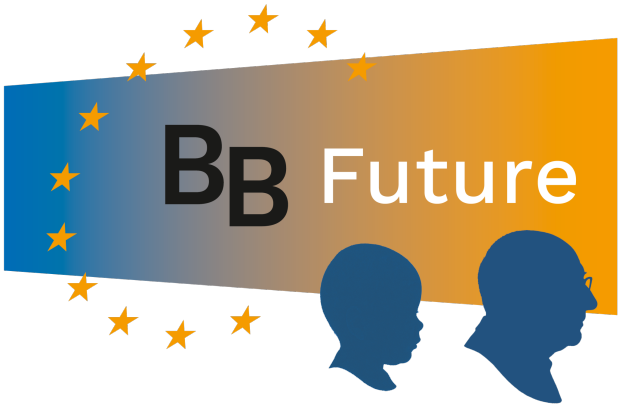

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In the mid-2030s, the health of the baby boomers will have deteriorated and many in these large cohorts will be in need of formal and/or informal long-term care. This "**care wave**" will transform two generations: the baby boomers in need of care and their children who may supply care. It will have significant implications for labour supply, especially for women, saving behaviour, and therefore for productivity, economic growth and its inclusiveness.

The overarching objective of BB-Future is to understand the size and the implications of the care wave on economic and social outcomes, to appreciate the quality of this second ageing-related transformation and to develop policy recommendations for advance planning on the EU and Member State levels.

This deliverable reports the solution of the calibrated overlapping generations (OLG) model of Work Package 6 (Deliverable 6.1) under the demographic and health projections of Work Package 2, and the policy evaluations carried out with it for five EU Member States (France, Germany, Italy, Poland and Sweden): the macroeconomic and distributional cost of the care wave, the phase-out of pay-as-you-go pensions, and the choice between defined-benefit and defined-contribution rules under ageing, each traced to the welfare of every generation and to the households that provide care.

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Macroeconomic Implications of the Care Wave: OLG-based Policy Evaluations*

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September, 2026

Abstract

This paper solves the overlapping generations (OLG) model of Koo (2026) and presents simulation results from 2023 to 2070 under the BB-Future demographic and health projections, as well as policy evaluations of counterfactual pension reforms. Population ageing lowers EU5 output per capita by 8 percent relative to trend by 2070. The "care wave", the informal-care obligation that the baby-boom parents impose on their children, is a time tax on people in their 50s and early 60s: it costs 1.8 percent of output today and 2.5 percent in 2070 if longevity gains are added as years of dependency, and it is regressive, since lower earners have less healthy parents and pay more of their larger burden in forgone wages. Phasing out pay-as-you-go pensions raises long-run labour and capital substantially, but at the expense of the generations alive today. Choosing between defined-benefit and defined-contribution rules shifts the cost of ageing between today's older cohorts and future generations, and no mix makes both better off. Neither reform changes how much care is given, but each decides whether caregivers pay for it in forgone work or forgone leisure.

JEL Codes: E21, H55, I11, J11, J14, J26

Keywords: population ageing, long-term care, informal care, pension reform, overlapping generations, intergenerational distribution

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1 Introduction

Europe is passing through two ageing-related transformations. The first, the "pension wave", is the retirement of the baby-boom cohorts, which has dominated the policy debate and is visible in every projection of contribution rates and benefit ratios. The second, the "care wave", is crucial but has received less attention: by the mid-2030s the health of the same cohorts will have deteriorated, and many will need long-term care (LTC), formal or informal. The care wave falls on two generations at once, the baby-boom parents who need care and the adult children who may provide it. As these children are in their 50s and early 60s, at the peak of their earnings and close to retirement, the care wave reaches beyond care needs and public budgets to the economy as a whole, through the labour supply, saving and output of the younger generation, channels that the pension debate does not capture. This paper analyses the macroeconomic implications of the care wave with simulations of an overlapping generations (OLG) model.

The model is documented in detail in Koo (2026). It is an OLG model of five EU Member States, France, Germany, Italy, Poland and Sweden (EU5), designed to represent continental Europe. Calibrated to 2023 data for each country, it features an integrated capital and labour market and four dimensions of household heterogeneity, and it explicitly accounts for public pensions, health and LTC insurance, and an informal-care obligation that ties adult children's time to their parents' health. This paper applies the calibrated model to simulation and policy analysis. It simulates the five economies from 2023 to 2070 under the BB-Future demographic and health projections and uses the results to address the questions that the BB-Future digest series has raised one at a time: what the care wave costs and who pays for it, and how the two main pension-reform margins, the size of the pay-as-you-go (PAYG) promise and the choice between defined-benefit (DB) and defined-contribution (DC) rules, interact with it. Answering them within one model makes the results directly comparable.

The analysis builds on the OLG literature on ageing and pension reform (Auerbach and Kotlikoff, 1987; Kitao, 2014; Börsch-Supan et al., 2023), which has rarely accounted for the care needs that arise as populations age. It also draws on the household-level literature on LTC, including how the prospect of care needs shapes saving (Lockwood, 2018) and the choice between formal and informal care (Barczyk and Kredler, 2019), and on the evidence that caring for a parent reduces the labour supply of the adult children who provide it (Løken et al., 2017; Ciccarelli and Van Soest, 2018). Bringing the two strands together in general equilibrium lets the cost of care feed back on wages, interest rates and the contribution rates that finance social insurance, and lets the pension reforms be evaluated with the care obligation inside the model rather than beside it.

Two features distinguish the analysis from the projections that policymakers usually see. First, the care obligation is inside the model. Care is a time tax on the working-age population that competes with market work and leisure, so its cost is not an accounting entry but the outcome of household choices about hours, retirement and saving, and of the general-equilibrium response of wages and interest rates. Second, the gains and losses from every experiment are traced to cohorts: to each generation alive today by age, to each generation yet to enter by year of entry, and to the households that provide care as against those that do not.

The main findings are the following. Under current rules, ageing alone lowers EU5 output per capita by 8 percent relative to trend by 2070, raises the combined contribution rate for pensions, health and LTC by 6 percentage points of the wage, and moves the average retirement age up by less than a year. The informal-care obligation, which peaks in the 2040s and 2050s as the baby-boom parents reach the ages of dependency, costs 1.7 to 1.8 percent of output today and in 2070 under Neutral morbidity (healthier ageing) and 2.5 percent in 2070 under Expand morbidity (pure ageing); the loss is borne by caregivers in their 50s and 60s, increasingly in hours of work rather than leisure, and it falls hardest on lower earners, whose parents are less healthy. Phasing out PAYG pensions raises long-run labour and capital substantially, but the transition generations pay for it: households aged 55–64 in 2023 lose almost a third of their remaining consumption under a full phase-out, and caregivers lose exactly as much as non-caregivers of the same age, but adjust through different margins. The choice between DB and DC rules decides which generation carries the ageing risk: holding pensions and letting contributions rise favours everyone over 40 today and costs cohorts entering after 2070 about 8 percent of lifetime consumption and the economy 6 percent of output, while the fixed-contribution rule is the mirror image, with no mix that makes both groups better off. The rule also governs how caregivers make room for care, out of work under DB and out of leisure under DC, and whether care moves their retirement date.

The results on the care wave and on the two pension experiments were first reported in BB-Future Digests 4, 17 and 18; this paper gives the full account on a single set of runs, and where its numbers differ from the digests, the numbers here should be used (Appendix A). The remainder of the paper is organised as follows. Section 2 restates the model in brief and how its transition is solved. Section 3 reports the simulation results under the demographic and health projections: the baseline projection under current rules and the care wave under the Neutral and Expand morbidity paths. Section 4 evaluates two counterfactual pension reforms, the phase-out of PAYG pensions and the choice between DB and DC rules, and Section 5 concludes with the policy implications.

2 The Model in Brief

This section restates the elements of the model that the reader needs to follow the experiments; the full specification, the construction of the household-level profiles and the calibration are documented in Koo (2026). The economy is a union of five countries $c \in \{\text{DE, FR, IT, PL, SE}\}$, each populated by overlapping generations of households that enter at age 20 ($j = 1$) and live to at most 100 ($J = 81$). Households are heterogeneous ex ante in productivity, health, life expectancy and preferences (30 active types per country, weighted by their SHARE population shares), and homogeneous within a type. Cohort sizes $N_{j,c,t}$ and survival probabilities are exogenous and taken from the BB-Future demographic projections, including net migration.

Households. A household of type x chooses consumption, hours of market work and saving each year, and a retirement age J_r from the window $[60, 72]$, to maximise

$$\mathcal{U} = \sum_{j=1}^{J} \beta^{j-1} \pi_{j,t} \frac{\left(c_{j,t}^{\phi_j} \ell_{j,t}^{1-\phi_j}\right)^{1-\sigma}}{1-\sigma},$$

subject to the time constraint

$$1 = h_{j,t} + h_{j,t}^{IC} + \ell_{j,t},$$

where the time endowment in each period is normalised to 1. The *informal-care obligation* $h^{IC}_{j,t} = S^{p}_{j,t} f(\chi_{j+30})$ is the time an adult child spends caring for a parent thirty years older: it is switched on when the parent's deficiency crosses the LTC threshold $\bar{\chi}$, grows with the parent's ill-health, and is weighted by the probability S^p that the parent is still alive. Care is thus a time tax on the working-age population, concentrated on people in their 50s and early 60s, that competes with market work and leisure; a subsidy η^{IC} reimburses part of its wage value.
Households are also subject to the budget constraint

$$c_{j,t} + (1+g)a_{j+1,t+1} = (1+r_t)a_{j,t} + y_{j,t} - w_t \mathcal{M}_{j,t}, \qquad y_{j,t} = \begin{cases} (1-\tau_t)\epsilon_j h_{j,t} w_t + \eta^{IC} h^{IC}_{j,t} w_t & j < J_r \\ pen_{j,t} + \eta^{IC} h^{IC}_{j,t} w_t & j \geq J_r, \end{cases}$$

where $\tau_t = \tau^p_t + \tau^{GH}_t + \tau^{LTC}_t$ is the total social-insurance contribution rate and $\mathcal{M}_{j,t} = (1-\eta^{GH})e^{GH}_j + (1-\eta^{LTC})e^{LTC}_j$ the out-of-pocket health and LTC cost, which rises with the household's health deficiency χ_j and is indexed to the wage.

Pensions. Workers accumulate earnings points pt in proportion to their effective labour relative to the country average; the pension is $pen = b_t\, \gamma(J_r)\, w_t \bar{L}_t\, pt_{J_r}/(J_r - 1)$, indexed to current wages, with an actuarial adjustment γ of ω per year of early or late retirement. The PAYG budget balances every year. How it balances is governed by the closure parameter $\theta \in [0,1]$, the share of the ageing shortfall carried by contributors: with reference rates $(\bar{\tau}^p, \bar{b})$ and the shortfall D_t between the cost of the reference promise and the revenue of the reference contribution rate,

$$\tau^p_t = \bar{\tau}^p + \theta\, \frac{D_t}{w_t L_t}, \qquad \sum pen_t(b_t) = \sum pen_t(\bar{b}) - (1-\theta)D_t.$$

A value of $\theta = 1$ corresponds to a DB system (the benefit ratio is held, contributions rise), $\theta = 0$ to a DC system (the contribution rate is held, benefits fall), and the baseline reproduces the 2023 rules, $\theta = (0.5, 1, 0, 0, 0)$ for Germany, France, Italy, Poland and Sweden. Public health and LTC are financed by two further balanced budgets, τ^{GH}_t and τ^{LTC}_t, the latter covering the public share of formal care and the informal-care subsidy.

Production and equilibrium. A representative firm produces with a Cobb–Douglas technology and labour-augmenting productivity A_t,

$$Y_t = K^{\alpha}_t (A_t L_t)^{1-\alpha},$$

using the capital and effective labour of all five countries, so that a single wage per efficiency unit and a single interest rate clear the integrated factor markets, while the three social-insurance budgets balance country by country. A stationary equilibrium is a set of household decision rules, prices, fiscal instruments and a population distribution consistent with one another; the transition path is the sequence of such objects along which the demographic and health projections unfold and households have perfect foresight of prices and policies. Welfare is measured by the consumption-equivalent variation (CEV): the percentage by which a household's consumption along the baseline path would have to be changed in every remaining year to make it as well off as under the counterfactual, positive numbers denoting a gain.

