

Years and Dollars

Longevity and the Black–White Wealth Gap in the United States

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Abstract

Wealth and longevity are linked in both directions: wealth buys years, and years build wealth. Using the 2024 U.S. life tables, we ask how much of the Black–White wealth gap the survival gap explains, and what would close the wealth gap. Life expectancy at birth was 74.8 years for non-Hispanic Black and 78.9 for non-Hispanic White Americans, and 77–79% of the difference arose from deaths before 65. Measured in net worth, the effect is small: shorter lives account for about 1.4–1.5% of the log wealth gap through the age structure of the population and 1.6% through shorter working lives. Outside net worth, it is larger. In a projection model anchored to the Social Security Trustees’ assumptions, with disability and family benefits, shorter survival costs a Black man entering work in 2024 an expected \$15,500 of Social Security wealth in present value and adds \$45,450 to the earnings a Black couple aged 30 can expect to lose to a partner’s death. A microsimulation of household wealth, calibrated to the 2022 Survey of Consumer Finances and backcast, with mixed success, from 1992, finds that under current conditions the ratio of median wealth moves only from 0.14 to 0.21 by 2100, toward the model’s steady state, and that no single lever closes the gap. In the best-fitting specification, Black households save less at equal income; equal earnings, mobility, returns, and survival raise the median ratio to 0.90 by 2100 (at least 0.9 in 48% of runs), equal saving as well to 1.07, and a one-time transfer on top closes the gap from 2030 in half the runs; a transfer alone fades. With one saving schedule for both groups (a worse fit), they reach 1.01. Equal conditions would add about \$22.8 trillion to Black household wealth by 2075. The model understates past White wealth growth, so its current-conditions path is probably optimistic. We also review stress spending and eight other wealth gaps.

Keywords: longevity; wealth; racial wealth gap; life tables; Arriaga decomposition; Social Security; stress spending; financial health

1 Introduction

Personal finance keeps one ledger and medicine keeps another. The first counts dollars; the second counts years. This paper argues that they are a single ledger, and that its most consequential entries are written in the decades between leaving school and reaching retirement.

The link runs in both directions. Wealth buys time. Across the U.S. income distribution, higher income is associated with longer life at every percentile [1]; in a national cohort followed from the mid-1990s, the mortality gap by wealth was larger than the gaps by education, occupation, or income [2]; low wealth in later middle age is associated with both death and disability

[3]; and a sudden collapse in wealth is followed by a sharp rise in mortality [4]. Time, in turn, builds wealth. Savings compound only over the years a saver lives, retirement income arrives only while a retiree survives, and a death in the household removes an earner, imposes costs, and often forces the sale of assets.

Both directions bear on the racial wealth gap, which Derenoncourt and colleagues describe as the largest economic disparity between Black and White Americans and one of the most persistent [5]. In 2022 the typical White family held \$285,000 in net worth and the typical Black family \$44,900 [6, 7]. Measured per person, White Americans held about six times as much wealth as Black Americans in 2020; the gap stopped narrowing around 1950 and has widened since the 1980s, as gains on assets went mostly to White households [5]. Black Americans also live shorter lives: in 2024, life expectancy at birth was 74.8 years for the non-Hispanic Black population and 78.9 for the non-Hispanic White population [8]. It is natural to ask how much of the first gap the second explains. Our answer is that the part we can measure directly in net worth is small: about 1.4–1.5% of the log wealth gap through the age structure of the adult population and about 1.6% through shorter working lives. Through channels that net worth does not record, the amounts are larger: a projection model built on the Social Security Trustees’ mortality assumptions puts the cost of shorter lives at \$15,500 of Social Security wealth for a Black man entering work today, and at \$45,450 of expected lost earnings for a Black couple aged 30.

This paper makes three contributions and adds a review. First, after synthesizing the evidence on the two-way relationship between wealth and longevity (Section 2), we use the 2024 life tables to locate the Black–White survival gap by age and to quantify four accounting channels through which it reaches wealth: the age composition of the population, the annuity structure of retirement income, the loss of partners within households, and the length of working lives (Section 3). Second, we build an open projection model that puts the channels net worth does not record in dollars: Social Security wealth with spousal, survivor, disability, and children’s benefits, the economics of losing a partner, and the timing and size of bequests, with forecasts to 2075 under the Social Security Trustees’ mortality assumptions (Section 4). Third, we build a microsimulation of household wealth, calibrated to the 2022 Survey of Consumer Finances, tested by running it forward from the 1989 and 1992 surveys, and run for 10 million households per path, that asks what would close the gap, how quickly, how much each lever contributes, and what closing the gap would add in dollars and in years of life (Section 5). Its headline specification, which fits the survey and its history better than the alternative, lets each group’s saving rate differ and finds Black households saving less at equal income; we therefore treat equal saving as a lever of its own, separate from equal earnings, returns, and survival, and report one saving schedule for both groups as a sensitivity. Like structural models, the microsimulation finds that earnings parity is the dominant lever [9] and that one-time transfers fade [9, 10], and an independent re-implementation with separate code reproduces its inputs and its main conclusions (Section 5.8). Finally, we review the evidence on the quality of the later years (Section 6), on stress spending, one everyday route by which strain can become debt and debt can become strain (Section 7), and on other wealth gaps that similar mechanisms may widen: those of women, Hispanic Americans, American Indian and Alaska Native people, people with disabilities

or mental health conditions, and households harmed by gambling, penalty fees, or exclusion on grounds of their values (Section 8). Section 9 sets out threats to validity and Section 10 concludes.

