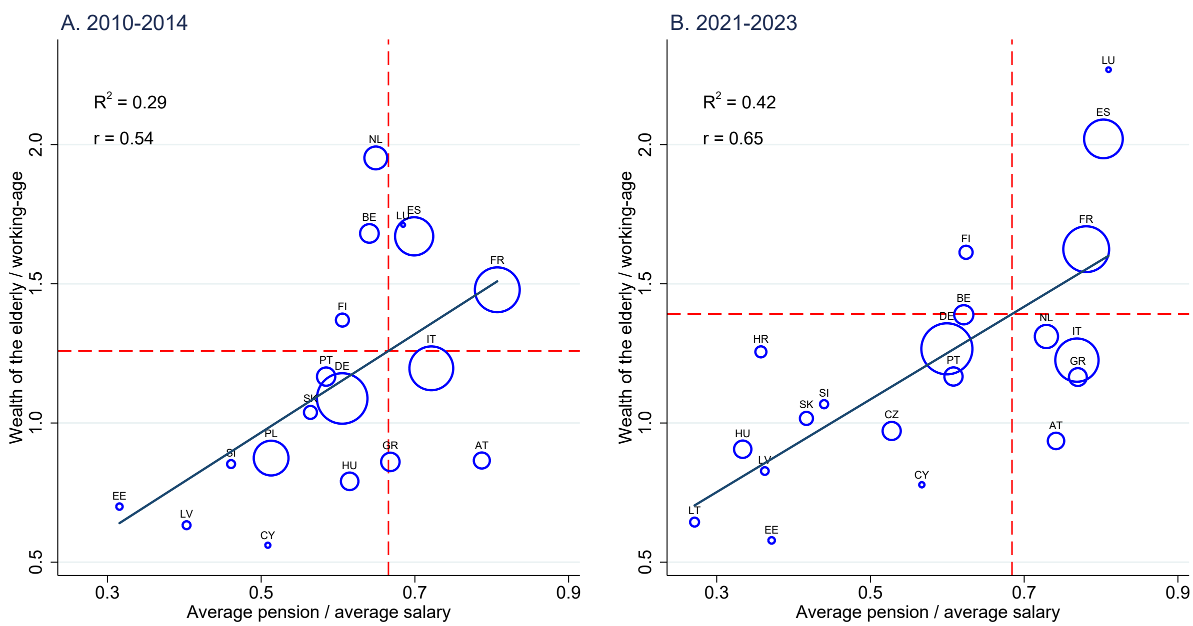

Figure 1: Pension generosity and the relative wealth of the elderly Each circle area is proportional to the country's population, measured as the survey sum of the household weight times household size. The pension-to-salary ratio represents the average total pension divided by the average gross employee income. The mean per-adult net wealth of individuals aged 70–85 is divided by that of the working-age population (ages 26–59). Panel A pools the 2010 and 2014 waves (18 countries); Panel B pools the 2021 and 2023 waves (20 countries). The solid line is the population-weighted OLS fit. The red dashed lines mark the population-weighted means of the two variables.

[1]The data come from the Household Finance and Consumption Survey (HFCS), administered by the European Central Bank. Figure D.1 in Appendix D plots the population-weighted mean of the country-level ratios of median wealth by survey wave. The rise is not driven by the survey's expanding country coverage: on the fixed set of the 14 first-wave countries it is larger, from 1.50 to 1.74.

The fact that the countries in which the elderly are richer than their descendants are also those in which governments organize larger transfers from workers to retirees raises questions about how retirement systems and pension reforms may accentuate the role of inheritance in developed countries over the coming decades. This paper seeks to answer these questions.

The canonical account of how wealth tilts across generations is a race between the rate of return on capital, which compounds the wealth the old set aside when they worked, and the growth of the economy, which raises the resources of the young (Piketty, 2011). By that logic, a slowdown tilts the distribution of wealth toward the old as long as the return falls by less than growth. This paper sheds light on a third runner: pension reform. When growth slows, the budget of pay-as-you-go (PAYG) systems stops balancing, and governments must raise contribution rates or cut benefits. When they choose to raise taxes, the net wages of workers fall proportionally more than retirement benefits, part of which is bequeathed. As a result, the inability to reform generous pension systems tilts wealth toward the old when growth slows, and inheritances play a greater role among the next generations.

This paper formalizes this argument in an overlapping-generations model with a PAYG system in which retirees derive a warm glow from bequeathing wealth to their descendants. It then tests the model's predictions on household balance sheets across the twenty countries of the Household Finance and Consumption Survey (HFCS).

The model is in the spirit of Diamond (1965), augmented with an unfunded pension system. It is populated by two generations at a time: workers, who save to fund their old age, and retirees, who save to bequeath. The object of interest is the per-capita wealth of the old relative to the young, s^o/s^y. Economic growth is driven by exogenous technological progress and fertility. A single parameter spans the spectrum of pension designs and policy responses to changes in economic growth, from systems that balance the budget entirely through benefits, holding the tax rate fixed, to systems that fully insulate retirees and let the tax rate rise. The model delivers three predictions.

First, in the fixed-contribution-rate benchmark — the notional defined contribution (NDC) account systems of Sweden and Italy — net wages and benefits rise and fall with growth in identical proportion, and a slowdown raises s^o/s^y if and only if the equilibrium return falls less than one-for-one with growth; in the model, if and only if the elasticity of intertemporal substitution exceeds one. Under this design the pension system is neutral and market forces alone decide the race between inherited and newly minted wealth. This theoretical benchmark stands far from historical experience, and even Sweden and Italy introduced NDC accounts gradually, letting older workers continue to benefit from pre-existing rules. The more realistic case is partial adjustment, with taxes rising when growth slows.

Second, away from this benchmark, the race between pension reform and tax hikes comes into play. The elasticity of s^o/s^y to growth increases linearly with the elasticity of the payroll tax rate to growth — a measure of a government's propensity to raise taxes rather than adjust retirement rules. Whenever a slowdown tilts wealth toward the old, the tilt is increasing in the generosity of the system, because the fiscal forces are proportional to the size of the pension budget. This interaction between growth and generosity is the model's central testable prediction.

Third, the source of the slowdown matters. Demographic and productivity slowdowns open the same budgetary gap and depress the return on capital equally, but only the productivity slowdown reduces the growth rate of wages. The two are equivalent for the share of *aggregate* wealth held by the old. A demographic slowdown, however, also thins the ranks of the young, raising their resources per capita, and is therefore less likely to raise s^o/s^y. The distinction has recently become particularly relevant: Europe's demographic drag is several decades old, while Western Europe's productivity stagnation is more recent.[2]

The empirical analysis takes these predictions to the HFCS, which records the earnings, pension benefits and balance sheets of households in twenty European countries that differ widely in both pension generosity and productivity growth over the past generation. The first contribution is to document the stylized facts of Figure 1: the relative level of retirement benefits correlates strongly with the wealth of households above 70, and increasingly so as growth stalled ($r = 0.54$ in the 2010 and 2014 waves, 0.65 in 2021 and 2023). This finding is echoed in bequest statistics: the relative level of pensions strongly correlates with the value of gifts and inheritances received from the previous generation by households aged 45 to 65 ($r = 0.71$), and with the share of inheritances in their net worth ($r = 0.65$).

The model predicts that this relationship is stronger in countries with lower productivity growth.

[2]Figure B.1 in Appendix B plots log GDP per hour worked since 1950 for sixteen European countries, from the Long-Term Productivity Database of Bergeaud et al. (2016). Growth of labor productivity averages 4.6 percent a year over 1950–1975 and 2.3 percent over 1975–2000, but only 0.9 percent since 2000, and it is close to zero over the last quarter century in Italy and Greece.

The data confirm this prediction: in household-level regressions, the interaction of pension generosity with productivity growth over the past generation (1991–2019) is negative and statistically significant. The magnitudes are large. A one-standard-deviation increase in the pension-to-salary ratio — eighteen percentage points of the average wage — is associated with roughly 45 log points of additional relative wealth for the elderly at the sample's average growth, and one percentage point of additional annual growth sustained over the window essentially erases that gradient. The result survives when we compare only elderly retirees who worked in the same occupation and industry in different countries, and it is not driven by systematic differences between Western Europe and the former Soviet bloc.

Comparisons of wealth levels across countries, however, cannot exhaust the permanent differences between them, so the second step of the analysis turns to changes. While the model delivers predictions regarding countries on different balanced growth paths, the sample period of the HFCS (2010–2023) itself coincides with a significant slowdown in economic growth in Europe. We therefore follow fixed elderly cohorts over these thirteen years, which absorbs any differences in relative wealth already observable in 2010. The wealth of elderly cohorts, scaled by the average wage of their country, increased faster in countries with larger pension systems and low productivity growth. One endogeneity concern is that governments that favor retirees might also implement policies supporting house prices. In the data, the geography runs the other way — house prices stagnated in the generous, slow-growth countries and boomed in the fast-growing East — and controlling for national house-price trends only reinforces the finding.

Extending the cohort analysis to all age groups above 40 at the end of the window sharpens the interpretation: the generosity gradient of wealth accumulation is zero at every working age, in fast- and slow-growth countries alike, and emerges only as cohorts cross into retirement. Nationwide confounders unrelated to the pension system would not produce this age profile.

Since the age groups' shares of national wealth sum to one, the gains of the elderly must be matched by losses elsewhere in the age distribution. Our last empirical exercise therefore considers how the level of pensions redistributes the *shares* of aggregate national wealth between cohorts, in a specification where the shares add up by construction. A more generous pension system reduces the share of national wealth held by households between their mid-forties and the typical retirement age — by 0.37 to 0.46 of the country's average wealth per standard deviation of generosity when growth is slow — while increasing the shares of those older than 70, by up to 1.3 times the average wealth for the oldest group. Slow productivity growth amplifies both sides of this reallocation, deepening the mid-career deficit and roughly tripling the gain of the oldest group: the generosity gradient itself turns from negative to positive around age 60, and its interaction with growth switches sign around age 70.

Contribution to the literature. This paper contributes to the literatures on pension systems, saving, and inheritance.

Empirically, the importance of inheritances in the economy is well documented (Kotlikoff and Summers, 1981), as is its rise over recent decades (Alvaredo et al., 2017). Traditionally, the importance of inheritance has been attributed to at least two factors. First, a race between the rate of return on capital, which compounds the value of old wealth, and economic growth, which deflates its share in the economy (Piketty, 2011). Second, the propensity of households to bequeath large amounts of wealth when they die. A substantial share of the population has an operative bequest motive, regardless of whether they have children (Kopczuk and Lupton, 2007), which suggests a warm-glow type of motive. The propensity to bequeath increases with wealth, which also suggests that this warm glow acts as a luxury good (De Nardi, 2004).

Our first contribution is to combine these different strands of the literature in a unifying model in which the race between r and g is complemented by government transfers between generations. The notion that retirees can bequeath a substantial share of their pensions arises naturally from Ricardian equivalence in models with dynastic altruism (Barro, 1974) and is empirically supported by causal evidence (Lee and Tan, 2023). Our model allows us to consider how the need to fix budgetary gaps in pension systems can amplify the effect of an economic slowdown on the importance of inheritances.

By showing that this amplification depends on whether the gap is closed by reducing benefits or raising taxes, we also contribute to the literature on intergenerational risk sharing in unfunded systems (Auerbach and Lee, 2011). Rather than welfare, our focus is on explaining an empirical phenomenon, the rising concentration of wealth among the elderly.

In doing so, our work joins a long tradition of papers studying how pension systems affect wealth accumulation, which dates back to debates between Feldstein (1974) and Barro (1974). This literature has focused on displacement: the notion that households accumulate less wealth because they can rely on Social Security (Alessie et al., 2013; Attanasio and Brugiavini, 2003; Attanasio and Rohwedder, 2003; Gale, 1998; Lachowska and Myck, 2018). Our contribution differs in two ways. First, our focus is on the *distribution* of wealth between overlapping generations.[3] Second, we study how changes in the pace of economic growth shift this distribution through the operations of the pension system.

The rise of elderly wealth is not just a European phenomenon and is also observed in the United States (Bauluz and Meyer, 2024). To explain this trend, existing research has emphasized the role of rising asset prices (Catherine et al., 2025b; Fagereng et al., 2025; Greenwald et al., 2021), which goes against the r vs g race. When the discount rate r falls, the valuation of the existing stock of assets, held by older households, *rises*, making those assets more costly for younger households to buy. The (lack of) pension reform channel complements this story: when rates and growth decline, younger households are caught in a pincer movement between rising asset prices (although they benefit from lower financing costs) and the need to raise taxes to fund pension promises.

Finally, by showing that the way the budgetary gap is closed — whether by cutting benefits or raising taxes — is key to the rise in the elderly share during economic slowdowns, we contribute to the political economy literature on the provision of pension systems (Boldrin and Rustichini, 2000; Browning, 1975; Cooley and Soares, 1999; Mulligan and Sala-i Martin, 1999). Galasso and Profeta (2002) provide a review of this literature.

2 Model

We study a closed, two-period overlapping-generations economy in the tradition of Diamond (1965). Time is discrete and a period is a generation — thirty years in the calibration. Each generation lives for two periods: young, it supplies one unit of labor, pays the pension contribution, receives a bequest, consumes, and saves in capital; old, it collects the return on its savings and a pay-as-you-go pension, consumes, and leaves a bequest to its descendant. A representative firm produces a single good from capital and labor. The capital stock is the saving of the young. Pro-

[3] Feldstein (1976), Sabelhaus and Volz (2022) and Catherine et al. (2025a) study how Social Security mitigates wealth inequality while Catherine and Sarin (2025) considers its importance in correcting racial wealth inequality.

ductivity and the size of the cohorts grow at exogenous rates.

This section describes the technology, the pension system, and the households, then solves for the balanced growth path.

2.1 Agents and environment

2.1.1 Technology and factor prices

Demographics. Each household has $1 + g_n$ descendants, so the cohort born at t has mass

$$N_t = (1 + g_n)\, N_{t-1}, \tag{1}$$

with g_n the demographic growth rate.

Production and factor prices. A representative firm produces with a Cobb–Douglas technology in capital K_t and labor — each young household supplies one unit — augmented by productivity A_t:

$$Y_t = K_t^{\alpha}\, (A_t N_t)^{1-\alpha}, \qquad \alpha \in (0, 1), \tag{2}$$

where productivity grows at the constant rate g_a: $A_t = (1 + g_a)\, A_{t-1}$. On a balanced path, output and aggregate earnings grow at the *total* growth rate g:

$$1 + g \equiv (1 + g_a)(1 + g_n). \tag{3}$$

Because a generation is long, we let capital fully depreciate within the period. Competitive factor markets pay each factor its marginal product:

$$1 + r_t = \alpha\, K_t^{\alpha-1}(A_t N_t)^{1-\alpha}, \qquad w_t = (1 - \alpha)\, \frac{Y_t}{N_t}, \qquad \Pi_t \equiv (1 + r_t)\, K_t = \alpha\, Y_t, \tag{4}$$

with w_t the wage of a young household's unit of labor. The aggregate wage bill $W_t \equiv w_t N_t = (1 - \alpha)\, Y_t$ grows at the total rate g along the balanced path and will serve as the natural deflator for balanced-growth ratios. Competitive forces split output between aggregate profits Π_t and W_t, and their ratio is a constant $\Pi_t / W_t = \alpha / (1 - \alpha)$ of the technology.

2.1.2 The pension system

The public pension system is unfunded. Period by period, the contributions of the young pay the benefits of the old. Benefits b_t are tied to the retiree's own past earnings through the replacement rate $\rho_t \in (0,1)$, and the budget equates the contributions of the workers to the benefits of the retirees:

$$\underbrace{b_t = \rho_t \, w_{t-1},}_{\text{benefits rule}} \qquad \underbrace{\tau_t \, W_t = \rho_t \, W_{t-1},}_{\text{budget constraint}} \qquad \Longrightarrow \qquad \tau_t = \frac{\rho_t}{1+g}. \tag{5}$$

On a balanced growth path the replacement rate and the contribution rate are both constant, and linked by the growth rate of the economy g. To balance the budget, a lower growth rate g implies a higher tax rate or a lower replacement rate.

2.1.3 Households

Preferences. A household born at t values its own consumption when young and old, and derives a warm glow from the *bequest* it leaves to its descendant:

$$V_t = u(c_t^y) + \beta\big[u(c_{t+1}^o) + \varphi \, u(s_{t+1}^o)\big], \qquad u(c) = \frac{c^{1-\gamma}}{1-\gamma}, \qquad \gamma > 0,\ \varphi > 0, \tag{6}$$

where β is the within-life discount factor, φ the weight on the gift, and γ the coefficient of relative risk aversion. The household cares about the size of the estate it leaves and divides it equally among its descendants.