2.1 Solution and computation

Every experiment in this paper starts from the initial stationary equilibrium of Koo (2026), in which the age structure, survival rates and health profiles are those of 2023 and the fiscal instruments are the calibrated contribution and replacement rates, and solves for the transition path to a final stationary equilibrium. The calibration matches its targets in the first year of the baseline transition, 2023, in which households already respond to the ageing they foresee, rather than in the initial steady state (Koo, 2026, Section 4); the 2023 values reported below are therefore the calibrated benchmark. Along the transition the population by age and the survival probabilities follow the BB-Future demographic projection year by year from 2023 to 2070 and are held at their 2070 values thereafter; the health-deficiency profiles shift with longevity according to the morbidity scenario; and the three social-insurance budgets of each country balance in every year, so that the contribution rates τ_t^{GH}, τ_t^{LTC} and the pension instrument (τ_t^p, b_t, or both, depending on θ) adjust endogenously to the cost of ageing. The simulation horizon extends well beyond 2070 (100 years, i.e. to 2122) so that the final steady state does not contaminate the reported window.

Households alive in 2023 enter the transition with the assets and pension points they hold in the benchmark and re-optimise under perfect foresight of the new price and policy paths; cohorts born after 2023 are solved along their full life cycle. Under an *announced* reform, households already in the labour force re-choose their retirement age subject to it being no earlier than their current age, and households already retired keep their retirement date. Two objects are reported for every experiment: the aggregate paths (output, capital, effective labour, wages and interest rate, hours and retirement ages, the contribution rates and benefit ratios, and the public spending shares by country) and the cohort-level welfare effects, measured as the CEV of each cohort alive in 2023 by age, and of each cohort entering after 2023 by year of entry.

Computation. Steady states and transitions are computed with the solver documented in Koo (2026, Appendix A). In brief, the integrated capital market is the outer fixed point, updated by a quasi-Newton step in the spirit of Ludwig (2007); the fifteen budget-balancing contribution rates and the pension instruments adjust in a damped inner loop; and each household type solves its life cycle by the endogenous grid method for every admissible retirement age and picks the best one. For the transitions two features matter. Cohorts born after 2023 are solved every fifth birth year and interpolated in between, while every cohort alive in 2023 is solved explicitly; and a final pass drives the policy residuals to a root-mean-square of 2×10^{-3}, leaving pension-budget residuals below 2 percent of outlays in most country-years and below 7 percent at the maximum. The retirement margin is flat (retiring a year away from the optimum costs less than 0.25 percent of lifetime consumption), so small changes in resources can move whole household types across a year; in the care-weighted retirement statistics of Sections 3.2 and 4, types whose exit age moves by six years or more between the care-on and care-off economies are therefore excluded and their weight is reported. A transition with 150 country-types takes 20–35 minutes on an 18-thread workstation.

3 Results under the Demographic and Health Projections

The experiments vary along three scenario dimensions and the pension policy (Table 1). *Demography* follows the BB-Future demographic projections: the baseline, and the "modest" and "stronger" ageing variants that bracket it (lower and higher life-expectancy gains with correspondingly adjusted fertility and migration); the experiments of this paper use the baseline. *Morbidity* governs how the health-

deficiency profiles move as people live longer: under *Neutral* (healthier ageing) the profile shifts with life expectancy so that the years spent above the care threshold stay roughly constant, under *Expand* (pure ageing) longevity gains are added as years of dependency, and under *Compress* they are added as healthy years. *Care* is either on, the informal-care obligation as estimated, or off, a counterfactual in which children bear no care obligation; the difference between the two isolates what the care wave costs, and, when both are solved under a policy reform, whether caregivers are affected differently from non-caregivers. Unless stated otherwise the experiments below use baseline demography, Neutral morbidity and care on.

Table 1: Scenario dimensions

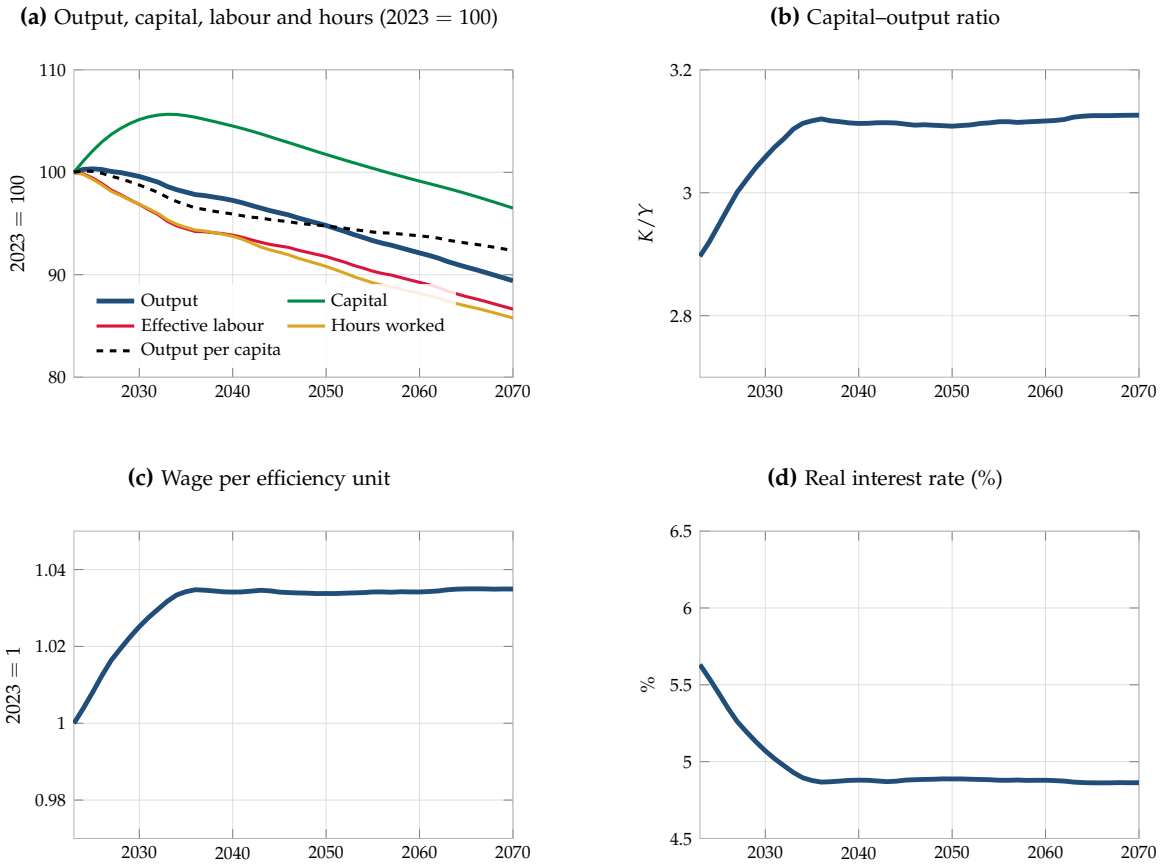
Dimension	Variants	Source / role
Demography	Baseline; Modest ageing; Stronger ageing; No / half / double migration; life expectancy ± 2, ± 4 years	BB-Future projections, 2023–2070; baseline in all experiments, variants left for further work
Morbidity	Neutral; Expand; Compress	Forward shift of the SHARE health-deficiency profile with longevity (Koo, 2026, Appendix C); Neutral (healthier ageing) is the central case, Expand (pure ageing) the pessimistic one
Informal care	On; Off	Care obligation as estimated, or removed; the pair identifies the cost of the care wave and how reforms affect caregivers
Pension policy	Current rules ($\theta = (0.5, 1, 0, 0, 0)$); PAYG replacement rate phased down to one half or to zero over 2023–2048; uniform closure $\theta \in \{0, 0.25, 0.5, 0.75, 1\}$ phased in over 2023–2028	Sections 4.1 and 4.2; all reforms announced in 2023

3.1 The baseline projection: ageing under current rules

The baseline is the projection of the five economies from 2023 to 2070 under the current rules: today's pension, health and LTC institutions, the baseline demographic projection, Neutral morbidity and the informal-care obligation as estimated. It is the path against which the care wave of Section 3.2 and every reform of Section 4 is measured, and it is in itself the answer to the first question of the analysis: what ageing alone does to growth, factor prices, labour supply and the social-insurance budgets when nothing is reformed.

Macroeconomic path. Figure 1 shows the EU5 aggregates. The old-age dependency ratio of the five countries rises from 0.38 in 2023 to 0.55 in 2050 and 0.59 in 2070 (Koo, 2026, Section 2), and with it effective labour falls by 8 percent by 2050 and by 13 percent by 2070, hours worked by 14 percent. Output falls less, by 5 and 11 percent, since the economy deepens: the capital stock keeps growing until the mid-2030s, when the baby-boom cohorts are still saving for retirement, and declines only slowly thereafter as they decumulate, so that the capital–output ratio rises from 2.90 to 3.13 and the real interest rate falls from 5.6 to 4.9 percent while the wage per efficiency unit rises by 3.5 percent. Output per capita, the measure that matters for living standards, falls by 7.6 percent relative to the productivity trend by 2070, two thirds of it before 2050. Households respond to the rising contribution rates and the falling benefit ratios by working longer: the EU5 average retirement age rises from 63.4 to 64.2 years, most in Poland (2.4 years), Sweden and Italy (1.2 and 1.1 years), where the DC rule lets the benefit ratio fall, and least in France, where the benefit ratio is held.

Figure 1: Baseline: macroeconomic aggregates



Note. EU5, 2023–2070. Current rules, baseline demography, Neutral morbidity, informal care as estimated. Output, capital and labour are the EU5 sums; the wage is per efficiency unit of labour (2023 = 1). Macroeconomic aggregates are reported for the EU5 only, since with one integrated capital market the model's output by country is national income rather than domestic product.
Source. Model simulations.

Fiscal path by country. Table 2 reports the fiscal instruments and the public spending shares in 2023 and 2070, and Figure 2 their paths. The pension cost of ageing is carried by whoever the closure rule assigns it to. In France, a DB system, the benefit ratio stays at 0.52 and the contribution rate rises from 19.7 to 31.4 percent of the wage, with pension spending rising from 13.5 to 24.2 percent of GDP.[1] In Italy, Poland and Sweden the contribution rate is held and the benefit ratio falls, from 0.54 to 0.36, from 0.40 to 0.25 and from 0.34 to 0.24 respectively, so that pension spending over GDP is flat or slightly falling. Germany, which shares the shortfall equally, sees both: the contribution rate rises from 15.9 to 19.2 percent and the benefit ratio falls from 0.42 to 0.36. The EU5 average pension contribution rate rises from 18.1 to 22.2 percent and the average benefit ratio falls from 0.47 to 0.38. Health and LTC contributions rise everywhere with the dependency ratio, health by 0.5 to 2.3 points of the wage and LTC by 0.1 to 0.8 points, most in Sweden, whose formal LTC sector is the largest, and in France; public LTC spending over GDP rises by a fifth to a half, most in France and Poland. Adding up the three branches, the total social-insurance wedge on the wage rises by about 6 percentage points on the EU5 average, from 31 to 37 percent, ranging from under two points in Italy, Poland and Sweden, where the pension rule shifts the cost to pensioners, to 14.6 points in France.