A note on terms. “Black” and “White” refer to the non-Hispanic Black and non-Hispanic White populations as classified by the National Center for Health Statistics and the Survey of Consumer Finances. Racial differences in survival and wealth reflect differences in conditions, opportunities, and exposures, not biology [5, 11].

2 Longevity and wealth: a two-way street

2.1 Wealth buys time

The income gradient in U.S. mortality is steep and continuous. Linking 1.4 billion person-year tax records to death records, Chetty and colleagues found that life expectancy rises with income throughout the distribution; in 2001–2014 the gap in life expectancy at age 40 between the richest and poorest 1% was 14.6 years for men and 10.1 years for women, and it widened over the period [1]. The National Academies projected that men born in 1960 who reach 50 can expect to live to about 89 if they are in the top fifth of earners and to about 76 if they are in the bottom fifth, a gap of more than 12 years, up from about 5 years for men born in 1930 [12].

For mortality in middle and later life, wealth is an even sharper predictor than income, perhaps because it measures accumulated security rather than a single year’s flow. In the Midlife in the United States cohort, the mortality disparity by wealth was larger than the disparities by education, occupation, income, or childhood socioeconomic status: after age 65, adults with no assets had an estimated 40% chance of surviving to 85, against 71% for those with at least \$300,000 (in 1995 dollars), a difference that narrowed to 51% versus 70% after full adjustment for confounders [2]. In the Health and Retirement Study, Americans aged 54–64 in the lowest wealth quintile had a 17% risk of death and a 48% risk of disability over ten years, against 5% and 15% in the highest quintile [3]. The gradient is unusually steep in the United States: among 73,838 adults aged 50–85 in American and European cohorts, survival in the wealthiest American quartile appeared similar to survival in the poorest quartile of northern and western Europe [13].

Changes in wealth matter as well as levels. Among Americans aged 51–61 at entry to the Health and Retirement Study, a negative wealth shock, defined as losing 75% or more of net worth over two years, was associated with an adjusted hazard ratio for death of 1.50, and asset poverty at baseline with 1.67; death rates were 64.9 per 1,000 person-years after a shock against 30.6 for those whose wealth stayed positive [4].

Several mechanisms carry wealth into survival: access to care, healthier housing and neighborhoods, the ability to absorb a shock without forgoing treatment, food, or rent, and relief from the physiological cost of chronic insecurity. McEwen’s account of allostatic load describes how the stress mediators that protect the body in the short run damage it when they are activated chronically [14]. Financial insecurity can be such a chronic stressor; Section 7 reviews the evidence linking debt with stress and health.

2.2 Time builds wealth

The reverse direction is stated less often, but it is just as mechanical. Wealth is a stock accumulated from flows over time: earnings saved, returns compounded, debts repaid. Each additional working year adds a year of earnings and contributions, and each additional year of life lengthens the horizon over which assets compound. Social Security retirement benefits are an annuity: they are paid only while the beneficiary lives, and in December 2024, 55.0 million Americans aged 65 or older received Social Security benefits [15]. Because lifespans have grown faster for high earners, the National Academies projected that men born in 1960 in the top fifth of earners will receive \$132,000 more in lifetime benefits from the major entitlement programs (Social Security, Medicare, Medicaid, and Supplemental Security Income), in present value at age 50, than men in the bottom fifth [12].

Health shocks that precede death are also wealth shocks. Three years after a hospital admission, insured adults admitted at ages 50–59 were 11 percentage points (15%) less likely to be employed and earned \$9,000 a year less (20% of their prior earnings), a loss far larger than the \$1,400 annual rise in their out-of-pocket medical spending [16]. Deaths impose further costs on survivors: lost earnings, funeral expenses, caregiving time, and, often, the sale of a home or business to settle an estate.