Budget constraints. A young household born at t receives its share $s_t^o/(1+g_n)$ of the estate $s_t^o \geq 0$ left by its predecessor, earns after-tax labor income $(1-\tau_t)\, w_t$, consumes c_t^y, and saves the rest, s_t^y, in capital:

$$c_t^y + s_t^y = (1-\tau_t)\, w_t + \frac{s_t^o}{1+g_n}. \tag{7}$$

When old the household holds gross assets $(1+r_{t+1})\, s_t^y$ and collects its pension b_{t+1}. These resources, denoted j_{t+1}^o, are divided between consumption and a bequest to its own descendant:

$$c_{t+1}^o + s_{t+1}^o = \underbrace{(1+r_{t+1})\, s_t^y + b_{t+1}}_{\equiv\, j_{t+1}^o}. \qquad s_{t+1}^o \geq 0, \tag{8}$$

Optimal consumption. The household chooses $\{c^y_t, s^y_t, c^o_{t+1}, s^o_{t+1}\}$ to maximize (6) subject to (7)–(8). Two first-order conditions determine the optimal consumption plan. Each generation splits its own consumption between the two periods of the life cycle to equalize the marginal utility of each dollar of present value:

$$(c^y_t)^{-\gamma} = \beta\,(1 + r_{t+1})\,(c^o_{t+1})^{-\gamma}. \tag{9}$$

In the second period, the division of the old's resources between their own consumption and the gift is a static problem: the marginal utility of consuming must equal the marginal warm glow, $(c^o_{t+1})^{-\gamma} = \varphi\,(s^o_{t+1})^{-\gamma}$, so the old bequeath a fixed share of their resources and consume the rest:

$$s^o_{t+1} = \Phi\, j^o_{t+1}, \qquad c^o_{t+1} = (1-\Phi)\, j^o_{t+1}, \qquad \Phi \equiv \frac{\varphi^{1/\gamma}}{1+\varphi^{1/\gamma}} \in (0,1). \tag{10}$$

2.2 Optimal actions and equilibrium

2.2.1 The balanced growth path

On the balanced growth path every aggregate grows at the total rate g. We therefore solve the model in cohort aggregates: write $C^y_t \equiv N_t\, c^y_t$ and $S^y_t \equiv N_t\, s^y_t$ for the consumption and saving of the young cohort, and $C^o_t \equiv N_{t-1}\, c^o_t$ and $S^o_t \equiv N_{t-1}\, s^o_t$ for the old. Scaling by the contemporaneous payroll then removes the trend: for any aggregate X_t, let $\hat{X} \equiv X_t/W_t$. Define

$$\Lambda \equiv \frac{W_{t+1}/(1+r)}{W_t} = \frac{1+g}{1+r}, \tag{11}$$

the market value today of a claim on the next generation's earnings, per unit of this generation's.

Resources in old age. The economy is closed à la Diamond (1965): the capital stock is the saving of the young cohort, $K_{t+1} = S^y_t$. Since capital fully depreciates within a generation, buying the capital stock is buying a claim to what it will pay — the payout Π_{t+1}, worth $\hat{\Pi}$ units of the earnings of the generation working then, or equivalently $\Lambda\hat{\Pi}$ today. Hence, the savings of the young must be equal to:

$$\hat{S}^y = \Lambda\,\hat{\Pi} = \frac{1+g}{1+r}\frac{\alpha}{1-\alpha}. \tag{12}$$

One period later, these savings, grossed up by the return on capital and combined with the taxes paid by the next generation, constitute the resources of the old cohort:

$$\hat{J}^o \equiv \frac{(1+r_{t+1})\, S_t^y + \tau_{t+1}\, W_{t+1}}{W_{t+1}} = \hat{\Pi} + \tau. \tag{13}$$

Hence these resources are determined by the technology parameter α and the share of wages τ allocated to the pension system. Even in a country with a moderately-sized PAYG system like the United States, benefits represent half of the resources of most households (Catherine et al., 2025a). As previously discussed, a share $1-\Phi$ is consumed and a share Φ is passed on:

$$\hat{C}^{\,o} = (1-\Phi)\,(\hat{\Pi}+\tau), \qquad \hat{S}^o = \Phi\,(\hat{\Pi}+\tau). \tag{14}$$

The equilibrium condition. The resource constraint is $C_t^y + C_t^o + K_{t+1} = Y_t$. Noting that $Y_t = W_t/(1-\alpha)$, the constraint can be expressed per unit of the payroll:

$$\hat{C}^{\,y} + \hat{C}^{\,o} + \hat{S}^y = \frac{1}{1-\alpha}, \tag{15}$$

and combined with (12)–(14), delivers the young's consumption:

$$\hat{C}^{\,y} = \frac{1}{1-\alpha} - (1-\Phi)\,(\hat{\Pi}+\tau) - \Lambda\,\hat{\Pi}. \tag{16}$$

The life-cycle Euler equation (9) pins down the return households require to accept this consumption path. Since the young cohort of period t and the old cohort of period $t+1$ are the same N_t households, the slope of the lifetime consumption profile equals the ratio of the cohort aggregates, $c_{t+1}^o/c_t^y = (\hat{C}^{\,o}/\hat{C}^{\,y})\,(W_{t+1}/W_t) = (1+g)\,\hat{C}^{\,o}/\hat{C}^{\,y}$, where the factor $1+g$ appears because the two aggregates are scaled by payrolls one period apart. Substituting this slope into (9) gives the required return:

$$1+r = \frac{1}{\beta}\left[(1+g)\,\frac{\hat{C}^{\,o}}{\hat{C}^{\,y}}\right]^{\gamma}. \tag{17}$$

The saving of the young must therefore satisfy two conditions at once: it is the present value of the profits the capital stock will pay, (12), and it is an amount households are willing to defer at the return (17). Substituting (14)–(16) into the pair collapses the system to one equation in the single unknown Λ:

$$(1-\Phi)\,(\hat{\Pi}+\tau)\,(1+g) = \left[\frac{\beta\,(1+g)}{\Lambda}\right]^{1/\gamma}\left[\frac{1}{1-\alpha} - (1-\Phi)\,(\hat{\Pi}+\tau) - \Lambda\,\hat{\Pi}\right]. \tag{18}$$

The left side does not depend on Λ while the right side is strictly monotonic in it from $+\infty$ to zero on the admissible range — the interval of candidate values of Λ for which the young's consumption (16) is positive. The balanced growth path exists and is unique, with no restriction on the primitives. In particular, at log utility the fixed point is closed form:

$$\gamma = 1: \qquad \Lambda = \frac{\beta\left[\dfrac{1}{1-\alpha} - (1-\Phi)\,(\hat{\Pi}+\tau)\right]}{(1-\Phi)\,(\hat{\Pi}+\tau) + \beta\,\hat{\Pi}}. \tag{19}$$

Capital intensity and the wage path. Given the equilibrium Λ, the firm's first-order condition (4) pins capital per efficiency unit of labor and hence the wage,

$$\tilde{k} \equiv \frac{K_t}{A_t N_t} = \left(\frac{\alpha\Lambda}{1+g}\right)^{\frac{1}{1-\alpha}}, \qquad w_t = (1-\alpha)\,\tilde{k}^{\alpha} A_t, \tag{20}$$

so the wage grows at the productivity rate g_a along the path — but its *level* now moves with anything that moves Λ, the pension included.

2.2.2 Generational distribution of wealth

At any date two generations hold the economy's wealth: the old, whose resources end as consumption and an estate, and the young, whose saving is the capital stock. The model's measure of the balance between them is the estate-to-saving ratio s^o/s^y — the estate of an old household relative to the saving of a young one, the ratio of *means* that the survey data measure directly. This is where the composition of growth re-enters: the two cohorts differ in size, so converting the scaled aggregates into per-head quantities brings in their relative mass. The estate per old household is $s^o_t = S^o_t/N_{t-1}$ and the saving per young household $s^y_t = S^y_t/N_t$, so $s^o/s^y = (N_t/N_{t-1})\,\hat{S}^o/\hat{S}^y = (1+g_n)\,\hat{S}^o/\hat{S}^y$, and (14)–(12) deliver it in closed form:

$$\frac{s^o}{s^y} = (1+g_n)\,\frac{\Phi(\hat{\Pi}+\tau)}{\Lambda\,\hat{\Pi}} = \Phi\,\frac{1+r}{1+g_a}\left[1+\frac{1-\alpha}{\alpha}\,\tau\right]. \tag{21}$$

The numerator is a preference share Φ of resources that technology and the pension budget pin; the denominator is the present value of the profits the next capital stock will pay. The closed form shows how the two growth rates divide the labor: productivity growth appears in the discounting term $(1+r)/(1+g_a)$, while demographic growth survives only inside the contribution rate $\tau = \rho/(1+g)$.

3 Theoretical predictions

We now ask what a slowdown in growth does to this economy, and how the answer depends on the design of the pension system. A slowdown can tilt wealth toward the older cohort through two channels. First, wealth is redistributed toward the old when the equilibrium return falls by less than growth, widening the $r-g$ gap. Second, wealth concentrates among the old when the pension system's budget gap is closed by raising taxes, because doing so raises benefits relative to after-tax wages.

3.1 Spectrum of pension adjustment rules

When its budget is balanced, the relationship between the replacement rate of the system and the payroll tax rate depends on the total growth rate of the economy:

$$\tau = \frac{\rho}{1+g}. \tag{22}$$

A fall in g thus implies either a reduction in the replacement rate, a rise in the tax rate, or a combination of the two to balance the budget. We span the possibilities with a single parameter $\theta \in [0,1]$,

$$\rho(g) = \rho_0 \left(\frac{1+g}{1+g_0}\right)^{\theta}, \qquad \tau(g) = \frac{\rho(g)}{1+g} = \tau_0 \left(\frac{1+g}{1+g_0}\right)^{-(1-\theta)}, \tag{23}$$

where (g_0, ρ_0, τ_0) describes the initial path. θ and $-(1-\theta)$ are the elasticities of benefits and taxes to growth:

$$d\ln\rho = \theta\, d\ln(1+g), \qquad d\ln\tau = -(1-\theta)\, d\ln(1+g). \tag{24}$$

At $\theta = 0$, the system holds the *replacement rate fixed*: retirees are insulated and a slowdown raises the contribution rate one-for-one in logs. At $\theta = 1$, it holds the *contribution rate fixed*: the tax rate never moves and the replacement rate falls with total growth — each worker in effect owns a notional account credited at the growth rate of aggregate earnings, as in the notional defined contribution (NDC) systems of Sweden and Italy.

More generally, the parameter θ can be interpreted as the government's ability to reform pensions by aligning the internal rate of return of the system with economic growth by reducing benefits or deferring the retirement age rather than moving the burden to the next generations.

3.2 The response of estates and savings to declining total growth

To analyze how a slowdown affects the relative wealth of the elderly, we examine two components in turn: how the scaled estate of the old $\hat{S}^o$ depends on growth, and how the scaled saving of the young $\hat{S}^y$ does.

3.2.1 Estate

The scaled estate (14) is a preference share of old-age resources $\hat{\Pi} + \tau$, so growth reaches it only through the contribution rate:

$$\frac{d \ln \hat{S}^o}{d \ln(1+g)} = -(1-\theta)\frac{\tau}{\hat{\Pi} + \tau}\,. \tag{25}$$

The elasticity is the product of the share of benefits in the old's resources, $\tau/(\hat{\Pi} + \tau)$, and the fraction $1 - \theta$ of the budgetary adjustment borne by contributions. Under a fixed replacement rate ($\theta = 0$), the benefit bill relative to contemporaneous aggregate earnings ($\tau = N_{t-1}b_t/W_t$) rises when total growth falls, which raises the estate in proportion to the retirees' marginal propensity to bequeath, Φ. At the opposite end of the spectrum ($\theta = 1$), the budget is balanced by letting the replacement rate fall. In this case, benefits relative to contemporaneous earnings, and with them the scaled estate, do not move.

3.2.2 Savings of the young

Under a fixed contribution rate ($\theta = 1$). For the capital market to clear (12), the savings of the young must equal the present value of profits. Holding the discount rate r fixed, a one percent increase in $1 + g$ raises that present value by one percent, and with it the required savings of the young.

At the same time, households require a higher rate of return to postpone consumption when the economy grows faster (17). Specifically, assuming for a moment that the consumption ratio $\hat{C}^o/\hat{C}^y$ stays put, a one percent increase in $1 + g$ raises the equilibrium gross return by γ percent.

Taking together the change in growth and the equilibrium rate response, the net effect on the present value of future profits — and thus on the savings of the young — is $1 - \gamma$ percent. The larger payout wins when $\gamma < 1$, the heavier discounting wins when $\gamma > 1$, and the two cancel exactly at log utility.

The consumption ratio $\hat{C}^o/\hat{C}^y$ does not, in fact, quite stay put. The extra saving must come out of the young's consumption: $d\hat{C}^y = -\hat{\Pi}\, d\Lambda$ by (16). With a lower $\hat{C}^y$ the consumption path is steeper still, and the required return (17) rises a little further, reducing the value of future profits and undoing part of the extra saving. Solving for the fixed point:

$$\left.\frac{d \ln \hat{S}^y}{d \ln(1+g)}\right|_{\theta=1} = \frac{1-\gamma}{D}, \qquad D \equiv 1 + \gamma\,\frac{\hat{S}^y}{\hat{C}^y} > 1. \tag{26}$$

The feedback D dampens the direct effect but never reverses it. A slowdown raises the young's scaled saving if $\gamma > 1$, lowers it if $\gamma < 1$, and leaves it unchanged at log utility.

When the tax rate changes ($\theta < 1$). When the level of pensions does not fully adjust to the new pace of total growth, taxes must increase to balance the budget.

Each additional contribution euro is transferred from the young to the old. The latter consume $1-\Phi$ of it and return the rest through the estate. The old's consumption therefore rises by $1-\Phi$ per euro and the young's resources fall by the same amount, so the slope of the lifetime consumption path, $\hat{C}^o/\hat{C}^y$, steepens through its numerator and its denominator at once. Before the young's saving responds, the tilt per euro of contributions is

$$\Psi \equiv \left.\frac{\partial \ln\big(\hat{C}^{\,o}/\hat{C}^{\,y}\big)}{\partial \tau}\right|_{\hat{S}^y} = (1-\Phi)\left(\frac{1}{\hat{C}^{\,o}} + \frac{1}{\hat{C}^{\,y}}\right), \tag{27}$$

one term for each end of life.

To accept a steeper consumption plan, households require a higher return (17), which lowers the present value of profits (12) and thus the savings of the young required to clear the capital market. The same fixed point as before dampens the effect on their savings:

$$\frac{\partial \ln \hat{S}^y}{\partial \tau} = -\,\frac{\gamma\,\Psi}{D} < 0. \tag{28}$$

Combining the growth channel and its amplification by the fiscal adjustment (24) gives the total response:

$$\frac{d \ln \hat{S}^y}{d \ln(1+g)} = \underbrace{\frac{1-\gamma}{D}}_{\text{growth channel}} + \underbrace{\frac{(1-\theta)\,\gamma\,\tau\,\Psi}{D}}_{\text{fiscal amplification}}. \tag{29}$$

3.3 Trends in the relative wealth of the elderly

The estate and saving responses (25) and (29) combine into a single statistic — the response of the young's scaled saving net of the scaled estate's, signed so that a positive R tilts wealth toward the old:

$$R \equiv \frac{(1-\theta)\,\tau}{\hat{\Pi}+\tau} + \frac{1-\gamma}{D} + \frac{(1-\theta)\,\gamma\,\tau\,\Psi}{D}, \tag{30}$$

which either source of growth reaches only through g. The three terms are the two fiscal forces and the race: the gross-up of the estate and the crowding out of the young's saving, both proportional to $(1-\theta)\,\tau$, and the race term $(1-\gamma)/D$, positive exactly when the equilibrium return falls less than one-for-one with growth. The wealth ratio (21) adds the cohort factor $1+g_n$, which responds to a demographic slowdown and not to a productivity one, so the two compositions part ways at exactly this step.

Proposition 1 (Productivity versus demographic slowdowns). *Whatever the design θ, the generosity of the system, and the curvature γ, a demographic slowdown moves the per-capita wealth* *ratio by exactly one log point per log point of growth less than an equal-sized productivity slowdown:*

$$-\frac{d\ln(s^o/s^y)}{d\ln(1+g_a)} = R, \qquad -\frac{d\ln(s^o/s^y)}{d\ln(1+g_n)} = R-1\,. \tag{31}$$

On a balanced growth path, cohort-level aggregate statistics grow at the same rate as the economy, regardless of whether this growth is driven by productivity or fertility. The same is true of the fiscal dynamics of the PAYG system. However, unlike productivity gains, fertility growth dilutes the aggregate wealth of each subsequent generation on a per capita basis.

Proposition 2 (Conditions under which a slowdown raises the relative wealth of the elderly). *Across balanced-growth paths, a permanent fall in productivity growth g_a raises the wealth ratio s^o/s^y if and only if $R > 0$, i.e.*

$$\underbrace{\frac{(1-\theta)\,\tau}{\hat{\Pi}+\tau}}_{\substack{\textit{gross-up of scaled} \\ \textit{estate } \hat{S}^o\ (>0)}} + \underbrace{\frac{(1-\theta)\,\gamma\,\tau\,\Psi}{D}}_{\substack{\textit{fiscal crowd-out of} \\ \textit{young saving } \hat{S}^y\ (>0)}} > \underbrace{\frac{\gamma-1}{D}}_{\substack{\textit{race term: deepening} \\ \textit{of young saving } \hat{S}^y\ (\gtreqless 0)}}, \tag{32}$$

that is, if and only if the two fiscal forces on the left — the gross-up of the estate and the crowding out of the young's saving, both proportional to $(1-\theta)\,\tau$ — outweigh the race term on the right, the deepening response of the young's saving to the slowdown itself (26)*, which favors the old only when the return falls less than one-for-one. A permanent fall in demographic growth g_n raises s^o/s^y if and only if the same forces clear the higher threshold $R > 1$: they must beat not only the deepening force but the cohort arithmetic. In particular:*

- *under a fixed contribution rate ($\theta = 1$), a productivity slowdown raises the ratio if and only if $\gamma < 1$; a demographic slowdown never does, since $R = (1-\gamma)/D < 1$ for every $\gamma > 0$;*
- *under a fixed replacement rate ($\theta = 0$), for a productivity slowdown every curvature $\gamma \le 1$ qualifies, and curvatures above one qualify as long as the fiscal and crowding-out forces outweigh the deepening force; a demographic slowdown requires the strictly stronger condition $R > 1$ at every curvature.*

When $\theta = 1$, a productivity slowdown multiplies net wages and benefits by the same factor $(1+g)/(1+g_0)$ relative to the previous growth path (g_0), so the pension system adjusts without redistributing income between generations. Whether the wealth share of the elderly and the s^o/s^y ratio increase depends only on the race between r and g_a: they do if r falls less than g_a, which in the model occurs when $\gamma < 1$. A demographic slowdown must clear the higher threshold $R > 1$ of Proposition 1, and under a fixed contribution rate never does.