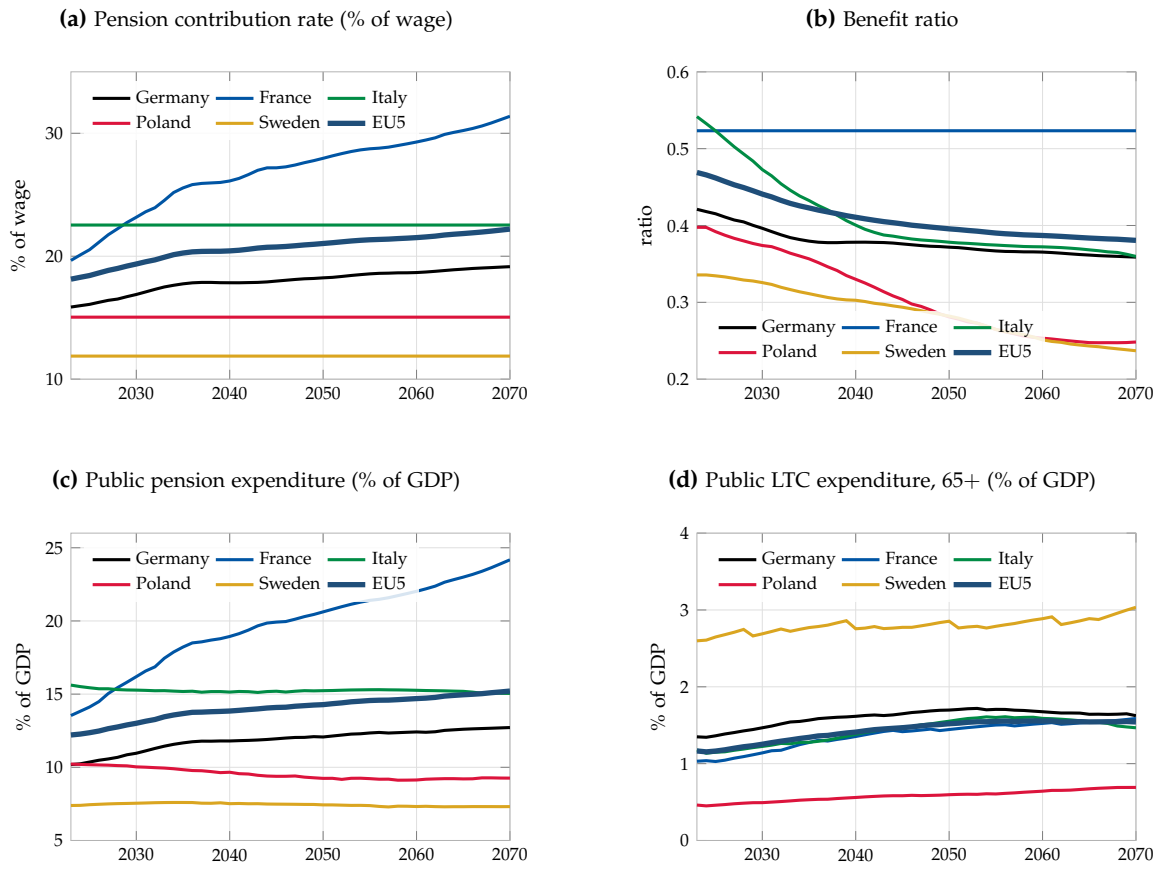
[1]The baseline holds the 2023 pension rules fixed and does not build in legislated reforms such as higher retirement ages or changes in benefit indexation, which the Ageing Report projections include. This is the main reason why the French numbers here differ from the Ageing Report.

Table 2: Baseline: fiscal instruments and spending by country

	DE		FR		IT		PL		SE	
	2023	2070	2023	2070	2023	2070	2023	2070	2023	2070
Fiscal instruments (% of wage, benefit ratio)										
Pension contribution rate τ^p	15.9	19.2	19.7	31.4	22.5	22.5	15.0	15.0	11.9	11.9
Benefit ratio b	0.42	0.36	0.52	0.52	0.54	0.36	0.40	0.25	0.34	0.24
Health contribution rate τ^{GH}	12.1	12.6	12.5	14.8	9.4	10.7	7.7	9.2	12.2	13.1
LTC contribution rate τ^{LTC}	2.7	2.8	1.6	2.2	2.5	3.0	1.0	1.4	4.2	5.0
Total wedge τ	30.7	34.6	33.8	48.4	34.5	36.2	23.8	25.7	28.3	30.0
Public spending (% of GDP)										
Pensions	10.2	12.7	13.5	24.2	15.6	15.1	10.2	9.3	7.4	7.3
Health	7.9	8.3	8.7	11.4	6.5	7.0	5.2	5.6	7.6	7.9
LTC (65+)	1.3	1.6	1.0	1.6	1.2	1.5	0.5	0.7	2.6	3.0
Informal-care subsidy	0.25	0.24	0.09	0.10	0.58	0.51	0.22	0.19	0.02	0.02
Behaviour										
Average retirement age	64.3	64.8	61.8	62.0	63.8	65.0	62.8	65.2	65.3	66.5

Note. Current rules frozen at their 2023 setting: closure $\theta = (0.5, 1, 0, 0, 0)$ for (DE, FR, IT, PL, SE), baseline demography, Neutral morbidity, informal care as estimated. The 2023 column is the first year of the transition, in which households already respond to the announced future; the calibration matches its moments to the data (Koo, 2026, Section 4). The 2070 column is year 48 of the transition. Health spending is the health bucket of the calibration (general health at all ages plus LTC below 65); the informal-care subsidy is η^{IC} times the wage value of care hours and is financed within the LTC budget. It is calibrated to observed cash-for-care spending and has no incentive effect on the care provided.
Source. Model simulations.

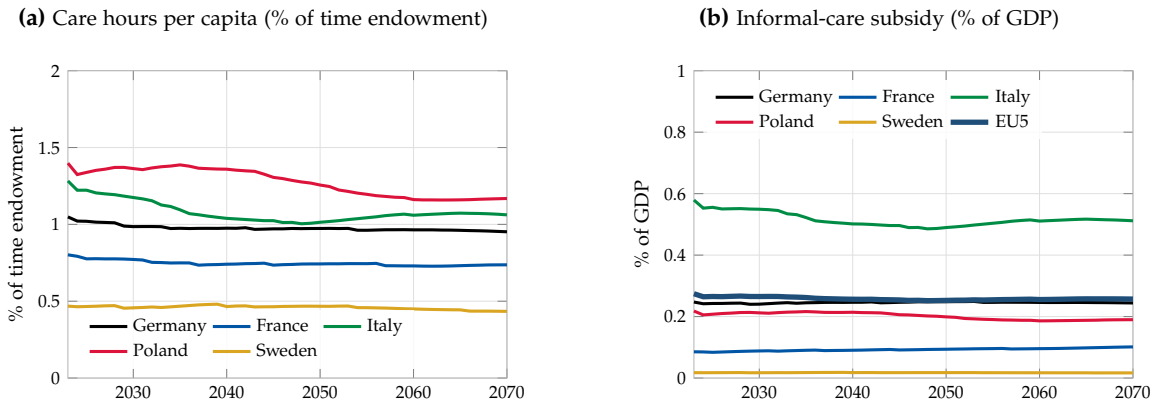
Figure 2: Baseline: fiscal paths by country



Note. 2023–2070. Under current rules France holds its 2023 benefit ratio (DB) and lets the contribution rate rise; Italy, Poland and Sweden hold the contribution rate and let the benefit ratio fall; Germany splits the adjustment.
Source. Model simulations.

The care wave in the baseline. Figure 3 shows the informal-care obligation and its subsidy cost by country. Two forces work against each other. The number of parents at the ages of dependency grows through the 2040s and 2050s as the baby-boom cohorts pass 80, which raises the obligation on their children; at the same time, under the Neutral morbidity path, each cohort of parents reaches a given level of dependency later than the previous one, which lowers it.

Figure 3: Baseline: informal care and its cost



Note. 2023–2070. Care hours are the expected informal-care obligation summed over the population and divided by the total population; the subsidy is η^{IC} times the wage value of care hours.
Source. Model simulations.

On the Neutral path the second force dominates in per-capita terms: care hours per head of population fall by 7 to 17 percent by 2070, least in Germany, France and Sweden, and the subsidy cost stays at about a quarter of a percent of GDP for the EU5. Measured on the caregiving ages, the picture is the familiar hump: the additional care hours of the 25–64 population relative to 2023 peak at about 4 hours per person per year in the early 2040s under Neutral morbidity, and rise to about 24 hours per person per year by 2070 under the Expand path, on which longevity gains are added as years of dependency. Under Expand the per-capita obligation rises by a fifth in Germany and France and by a third in Poland and Sweden by 2070, the subsidy cost by two fifths, and public LTC spending by about 0.7 points of GDP more than under Neutral (2.2 against 1.5 percent of GDP in 2070). Section 3.2 measures what this obligation costs in output and welfare by comparing each economy with its counterpart in which children bear no care obligation; the difference is 1.8 percent of EU5 output in 2023 and 1.7 percent in 2070 on the Neutral path, and 2.5 percent in 2070 under Expand.

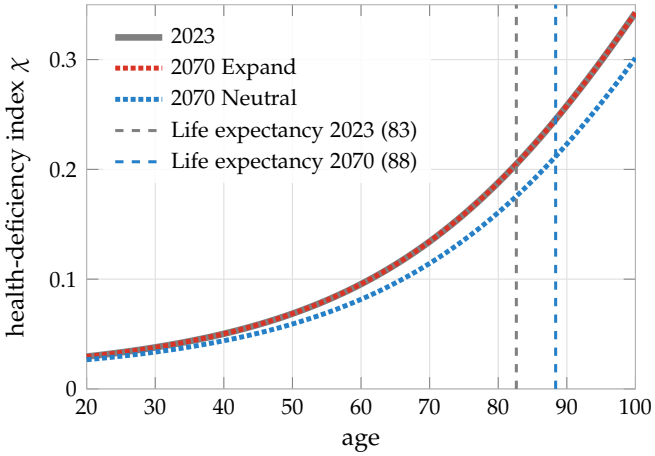
3.2 The care wave: Neutral and Expand morbidity

The baseline shows the care obligation on the Neutral path. This subsection asks what the care wave costs and who bears it, and brackets the uncertain path of population health with the two polar morbidity scenarios, Neutral and Expand. The central question is where the additional care hours that population ageing demands will come from: market work, or leisure. We trace the caregiving burden, its crowd-out of work and leisure and how it is shared across income groups, and then aggregate these household responses into the implied loss of effective labour supply and output.

Morbidity scenarios. The model combines two time-varying forces along the transition: the shifting population and survival structure (the demographic wave), and the shifting age–morbidity profile $\chi(j, x, c, t)$ (the health wave). We separate them using the morbidity scenarios constructed in Koo (2026, Appendix C). Under Expand the age-specific morbidity profile is held at its 2023 shape; as

people nonetheless live longer, the share of the population in poor health rises purely through the demographic channel, so Expand isolates the effect of *pure ageing*. Under Neutral, age-specific morbidity is postponed in step with the gain in life expectancy at 65 (*healthier ageing*), so that a 70-year-old in 2070 carries the morbidity of a roughly 65-year-old today. Neutral and Expand correspond to the optimistic and pessimistic health scenarios of the BB-Future digests. Expand coincides with the 2023 age–morbidity profile by construction, while Neutral lies uniformly below it (Figure 4; see Koo, 2026, Appendix C, for the country profiles and the estimated shifts). The gap between the two scenarios therefore measures how much healthier ageing reduces the care burden.

Figure 4: Morbidity scenarios: health deficiency by age

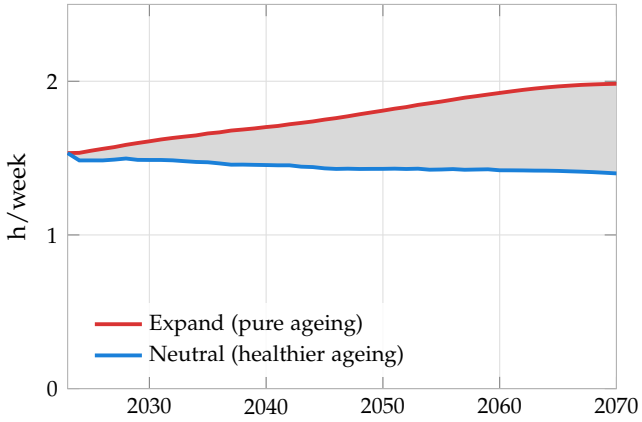


Note. Population-weighted EU5 average of the health-deficiency index χ by age. Under Expand the 2070 profile coincides with the 2023 profile (pure ageing); under Neutral age-specific morbidity is postponed in step with the gain in life expectancy. The vertical lines mark life expectancy at age 20 in 2023 and 2070 in the BB-Future baseline projection.
Source. Model inputs based on SHARE and the BB-Future demographic projections.

Isolating the causal effect of care. The transition under either scenario blends the care burden with all the other forces of an ageing economy: a rising old-age dependency ratio, a heavier contribution wedge, and the associated movements in factor prices. To isolate the part of the macroeconomic adjustment that is *caused* by informal care, we re-solve each transition in general equilibrium with the informal-care time requirement switched off ($h^{IC} \equiv 0$), holding everything else fixed, and report the difference between the care-on and care-off equilibria. All "cost of care" objects below are these care-on/care-off differences, not raw changes along the transition.

The caregiving burden. Figure 5 traces the informal-care burden borne by the working-age population (ages 25–64), expressed as average weekly care hours per working-age adult. In 2023 the burden is about 1.5 hours per week. Its evolution then depends sharply on the health scenario. Under pure ageing (Expand) it climbs by 29 percent, from 1.53 to 1.98 hours per week, as longer-lived but equally frail cohorts generate more care need per worker. Under healthier ageing (Neutral) the burden edges down by 9 percent ($1.53 \rightarrow 1.40$): morbidity postponement more than offsets the demographic pressure. The shaded gap between the two paths is the "prevention dividend", the care burden that better population health would avert. Behind this aggregate, the burden falls unevenly over the life cycle: care hours conditional on actively providing care rise from about 5 hours per week for caregivers in their 30s to 10 hours at 60 and 13 hours by 70, around the retirement margin, in line with the SHARE evidence on which the care schedule is estimated (Koo, 2026, Appendix E).

Figure 5: Care wave: care hours per working-age adult

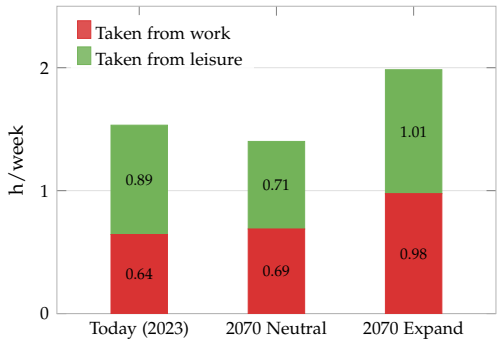


Note. EU5, 2023–2070. Expected informal-care obligation of the 25–64 population under current rules, care on, per working-age adult, under the Expand (pure ageing) and Neutral (healthier ageing) morbidity paths. The shaded band is the prevention dividend.
Source. Model simulations.

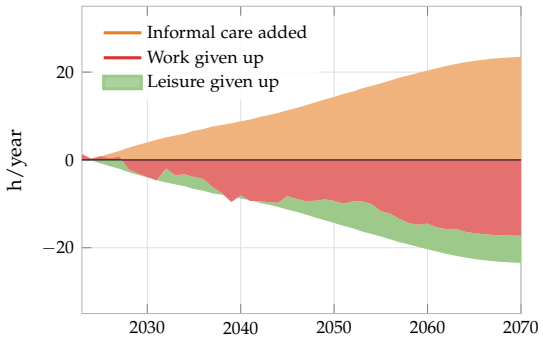
Crowd-out: care as a time tax. Since time is finite, every care hour must be drawn from work or from leisure. The model resolves this margin endogenously, and the way the burden is split is the central result of this section. Figure 6 reports the care-on/care-off split of the burden into forgone work and forgone leisure. Today the split leans towards leisure: of the 1.5 weekly hours, about 0.64 comes out of paid work and 0.89 out of leisure, so 42 percent falls on work. Leisure absorbs most of the burden, since cutting work also reduces current earnings. Work still carries a large share since care concentrates on those near the retirement margin and on lower earners, for whom the forgone wage is smallest.

Figure 6: Care wave: care taken from work and leisure

(a) Levels: today and 2070 under each scenario (h/week)



(b) Change since 2023 under pure ageing (h/year)



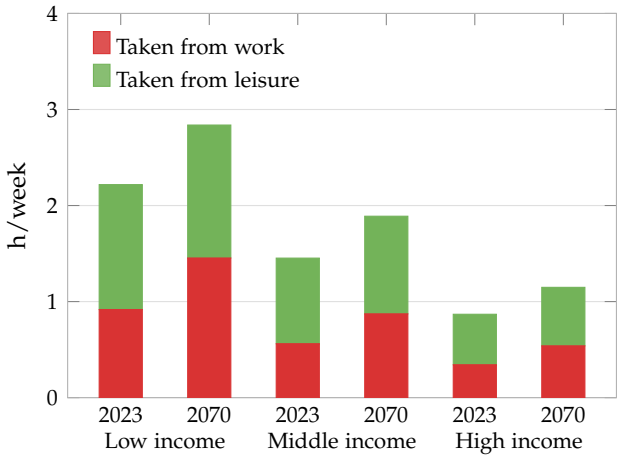
Note. EU5. Care hours per working-age adult (25–64) split into hours taken from market work and from leisure, care-on minus care-off economies in general equilibrium. (a) Today (Neutral path, 2023), 2070 under Neutral and 2070 under Expand. (b) Expand path: additional informal care relative to 2023 (above the axis) and the work and leisure given up to provide it (below the axis), hours per adult per year; where the leisure area falls below zero, leisure is regained.
Source. Model simulations.

The key question is where the additional hours come from. As pure ageing deepens the burden, the scope to reduce leisure is progressively exhausted and the *additional* care hours fall increasingly on work. By 2070 under Expand the burden of 2.0 weekly hours is split evenly in levels (49 percent from work), but the increment relative to today, an extra 0.45 hours per week, is nearly three quarters work

(0.33 against 0.12 from leisure). Under healthier ageing the same mechanism operates on a burden that shrinks rather than grows: the split moves to 49 percent work while the level falls, so that the hours taken from work rise only slightly and it is leisure that recovers. Figure 6b puts the pure-ageing case in motion: cumulating the care-on/care-off difference, by 2070 pure ageing adds about 23 care hours per working-age adult per year relative to today, of which 17 would otherwise have been worked and 6 come from leisure.[2] The marginal care hour is, increasingly, a lost work hour. This is why the economic cost of the care wave grows faster than the burden itself, and it is the precise sense in which, in this model, *care policy is labour-market policy*.

Distribution: who bears the burden, and through which margin. The care wave is not distributionally neutral. Figure 7 splits the burden by permanent-income (productivity) group. The care burden *falls* with income: low earners bear about 2.2 weekly hours today, rising to 2.8 under pure ageing by 2070, middle earners 1.5 rising to 1.9, and high earners 0.9 rising to 1.1.

Figure 7: Care wave: care burden by income group



Note. Care hours per working-age adult (25–64) within each income group, split into hours taken from market work (forgone wages) and from leisure; 2023 from the Neutral path, 2070 under Expand. The burden falls with income since higher earners have healthier parents; the split is the behavioural response.
Source. Model simulations.

The reason is not income *per se* (there is no income–care channel in the model) but composition: higher earners tend to have healthier parents. In the SHARE-derived household types and population weights the model uses (Koo, 2026, Appendix B.3), income and health type are positively correlated, with a population-weighted correlation of about 0.3, and informal care depends on parental health, so the better-off simply face less care need. How the burden is paid then compounds this. Lower earners carry the most care to begin with, and over time they come to pay it in the costlier form: today the work–leisure split is similar across groups (41, 41 and 45 percent from work for the low, middle and high group),[3] but low-income households have the least leisure to reallocate and exhaust it fastest, so by 2070 low earners pay the majority of their much larger burden in *forgone work* (51 percent, up from 41 percent), while middle and high earners hold near 46–47 percent. The care wave thus falls hardest,

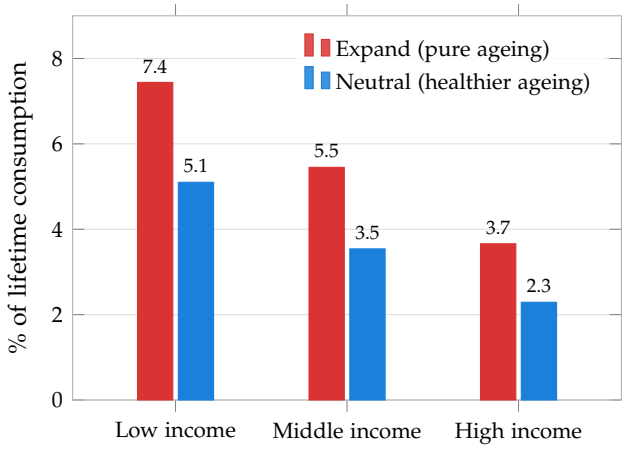
[2]The 2023 split itself depends slightly on the path households foresee: under Expand, where the burden is known to grow, households take a little more of today's care out of leisure (0.62 from work against 0.91 from leisure). Today's split is therefore reported from the Neutral path, and the Expand changes are measured against it.

[3]Within this narrow range high earners sit at the top since they retire later, so more of their caregiving years fall in working life; low earners retire at or near the earliest eligible age, so more of their care is provided in retirement, when it can only be drawn from free time.

and through the more costly margin of forgone earnings, on the households with the lowest incomes. The extensive margin moves little: care-induced earlier retirement, relative to the care-off economy, is 0.04 of a year today and about a tenth of a year by 2070 under either morbidity path (Figure 9b), so the cost runs predominantly through hours rather than labour-force exit.

The same regressivity shows up, even more sharply, in a consumption-equivalent welfare measure. We compute a newborn-cohort CEV: the uniform percentage by which lifetime consumption in the care economy must be raised to make a newborn of a given permanent-income type as well off as in an otherwise-identical economy without the informal-care requirement, holding the equilibrium allocation fixed.[4] The welfare cost is large, roughly 2.5 to 8 percent of lifetime consumption, several times the aggregate output loss, since it is borne in leisure and lifetime utility rather than in measured GDP, and it is steeply regressive: for a newborn entering in 2070 under pure ageing it reaches 8.2 percent for the low-income group, 6.0 percent for the middle and 4.1 percent for the high group, so the poorest bear twice the welfare cost of the richest. Healthier ageing delivers a sizeable, and also progressive, dividend: it lowers the same-cohort cost to 5.5, 3.9 and 2.5 percent respectively (Figure 8), a reduction of 2.8, 2.1 and 1.5 percentage points of lifetime consumption, largest, again, for the low-income group. For the cohort entering today the cost is 7.4, 5.3 and 3.5 percent under Expand and 6.0, 4.1 and 2.6 percent under Neutral: the care wave is already a first-order welfare cost for today's entrants, and pure ageing makes it grow over the coming half-century while healthier ageing makes it recede.

Figure 8: Care wave: welfare cost by income group



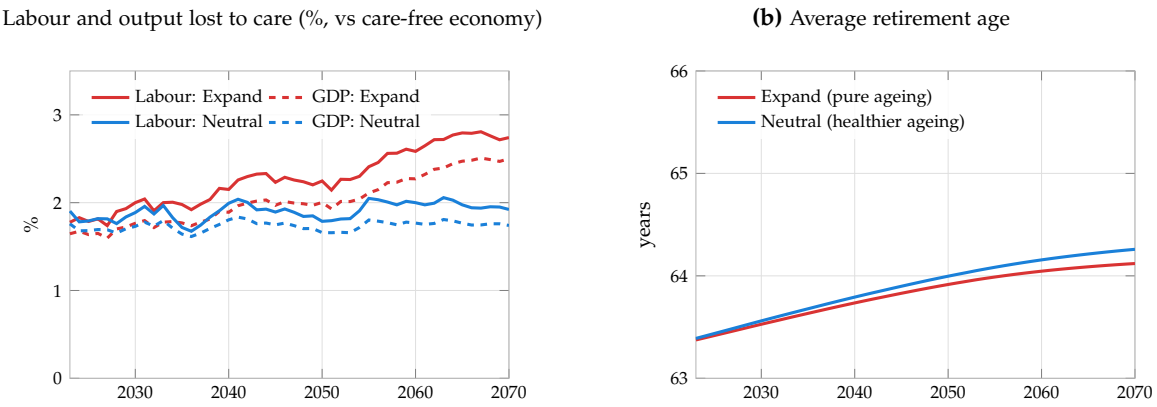
Note. CEV (percent of lifetime consumption) that compensates a household entering in 2070 for the informal-care obligation, care-on against care-off economy, by permanent-income group, under Expand (pure ageing) and Neutral (healthier ageing). The difference between the bars is the prevention dividend.
Source. Model simulations.