When $\theta < 1$, net wages adjust proportionally more than pensions, so a slowdown raises the income share of retirees, which also pushes their wealth share up. When r does not win the race, that is, when $\gamma \leq 1$, there is no offsetting force, so the wealth share of the old increases unambiguously. For $\gamma > 1$, the forces of capital markets and fiscal adjustment act in opposite directions and the net result is ambiguous.

Proposition 3 (Role of pension generosity). *Assume $\gamma \geq 1 - \Phi$ and $\rho \leq \hat{\Pi}\,(1+g)$. The slowdown responses of the wealth ratio — R for productivity, $R-1$ for demographics — differ by a constant, so they share their generosity gradient. Whenever a slowdown of either composition raises the relative wealth of the old, the rise is strictly increasing in the replacement rate: for every rule $\theta \in [0,1]$, comparing economies at a common initial total growth rate,*

$$R > 0 \qquad \Longrightarrow \qquad \frac{\partial R}{\partial \rho} = \frac{\partial\,(R-1)}{\partial \rho} > 0. \tag{33}$$

For $1 - \Phi \leq \gamma \leq 1$ the conclusion of (33) holds whether or not the slowdown raises relative wealth, except at the knife-edge $\gamma = 1$, $\theta = 1$, where a productivity slowdown moves nothing — and a demographic slowdown moves the ratio only through the cohort factor — and the derivative is zero.

The two assumptions are mild. The first, $\gamma \geq 1-\Phi$, asks that curvature exceed the share of their resources that the old consume; it guarantees that a more generous pension, by crowding out the young, sharpens the feedback ($\partial D/\partial\tau < 0$). The second, $\rho \leq \hat{\Pi}\,(1+g)$ — equivalently $\tau \leq \hat{\Pi}$ — caps benefits at the payout to capital and is needed only for $\gamma > 1$. In terms of observables, it implies that pay-as-you-go outlays may not exceed the capital share of GDP. Across the OECD, public pension spending runs 5 to 16 percent of GDP against a gross capital share of 35 to 40 percent, so the condition holds with room to spare.

Proposition 4 (Role of adjustment policy). *On a given balanced path, the response of relative* *wealth to a slowdown of either composition is affine and strictly decreasing in θ:*

$$R = \frac{1-\gamma}{D} + (1-\theta)\,\tau\left[\frac{1}{\hat{\Pi}+\tau} + \frac{\gamma\,\Psi}{D}\right], \qquad -\frac{d\ln(s^o/s^y)}{d\ln(1+g_a)} = R, \quad -\frac{d\ln(s^o/s^y)}{d\ln(1+g_n)} = R-1. \tag{34}$$

Likewise, for a discrete fall in g_a or in g_n, the rise in $\ln(s^o/s^y)$ between balanced paths is strictly decreasing in θ. A fixed replacement rate therefore maximizes, and a fixed contribution rate minimizes, the tilt of wealth toward the old, at every curvature, every generosity, and either composition of the slowdown.

3.4 Simulations

The propositions compare balanced growth paths; we now trace the full perfect-foresight transition between them, for each composition of the slowdown in turn. In the *productivity* experiment, annual productivity growth g_a falls unexpectedly and permanently from 2 to 1 percent between generations 0 and 1, with demographic growth at zero throughout. In the *demographic* experiment, the total fertility rate falls from 2 to 1.5 over the same dates — the cohort factor $1+g_n$ drops from 1 to 0.75 — while productivity growth is unchanged. In both, generation 0 worked and saved under the old expectation, so its realized return and benefit come as a surprise, and every later generation sees the slow path coming.

3.4.1 Calibration

Table 1 collects the parameters. A model period is a generation of 30 years, and all rates below are annual. The gross capital share is $\alpha = 0.40$. The discount factor compounds an annual 0.98, $\beta = 0.98^{30} \approx 0.55$, and curvature is logarithmic, $\gamma = 1$, the interior benchmark of Proposition 2. The warm-glow weight $\varphi = 0.5$ implies the old pass $\Phi = 1/3$ of their terminal resources to their descendant. The replacement rate is $\rho = 0.56$, the average of the Eurostat aggregate replacement ratio across the countries of our sample at the end of the period (2023). These choices imply, on the initial balanced path, a contribution rate of 31 percent of earnings, an annual interest rate of 4.1 percent — comfortably above total growth, so the economy is dynamically efficient and participation is a burden — and an estate-to-saving ratio of 0.89: the old begin with slightly less wealth than the young.

Table 1: Calibration. One model period is a generation of 30 years; annual rates are compounded accordingly. Panel B reports the implied moments of the balanced growth path.

	Description	Value
Panel A: parameters		
α	capital share (gross, full depreciation)	0.40
β	discount factor (0.98 annual)	$0.98^{30} \approx 0.545$
γ	relative risk aversion	1
φ	warm-glow weight ($\Phi = \varphi/(1+\varphi)$)	0.5
g_a	productivity growth	2%/yr
TFR	total fertility rate ($g_n = 0$)	2
ρ	replacement rate	0.56
Panel B: implied balanced path		
Φ	bequest share of the old's resources	$1/3$
τ	contribution rate $\rho/(1+g)$	0.309
r	interest rate	4.1%/yr
$\hat{S}^y$	saving of the young per unit of earnings	0.364
s^o/s^y	estate-to-saving ratio	0.89

The two choices least disciplined by outside evidence are the curvature γ and the warm-glow weight φ, and Proposition 2 makes the direction of the tilt depend on exactly these. Figure 2 therefore maps the response R itself in the plane of the intertemporal elasticity of substitution $1/\gamma$ and the bequest share Φ, one panel per generosity level, holding every other parameter at its Table 1 value: blue where a productivity slowdown lowers the wealth ratio, red where it raises it, with the two thresholds of Proposition 2 drawn as contours — solid at $R = 0$, dashed at $R = 1$, beyond which even a demographic slowdown raises the ratio. Under a fixed replacement rate the productivity condition holds at every bequest share whenever the elasticity is one or above, so the map covers only elasticities below one. The blue region is confined to the low-elasticity edge of the plane and shrinks as generosity rises — the fiscal forces in (32) are proportional to the size of the system: a productivity slowdown tilts wealth toward the old at every bequest share whenever the elasticity exceeds 0.38 at $\rho = 0.4$, 0.26 at $\rho = 0.6$, and 0.18 at $\rho = 0.8$ — curvatures of 2.6, 3.9, and 5.6. The region beyond the dashed contour grows from the opposite corner — high elasticity and low bequest share, where the young's saving is most responsive and the estate smallest — and its fiscal forces too are proportional to τ: it is absent at $\rho = 0.4$ and expands with generosity, with responses well above one at low bequest shares. The log-utility calibration

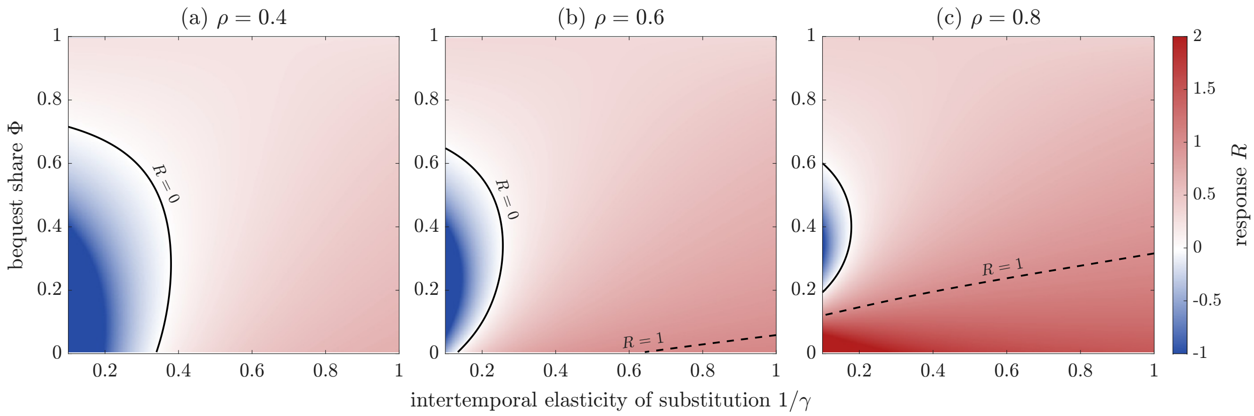

Figure 2: The response of relative wealth to a slowdown. The balanced-path response R (30) — the response of the wealth ratio s^o/s^y to a productivity slowdown; a demographic slowdown's is $R-1$ (31) — in the plane of the intertemporal elasticity of substitution $1/\gamma$ and the bequest share Φ, under the fixed-replacement-rate rule ($\theta = 0$), one panel per replacement rate $\rho \in \{0.4,\ 0.6,\ 0.8\}$, with all other parameters at their Table 1 values.

($1/\gamma = 1$, $\Phi = 1/3$, with $R = 0.54$, 0.77, and 0.98 across the panels) approaches the demographic threshold as generosity rises but stays just below it even at $\rho = 0.8$: a fertility slowdown leaves the wealth ratio roughly flat in the most generous systems and lowers it everywhere else.

3.4.2 Productivity slowdown

Fixed replacement rate across generosity levels. Figure 3 shows the transition under the fixed-replacement-rate rule ($\theta = 0$) for $\rho \in \{0.3,\ 0.56,\ 0.7\}$. With retirees insulated, the whole budgetary adjustment falls on the contribution rate. Consequently, the level of benefits increases relative to the after-tax wages of the next generations.

The estate-to-saving ratio rises by roughly 20% within a generation (24 log points for $\rho = 0.56$), which is in the ballpark of recent empirical trends of roughly 1% per year. Quantitatively, the mechanism is therefore a plausible explanation for a meaningful part of the rise in the elderly share of wealth.

The interest-rate panel shows the non-neutrality at work twice. On impact, the return realized by generation 0 falls by about 0.6 percentage points at every replacement rate. In the long run, the rate falls by less than the fall in growth — in particular in high-replacement-rate economies — because the expanding pension crowds out private savings and props the return up, the more so the more generous the system.

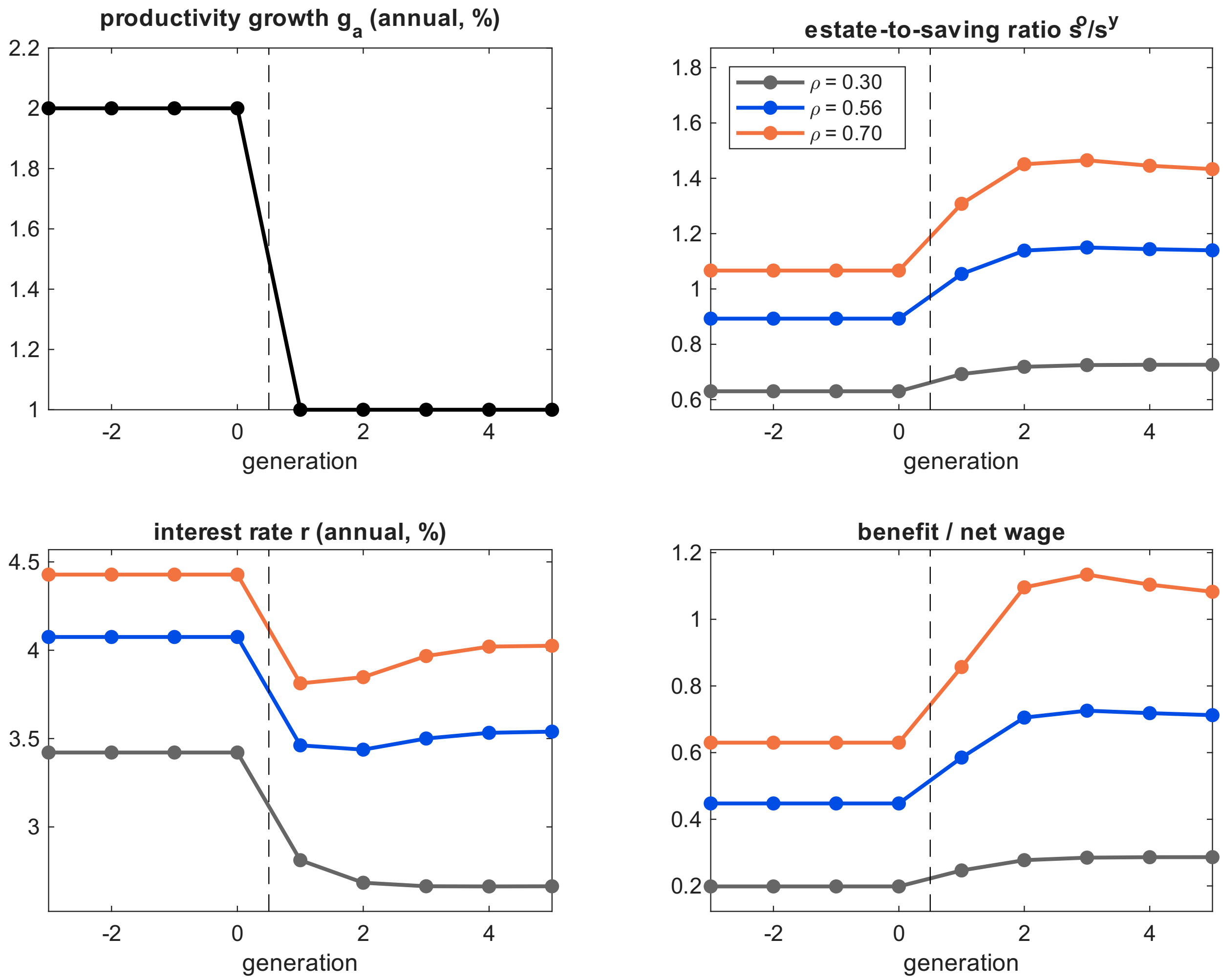

Figure 3: Productivity slowdown under a fixed replacement rate, across generosity levels. Annual productivity growth falls unexpectedly and permanently from 2 to 1 percent between generations 0 and 1 (dashed line), under the fixed-replacement-rate rule ($\theta = 0$) for replacement rates $\rho \in \{0.3,\ 0.56,\ 0.7\}$.

The adjustment spectrum. Figure 4 fixes $\rho = 0.56$ and spans the design rule, $\theta \in \{0, \frac{1}{2}, 1\}$. At log utility the fixed-contribution-rate pole is the knife-edge of Proposition 2: with τ frozen and $\gamma = 1$, neither the estate nor the saving of the young moves per unit of earnings, and the coral line in the ratio panel is exactly flat — date by date, surprises included, by the constant-saving-rate rule of Appendix A.5. What does move under the fixed contribution rate is the price of capital: the interest rate falls one-for-one with growth, from 4.1 to 3.1 percent, and the retirees' replacement rate absorbs the slowdown, drifting from 0.56 down to 0.42. The fixed-replacement-rate rule is the mirror image: the replacement rate never moves, the contribution rate absorbs the slowdown, and the ratio tilts most — the ranking of Proposition 4, with the $\theta = \frac{1}{2}$ path settling in between

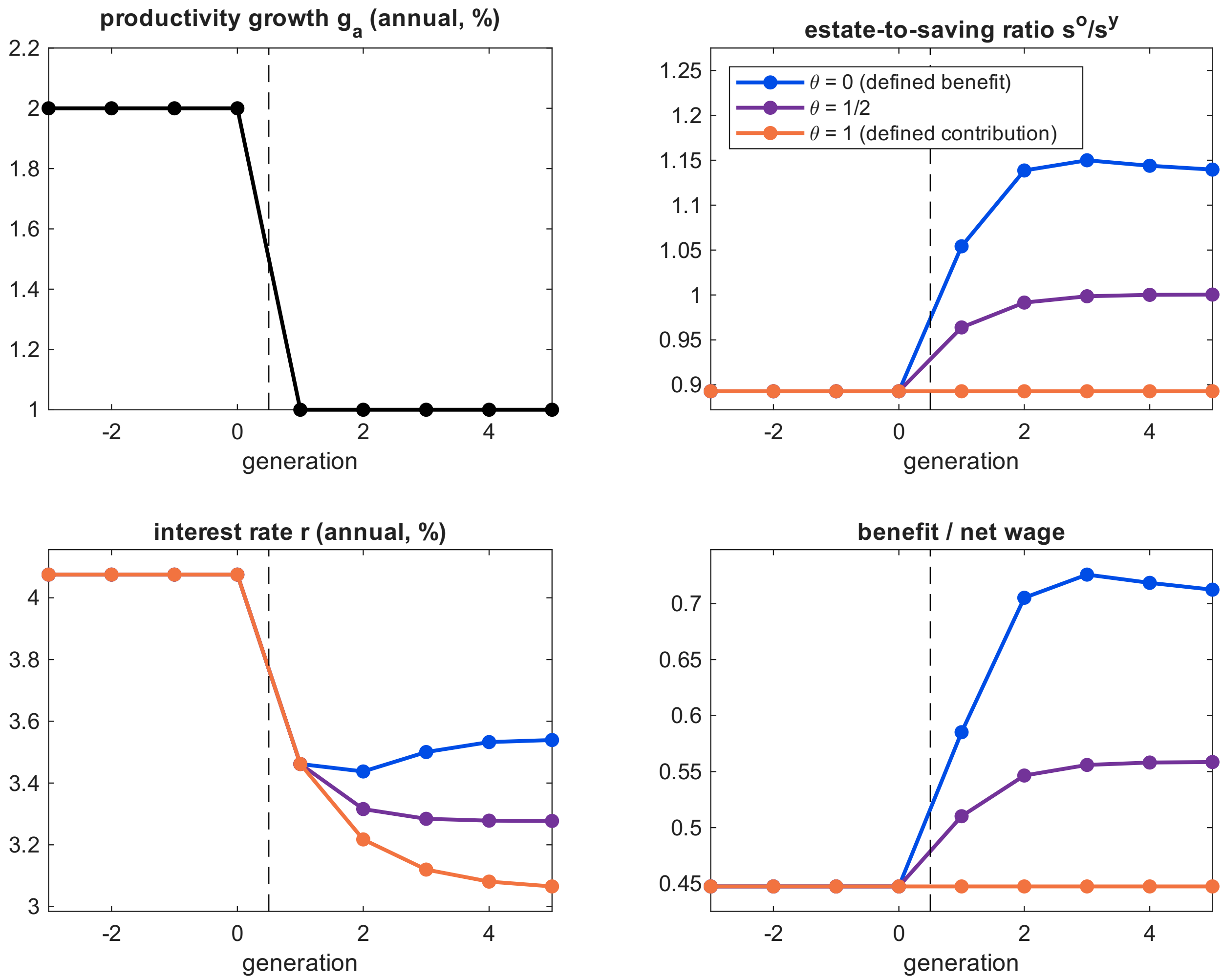

Figure 4: Productivity slowdown across the adjustment spectrum. The experiment of Figure 3 at $\rho = 0.56$ for the one-parameter family of designs indexed by θ, the share of the adjustment borne by benefits: a fixed replacement rate ($\theta = 0$), the midpoint ($\theta = \frac{1}{2}$), and a fixed contribution rate ($\theta = 1$).

(11 log points against 24). The comparison makes the incidence of the design choice plain: θ decides whether a slowdown is paid by workers, through contributions that finance a gross-up of the old's estates, or by retirees, through benefits that shrink with the economy while the distribution of wealth between generations stays put.

3.4.3 Demographic slowdown

Figure 5 repeats the fixed-replacement-rate experiment for the demographic slowdown: the total fertility rate falls unexpectedly and permanently from 2 to 1.5 between generations 0 and 1, so the cohort factor $1 + g_n$ drops from 1 to 0.75 and total growth falls from 2 to 1.03 percent a year, while productivity growth stays at 2 percent. The experiment is deliberately comparable to the productivity slowdown: it moves $\ln(1 + g)$ by -0.29 against the productivity experiment's -0.30.

Since the detrended economy only depends on total growth (Section 3.3), the hat objects trace nearly the same paths as in Figure 3. At $\rho = 0.56$ the contribution rate climbs from 0.31 to 0.41 as before, the interest rate settles half a point lower, and on impact generation 0's realized return falls by the same 0.6 percentage points: the capital overhang is the same because the total-growth surprise is.

However, the *per-capita* wealth ratio tells a very different story, and the gap is exactly the cohort factor of Section 3.3. The fiscal forces, worth 24 log points at $\rho = 0.56$, now compete with the $\ln 0.75 = -0.29$-log-point fall in the cohort factor, and lose. The wealth ratio drifts down from 0.89 to 0.85, a fall of 5 log points, where the equal-sized productivity slowdown raised it by 24.

The generosity gradient survives intact (in line with Proposition 3). Nonetheless, the most generous system barely reaches the $R > 1$ threshold of Proposition 2: at $\rho = 0.7$ the response is $R \approx 1$, and the fertility slowdown leaves the per-capita wealth ratio where it was.

Read together, Figures 3 and 5 make the growth composition point quantitative: the same fall in total growth, run through the same fixed-replacement-rate rule, raises the relative wealth of the old when it comes from productivity, and lowers it — or, at the highest generosity, leaves it flat — when it comes from fertility.

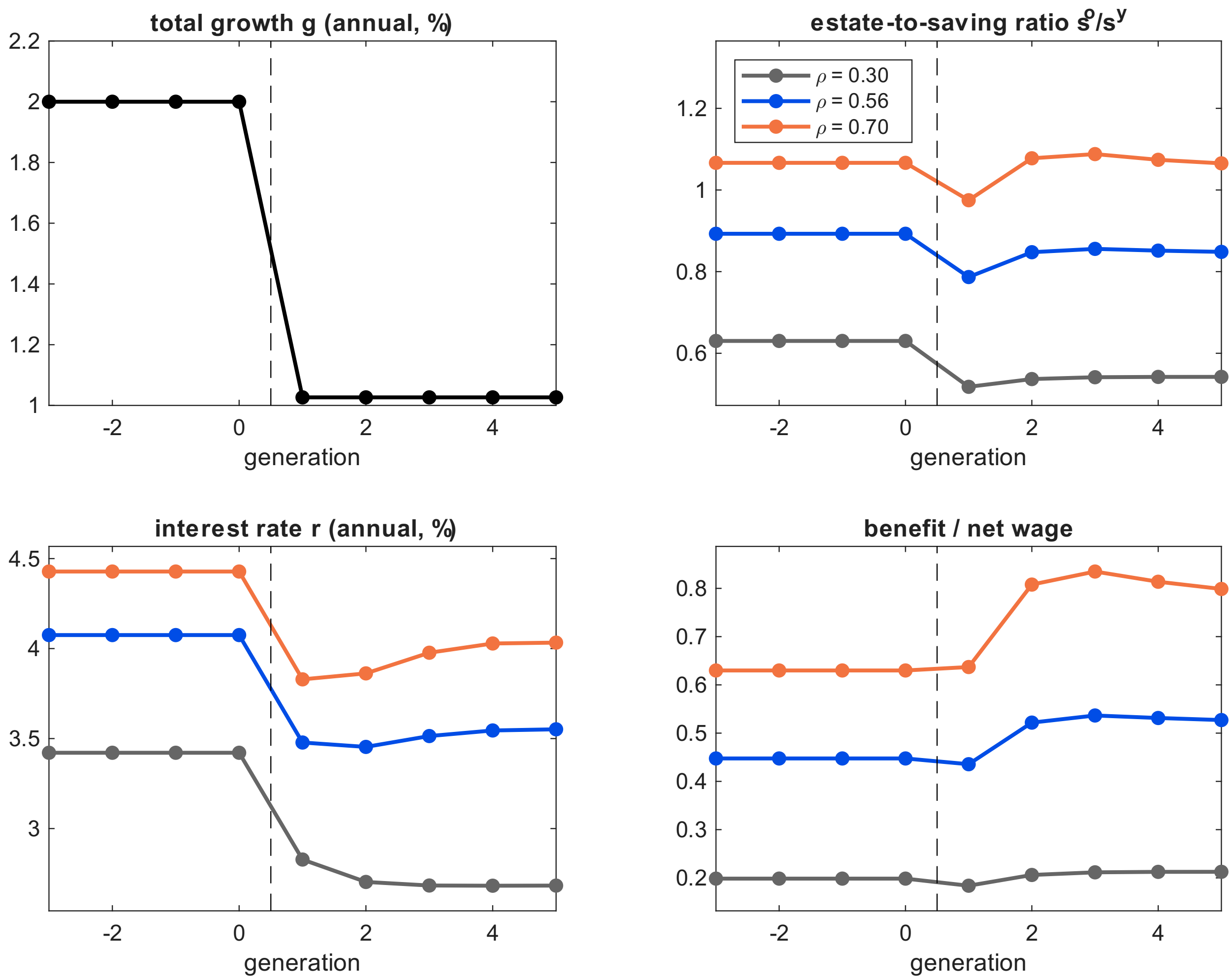

Figure 5: Demographic slowdown under a fixed replacement rate, across generosity levels. The total fertility rate falls unexpectedly and permanently from 2 to 1.5 between generations 0 and 1 (dashed line): the cohort factor $1 + g_n$ drops from 1 to 0.75 and total growth from 2 to 1.03 percent a year, while productivity growth is unchanged at 2 percent. Fixed-replacement-rate rule ($\theta = 0$), replacement rates $\rho \in \{0.3,\ 0.56,\ 0.7\}$.

4 Data

4.1 The Household Finance and Consumption Survey

Our main data source is the Household Finance and Consumption Survey (HFCS), a harmonized household survey coordinated by the European Central Bank and carried out by the national central banks of the euro area and several other European Union countries. We use all five currently available waves, with reference years 2010, 2014, 2017, 2021 and 2023, drawn from the public User Database (UDB).[4] The HFCS records detailed household balance sheets together with the income, labor-market status, and demographics of every household member. Table B.1 in Appendix B details the country coverage of each wave: 15 countries participate in 2010, and the survey grows to 21 from 2017 on as it expands into Central and Eastern Europe; Poland participates only in 2014 and 2017. Malta takes part in every wave but is excluded from all our analyses because age is not released in its User Database extract, leaving between 14 and 20 countries per wave. We treat each country–wave as the relevant population and weight every statistic by the household weight.

Missing values in the UDB are multiply imputed: each observation is provided in five *implicates*. We perform every calculation separately on each implicate and combine the resulting estimates using Rubin's rules, so that all reported standard errors incorporate both sampling and imputation uncertainty.

We supplement the survey with four country-level series. Pension generosity in the regressions is the Eurostat *aggregate replacement ratio*: the median individual gross pension of the 65–74 age group relative to the median gross earnings of the 50–59 age group, measured for the income year 2016 — a country-level, time-invariant measure available for every HFCS country. Growth is the cumulative growth of real GDP per working-age adult between 1991 and 2019: national-accounts real GDP from the Penn World Table (10.01), which ends in 2019, over the resident population aged 15–64 from the World Bank's World Development Indicators. To express inheritances received in past decades in survey-year prices, we use the Eurostat HICP (all-items annual average index, available from 1996), extended backward to 1960 by chaining World Bank CPI growth

[4]European Central Bank, Household Finance and Consumption Survey, User Database, waves 1–5. The survey is conducted under a common methodology, which makes balance-sheet and income variables comparable across countries and over time.

rates onto the 1996 level in the Western countries (Section 5.1 details the conventions). Finally, the house-price control of Section 5.2 uses the Eurostat harmonized house price index (total dwellings, annual average), deflated by the same HICP; the index covers every sample country from 2010 on, except Greece, which does not report it.

4.2 Variables

Table B.3 in Appendix B lists the User Database variables we use, with their code names. From these inputs we construct the following variables; throughout, i indexes individuals, h households, c countries, and t survey waves.

- *Net wealth per partner.* Net wealth is recorded at the household level and is, to a first approximation, held jointly by the couple at the head of the household. We therefore assign household net wealth to the reference person and their spouse or partner, splitting it equally between them:
$$\tilde{s}_{ict} = \frac{\text{net wealth}_{hct}}{n_{hct}}, \tag{35}$$
where $n_{hct} \in \{1, 2\}$ counts the reference person and, if present, their spouse or partner: one for a single person or a single parent, two for a couple. All other household members — including co-resident adult children and other adult relatives — are treated as dependents who receive no share of household wealth, and we restrict the analysis to reference persons and partners.[5]

- *Pension generosity.* We summarize the generosity of a country's pension system by the pension-to-salary ratio
$$\frac{\bar{b}_{ct}}{\bar{w}_{ct}}, \tag{36}$$
where $\bar{b}_{ct}$ is the weighted average total pension (public plus occupational and private) among pension recipients, and $\bar{w}_{ct}$ is the average wage, measured as the survey average gross employee income. This is the direct counterpart of the model's contribution rate $\tau_t = b_t/w_t$ —

[5] Assigning per-adult wealth to *all* adult members would attribute the accumulated wealth of middle-aged parents to the young adults who still live with them. Because the share of young adults living in the parental home is large and falls steeply with age, doing so mechanically depresses measured wealth between the early twenties and the early thirties; restricting to heads and partners removes this artifact.

the pension of the current old relative to the wage of the current young, equal to $\rho/(1+g)$ on the balanced path (22) — and thus measures the share of earnings that the pay-as-you-go system transfers between generations. The Eurostat aggregate replacement ratio used in Sections 5.1 and 5.2, which compares pensions with the earnings of workers close to retirement, corresponds instead to the replacement rate ρ.

- *Occupation and industry.* We harmonize occupation to the one-digit ISCO major group and industry to the NACE section, the most granular classifications released in the UDB. For individuals who are retired or otherwise not currently employed we use the occupation and industry of their last (main) job, so that the classification is defined throughout the life cycle.
- *Inheritances.* We measure received inheritances as the sum of the reported gift and inheritance values. Values are reported in prices of the year of receipt, which the survey also records; whenever we use them, we revalue each dated transfer to survey-year prices with the national all-items HICP (Section 5.1 details the conventions).

5 Empirical results

The empirical analysis is organized around the model's prediction that the wealth of the elderly, relative to their working-age descendants, depends on pension generosity, on productivity growth over recent decades, and on their interaction.

This section documents three empirical patterns in line with the model's predictions. First, the relative wealth of the elderly in the last two HFCS waves (2021 and 2023) indeed correlates with these variables. Second, these variables also predict the change since the first two waves (2010 and 2014) in the wealth of cohorts above retirement age, but not of those below. Finally, pension generosity predicts a higher concentration of national wealth among retirees, lowering the wealth shares of cohorts in their late forties and fifties, especially in countries where productivity growth has been slow.

5.1 Pension generosity and the wealth of the elderly

Figure 1 shows a steep relationship between the relative level of pensions (b/w) and the relative wealth of the elderly (s^o/s^y), in the early waves of the survey and in the late ones alike. Over the decade separating the two panels, a decade of slow productivity growth, the ratio itself drifted upward, from 1.27 to 1.47 for the 14 countries covered since the first wave.

In the model, generous pensions raise the wealth of the elderly because retirees retain resources they intend to bequeath. This naturally raises the question of whether these bequests are observable in the data. Figure 6 therefore turns to the recipients' balance sheets at the end of the sample, pooling the 2021 and 2023 waves and focusing on households aged 45–65, the ages at which parental estates are typically received. Panel A divides each country's aggregate revalued gifts and inheritances[6] by these households' aggregate net wealth, while Panel B scales the mean household inheritance by the average salary instead. Both line up with generosity (correlations of 0.65 and 0.71). In the most generous systems, received transfers amount to 15 to 30 percent of these households' net wealth — two to three and a half years of average salary — against 2 to 7 percent, or a few months of salary, in the least generous ones.

Nonetheless, we focus the remainder of the analysis on the relative wealth of the elderly. Survey measures of inheritance are known to be unreliable and to understate transfers considerably relative to fiscal sources (Alvaredo et al., 2017), and the wealth of households aged 70 and older has the advantage of being forward-looking: it reflects recent trends and contains the estates to come, whereas reported inheritances record transfers received decades earlier.

Table 2 restates the relationship of Figure 1 at the household level. The outcome is the log of net wealth per partner of each household aged 70 or older, less the weighted mean of log net wealth per partner among working-age adults (ages 26–59) of the same country and wave, so that each elderly household is compared with the typical working-age household of its country. The sample pools the 2021 and 2023 waves, which follow the window over which growth is measured, and the

[6] Transfer values are reported in prices of the year of receipt; we revalue each dated transfer to survey-year prices with the national all-items HICP (Eurostat, annual average index), extended before 1996 by chaining World Bank CPI growth rates onto the 1996 level in the Western countries. Receipt years before a country's earliest index year — 1960 in the West, the mid-1990s in the formerly planned economies, whose earlier administered prices do not support revaluation — are treated as received in that year, and transfers with a missing receipt year enter at face value. Both conventions understate the adjustment, as does consumer-price indexing itself, since bequeathed assets appreciated faster than consumer prices.

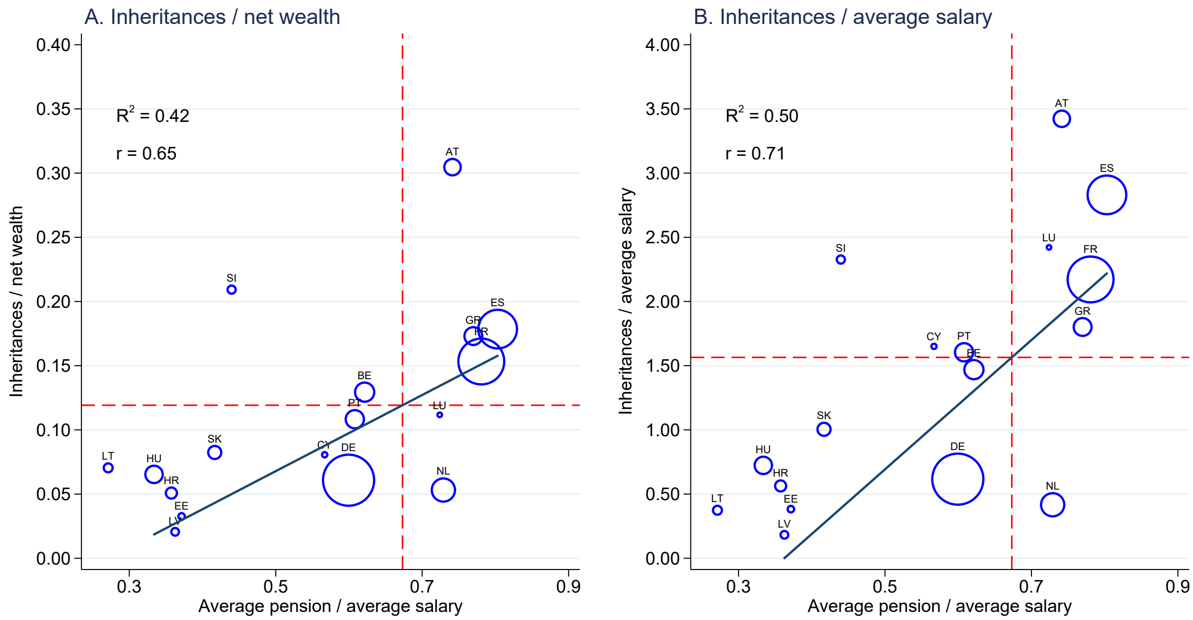

Figure 6: Pension generosity and the inheritances received by households aged 45–65, 2021–2023. Each circle is a country in the HFCS, pooling the 2021 and 2023 waves; a country is averaged over the waves in which the inheritance module was fielded (17 countries). Circle areas are proportional to population. The horizontal axis reports the pension-to-salary ratio. In Panel A, the vertical axis reports the aggregate value of the gifts and inheritances reported by households whose reference person is aged 45–65 (zero if none), revalued to survey-year prices with the HICP, divided by their aggregate net wealth. In Panel B, gifts and inheritances are scaled by the average gross employee income. The line is the population-weighted OLS fit. The red dashed lines mark the population-weighted means of the two variables.

specification is

$$\ln \tilde{s}^{o}_{ict} - \overline{\ln \tilde{s}^{y}_{ct}} = \beta_b \frac{\bar{b}_{ct}}{\bar{w}_{ct}} + \beta_g \ln\big(1+g_c\big) + \beta_{bg} \frac{\bar{b}_{ct}}{\bar{w}_{ct}} \ln\big(1+g_c\big) + \gamma\, E_c + \delta_t + \varepsilon_{ict}, \qquad (37)$$

where g_c is the 1991–2019 growth of real GDP per working-age adult and δ_t are survey-year effects. Columns (3) and (6) are the columns of interest: they enter generosity, growth, and their interaction together, with the two regressors centered at their weighted means so that each main effect is the marginal effect at the sample mean of the other.