The macroeconomic cost. The individually optimal choices of heterogeneous households aggregate into a macroeconomic cost. Comparing otherwise-identical economies with and without the informal-care requirement (Figure 9), informal care lowers EU5 effective labour supply by about 1.9 percent and output by 1.8 percent in 2023. Under healthier ageing the loss stays at that level throughout, 1.9

[4]Since the period felicity is Cobb–Douglas-in-CRRA with an age-varying consumption weight $\phi(j, x)$, a uniform consumption scaling does not factor into a closed form; the CEV is obtained by a one-dimensional root-find on the lifetime-utility identity, type by type, and aggregated within income group by population weight. The measure is reported for newborns (lifetime utility evaluated at the entry age), the standard veil-of-ignorance object.

percent of labour and 1.7 percent of output in 2070, since the burden per worker does not grow.

Figure 9: Care wave: macroeconomic cost and retirement



Note. EU5, 2023–2070. (a) Percentage gap between the care-off and care-on equilibria, $(X_{\text{off}} - X_{\text{on}})/X_{\text{off}}$, for EU5 effective labour (solid) and GDP (dashed), under Expand and Neutral morbidity. (b) Population-weighted average effective retirement age along the care-on transition; the care-induced component (care-on minus care-off) is 0.04 years in 2023 and 0.13 years in 2070 under Expand, 0.04 and 0.11 under Neutral.
Source. Model simulations.

Under pure ageing it rises to 2.7 percent of labour and 2.5 percent of output by 2070, so that the care wave adds about three quarters of a percentage point of output to the cost of ageing; the path starts slightly lower (1.7 percent in 2023) as households that foresee the heavier burden shield work in the early years, and climbs steadily from the mid-2030s as the baby-boom parents reach the ages of dependency. The output loss runs marginally below the labour loss since the capital stock adjusts only partially within the horizon. This cost is largely invisible in the public accounts, since it is paid in unpaid caregiving time rather than as a budget line; economically, though, it acts like a tax on work, shrinking employment, output and the contribution base much as a payroll tax of several percentage points would.

The care-on/care-off comparison is the right object for this cost since the raw transition blends the care burden with everything else that ageing does. Along the baseline of Section 3.1 effective labour falls by 13 percent by 2070, of which the growth of the care wave accounts for about one point under pure ageing and none of the *growth* under healthier ageing; the rest is the shrinking working-age population and the response of hours and retirement to the rising contribution wedge, which depends on the pension closure rule (Section 4) rather than on care. Reading the cost of care off the raw labour path would therefore attribute to it whatever the pension rule does, whereas the difference between the care-on and care-off economies isolates the same causal object under any closure.

4 Counterfactual Pension Reforms

The care wave of Section 3.2 unfolds on top of a pension system that must itself adapt to ageing, and the way it adapts shapes the labour market, the capital stock, and the welfare of every generation. This section applies the calibrated model to pension reform and separates two margins. The first is the *size* of the PAYG pillar: what happens if the public pension is phased down, to half of its current level or to zero, and households are left to provide for retirement out of their own saving (Section 4.1, the experiment of BB-Future Digest 17). The second is the *rule* by which a PAYG system of given size absorbs ageing: DB, which holds the pension and lets the contribution rate rise, or DC, which holds the contribution rate and lets the pension fall (Section 4.2, the experiment of BB-Future Digest 18).

Each experiment is a counterfactual on the same 2023-calibrated economy, announced in 2023 and measured against the continuation of current rules. "Current rules" means the 2023 closure rules of the five countries, $\theta = (0.5, 1, 0, 0, 0)$, held fixed: France holds its benefit ratio and lets contributions rise, Italy, Poland and Sweden hold contributions and let the benefit fall, and Germany does half of each (Section 3.1).[5] Since the care obligation is exogenous to pension policy (care hours are pinned by parental health), each experiment can ask a question that is specific to this analysis: not whether pension reform changes how much care is given, but whether it changes how caregivers make room for it, and whether care moves their retirement date.

4.1 Phasing out PAYG pensions

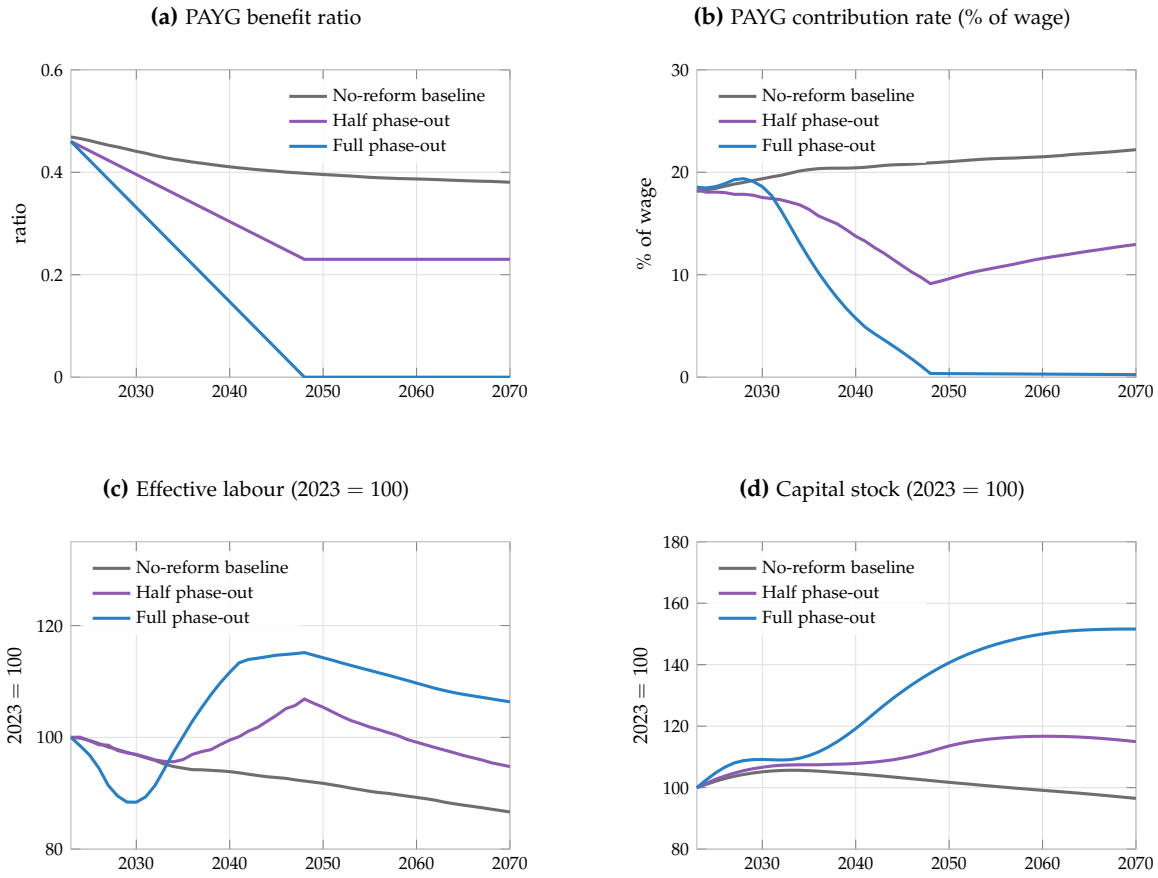
The experiment. The experiment operates on the replacement rate of the PAYG pension, which all five systems share. Each country's 2023 replacement rate is reduced linearly over 25 years (2023–2048), to one half of its 2023 level (the *half phase-out*) or to zero (the *full phase-out*), and then held. The contribution rate is not a separate lever: it balances the PAYG budget every year and falls with the benefit, so under the full phase-out it reaches zero in 2048. The reform is a surprise in 2023 and applies to pensions in payment, so rights already accrued are cut too. No funded account is introduced: the part of the contribution that is no longer needed is simply not levied, the after-tax wage rises, and households decide how much of it to save. The rise in saving reported below is therefore a response to losing the pension, not a rule of the reform, and the transition costs are upper bounds on what a reform with a funded pillar or protection for accrued rights would impose. They also abstract from risk: the model has no capital-return risk, which favours private saving relative to PAYG and leaves out the diversification argument for a mixed system, so the phase-out results are best read as the return to shifting retirement provision to a safe asset. Two details of the half phase-out matter for reading the figures. After 2048 its benefit is held at half the 2023 level with the contribution rate adjusting, so it is a DB system at half the current benefit; in the DC countries the no-reform benefit keeps falling while the reformed one does not, so the relative cut narrows over time (in Poland the reformed benefit is 0.69 of the no-reform benefit in 2048 and 0.80 in 2070). And as the contribution rate absorbs ageing after 2048, it rises again, from 9.1 percent of the wage in 2048 to 13.0 in 2070.

Macroeconomic effects. Table 3 reports the EU5 values in 2070 under current rules and the two phase-outs, and Figure 10 shows their paths from 2023. Under the full phase-out the contribution rate falls from 18 percent of the wage to zero, the net wage rises, and people work more: effective labour ends 2070 at 106 percent of its 2023 level instead of 87 percent under current rules, 23 percent higher. With no public pension to count on, households save far more, and the capital stock ends up 57 percent larger than in the baseline (152 against 97 on the 2023 index). The half phase-out does the same, about half as strongly: labour 9 percent and capital 19 percent above the baseline in 2070.

Two features of the labour panel deserve a note. Labour dips below the baseline for about a decade after the announcement, by up to 9 percent under the full phase-out around 2029. An hour of work earns a wage and pension rights; for anyone retiring after 2048 the full phase-out makes those rights worthless at once, while the contribution cut arrives only as the benefit is phased down. Workers under 40 therefore cut their hours immediately, and the near-retired in France and Sweden, where an early pension is available, take the pension while it is still worth something. From about 2034 the falling contribution dominates. The second feature is that the long-run gain comes from working longer, not harder: under the full phase-out every household type works to 72, the upper end of the

[5] Base demographics, Neutral morbidity, care-on, unless stated otherwise. Welfare is measured by the CEV: the percentage change in a household's consumption, over its whole life for cohorts entering after 2023 and over its remaining life for cohorts alive in 2023, that would make it as well off under current rules as under the reform; positive is a gain from the reform.

Figure 10: PAYG phase-out: macroeconomic paths



Note. EU5, 2023–2070; half and full phase-out against current rules. Population-weighted EU5 averages of the benefit ratio and contribution rate; effective labour and capital are EU5 aggregates indexed to 2023. The reform is announced in 2023 and phased in over 2023–2048; the half phase-out holds the benefit at half its 2023 level after 2048, so its contribution rate rises again with ageing.
Source. Model simulations.