Columns (3) and (6) show that elderly households in more generous systems hold more wealth relative to the working-age households of their country. The generosity coefficient is 2.3 and 2.7, so a one between-country standard-deviation increase in the pension-to-salary ratio (0.18, eighteen percentage points of the average wage) is associated with 42 to 48 log points of additional relative wealth at the sample's average growth. This advantage is largest where growth was slowest: the interaction is negative, as the model's central prediction requires, since slow growth steepens the generosity gradient. One percentage point of annual growth sustained over the 1991–2019 window lowers the gradient by roughly 1.9 to 2.4, comparable to the gradient itself at the sample mean.

The two columns differ in the comparison they make. Column (3) holds fixed only the survey year. Column (6), by contrast, adds occupation $\times$ industry $\times$ year fixed effects, so that retirees are compared with retirees who spent their careers in the same line of work in other countries. The additional fixed effects raise the coefficients, so the relationship is not explained by differences in the occupational and sectoral mixes across countries.

One potential concern with Figure 1 is that pension systems offer higher replacement rates in Western economies, which have higher overall wealth-to-income ratios than the countries of the former Eastern Bloc. The Eastern Bloc dummy absorbs this potential confounder.

Table 2: Log relative wealth of the elderly, pension levels and productivity growth

	(1)	(2)	(3)	(4)	(5)	(6)
Country pension/salary ratio	2.313**		2.326***	2.706**		2.680***
	(0.903)		(0.674)	(1.155)		(0.827)
$\log(1 + g_a)$ (centered)		-0.285	0.325		-1.188	-0.652
		(1.016)	(1.005)		(1.124)	(1.354)
Country pension/salary ratio $\times \log(1 + g_a)$			-6.735**			-8.718**
			(3.006)			(3.753)
Former Eastern Bloc	0.209	-0.261	-0.275	0.319	0.049	0.060
	(0.319)	(0.362)	(0.402)	(0.385)	(0.399)	(0.490)
Constant	-1.486**	0.054	-0.069	-1.693**	0.024	-0.090
	(0.586)	(0.156)	(0.081)	(0.716)	(0.166)	(0.081)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Occ.$\times$Ind.$\times$Year FE	No	No	No	Yes	Yes	Yes
R^2	0.0172	0.0053	0.0204	0.1519	0.1380	0.1566
Observations	25501	25501	25501	25501	25501	25501
Clusters	20	20	20	20	20	20

Notes: This table reports individual-level regressions of the relative wealth of the elderly on pension generosity, productivity growth, and their interaction. The sample consists of household heads and partners aged 70 and older in the 2021 and 2023 waves of the HFCS, and all regressions are weighted by the HFCS household weights. The dependent variable is the log of net wealth per partner minus the mean of the same log outcome among positive-wealth working-age adults (ages 26–59) in the same country and wave; we drop observations with non-positive net wealth. A household whose only head or spouse is widowed counts as two partners, because a lone widow or widower holds the wealth accumulated by a former couple. Generosity is the country pension-to-salary ratio, defined as the survey mean pension among recipients divided by the survey mean employee wage, by country and wave. The growth variable $\log(1+g_a)$ is the 1991–2019 log change in real GDP per working-age adult, computed from Penn World Table 10.01 real GDP and World Bank population aged 15–64. In columns (3) and (6), we center the generosity measure and $\log(1 + g_a)$ at their weighted means, so that each main effect is evaluated at the sample mean of the other regressor. All columns include survey-year fixed effects and an indicator for former Eastern Bloc countries, and columns (4) to (6) add occupation$\times$industry$\times$year fixed effects. The five imputation implicates are combined by Rubin's rules, and standard errors clustered by country are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

5.2 Within-cohort accumulation during the slowdown

The estimates of Section 5.1 compare wealth levels across countries, and no set of controls can exhaust the permanent differences between them. Moreover, the model provides comparative statics across balanced growth paths, but the data are drawn from a slowdown in progress, and the model's sharpest implication for this setting concerns changes: as growth slows, cohorts retiring in generous systems should accumulate more wealth as they move into old age, relative to the generation that follows them.

To test this prediction, we follow fixed cohorts across survey waves. In Table 3, the outcome is the change in log wage-scaled wealth — net wealth per partner over the economy's average wage — between the pooled 2010/2014 waves and 2021/2023, for the cohorts aged 70–85 at the end of the window (born 1936–1953, and thus roughly 57–78 when first observed; countries that enter the survey later drop out). The long difference removes the wealth each cohort had already accumulated by the beginning of the sample period. It thereby also removes any permanent country characteristic that shifts wealth levels, including the socialist histories that Section 5.1 could address only with an indicator.

Table 3 regresses the log change in wealth on relative pension levels, growth, and their interaction, with occupation $\times$ industry $\times$ year effects throughout. The interaction survives the differencing: in column (3) it is -6.5, significant at the one-percent level. Among retirees with the same pre-retirement career, cohorts in generous slow-growth countries accumulated wealth faster as they moved into old age.

A remaining concern is that, as retirees become a larger part of the electorate, governments that favor the elderly by offering generous pensions also do so in other ways, for instance by promoting policies that support house prices. The pattern in the data actually runs the other way. Between 2010 and the last waves, the real house price index[7] fell in Italy, Spain and Finland and was flat in France, the generous, slow-growth countries where the elderly are wealthiest. By contrast, it rose by 30 to 60 log points in the fast-growing Baltics, Hungary and Czechia, where their relative wealth is lowest. Nonetheless, column (4) introduces trends in house prices as a control, measured as the change in the log real index between the country's pooled baseline waves and the endpoint wave, so that its window matches the outcome's (Greece, which does not report the harmonized index, drops from columns (4) and (5)). The results remain significant, with the coefficient for relative pension levels increasing from 1.02 to 1.55.

One may also worry that the pension-to-salary ratio is contaminated by growth itself. To some extent, this is part of the model mechanism. Unless replacement rates are adjusted, lower growth increases the value of benefits relative to gross salaries — and even more so relative to net salaries if tax rates are raised to fill the budgetary gap. This, in turn, allows the wealth of retirees to outpace gross wages when productivity gains are low.

Nonetheless, we can run an alternative specification using the replacement rate itself, which

[7] We use the Eurostat harmonized index for total dwellings, deflated by the national HICP.

compares pensions with the end-of-career earnings of retirees. Outside NDC-type systems, this is a slow-moving policy parameter, insulated from the mechanical effect of productivity growth. Column (5) repeats column (4) with the Eurostat aggregate replacement ratio in place of the pension-to-salary ratio: the level effect is 1.90 per unit of the replacement rate, and the interaction sharpens from -3.4 without the control to -4.9, significant at the five-percent level. The replacement rate is nearly uncorrelated with growth on this sample ($r = 0.03$, against -0.66 for the pension-to-salary ratio), so its level effect is identified independently of the catch-up dimension of the sample. The tilt is thus not a housing-boom artifact: where the accumulation of one generation and the house-price movement are measured over the same years, the pension interaction survives, and the cross-country geography of the boom is in any case the mirror image of the one the objection requires.

Figure 7 estimates the same specification by age, interacting every regressor, including the house-price control, with five-year endpoint age groups; Appendix Table D.2 reports the full set of coefficients. At every working age, the generosity gradient of within-cohort accumulation is close to zero in both growth regimes. The gradient becomes positive in the sixties and is largest, under slow growth, for cohorts in their seventies, at 50 to 67 log points per standard deviation of generosity; under fast growth, the same groups gain little. The age profile above 75 is imprecisely estimated because the cells thin out, so the pooled 70–85 band of Table 3 remains the main test; the figure indicates where in the life cycle the effect appears.

Table 3: Pension generosity, growth, and the within-cohort change since 2010–2014 in the wage-scaled wealth of the elderly (aged 70–85 in 2021/2023)

	(1)	(2)	(3)	(4)	(5)
Country pension/salary ratio	0.490		1.016^{***}	1.554^{***}	
	(0.469)		(0.312)	(0.299)	
Replacement rate					1.903^{***}
					(0.353)
$\log(1+g_a)$ (centered)		0.123	-0.405	-0.383	0.217
		(0.275)	(0.307)	(0.485)	(0.191)
Pension/salary $\times \log(1+g_a)$			-6.462^{***}	-7.011^{***}	
			(1.672)	(2.659)	
Replacement rate $\times \log(1+g_a)$					-4.885^{**}
					(2.436)
Real house-price growth				0.529^{**}	0.216
				(0.221)	(0.157)
Constant	-0.567^{*}	-0.256^{***}	-0.314^{***}	-0.466^{***}	-0.316^{***}
	(0.305)	(0.062)	(0.028)	(0.073)	(0.070)
Occ.$\times$Ind.$\times$Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.1502	0.1494	0.1531	0.1558	0.1558
Observations	21177	21177	21177	20295	20295
Clusters	17	17	17	16	16

Notes: This table reports individual-level regressions of the within-cohort change in the wage-scaled wealth of the elderly on pension generosity, productivity growth, and their interaction. The sample consists of household heads and partners aged 70–85 in the 2021 and 2023 waves of the HFCS (born 1936–1953), and all regressions are weighted by the HFCS household weights. The dependent variable is the log of wage-scaled wealth — net wealth per partner divided by the survey mean employee wage — minus the mean of the same outcome for the same birth cohorts in the country's pooled 2010/2014 waves. We drop observations with non-positive net wealth in either period, as well as countries without a 2010 or 2014 wave. A household whose only head or spouse is widowed counts as two partners in both periods, because a lone widow or widower holds the wealth accumulated by a former couple. Generosity is the pension-to-salary ratio, defined as the survey mean pension among recipients divided by the survey mean employee wage, by country and wave. The growth variable $\log(1+g_a)$ is the 1991–2019 log change in real GDP per working-age adult, computed from Penn World Table 10.01 real GDP and World Bank population aged 15–64. Column (4) adds the country's real house-price growth, measured as the log change of the Eurostat house price index deflated by the national HICP over the same window as the outcome; Greece, which does not report the index, drops from columns (4) and (5). Column (5) repeats column (4) with the centered Eurostat aggregate replacement ratio in place of the pension-to-salary ratio. All columns include occupation$\times$industry$\times$year fixed effects. In the interaction columns, we center the generosity measure and $\log(1+g_a)$ at their weighted means, so that each main effect is evaluated at the sample mean of the other regressor. The five imputation implicates are combined by Rubin's rules, and standard errors clustered by country are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

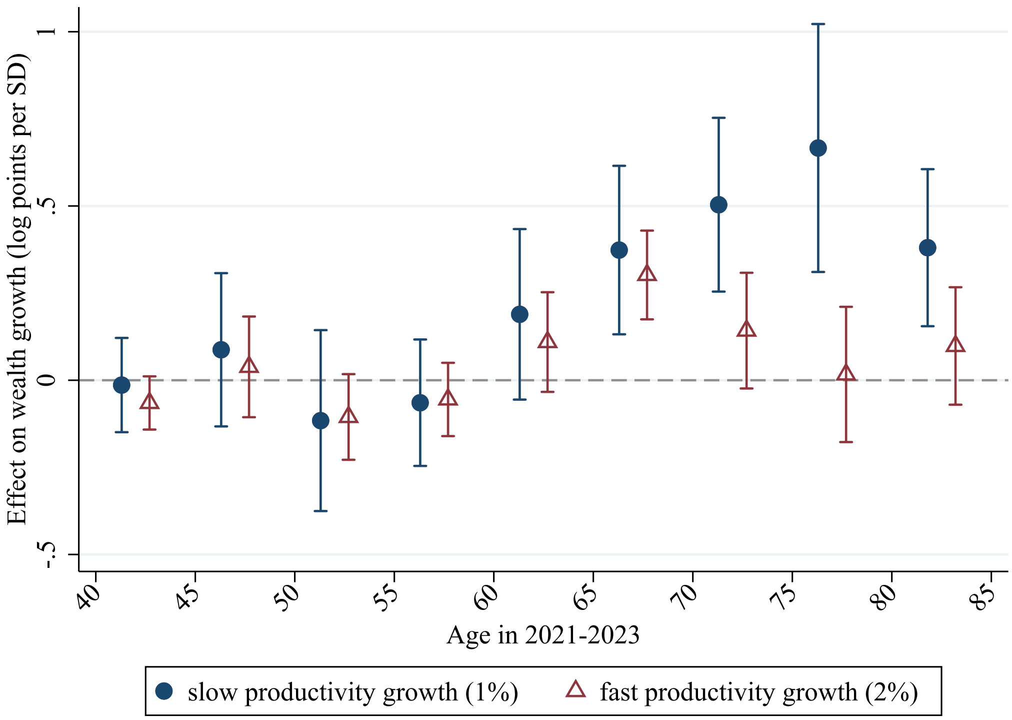

Figure 7: The generosity gradient of within-cohort wealth growth, by age group. This figure displays the per-age-group generosity slope of the fixed-cohort specification of Table 3, column (4). We estimate the specification for each five-year endpoint age group, from 40–44 through 75–79 and then 80–85 at the survey's age topcode, and place the markers at the interval midpoints. For each group, the outcome is the change in log wage-scaled wealth between the cohort's pooled 2010/2014 baseline and 2021/2023, and the plotted point is the effect of a one between-country standard deviation increase in the pension-to-salary ratio (0.17), evaluated at annual productivity growth of 1 percent (circles) and 2 percent (triangles) sustained over the 1991–2019 window. The vertical bars are 95 percent confidence intervals. All regressors, including the real house-price control, are interacted with the age groups, and the fixed effects are occupation $\times$ industry $\times$ year $\times$ age group. Regressions are weighted by the HFCS household weights, standard errors are clustered by country, and the five imputation implicates are combined by Rubin's rules. As in the table, Greece, which does not report a harmonized house price index, and the countries without a 2010/2014 baseline drop from the sample.

5.3 The age distribution of wealth

The evidence so far tracks the elderly alone. Propositions 1 and 2, however, predict a reallocation: a more generous pay-as-you-go system raises the wealth of the old relative to the working-age population, and more so when growth is slow. Since the age groups' shares of total wealth sum to one, a gain for the old must be matched by losses elsewhere in the age distribution. We therefore estimate the response of the full age distribution, with a specification in which this constraint holds by construction.

For each country and wave, we compute the mean net wealth per partner of eleven age groups — five-year groups from 25–29 through 70–74, with 75–85 pooled because the oldest cells are thin in the smaller countries — and divide each by the country's *standardized* average wealth. The standardization applies the same age pyramid to every country. Denoting by $\bar{W}_g$ the pooled population share of age group g, the standardized average wealth is $\bar{s}^*_{ct} = \sum_g \bar{W}_g \, \bar{s}_{gct}$. By construction the share-weighted outcome equals one in every country and wave. The scaled group means are then regressed on generosity, growth, and their interaction, group by group:

$$\frac{\bar{s}_{gct}}{\bar{s}^*_{ct}} = \beta^g_b \frac{\bar{b}_{ct}}{\bar{w}_{ct}} + \beta^g_g \ln\bigl(1 + g_c\bigr) + \beta^g_{bg} \frac{\bar{b}_{ct}}{\bar{w}_{ct}} \ln\bigl(1 + g_c\bigr) + \delta_{gt} + \varepsilon_{gct}, \tag{38}$$

with group$\times$wave effects δ_{gt}, generosity and growth centered at their weighted means, every group of a country weighted by the country's population, and standard errors clustered by country.

Because the regressors are common to all groups and each country enters every group equation with the same weight, the population-weighted coefficients of each regressor sum to zero. This restriction is not imposed in estimation; it follows from the construction of the outcome, which Appendix C presents in detail and relates to the estimation of demand systems. Scaling by the country's average wealth also removes any level difference that could be explained by a confounder, for instance the tendency of generous systems to operate in economies with high wealth-to-income ratios.

Figure 8 shows how pension generosity redistributes wealth across overlapping cohorts at different rates of productivity growth. Specifically, it plots each group's generosity gradient, $\beta^g_b + \beta^g_{bg} \ln(1 + g)$, at annual growth of 1 and 2 percent sustained over the 1991–2019 window, per one between-country standard deviation of the pension-to-salary ratio (0.18, eighteen percentage points of the average wage). Appendix Table D.1 reports the full set of regression coefficients.

The profile has three segments. Before age 45 the generosity of the pension system has little effect on wealth shares, which are small in any case. The effect turns significantly negative for the mid-career groups: at 1 percent growth, households aged 45–54 in a one-standard-deviation more generous system hold 0.37 to 0.46 less of their country's average wealth, a deficit that extends to the 55–59 group (-0.26). Past the retirement boundary the gradient changes sign and rises with age. This is consistent with the model mechanism: saving is first depressed by the fiscal weight of pensions, but the effect of the pension system on household finances reverses as households enter retirement. By the time they reach the end of their sixties, the net cumulative effect is no longer negative, and it becomes significantly positive in their early seventies. In terms of shares, the effect of productivity growth reverses as well: slow growth in high-benefit countries inflates the wealth shares of the elderly at the expense of workers in their forties and fifties.

The change of sign at retirement also helps with identification. The scaling removes country-level differences in housing institutions, financial development, and wealth-to-income levels; a remaining confounder would need to lower the relative wealth of mid-career households and raise that of retirees within the same countries, with the reversal occurring at retirement age.

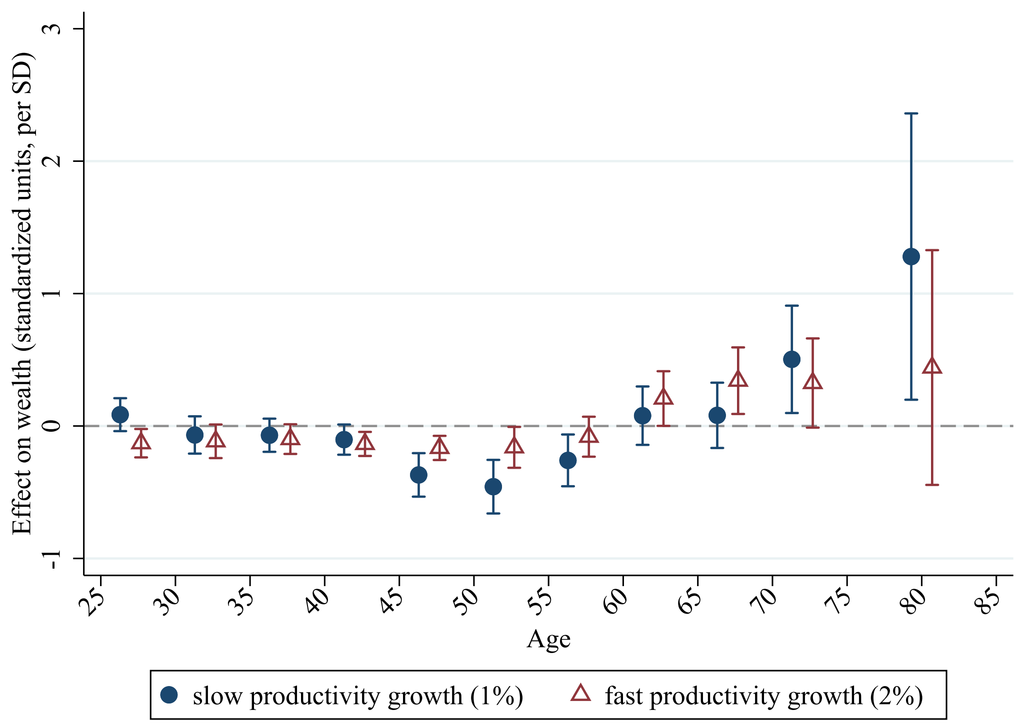

Figure 8: The pension-to-salary gradient of mean wealth by five-year age group. This figure displays the share-system estimates of Section 5.3 at five-year resolution. For each country and wave, we compute the group mean net wealth per partner of eleven age groups, from 25–29 through 70–74 with 75–85 pooled, and scale it by the standardized average wealth built from the pooled group shares. We then regress the scaled group means on generosity, growth, and their interaction, fully interacted with group indicators, and include group$\times$wave fixed effects. Every group of a country carries the country's population weight, so the population-weighted responses sum to zero exactly (Appendix C). Each point is the change in the group's mean wealth, as a fraction of the standardized average wealth, associated with a one-standard-deviation increase in the pension-to-salary ratio (0.18, the between-country standard deviation), evaluated at annual growth of 1 percent (circles) and 2 percent (triangles). The vertical bars are 95 percent confidence intervals. We winsorize households at the 1st and 99th percentiles within country$\times$group$\times$implicate before averaging. The sample consists of household heads and partners in the HFCS 2021 and 2023 waves, standard errors are clustered by country, and the five imputation implicates are combined by Rubin's rules.

6 Conclusion

This paper studies the distribution of wealth between overlapping generations and the part unfunded pension systems play in it when growth slows. That the elderly hold a growing share of national wealth is by now a well-documented pattern, in Europe as in the United States, with consequences for the role of inheritance in the next generation's fortunes. We argue that it is not only the outcome of a race between r and g: it also reflects a fiscal choice. A slowdown opens a gap in the pay-as-you-go budget, and closing it by raising contributions rather than by cutting benefits or deferring retirement hands retirees resources they partly bequeath, while reducing the net wages out of which the young accumulate.

The adjustment parameter θ is not a constant of nature but a political decision, and several large economies are taking it now. In the United States, the 2026 Trustees Report moves the depletion of the OASI trust fund to the fourth quarter of 2032, when scheduled benefits become 78 percent payable, leaving a seventy-five-year shortfall of 4.42 percent of taxable payroll to close.[8] In France, where the elderly are among the wealthiest relative to the working-age population, the 2023 reform raising the minimum retirement age from 62 to 64 was suspended by the 2026 social security budget until after the 2027 presidential election, though the Cour des comptes projects the system's deficit at some 15 billion euros by 2035.[9] China began in January 2025 to raise statutory retirement ages over a fifteen-year phase-in, against projections that the urban worker fund would otherwise be exhausted around 2035.[10]

Our results do not say which choice is preferable: we take no stand on the welfare of either generation, and the political economy that produces θ lies outside the model. What they do say is that protecting the level of benefits when growth is slow is not distributionally neutral. Its cost falls on the working-age population twice — through contributions today, and through a wealth distribution in which what one inherits weighs more than what one earns.

[8] *2026 Annual Report of the Board of Trustees of the OASI and DI Trust Funds*. The combined OASDI funds are projected to deplete in the third quarter of 2034.

[9] Cour des comptes, *Situation financière et perspectives du système de retraites*, February 2025.

[10] Chinese Academy of Social Sciences, *China Pension Actuarial Report 2019–2050*.

References

Alessie, Rob, Viola Angelini, and Peter van Santen, "Pension Wealth and Household Savings in Europe: Evidence from SHARELIFE," *European Economic Review*, 2013, *63*, 308–328.

Alvaredo, Facundo, Bertrand Garbinti, and Thomas Piketty, "On the Share of Inheritance in Aggregate Wealth: Europe and the USA, 1900–2010," *Economica*, 2017, *84* (334), 239–260.

Attanasio, Orazio P. and Agar Brugiavini, "Social Security and Households' Saving," *Quarterly Journal of Economics*, 2003, *118* (3), 1075–1119.

Attanasio, Orazio P. and Susann Rohwedder, "Pension Wealth and Household Saving: Evidence from Pension Reforms in the United Kingdom," *American Economic Review*, 2003, *93* (5), 1499–1521.

Auerbach, Alan J. and Ronald D. Lee, "Welfare and Generational Equity in Sustainable Unfunded Pension Systems," *Journal of Public Economics*, 2011, *95* (1), 16–27.

Barro, Robert J., "Are Government Bonds Net Wealth?," *Journal of Political Economy*, 1974, *82* (6), 1095–1117.

Barten, Anton P., "Maximum Likelihood Estimation of a Complete System of Demand Equations," *European Economic Review*, 1969, *1* (1), 7–73.

Bauluz, Luis and Timothy Meyer, "The Wealth of Generations," Working Paper 2024/04, World Inequality Lab January 2024.

Bergeaud, Antonin, Gilbert Cette, and Rémy Lecat, "Productivity Trends in Advanced Countries between 1890 and 2012," *Review of Income and Wealth*, 2016, *62* (3), 420–444.

Boldrin, Michele and Aldo Rustichini, "Political Equilibria with Social Security," *Review of Economic Dynamics*, 2000, *3* (1), 41–78.

Brock, William A. and Leonard J. Mirman, "Optimal Economic Growth and Uncertainty: The Discounted Case," *Journal of Economic Theory*, 1972, *4* (3), 479–513.

Browning, Edgar K., "Why the Social Insurance Budget Is Too Large in a Democracy," *Economic Inquiry*, 1975, *13* (3), 373–388.

Catherine, Sylvain and Natasha Sarin, "Social Security and the Racial Wealth Gap," in Olivia S. Mitchell and Nikolai Roussanov, eds., *Reducing Retirement Inequality: Building Wealth and Old-Age Resilience*, Oxford: Oxford University Press, 2025, chapter 8.

Catherine, Sylvain, Max Miller, and Natasha Sarin, "Social Security and Trends in Wealth Inequality," *Journal of Finance*, 2025, *80* (3), 1497–1531.

Catherine, Sylvain, Max Miller, James D. Paron, and Natasha Sarin, "Who Gains When Interest Rates Fall?," Working Paper, University of Pennsylvania 2025.

Cooley, Thomas F. and Jorge Soares, "A Positive Theory of Social Security Based on Reputation," *Journal of Political Economy*, 1999, *107* (1), 135–160.

Deaton, Angus and John Muellbauer, "An Almost Ideal Demand System," *American Economic Review*, 1980, *70* (3), 312–326.

Diamond, Peter A., "National Debt in a Neoclassical Growth Model," *American Economic Review*, 1965, *55* (5), 1126–1150.

Fagereng, Andreas, Matthieu Gomez, Émilien Gouin-Bonenfant, Martin B. Holm, Benjamin Moll, and Gisle J. Natvik, "Asset-Price Redistribution," *Journal of Political Economy*, 2025, *133* (11), 3494–3549.

Feldstein, Martin, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," *Journal of Political Economy*, 1974, *82* (5), 905–926.

Feldstein, Martin, "Social Security and the Distribution of Wealth," *Journal of the American Statistical Association*, 1976, *71* (356), 800–807.

Galasso, Vincenzo and Paola Profeta, "The Political Economy of Social Security: A Survey," *European Journal of Political Economy*, 2002, *18* (1), 1–29.

Gale, William G., "The Effects of Pensions on Household Wealth: A Reevaluation of Theory and Evidence," *Journal of Political Economy*, 1998, *106* (4), 706–723.

Greenwald, Daniel L., Matteo Leombroni, Hanno Lustig, and Stijn Van Nieuwerburgh, "Financial and Total Wealth Inequality with Declining Interest Rates," Working Paper 28613, National Bureau of Economic Research 2021.

Kopczuk, Wojciech and Joseph P. Lupton, "To Leave or Not to Leave: The Distribution of Bequest Motives," *Review of Economic Studies*, 2007, *74* (1), 207–235.

Kotlikoff, Laurence J. and Lawrence H. Summers, "The Role of Intergenerational Transfers in Aggregate Capital Accumulation," *Journal of Political Economy*, 1981, *89* (4), 706–732.

Lachowska, Marta and Michał Myck, "The Effect of Public Pension Wealth on Saving and Expenditure," *American Economic Journal: Economic Policy*, 2018, *10* (3), 284–308.

Lee, Siha and Kegon Teng Kok Tan, "Bequest Motives and the Social Security Notch," *Review of Economic Dynamics*, 2023, *51*, 888–914.

Mulligan, Casey B. and Xavier Sala i Martin, "Gerontocracy, Retirement, and Social Security," Working Paper 7117, National Bureau of Economic Research 1999.

Nardi, Mariacristina De, "Wealth Inequality and Intergenerational Links," *Review of Economic Studies*, 2004, *71* (3), 743–768.

Piketty, Thomas, "On the Long-Run Evolution of Inheritance: France 1820–2050," *Quarterly Journal of Economics*, 2011, *126* (3), 1071–1131.

Sabelhaus, John and Alice Henriques Volz, "Social Security Wealth, Inequality, and Life-Cycle Saving," in Raj Chetty, John N. Friedman, Janet C. Gornick, Barry Johnson, and Arthur Kennickell, eds., *Measuring Distribution and Mobility of Income and Wealth*, Chicago: University of Chicago Press, 2022, chapter 9, pp. 249–285.

A Model appendix

A.1 First-order conditions

Attach the multiplier μ_t to (7) and μ^o_{t+1} to (8). Optimality in c^y_t, c^o_{t+1}, and s^y_t gives $\mu_t = (c^y_t)^{-\gamma}$, $\mu^o_{t+1} = \beta\,(c^o_{t+1})^{-\gamma}$, and $\mu_t = (1 + r_{t+1})\,\mu^o_{t+1}$, which is (9). Optimality in s^o_{t+1} trades the old's resources against the warm glow: $\beta\,\varphi\,(s^o_{t+1})^{-\gamma} = \mu^o_{t+1} = \beta\,(c^o_{t+1})^{-\gamma}$, i.e. $s^o_{t+1} = \varphi^{1/\gamma}\,c^o_{t+1}$, which combined with the old's budget (8) is (10); because $\varphi\,u'(s) \to \infty$ as $s \to 0$, the constraint $s^o_{t+1} \geq 0$ never binds and the margin always holds with equality. Earnings being exogenous to the household, the pension enters the budgets only through τ_t and b_{t+1}, both inframarginal.

A.2 The balanced growth path

The old's split. The bequest margin (10) and the old's budget (8) give $c^o_{t+1} = (1 - \Phi)\,j^o_{t+1}$ and $s^o_{t+1} = \Phi\,j^o_{t+1}$, and the split survives aggregation unchanged. With $K_{t+1} = S^y_t$, the old cohort collects the entire payout, $(1 + r_{t+1})\,S^y_t = \Pi_{t+1} = \alpha Y_{t+1}$ by (4), and $N_t\,b_{t+1} = \tau\,W_{t+1}$ on a balanced path, so per unit of the payroll W_{t+1}, $\hat{J}^o = \hat{\Pi} + \tau$, which is (13)–(14).

Existence and uniqueness. Write the equilibrium condition (18) as $f(\Lambda) = 0$ with

$$f(\Lambda) \equiv \left[\frac{\beta(1+g)}{\Lambda}\right]^{1/\gamma} \left[\,1 + \hat{\Pi} - \hat{C}^{\,o} - \Lambda\,\hat{\Pi}\,\right] - \hat{C}^{\,o}\,(1+g), \tag{A.1}$$

where $\hat{C}^{\,o} = (1 - \Phi)(\hat{\Pi} + \tau)$ does not depend on Λ and $1 + \hat{\Pi} = 1/(1 - \alpha)$. On the admissible range $\Lambda \in (0, \bar{\Lambda})$ with $\bar{\Lambda} \equiv (1 + \hat{\Pi} - \hat{C}^{\,o})/\hat{\Pi}$ (which keeps $\hat{C}^{\,y} > 0$) — nonempty for every parameterization, since $\hat{C}^{\,o} = (1 - \Phi)(\hat{\Pi} + \tau) < 1 + \hat{\Pi}$ whenever $\Phi \in (0, 1)$ and $\tau < 1$ — both factors of the first term are positive and strictly decreasing in Λ, so f is strictly decreasing; as $\Lambda \to 0^+$, $f \to +\infty$, and at $\Lambda = \bar{\Lambda}$, $f = -\hat{C}^{\,o}(1 + g) < 0$. A unique root exists. At $\gamma = 1$ the condition is linear in Λ and solves to (19).

Budget consistency. From (16), $\hat{C}^{\,y} + \hat{S}^y = 1 + \hat{\Pi} - \hat{C}^{\,o}$; and the young's budget requires $\hat{C}^{\,y} + \hat{S}^y = (1 - \tau) + \hat{S}^o = 1 - \tau + (\hat{\Pi} + \tau) - \hat{C}^{\,o} = 1 + \hat{\Pi} - \hat{C}^{\,o}$: the system is consistent, with the young's consumption the residual that clears it.

A.3 Non-neutrality of the pension

Take logarithms of (18),

$$\ln \hat{C}^o + \ln(1+g) = \frac{1}{\gamma}\big[\ln\beta + \ln(1+g) - \ln\Lambda\big] + \ln \hat{C}^y, \tag{A.2}$$

and differentiate totally, using $d\hat{C}^o = (1-\Phi)\,d\tau$, $d\hat{C}^y = -(1-\Phi)\,d\tau - \hat{\Pi}\,d\Lambda$, and $\hat{C}^o = (1-\Phi)\,(\hat{\Pi}+\tau)$:

$$\frac{d\tau}{\hat{\Pi}+\tau} + d\ln(1+g) = \frac{1}{\gamma}\,d\ln(1+g) - \frac{1}{\gamma}\,d\ln\Lambda - \frac{(1-\Phi)\,d\tau}{\hat{C}^y} - \frac{\hat{S}^y}{\hat{C}^y}\,d\ln\Lambda. \tag{A.3}$$

Collecting terms, with $\Psi \equiv (1-\Phi)\big(1/\hat{C}^o + 1/\hat{C}^y\big)$ — using $(1-\Phi)/\hat{C}^o = 1/(\hat{\Pi}+\tau)$ — and $D \equiv 1 + \gamma\,\hat{S}^y/\hat{C}^y$,

$$d\ln\Lambda = \frac{(1-\gamma)\,d\ln(1+g) - \gamma\,\Psi\,d\tau}{D}. \tag{A.4}$$

Holding g fixed, $\partial\ln\Lambda/\partial\tau = -\gamma\Psi/D < 0$: by (20), capital intensity and the wage level fall with τ and the interest rate rises. The consumption and estate loadings on τ are immediate from (14). This is the mirror image of the dynastic benchmark's full-neutrality result: there the interest rate was pinned by the dynastic Euler equation and τ appeared in no equilibrium condition; here τ appears in the one condition that determines the interest rate.