Table 3: PAYG phase-out: EU5 aggregates in 2070

	Current rules	Half phase-out	Full phase-out
PAYG contribution rate (% of wage)	22.2	13.0	0.3
PAYG benefit ratio	0.38	0.23	0.00
Effective labour (2023 = 100)	86.6	94.8	106.4
Capital stock (2023 = 100)	96.5	115.0	151.6

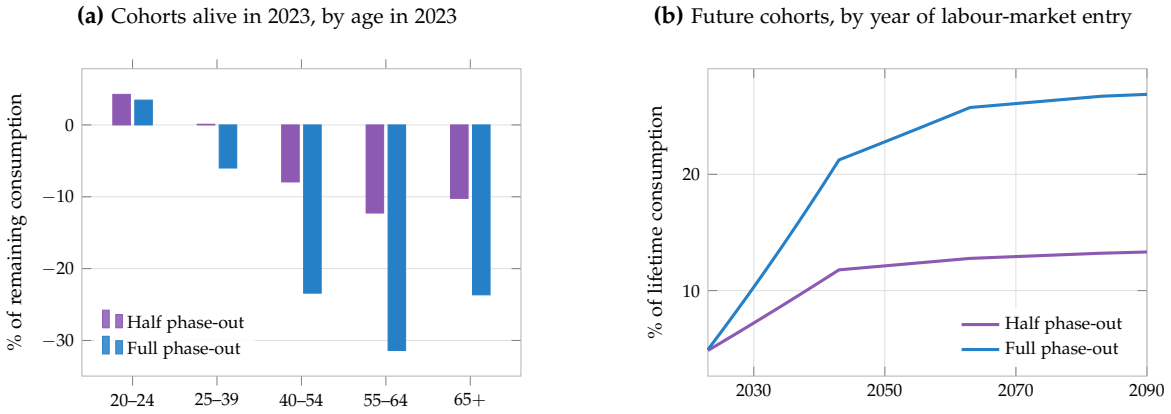
Note. Year 48 of the transition (2070); the 2023 values are 18.1 percent, 0.47, 100 and 100. Base demographics, Neutral morbidity, care on.
Source. Model simulations.

model's retirement window, while workers under 40 work about a tenth less than under current rules. Under the half phase-out labour peaks at 16 percent above the baseline when the ramp ends in 2048 and fades to 9 percent by 2070, as the cohorts surprised in mid-career, who work longest, are replaced by cohorts that have saved for the half pension and retire earlier.

Who bears the cost. The economy is richer, but the gain is a transfer across generations (Figure 11, Table 4). Future generations inherit a lightly taxed, capital-rich economy: the cohort entering the labour market in 2070 gains 13 percent of lifetime consumption at the half phase-out and 26 percent at the full one, and the gains are still rising slowly for later entrants. The generations alive in 2023 lose what they were promised, and those closest to retirement, with too few working years left to rebuild,

lose the most: 12 percent of remaining consumption at the half and 31 percent at the full phase-out for those aged 55–64, with today's retirees (10 and 24 percent) and the 40–54s (8 and 23 percent) not far behind. Only today's labour-market entrants come out ahead, by about 4 percent under either reform, since they face the full 25-year ramp of falling contributions with a whole career ahead. The reform is thus opposed by every generation alive today except the youngest; an actual reform would need transitional arrangements for today's cohorts, through a slower phase-out, a funded pillar, or protection for those already retired. Honouring accrued rights and financing them by contributions would move the cost from today's retirees and near-retirees to workers in mid-career, who would then carry losses of the order of one tenth of remaining consumption.

Figure 11: PAYG phase-out: who gains and who loses



Note. CEV against current rules, in percent of remaining-life consumption (a) and of lifetime consumption (b), population-weighted across countries and household types.
Source. Model simulations.

Table 4: PAYG phase-out: welfare by generation (CEV, %)

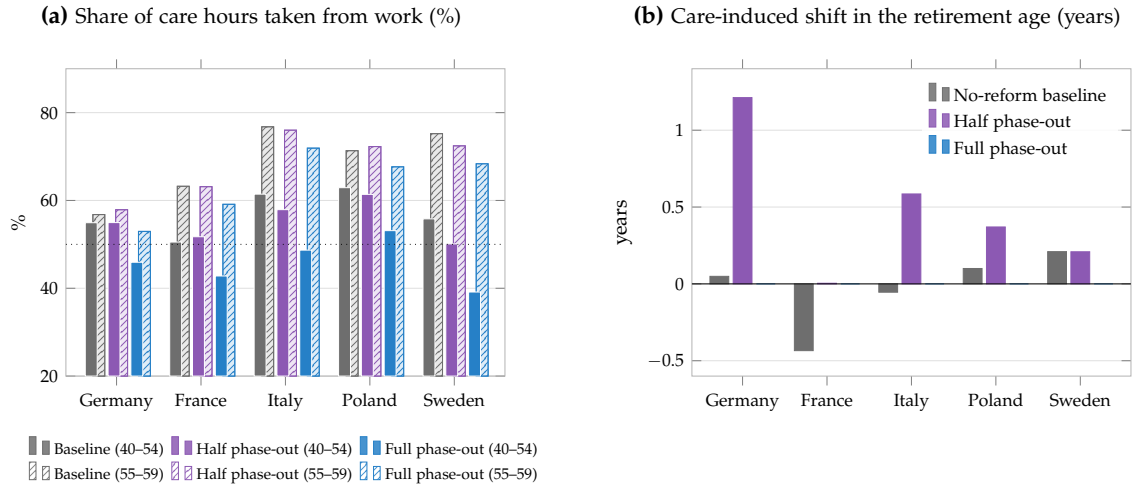
Generation	Half phase-out	Full phase-out
Alive in 2023, by age in 2023 (remaining consumption)		
Entrants (20–24)	+4.3	+3.5
Younger (25–39)	+0.1	−6.0
Mid-career (40–54)	−7.9	−23.4
Near retirement (55–64)	−12.3	−31.4
Retirees (65+)	−10.2	−23.7
Entering after 2023, by entry year (lifetime consumption)		
2023 entrants	+4.9	+4.9
2048 entrants	+12.0	+22.3
2070 entrants	+12.9	+26.1

Note. Population-weighted EU5 averages. The 2023 entrants appear in both blocks: in the first as the youngest band of the living, in the second as the first post-announcement cohort.
Source. Model simulations.

What the reform means for caregivers. Care hours are set by the health of the care recipient, so the reform cannot change how much care is given. It changes how caregivers pay for it, and whether caring moves the retirement date (Figure 12). Under current rules, prime-age caregivers (40–54) in 2070 take 51 to 63 percent of their care hours out of market work rather than leisure, the crowd-out of Section 3.2. Under the full phase-out, with a higher net wage and no pension to fall back on, they protect their work hours and the share falls to 39 to 53 percent; late-career caregivers (55–59)

move the same way but from a higher level (57 to 77 percent under current rules, 53 to 72 under the full phase-out). The half phase-out moves the shares by only a few points. For caregivers who can retire, panel (b) compares every household aged 55–64 in 2070 with and without its care obligation at the same wages and interest rates. Under current rules care moves the retirement date noticeably only in France, where the pension can be drawn early and caregivers leave about five months before non-caregivers. Under the half phase-out, caregivers in Germany, Italy and Poland stay on longer than non-caregivers, by several months: having worked less in their late 50s, they reach 60 with fewer assets and pension rights and cannot afford to leave. Under the full phase-out everyone works to 72, so the margin disappears.

Figure 12: PAYG phase-out: caregivers by country



Note. 2070. (a) Share of care hours taken from market work rather than leisure, care-on minus care-off at the reform's prices, caregivers aged 40–54 (filled) and 55–59 (hatched); the dotted line is an even split. (b) Retirement age with the care obligation minus without it, households aged 55–64, at the same prices; negative means care brings retirement forward. Household types whose exit age moves by six years or more between the two economies (lifetime utility flat within one percent of consumption) are excluded from the care-weighted means. Under the full phase-out every type works to 72, so the shift is zero by construction.
Source. Model simulations.

The reform does not cost caregivers more than others of their age. Re-solving every caregiving household aged 40–64 in 2023 on the reform's prices with its care obligation and, as a twin, without it, from the same 2023 assets and pension points, gives the same CEV to within a fraction of a point. The reform acts on wages and pensions in proportion to each household's own earnings, whereas the care obligation is a fixed claim on time; with the preferences of Section 2 the CEV depends only on the proportions by which consumption and leisure change, and caregivers keep those proportions equal to their twins' by working more and taking the care out of leisure. The two burdens are additive: a 55–64-year-old caregiver bears the reform (32 percent under the full phase-out) and the care (5 to 6 percent of remaining consumption at these ages), and the reform neither adds to nor relieves the latter. Where caregivers are worse off is in time and saving. Under the full phase-out in 2070, caregivers aged 55–64 work nine more hours a week than today, still give five hours of care, and end with nearly three hours a week less leisure than non-caregivers, against a few minutes under current rules; and they save about 2 percentage points of income less than they would without the obligation at 40–54 and nearly 4 at 55–59, a gap that the reform leaves in place even as private saving replaces the pension. The case for supporting caregivers in their late 50s and 60s in any reform that extends working lives rests on this double burden, not on a larger welfare loss.

4.2 Risk sharing: DB versus DC

The experiment. Where the phase-out changes how much the public system promises, the risk-sharing rule changes who bears the demographic risk within a PAYG system of unchanged size, without building any capital by design. As populations age, the 2023 promise costs more than the 2023 contribution rate raises, and the closure rule θ decides who closes that gap: under DB ($\theta = 1$) the benefit ratio is held at its 2023 level and the contribution rate rises; under DC ($\theta = 0$) the contribution rate is held and the benefit ratio falls; at intermediate θ workers carry the share θ of the gap and retirees the rest. Starting from the calibrated mix, we move all five countries to one rule, *all-DB* ($\theta \to (1,1,1,1,1)$) or *all-DC* ($\theta \to (0,0,0,0,0)$), and below trace the intermediate points $\theta \in \{0.25, 0.5, 0.75\}$. Since a change in the rule can be legislated quickly, the reform is announced in 2023 and phased in over five years (2023–2028); the new rule also applies to pensions in payment. As Italy, Poland and Sweden already follow DC and France DB, all-DC is a real change only for Germany and France, and all-DB for every country except France.

Macroeconomic effects. Table 5 reports the pension instruments in 2070 by country under current rules, all-DB and all-DC, and Figure 13 shows the EU5 paths from 2023. Under all-DB the contribution rate climbs from 18 to 28 percent of the wage by 2070 to hold the benefit ratio at 0.46; the burden of ageing falls on workers. Under all-DC the contribution rate stays at 19 percent and the benefit ratio erodes from 0.47 to 0.33; the burden falls on retirees. Country by country, the reform matters most where it changes the rule: under all-DB the contribution rate rises by 11 points in Italy and 13 in Poland by 2070 relative to current rules (to 34 and 28 percent), and by 6 in Sweden; under all-DC the French benefit ratio falls from 0.52 to 0.38 and the German one from 0.36 to 0.31, while the French contribution rate stays at 22 percent instead of climbing to 31.

The contribution rate does not jump in 2023, although the rule is switched within five years, since the rule only closes a gap and in 2023 there is none: the 2023 contribution rate raises exactly what the 2023 promise costs. The gap opens with the large cohorts retiring in the 2030s and 2040s, so the DB contribution rate follows a curve (23 percent by 2035, 28 by 2070) and the five-year phase-in barely shows.