A.4 Proofs

Proposition 1. By (21), $\ln(s^o/s^y) = \ln(1+g_n) + \ln\Phi + \ln(\hat{\Pi}+\tau) - \ln\Lambda - \ln\hat{\Pi}$. Every term beyond the cohort factor depends on (g_a, g_n) only through total growth g. Substituting the design rule $d\tau = -(1-\theta)\,\tau\,d\ln(1+g)$ into (A.4) and differentiating those terms gives $-R$ of (30), the difference (25) minus (29). A fall in g_a leaves the cohort factor fixed, so the response of the wealth ratio is R; a fall in g_n moves the cohort factor one for one, so the response is $R-1$, Q.E.D.

Proposition 2. By Proposition 1 the productivity condition is $R > 0$, which rearranges to (32), and the demographic condition is $R > 1$. At $\theta = 1$ the fiscal terms vanish and $R = (1-\gamma)/D$:

positive if and only if $\gamma < 1$ — globally, because nothing but γ and the sign-definite object $D > 0$ remains — and always below one, since $\gamma > 0$ gives $1 - \gamma < 1 \le D$, Q.E.D.

Proposition 3. Throughout write $c \equiv \hat{C}^{o}$, $y \equiv \hat{C}^{y}$, $v \equiv \hat{S}^{y}$, $X \equiv \hat{\Pi}+\tau$, $S \equiv 1/(1-\alpha) = c+y+v$, $P \equiv y + \gamma v$, $N \equiv (1+\gamma)y + \gamma(v+c)$, and $a \equiv (1-\theta)\,\tau/X \ge 0$, so that $D = P/y$. The level result first: $\ln(s^{o}/s^{y}) = \ln(1+g_n) + \ln\Phi + \ln X - \ln\Lambda - \ln\hat{\Pi}$ and (28) give $\partial \ln(s^{o}/s^{y})/\partial\tau = 1/X + \gamma\Psi/D > 0$ on every path. The slowdown response R of (30) — shared, up to the constant -1, by the demographic response, so one gradient serves both — reads, in this notation,

$$R = a\,\frac{N}{P} + (1-\gamma)\,\frac{y}{P} \tag{A.5}$$

(one checks that aN/P collects the two fiscal terms of (30)). Raising (18) to the power γ writes the equilibrium locus as $v\,(c/y)^{\gamma} = \beta\,\hat{\Pi}\,(1+g)^{1-\gamma}$; implicit differentiation at fixed g gives $d\ln y/d\ln c = (\gamma v - c)/P$ and $dv/d\ln c = -c - y(\gamma v - c)/P$, and with $d\ln c = d\tau/X$, collecting terms yields the identity

$$\frac{XP^{3}}{\gamma}\,\frac{\partial R}{\partial\tau} = \frac{(1-\theta)\,\hat{\Pi}\,NP^{2}}{\gamma\,X} + a\,cNP + (\gamma S - c)\,y\,\big[a(\gamma v - c) - (\gamma-1)\,v\big]. \tag{A.6}$$

Note $\gamma S - c > 0$ under the maintained assumption: $\tau < 1$ gives $X < S$, so $c = (1-\Phi)X < (1-\Phi)S \le \gamma S$. Three cases.

Fixed contribution rate ($\theta = 1$, $a = 0$). Identity (A.6) reduces to $\partial R/\partial\tau = \gamma(1-\gamma)\,vy\,(\gamma S - c)/(XP^{3})$, whose sign is that of $1-\gamma$; and $R = (1-\gamma)y/P$ is positive exactly when $\gamma < 1$. Premise and conclusion hold together.

Case $\gamma \le 1$, $\theta < 1$. The bracket of (A.6) is $a(\gamma v - c) + (1-\gamma)v$, whose second piece is nonnegative. If its first piece is negative ($c > \gamma v$), it is dominated by the middle term of (A.6): $(\gamma S - c)\,y\,(c - \gamma v) \le NPc$, because each factor on the left is smaller than its counterpart on the right ($\gamma S - c = N - y - c < N$, $y < P$, $c - \gamma v < c$). The first term of (A.6) is strictly positive, so $\partial R/\partial\tau > 0$ — without using the premise.

Case $\gamma > 1$, $\theta < 1$. The premise is used once: $R > 0$ means $\gamma - 1 < aN/y$, so the bracket obeys

$$a(\gamma v - c) - (\gamma-1)\,v > a\,\frac{(\gamma v - c)\,y - Nv}{y} = -\,a\,\frac{(v+c)\,P}{y}, \tag{A.7}$$

using $(\gamma v - c)\, y - Nv = -(v + c)\, P$. Substituting into (A.6) and using $cN - (\gamma S - c)(v + c) = S\,(c - \gamma v)$,

$$\frac{XP^3}{\gamma}\,\frac{\partial R}{\partial \tau} > \frac{(1-\theta)\,\hat{\Pi}\,NP^2}{\gamma X} + a\,P\,S\,(c - \gamma v). \tag{A.8}$$

If $c \geq \gamma v$, both terms are nonnegative and the first is strictly positive. Otherwise it suffices that $\hat{\Pi}\,NP \geq \gamma\,\tau\,S\,(\gamma v - c)$, which follows from $N > \gamma S$, $P > \gamma v$, and $\tau \leq \hat{\Pi}$: $\hat{\Pi}NP > \hat{\Pi}\gamma^2 Sv \geq \gamma^2 \tau Sv \geq \gamma\tau S(\gamma v - c)$. Finally, at a common initial growth rate $\partial R/\partial \rho = (1 + g_0)^{-1}\,\partial R/\partial \tau$, which carries the sign to (33), Q.E.D.

Proposition 4. On a given balanced path the objects τ, Ψ, and D do not depend on θ, which enters (30) only through the factor $1-\theta$; collecting terms gives (34), affine in θ with slope $-\tau\,[1/(\hat{\Pi}+\tau)+\gamma\Psi/D] < 0$ whenever $\tau > 0$; the demographic response $R - 1$ shares the slope. For the discrete statement: the initial path is common to all designs, the cohort factor $1 + g_n$ on the slow path does not depend on θ, and the slow path depends on θ only through $\tau_1(\theta) = \tau_0\,[(1+g_1)/(1+g_0)]^{-(1-\theta)}$, with $d\tau_1/d\theta = -\tau_1 \ln[(1+g_0)/(1+g_1)] < 0$; since $\partial \ln(s^o/s^y)/\partial \tau = 1/(\hat{\Pi}+\tau) + \gamma\Psi/D > 0$ on every path (the level result above), the chain rule gives $d\ln(s^o/s^y)_1/d\theta < 0$, whichever component of g fell, Q.E.D.

A.5 The transition

Two observations organize the computation. First, the warm-glow margin is contemporaneous — the old settle it after returns are realized — so $s^o_t = \Phi\, j^o_t$ holds at every date, surprises included, and factor shares give

$$c^o_t = \omega_t\, Y_t, \qquad \omega_t \equiv (1-\Phi)\,\big[\alpha + (1-\alpha)\,\tau_t\big], \tag{A.9}$$

with τ_t from the design rule ($\tau_t = \rho\, w_{t-1}/w_t$ under a fixed replacement rate, $\tau_t = \tau$ under a fixed contribution rate). Second, and in contrast with the dynastic benchmark, the contribution rate enters (A.9) directly: the real path is design-dependent, and each design must be solved separately. The detrended system depends on growth only through the total factors W_{t+1}/W_t, so the demographic experiment of Section 3.4 is solved by the same code run at the total growth factors, with the cohort factor $1 + g_n$ multiplied into the wealth ratio afterward; the notation below normalizes the cohort size to one. The system per design is, in detrended form $\hat{k}_t \equiv K_t/A_t$:

$$c_t^y = Y_t - c_t^o - K_{t+1}, \qquad (c_t^y)^{-\gamma} = \beta\,(1 + r_{t+1})\,(c_{t+1}^o)^{-\gamma}, \qquad 1 + r_{t+1} = \alpha\,\hat{k}_{t+1}^{\alpha-1}, \tag{A.10}$$

a second-order difference equation in $\hat{k}_t$ with boundary conditions $\hat{k}_1 = \tilde{k}_0\,(1 + g_0)/(1 + g_1)$ — generation 0's saving, chosen on the old path, deflated by the new productivity level — and convergence to the new balanced value from Section 2.2.1, solved by Newton's method on the detrended capital path over a long horizon (`simulate_wg`). Under a fixed replacement rate, τ_t depends on the current wage and hence on $\hat{k}_t$, which the solver handles inside the same system.

At $\gamma = 1$ under a fixed contribution rate, ω is constant and the Euler equation delivers a constant investment rate: substituting $c_{t+1}^o = \omega Y_{t+1}$ and $1 + r_{t+1} = \alpha Y_{t+1}/K_{t+1}$ into the Euler equation gives $c_t^y = \omega K_{t+1}/(\alpha\beta)$, and the resource constraint then yields

$$K_{t+1} = \frac{1 - \omega}{1 + \omega/(\alpha\beta)}\,Y_t, \tag{A.11}$$

the warm-glow counterpart of the Brock and Mirman (1972) saving rule, valid date by date, surprises included — the closed-form check on the numerical solver.

B Data appendix

Table B.3 lists the variables used in the paper, with their source codes: the HFCS User Database variables and the external country-level series. Table B.1 details the country coverage of each survey wave.

The productivity slowdown. The growth regressor of Section 5.3 measures the slowdown over the 1991–2019 window that the HFCS cohorts lived through. Figure B.1 places that window in its long-run context, plotting the log of GDP per hour worked since 1950 for the sixteen European countries of the Long-Term Productivity Database of Bergeaud et al. (2016). Because the vertical axis is in logs, the slope of each line is that country's productivity growth rate. Three features matter for the paper. First, the slowdown is common: the unweighted mean growth rate falls from 4.6 percent a year over 1950–1975 to 2.3 percent over 1975–2000 and 0.9 percent over 2000–2024,

Table B.1: Country coverage of the HFCS, by survey wave. A checkmark marks participation in the wave. Malta participates in every wave but is excluded from all analyses because age is not released in its User Database extract; the bottom row counts the countries entering the analysis sample.

	2010	2014	2017	2021	2023
AT, BE, CY, DE, ES, FI, FR, GR, IT, LU, NL, PT, SI, SK	✓	✓	✓	✓	✓
MT (excluded: age not released)	✓	✓	✓	✓	✓
EE, HU, LV		✓	✓	✓	✓
PL		✓	✓		
HR, LT			✓	✓	✓
CZ				✓	✓
Countries in the analysis sample	14	18	20	20	20

and no country in the sample grows faster after 2000 than before 1975. Second, the catch-up that compressed the cross-country spread ends with it: the lines fan in until the 1990s and run roughly parallel thereafter, so the countries that entered the slowdown poorer have stayed poorer. Third, the slowdown has been deepest where pensions are most generous: the three slowest-growing countries since 2000 are Italy (0.04 percent a year, essentially no productivity growth in a quarter century), Greece (0.10) and France (0.59), all in the upper part of the pension-to-salary distribution, against 1.0 to 1.2 percent in Denmark, Sweden and Switzerland. This is the joint variation in generosity and growth that the interaction of Section 5.3 exploits.

Table B.2: Number of observations by country and wave. Person-rows in the analysis population: household heads and spouses/partners with non-missing age, counted for a single implicate. Malta participates in the HFCS but its User Database extract does not release age, so none of its observations enter the analysis sample.

	2010	2014	2017	2021	2023	Total
Austria	3,641	4,512	4,709	3,415	4,163	20,440
Belgium	3,704	3,564	3,654	3,367	3,226	17,515
Croatia	–	–	2,202	2,118	2,308	6,628
Cyprus	2,229	2,288	2,312	2,337	2,172	11,338
Czechia	–	–	–	4,863	4,917	9,780
Estonia	–	3,687	4,282	3,525	4,029	15,523
Finland	18,113	18,233	16,892	15,576	14,562	83,376
France	24,332	19,577	22,197	16,584	19,369	102,059
Germany	5,981	7,546	8,375	6,832	6,631	35,365
Greece	4,797	4,920	4,860	5,243	5,770	25,590
Hungary	–	9,624	9,409	9,093	10,544	38,670
Italy	12,994	12,891	11,414	10,340	15,821	63,460
Latvia	–	1,820	1,914	1,807	1,857	7,398
Lithuania	–	–	2,428	2,400	2,347	7,175
Luxembourg	1,580	2,688	2,673	3,328	6,082	16,351
Malta	–	–	–	–	–	–
Netherlands	2,210	2,122	3,963	4,133	3,910	16,338
Poland	–	5,559	9,463	–	–	15,022
Portugal	7,279	10,527	9,873	10,313	8,641	46,633
Slovakia	3,242	3,403	3,499	3,362	3,502	17,008
Slovenia	578	4,296	3,322	3,284	3,289	14,769
Spain	10,249	10,204	10,743	10,461	10,490	52,147
Total	100,929	127,461	138,184	122,381	133,630	622,585

Table B.3: Variables and data sources.

Code	Description
Household level	
DN3001	Net wealth: total assets net of total liabilities (UDB-derived)
DH0001	Number of household members
HW0010	Household weight
HH0401–HH0403	Value of up to three substantial gifts or inheritances received, at the time of receipt
HH0201–HH0203	Year in which each gift or inheritance was received
Person level	
RA0300	Age
RA0100	Relationship to the reference person (1 = reference person, 2 = spouse or partner)
PG0110	Gross employee income
PG0310	Gross public pension income
PG0410	Gross occupational and private pension income
PE0300/0370/0350	Occupation, one-digit ISCO major group (current or last main job; the slot used varies across waves)
PE0400/0470/0450	Industry, NACE section (current or last main job; the slot used varies across waves)
External country-level series	
ilc_pnp3	Aggregate replacement ratio, income year 2016 (Eurostat)
rgdpna; SP.POP.1564.TO	Real GDP per working-age adult (15–64), 1991–2019 (Penn World Table 10.01; World Bank WDI)
prc_hicp_ainr	HICP, all-items annual average index, from 1996 (Eurostat)
prc_hpi_a	House price index, total dwellings, annual average, from 2005–2010 depending on the country; not reported by Greece (Eurostat)
FP.CPI.TOTL	Consumer price index, pre-1996 back-splice of the HICP (World Bank WDI)
Labor productivity	GDP per hour worked, US$ 2020 PPP, 1950–2024 (Long-Term Productivity Database v2.7, Bergeaud et al., 2016)

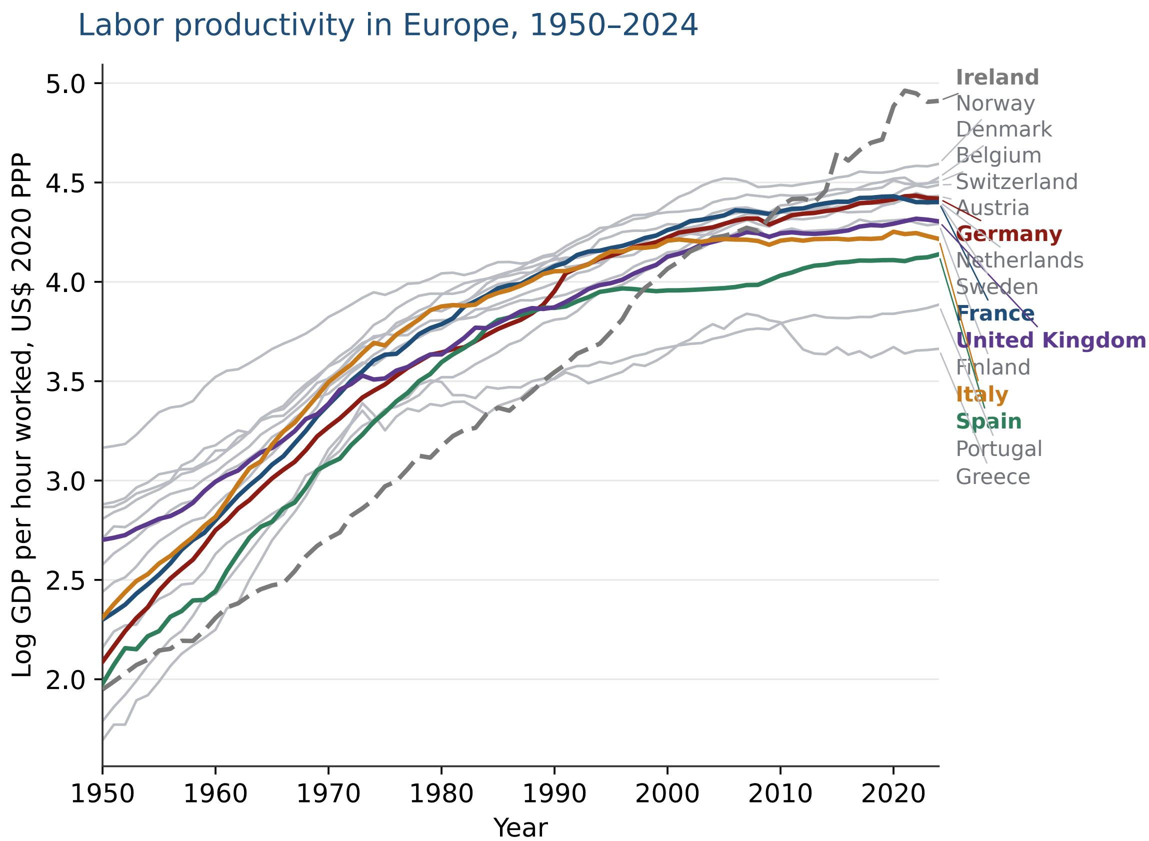

Figure B.1: Log labor productivity in Europe, 1950–2024. This figure plots the natural logarithm of GDP per hour worked, expressed in US$ at 2020 purchasing power parity, for the sixteen European countries covered by version 2.7 of the Long-Term Productivity Database of Bergeaud et al. (2016). The database begins in 1890, and the figure starts in 1950. Because the vertical axis is in logs, the slope of a line is the country's annual productivity growth rate. The five largest European economies are drawn in color and the remaining countries in gray. Ireland is dashed because the level break after 2015 reflects the redomiciling of multinational intangible assets rather than a change in Irish production, so that its post-2015 level is not comparable to the others.