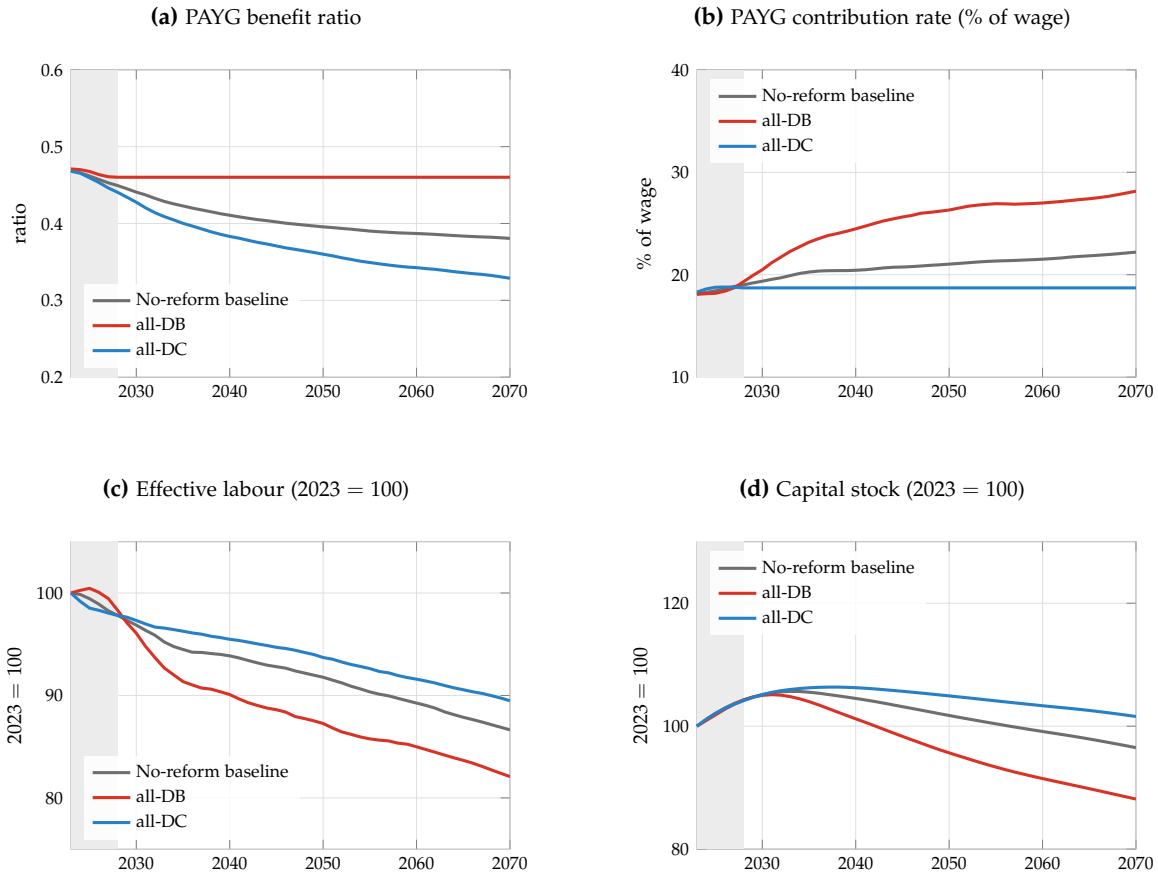
Table 5: DB versus DC: pension instruments in 2070

	DE		FR		IT		PL		SE		EU5	
	τ^p	b	τ^p	b	τ^p	b	τ^p	b	τ^p	b	τ^p	b
2023 (baseline)	15.9	0.42	19.7	0.52	22.5	0.54	15.0	0.40	11.9	0.34	18.1	0.47
2070, current rules	19.2	0.36	31.4	0.52	22.5	0.36	15.0	0.25	11.9	0.24	22.2	0.38
2070, all-DB	22.6	0.41	31.8	0.52	33.8	0.53	27.9	0.38	17.9	0.33	28.2	0.46
2070, all-DC	16.2	0.31	21.5	0.38	22.5	0.36	15.0	0.25	11.9	0.24	18.7	0.33

Note. PAYG contribution rate τ^p in percent of the wage and benefit ratio b (average pension over the average wage). Current rules are $\theta = (0.5, 1, 0, 0, 0)$: France is already DB, Italy, Poland and Sweden already DC, so those cells differ from current rules only through union-wide prices. EU5 is the population-weighted average; the 2023 row is the baseline of Table 2. Neutral morbidity.
Source. Model simulations.

Although the rule builds no capital by design, the two reforms move the economy in opposite directions, through two channels that point the same way. The first is labour. In the model an hour of work is rewarded by the after-tax wage plus the value of the pension rights it earns, valued at the future benefit rule. DB keeps the benefit ratio at 0.46 instead of letting it erode to 0.38, so a pension point is worth about a fifth more to anyone with decades of accrual ahead while the higher contribution has not yet arrived: the young work more in the first years, which is the brief rise of labour above the baseline in 2024–28 (up to 1.2 percent) in panel (c). Once the contribution rate climbs, the lower

Figure 13: DB versus DC: macroeconomic paths



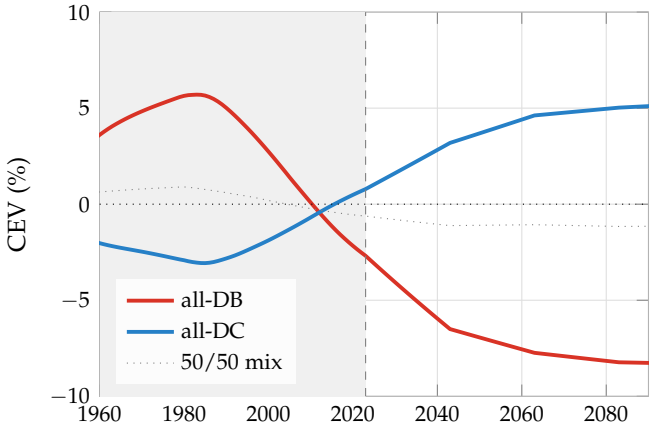
Note. EU5, 2023–2070; all-DB and all-DC against current rules. Population-weighted EU5 averages of the benefit ratio and contribution rate; effective labour and capital are EU5 aggregates indexed to 2023. The reform is announced in 2023 and phased in over 2023–2028 (shaded). Under all-DB the benefit is held and the contribution rate rises; under all-DC the contribution rate is held and the benefit falls. Neutral morbidity; the Expand paths are in Figure 17.
Source. Model simulations.

after-tax wage dominates for everyone past mid-career, and the near-retired, better provided for, work less and retire earlier: labour ends 2070 5 percent below the baseline. Under DC the mirror image: the older cohorts work more to replace the less generous pension, and labour ends 3 percent above. The second channel is capital. Retirement is financed by the pension plus own assets, so a secure, higher pension lowers the assets households accumulate (9 percent below the baseline by 2070) and a less generous one raises them (5 percent above); the capital paths coincide for a decade as the early flow responses offset, and diverge once the tax and benefit gaps are large. Output in 2070 is 6 percent lower under all-DB and 4 percent higher under all-DC than under current rules. The effects are smaller than under the phase-out since the pension is re-set, not removed, but they are not negligible: the choice of rule moves 2070 output by an amount of the same order as the loss that ageing itself imposes under current rules (11 percent, Section 3.1).

Who gains and who loses. The two rules split the generations along a clean line (Figure 14, Table 6). For a household alive in 2023 the reform changes the contribution rate over its remaining working years and the benefit over its retirement, weighted by how many years of each it has left. Under all-DB the over-40s get the full benefit protection and pay the higher rate for a few years only: the gain peaks at 5.7 percent of remaining consumption for those who entered the labour market in the early 1980s (today's early 60s), today's retirees gain 4.4, and the 1990s entrants less. Those who entered after 2010

lose, up to 7.9 percent for the 2070 entrants and 8.3 in the long run, as they pay the higher contribution for a whole career and inherit a smaller capital stock. All-DC is the mirror image with a smaller swing: today's over-40s lose 2 to 3 percent, the cohorts entering after 2070 gain 4.8 to 5.2. The two profiles cross zero close together, at the 2010 entrants under DB and the 2015 entrants under DC, so those aged 25–39 in 2023 lose a little under either rule: enough working years left to pay under DB, enough retirement years to feel the erosion under DC. Today's 20–24-year-olds are the one living group on the future side of the line, losing 2.3 under DB and gaining 0.6 under DC.

Figure 14: DB versus DC: welfare by year of labour-market entry



Note. EU5; all-DB and all-DC against current rules. CEV against current rules, in percent of remaining-life consumption for cohorts alive in 2023 (shaded; entry year before 2023) and of lifetime consumption for cohorts entering after 2023; population-weighted EU5 averages. The thin dotted line is the 50/50 mix ($\theta = 0.5$ everywhere).
Source. Model simulations.

Table 6: DB versus DC: welfare by generation (CEV, %)

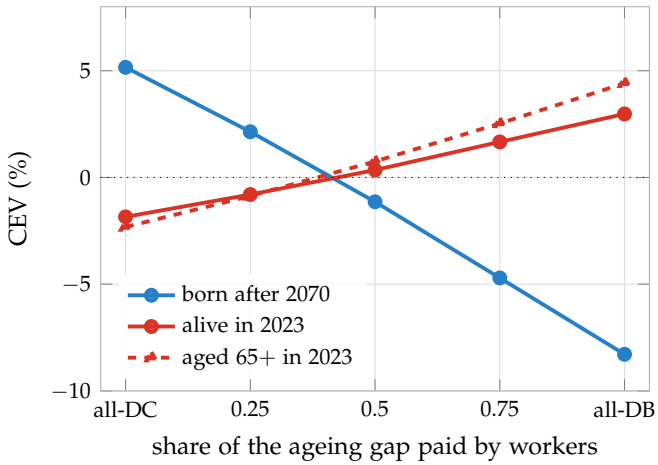
Generation	all-DC	$\theta = 0.25$	$\theta = 0.5$	$\theta = 0.75$	all-DB
Alive in 2023, by age in 2023 (remaining consumption)					
Entrants (20–24)	+0.6	+0.1	−0.6	−1.3	−2.3
Younger (25–39)	−0.6	−0.4	−0.2	−0.1	−0.1
Mid-career (40–54)	−2.3	−1.0	+0.4	+2.0	+3.7
Near retirement (55–64)	−3.0	−1.2	+0.8	+3.2	+5.6
Retirees (65+)	−2.3	−0.9	+0.8	+2.5	+4.4
All alive in 2023	−1.8	−0.8	+0.3	+1.7	+3.0
Entering after 2023, by entry year (lifetime consumption)					
2023 entrants	+0.8	+0.2	−0.6	−1.5	−2.7
2043 entrants	+3.2	+1.2	−1.1	−3.7	−6.5
2070 entrants	+4.8	+2.0	−1.1	−4.4	−7.9

Note. Population-weighted EU5 averages. Under θ workers carry the share θ of the gap between the cost of the 2023 promise and what the 2023 contribution rate raises, uniformly in all five countries; all-DC is $\theta = 0$, all-DB $\theta = 1$. Five-year phase-in from 2023; Neutral morbidity.
Source. Model simulations.

The dial between the two rules. One could also think of a mix of DB and DC, like Germany's hybrid. Figure 15 traces the welfare of today's and future cohorts as the share of the ageing gap carried by workers moves from zero (all-DC) to one (all-DB). Both lines are close to straight, since the rule is linear in θ and the model is nearly linear for these magnitudes: each quarter-step towards DB gives today's cohorts about 1.2 percent of remaining consumption and costs the cohorts born after 2070

about 3.4 percent of lifetime consumption; today's retirees, who pay none of the contribution, gain most from each step (4.4 percent at all-DB). The two lines cross near $\theta \approx 0.42$, which is the effective share of the current mix (Germany 0.5, France 1, the three DC countries 0); both pass through zero there since both are measured against it. The crossing is the status quo, not an optimum: every step away from it creates a winner and a loser, and no mix makes both groups better off. A mix shares the cost of ageing between the generations but does not make it go away. Weighing the two groups by a generational discount rate, DC is preferred at discount rates up to about 3 percent a year and DB from about 4 percent on; full DB is never preferred below 4 percent. The policy reading is that the observed drift towards DC is the direction that favours future generations, and by a larger margin than it costs the present (the future line is nearly three times as steep), but it is not a free move: it asks today's and near-term retirees to accept smaller pensions, so a credible package pairs the move to DC with transitional protection for the cohorts closest to retirement.

Figure 15: DB versus DC: today's against future cohorts

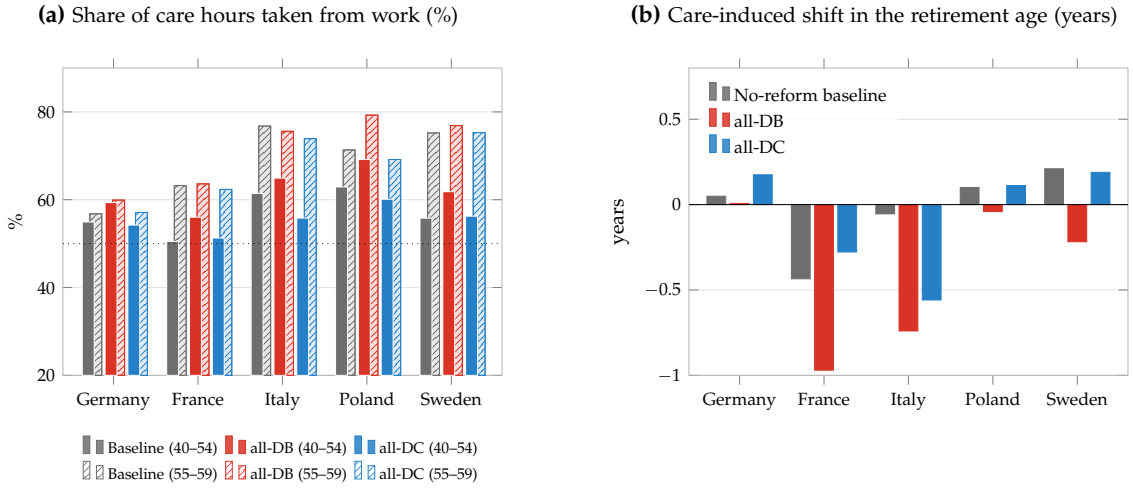


Note. EU5. CEV against current rules as a function of the uniform closure parameter θ, the share of the ageing gap carried by workers: cohorts born after 2070 (lifetime consumption), all cohorts alive in 2023 and those aged 65+ in 2023 (remaining consumption). Both groups are measured against the current mix, whose effective share is about 0.42, so both lines pass through zero there.
Source. Model simulations.

What the rule means for caregivers. As under the phase-out, neither rule changes how much care is given, only how caregivers make room for it (Figure 16). Under all-DC the pension is relatively low and retirement must be financed from work and saving, so caregivers protect their work hours: for the 40–54s the share of care taken from work falls in Germany, Italy and Poland and barely moves in France and Sweden (51–63 percent under current rules, 51–60 under all-DC). Under all-DB the household is better provided for in retirement and each hour of work brings home less, so caregivers can afford to let care reduce their working hours: the share rises in all five countries, to 56–69 percent. The moves are small, a few points of the share, since the underlying shifts are 0.05 to 0.15 hours a week on a care load of one to four hours; what moves them is affordability, since pension rights depend on hours under both rules. The retirement margin responds more visibly, although the country detail is fragile (Appendix A), so we discuss only its direction. Under all-DB, caregivers aged 55–64 retire earlier than non-caregivers in France, Italy and Sweden (by about nine months in Italy, where DB is a real change) and hardly differently in Germany and Poland: DB raises the pension per point and lowers the net wage, so exit ages shift earlier and, with an early exit affordable, care leads caregivers to retire earlier still. Under all-DC care brings retirement forward in France and Italy, by three to seven

months, and delays it slightly, by one to two months, in Germany, Poland and Sweden, where exit ages are closer to the upper end of the model's window. Caregivers gain or lose from either rule as much as non-caregivers of the same age (55–64: +6.6 percent under DB, +6.6 without the obligation; −2.7 under DC, −2.7 without), for the reason given under the phase-out; what differs is where they find the time for care. Under DC those aged 55–64 work about three hours a week more in 2070 than today and give up leisure, ending with half an hour a week less than non-caregivers; under DB they work nearly four hours a week less and have slightly more leisure than non-caregivers.

Figure 16: DB versus DC: caregivers by country

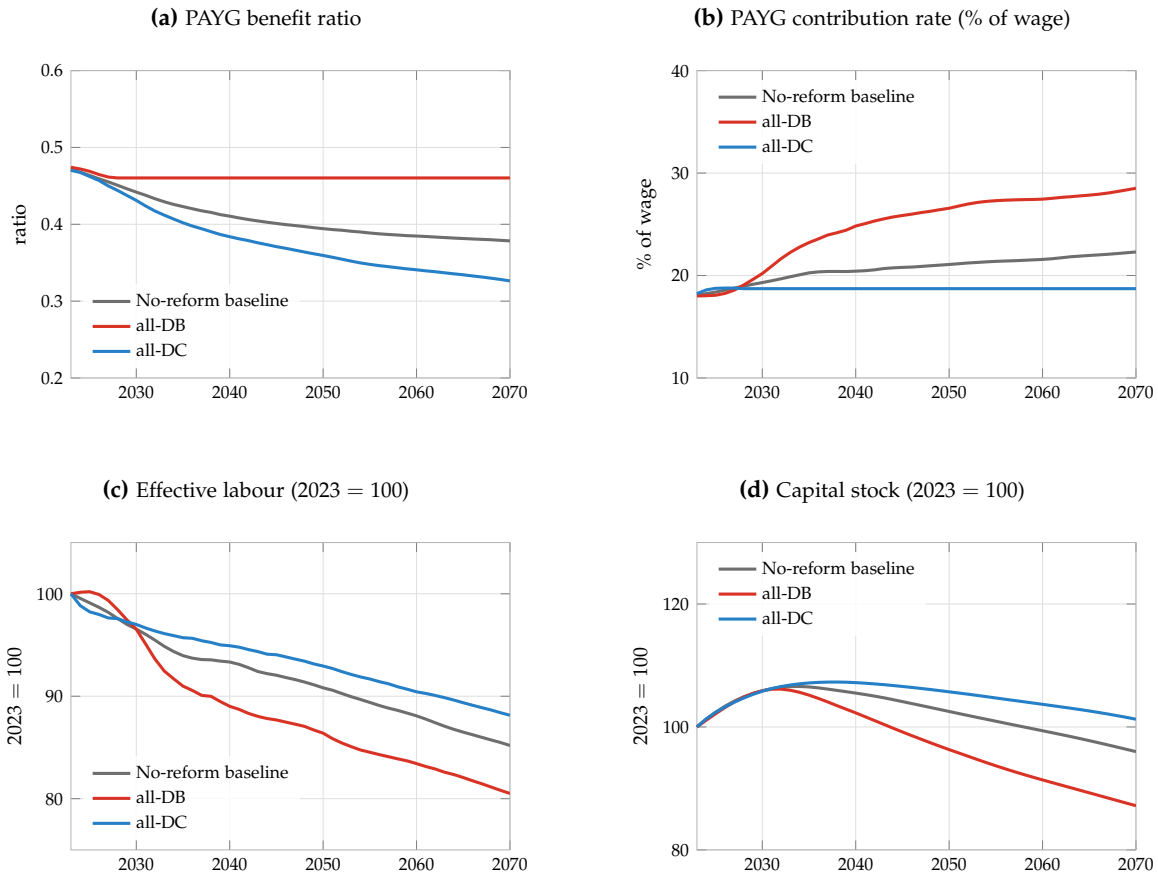


Note. 2070. As Figure 12, for current rules, all-DB and all-DC. For Italy, Poland and Sweden all-DC is the current rule and for France all-DB is, so those bars differ from current rules only through union-wide prices; the substantive contrasts are DB for Italy, Poland and Sweden and DC for Germany and France.
Source. Model simulations.

Robustness to pure ageing. The rule interacts with morbidity in principle, since it operates on the benefit–tax split that the dependency ratio drives, but the interaction is quantitatively small (Figure 17). Under Expand morbidity the 2070 contribution rate under all-DB is 28.5 percent (Neutral: 28.2), the benefit ratio under all-DC 0.33 in both, and output in 2070 relative to the scenario's own baseline is −6.7 percent under all-DB and +4.7 under all-DC against −6.4 and +4.5 under Neutral. The cost of the care obligation itself varies little with the pension design: 1.7 to 1.8 percent of 2070 output under Neutral, and 2.3 to 2.8 percent under Expand, highest under all-DB, where care reduces working hours the most (Section 3.2). Who gains and who loses from the rule is therefore robust to the health outlook; what the health outlook changes is the size of the cost, not who bears it.

Comparing the two levers. Read together, the two experiments order the instruments. Moving the rule towards DC captures, for the cohorts of the future, a gain of the same sign as the phase-out at a small fraction of the cost to the present: the 2070 entrants gain 4.8 percent of lifetime consumption under all-DC against 26 under the full phase-out, while today's 55–64-year-olds lose 3.0 percent of remaining consumption instead of 31. The rule is therefore the cheaper first move in the direction the future would choose, and the size of the promise the more expensive second one; a package that combines a smaller PAYG pillar with private saving, closest to the Swedish design, needs transitional arrangements for the cohorts that cannot rebuild their retirement provision.

Figure 17: DB versus DC: macroeconomic paths under Expand morbidity



Note. EU5, 2023–2070. As Figure 13, under Expand morbidity; each reform is measured against the Expand baseline.
Source. Model simulations.

5 Conclusions and Policy Relevance

This paper has solved the BB-Future OLG model of Koo (2026) along the transition from 2023 to 2070 under the BB-Future demographic and health projections, and used it within one consistent framework to ask what ageing does under current rules, what the care wave adds, and how the two main pension-reform margins interact with it.

Three messages are as follows. First, the care wave is a time tax on the working-age population, concentrated on people in their 50s and early 60s. Its economic cost grows faster than the care burden itself, since the leisure of heavy caregivers is exhausted first and the additional care hours increasingly come out of market work; and it is regressive, since lower earners have less healthy parents and pay more of their burden in forgone wages. Whether longevity gains come as healthy years or as years of dependency matters a great deal: healthier ageing turns a growing burden into a shrinking one, and its dividend is largest for the least well off. Second, pension reform is a decision about which generation pays for ageing. Every lever that favours future cohorts, whether a smaller PAYG promise or a rule that holds contributions and lets benefits adjust, asks more of the generations alive today, and no setting makes every generation better off; changing the rule is the cheaper first step, and shrinking the promise the more expensive second one. Third, pension rules are care policy. They do not change how much care is given, nor do they cost caregivers more than others of their age, but they determine the margin through which caregivers adjust: a less generous pension leads them to protect their working hours and take the care out of leisure, whereas a more generous one lets care reduce their working hours and tends to bring their retirement forward.

For policy, the results point in a consistent direction. Ageing and the care wave weigh on growth, the care wave falls hardest on low-income households, and every pension lever that favours the future asks more of the present. Prevention, support for working caregivers and the transition design of pension reform are therefore complements: healthier ageing reduces the cost, caregiver support decides who can afford to keep working while paying it, and the pension rule decides which generation pays the rest.

The framework can be extended in several directions, each suited to a different set of questions. Making the choice between formal and informal care endogenous would allow care-policy reforms, such as formal-care provision or cash benefits, to be evaluated alongside the pension reforms studied here. A richer treatment of pension entitlements and of capital-return risk would sharpen the analysis of retirement timing and of the balance between public and private provision. Finally, the demographic variants of the BB-Future projections and the Compress morbidity path would show how the results change with the demographic and health outlook.

Appendices

A Relation to the BB-Future Digests and Robustness

Relation to the digests. The results on the care wave and on the two pension experiments were first reported in BB-Future Digests 4, 17 and 18. The model has been refined since, and the numbers in this paper therefore differ from those in the digests, in levels more than in direction; no conclusion of the digests changes. The results reported here are the final version and replace those in the digests.

The retirement margin. The retirement decision is discrete and, for most household types, flat: retiring a year away from the optimum costs less than a quarter of a percent of lifetime consumption. A small change in resources, such as the wage difference between the care-on and care-off economies, can therefore tip a type across a year, and for a few low-productivity, heavy-care types across many years. The care-induced shifts in exit ages of Section 4 are care-weighted means over households aged 55–64, from which types whose exit age moves by six years or more between the two economies are excluded; they carry about 9 percent of the German care hours under the half phase-out and none in the other cells. Under the full phase-out every type works to 72, the upper end of the retirement window, so that cell shows no care-induced shift.

Pension expectations of low-productivity households. A household's pension depends on the average pension points it expects to earn, which the solver makes consistent with the points its plan actually earns. For a small group of low-productivity German households in poor health this consistency can fail, since the expected pension and the implied work effort feed on each other. A retirement age is therefore accepted only if its plan is consistent. This removes the problem from every experiment except the half phase-out, where affected households remain among the cohorts of working age in 2023 (about 1.8 percent of EU5 hours in 2023, falling to zero by 2060); their effect on the reported results is at most one to one and a half index points on effective labour and 0.1 points on the welfare measures.

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