C The age distribution of wealth as a share system

This appendix details the construction behind Figure 8 and Table D.1 and the sense in which their estimates satisfy the adding-up constraint exactly.

Construction. Let $\bar{s}_{gct}$ denote the mean net wealth per partner of age group $g \in \{1, \ldots, G\}$ in country c and wave t, computed over household heads and partners with the survey weights (separately within each imputation implicate; implicate indices are suppressed throughout). Let $\bar{W}_g$ be *fixed* group shares — the pooled population shares of the estimation sample — common to all countries and waves. Define the standardized average wealth

$$\bar{s}^*_{ct} = \sum_{g=1}^{G} \bar{W}_g \, \bar{s}_{gct}, \tag{C.1}$$

and the outcome $y_{gct} = \bar{s}_{gct}/\bar{s}^*_{ct}$. By construction,

$$\sum_{g=1}^{G} \bar{W}_g \, y_{gct} = 1 \qquad \text{for every } c, t, \tag{C.2}$$

an accounting identity: the fixed-share combination of the outcomes is the scale divided by itself. Equation (C.1) is a direct standardization in the demographer's sense, valuing every country's age distribution of wealth at the same demographic basket, and the fixed basket is what makes (C.2) hold with weights common to all countries. With the unstandardized average wealth, the shares would sum to one only with country-specific weights, and the aggregation property below would hold only approximately.

Estimation. The group equations are

$$y_{gct} = x'_{ct}\beta^g + \delta_{gt} + \varepsilon_{gct}, \tag{C.3}$$

where x_{ct} collects the country-level regressors — generosity, growth, and their interaction, identical across groups — and δ_{gt} are group$\times$wave effects. The system is estimated as one pooled weighted regression in which every group observation of a country–wave carries the same weight ω_{ct}; in the text, ω_{ct} is the country's population, so point estimates are population-weighted while standard errors cluster by country.

Exact adding-up. The estimates satisfy, coordinate by coordinate,

$$\sum_{g=1}^{G} \bar{W}_g \, \hat{\beta}^g = 0, \tag{C.4}$$

exactly. Least squares is linear in the outcome, and because regressors and weights are identical across the group equations, the pooled regression estimates each equation separately. The $\bar{W}$-weighted combination of the estimated equations is therefore the weighted regression of $\sum_g \bar{W}_g \, y_{gct}$, which by (C.2) equals one, on x_{ct} and the wave effects; a constant loads entirely on the wave effects, with zeros on every regressor. The restriction (C.4) is thus not imposed in estimation. The same adding-up property arises in demand and cost-share systems, where budget shares sum to one and estimation with identical regressors satisfies the aggregation restrictions automatically (Barten, 1969; Deaton and Muellbauer, 1980); the standardization (C.1) produces it for the age distribution of wealth across countries. Both conditions are needed. With each country's own demographic weights, the identity (C.2) fails for any common $\bar{W}_g$. With group-specific weights, which arise in individual-level regressions because a country contributes more observations to its larger groups, the combination of the estimated equations is no longer the regression of a constant.

Interpretation. The coefficients measure reallocations: β^g is the response of group g's mean wealth in units of the standardized average wealth, and $\bar{W}_g \beta^g$ its contribution to the zero total. Each column of Table D.1 therefore describes the distribution of wealth across age groups, not the response of total wealth, which is divided out with the scale; the estimates correspondingly understate absolute responses. The scaling also removes variation common to all of a country's age groups, such as asset valuations, the wealth-to-income ratio, or survey conventions, which improves precision relative to unstandardized outcomes. Households are winsorized within country$\times$group$\times$implicate before averaging, and the scale is built from the winsorized means, so (C.2) is preserved; the five implicates are combined by Rubin's rules.

D Additional empirical results

Table D.1 reports the full set of coefficients of the share-system regression behind Figure 8: for each five-year age group, the generosity main effect, the growth main effect, and their interaction, together with the two gradients the figure plots and the fixed population share of the group. The $\bar{W}_g$-weighted sum of every column is zero by construction (Appendix C).

Table D.2 reports the same decomposition for the fixed-cohort specification: for each endpoint age group, the generosity main effect, the growth main effect, their interaction, and the house-price control, together with the two gradients plotted in Figure 7.

The rise in the relative wealth of the elderly documented in the Introduction is not an artifact of the survey's expanding country coverage. Figure D.1 plots the series for every country surveyed in each wave alongside the series computed on the fixed set of the 14 first-wave countries: the balanced series rises by *more* (from 1.50 to 1.74, against 1.50 to 1.67 for the full set) — the countries that join after 2010 have relatively poorer elderly, so the expansion dampens the all-countries series rather than driving it.

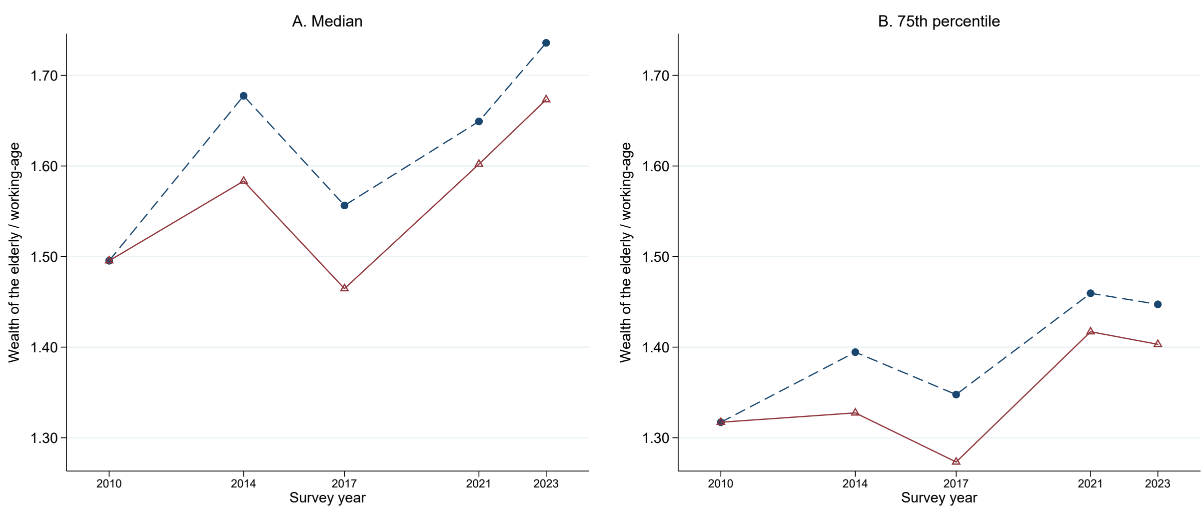

Figure D.1: The relative wealth of the elderly in Europe, 2010–2023. This figure plots, by survey wave, the population-weighted mean across HFCS countries of the ratio of the per-adult net wealth of individuals aged 70–85 to that of the working-age population (ages 26–59). Panel A uses the ratio of medians and Panel B the ratio of 75th percentiles. Country population is measured as the survey sum of the household weight times household size. In each panel, the solid line uses every country surveyed in each wave, from 14 in 2010 to 20 as the survey expands to Central and Eastern Europe, whereas the dashed line holds the country set fixed at the 14 countries of the 2010 wave.

Table D.1: The share-system regression behind Figure 8: full coefficient estimates

Age group	$\frac{\bar{b}}{\bar{w}}$	$\log(1+g_a)$	$\frac{\bar{b}}{\bar{w}} \times \log(1+g_a)$	Gradient at: 1%	Gradient at: 2%	Share $\bar{W}_g$
25–29	-0.13	-0.43	-4.35***	0.48	-0.72**	0.056
	(0.29)	(0.35)	(1.07)	(0.35)	(0.30)	
30–34	-0.51	0.06	-0.97	-0.38	-0.64*	0.087
	(0.34)	(0.36)	(1.20)	(0.40)	(0.36)	
35–39	-0.47	0.28	-0.58	-0.39	-0.55*	0.103
	(0.31)	(0.26)	(0.89)	(0.36)	(0.32)	
40–44	-0.66**	0.30	-0.66	-0.57*	-0.75***	0.113
	(0.26)	(0.31)	(0.98)	(0.32)	(0.26)	
45–49	-1.49***	0.21	4.11***	-2.06***	-0.92***	0.112
	(0.33)	(0.13)	(1.32)	(0.47)	(0.26)	
50–54	-1.72***	0.10	6.00***	-2.55***	-0.90**	0.121
	(0.48)	(0.37)	(1.28)	(0.57)	(0.44)	
55–59	-0.95**	0.05	3.61***	-1.45***	-0.45	0.120
	(0.48)	(0.26)	(1.01)	(0.56)	(0.43)	
60–64	0.80	0.76*	2.61***	0.43	1.16**	0.087
	(0.59)	(0.43)	(0.89)	(0.63)	(0.59)	
65–69	1.18*	1.40**	5.28**	0.45	1.91***	0.064
	(0.63)	(0.71)	(2.30)	(0.70)	(0.71)	
70–74	2.30**	-0.52	-3.61	2.80**	1.81*	0.049
	(1.01)	(0.67)	(2.39)	(1.15)	(0.96)	
75–85	4.78*	-2.20	-16.92***	7.13**	2.46	0.088
	(2.71)	(1.55)	(5.21)	(3.07)	(2.52)	
R^2				0.671		
Country×wave×group cells				436		
Countries (clusters)				20		

Notes: This table reports the full set of coefficients of the share-system regression plotted in Figure 8. The outcome is the country×wave×implicate mean net wealth per partner of each five-year age group (with 75–85 pooled), where a household whose only head or spouse is widowed counts as two partners, scaled by the standardized average wealth defined in Appendix C. We regress this outcome on the country pension-to-salary ratio, $\log(1+g_a)$ (the 1991–2019 log change in real GDP per working-age adult), and their interaction, each fully interacted with age-group indicators, and we include group×wave fixed effects. Both regressors are centered at their country-level weighted means, so that the main effects are marginal effects at the sample mean of the other variable. Every group of a country carries the country's population weight, so the $\bar{W}_g$-weighted sum of each column is exactly zero (Appendix C). All entries are per unit of the pension-to-salary ratio. The gradient columns evaluate the generosity slope at 1 and 2 percent annual growth; multiplied by 0.18, the between-country standard deviation of generosity, they equal the series plotted in Figure 8. We winsorize households at the 1st and 99th percentiles within country×group×implicate before averaging. The sample consists of the HFCS 2021 and 2023 waves, the five imputation implicates are combined by Rubin's rules, and standard errors clustered by country are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table D.2: The fixed-cohort regression behind Figure 7: full coefficient estimates

Age group	$\frac{\bar{b}}{\bar{w}}$	$\log(1+g_a)$	$\frac{\bar{b}}{\bar{w}} \times \log(1+g_a)$	Δ lnHP	Gradient at: 1%	Gradient at: 2%	N
40–44	-0.22	-1.31***	-1.10	0.16	-0.08	-0.39*	14,113
	(0.29)	(0.34)	(1.28)	(0.24)	(0.41)	(0.23)	
45–49	0.39	-0.83*	-1.05	0.27	0.52	0.23	16,101
	(0.54)	(0.43)	(1.28)	(0.32)	(0.67)	(0.44)	
50–54	-0.66	-0.77**	0.22	-0.00	-0.69	-0.62*	17,281
	(0.58)	(0.35)	(1.86)	(0.31)	(0.79)	(0.37)	
55–59	-0.36	-0.78**	0.20	0.27	-0.38	-0.33	17,712
	(0.40)	(0.40)	(1.61)	(0.27)	(0.55)	(0.32)	
60–64	0.91	0.26	-1.71	0.07	1.12	0.65	14,074
	(0.58)	(0.38)	(1.66)	(0.28)	(0.74)	(0.43)	
65–69	2.02***	0.94**	-1.54	0.80**	2.21***	1.79***	10,466
	(0.53)	(0.37)	(2.05)	(0.32)	(0.73)	(0.39)	
70–74	2.01***	-0.70	-7.76**	0.34	2.99***	0.84*	8,372
	(0.42)	(0.92)	(3.63)	(0.37)	(0.75)	(0.50)	
75–79	2.20***	-2.71***	-13.96***	0.75**	3.95***	0.10	5,947
	(0.70)	(0.80)	(3.98)	(0.36)	(1.08)	(0.59)	
80–85	1.49***	-0.61	-6.06*	0.45**	2.25***	0.58	5,908
	(0.37)	(0.75)	(3.54)	(0.22)	(0.68)	(0.51)	
R^2					0.259		
Observations (per implicate)					109,974		
Countries (clusters)					16		

Notes: This table reports the full set of coefficients of the fixed-cohort regression plotted in Figure 7. For each five-year endpoint age group, the last of which is 80–85 at the survey's age topcode, the outcome is the change in log wage-scaled wealth between the cohort's pooled 2010/2014 baseline and 2021/2023. We regress this outcome on the country pension-to-salary ratio, $\log(1+g_a)$ (the 1991–2019 log change in real GDP per working-age adult), their interaction, and the change in the log real house-price index over the outcome window (Δ lnHP), each interacted with the age groups; the fixed effects are occupation×industry×year×age group. The generosity and growth regressors are centered at their sample weighted means, so that the main effects are marginal effects at the mean of the other variable. All entries are per unit of the pension-to-salary ratio. The gradient columns evaluate the generosity slope at 1 and 2 percent annual growth; multiplied by 0.17, the between-country standard deviation of generosity on this sample, they equal the series plotted in Figure 7. N is the number of endpoint households in the group, counted for a single implicate. As in Table 3, Greece, which does not report the harmonized house-price index, and the countries without a 2010/2014 baseline drop from the sample. Regressions are weighted by the HFCS household weights, the five imputation implicates are combined by Rubin's rules, and standard errors clustered by country are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

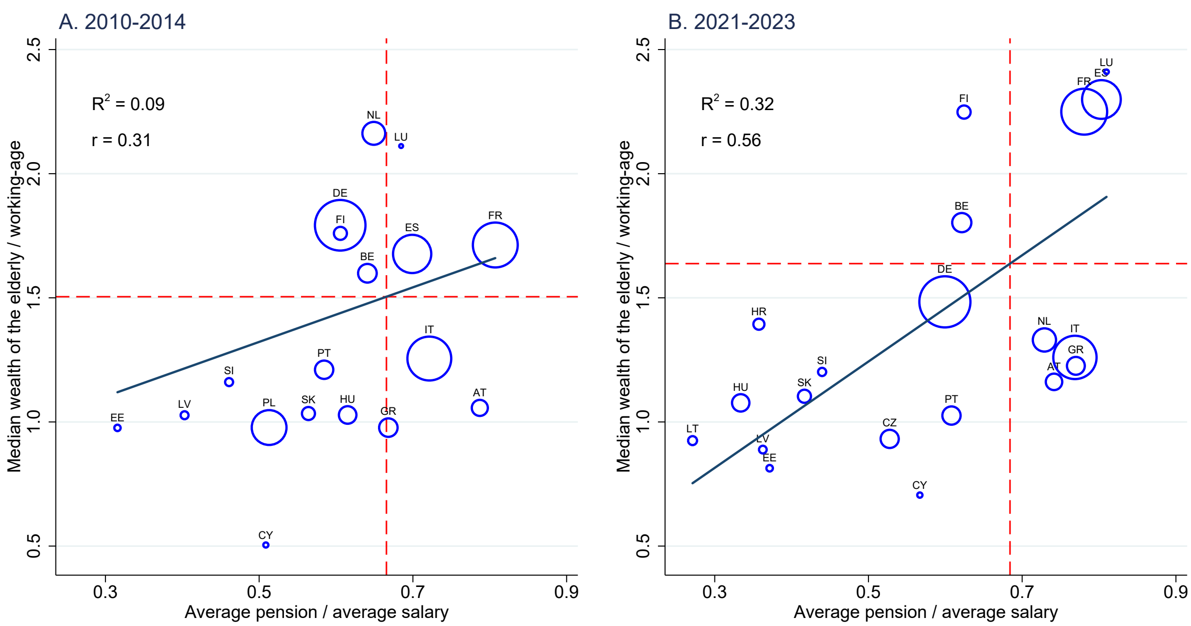

Figure D.2: Pension generosity and the relative median wealth of the elderly. This figure reproduces Figure 1 with the ratio of medians in place of the ratio of means: the median per-adult net wealth of individuals aged 70–85 is divided by that of the working-age population (ages 26–59), by country, averaged over the waves of each panel. Each circle area is proportional to the country's population, measured as the survey sum of the household weight times household size. Panel A pools the 2010 and 2014 waves, and Panel B pools the 2021 and 2023 waves. The solid line is the population-weighted OLS fit, and the red dashed lines mark the population-weighted means of the two variables.