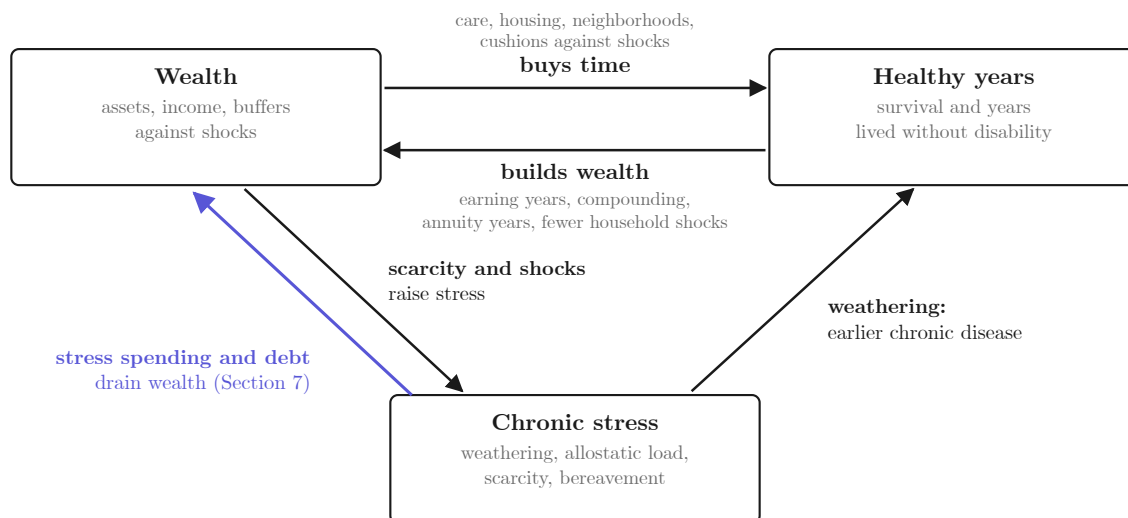


Figure 1. Wealth and healthy years reinforce each other, and chronic stress erodes both. Section 2 reviews the two upper arrows, Section 3 quantifies the “builds wealth” arrow for the Black–White gap, and Section 7 reviews stress spending (in color), the everyday path from stress to debt.

History shows how large the time channel can be. Karger and Wray estimate that the average White man born in 1900 earned 2.6 times as much over his lifetime as the average Black man, nearly twice the cross-sectional earnings gap, because 48% of Black men born in 1900 died before age 30, against 26% of White men. Convergence in mortality halved the Black–White welfare gap between the 1900 and 1920 birth cohorts; for cohorts born between 1920 and 1970, the gap stagnated as differences in income and life expectancy remained large [17].

3 The racial wealth gap and the lifespan gap

3.1 Two gaps

Wealth. The 2022 Survey of Consumer Finances put median net worth at \$285,000 for White families and \$44,900 for Black families; mean net worth was \$1,367,200 and \$211,500 [6]. The typical Black family thus held 15.8% of the wealth of the typical White family. The gap’s origins are historical and structural: vastly different starting conditions after Emancipation [5]; exclusion from mortgage credit and homeownership, including through the 1930s Home Owners’ Loan Corporation maps, which reduced homeownership, house values, and rents and increased racial segregation in the affected neighborhoods for decades [18]; and continuing disparities in income, returns, and access to credit. Differences in individual choices such as education, saving, or financial literacy do not close it [19]. Family transfers sustain it. In the 2019 survey, 29.9% of White families had received an inheritance or gift, against 10.1% of Black families; 17.1% versus 6.0% expected one; 71.9% versus 40.9% could get \$3,000 from family or friends in an emergency; and among middle-aged families, 65% of White and 44% of Black families held a retirement account [20].

Lifespan. In 2024, life expectancy at birth was 74.8 years for the non-Hispanic Black population and 78.9 for the non-Hispanic White population, a gap of 4.16 years. The gap was 5.4 years for men (71.3 versus 76.7) and 3.1 for women (78.2 versus 81.3) [8]. Table 1 summarizes the quantities used below; all are computed from the complete 2024 period life tables.

Table 1. Survival in 2024, non-Hispanic White and Black populations, from the complete period life tables [8]. Years lived are life-table person-years per person alive at 22 (T_{67}/l_{22} and $(T_{22} - T_{67})/l_{22}$).

	White	Black	White men	Black men	White women	Black women
Life expectancy at birth (years)	78.9	74.8	76.7	71.3	81.3	78.2
Life expectancy at 65 (years)	19.5	18.3	18.2	16.5	20.6	19.8
Alive at 65, share of birth cohort	84.1%	76.4%	80.6%	70.7%	87.7%	82.1%
Reach 67, share of 22-year-olds	82.7%	75.2%	79.0%	69.1%	86.6%	81.1%
Reach 85, share of 22-year-olds	43.5%	35.4%	37.1%	27.1%	49.9%	43.1%
Die between 22 and 65	15.1%	21.7%	18.4%	27.3%	11.6%	16.4%
Years lived at 67+, per 22-year-old	14.9	12.8	13.3	10.6	16.5	14.9
Years lived at 22–66, per 22-year-old	42.8	41.6	42.2	40.5	43.4	42.6

3.2 Where the survival gap arises

Figure 2 plots survivors by age. The curves separate early and widen through middle age. By 65, 84.1% of a White birth cohort is still alive against 76.4% of a Black cohort, and half of each cohort has died by about age 83 and 79 respectively. After 65 the remaining difference is comparatively small: a Black 65-year-old can expect 18.3 more years and a White 65-year-old 19.5, a difference of 1.14 years.

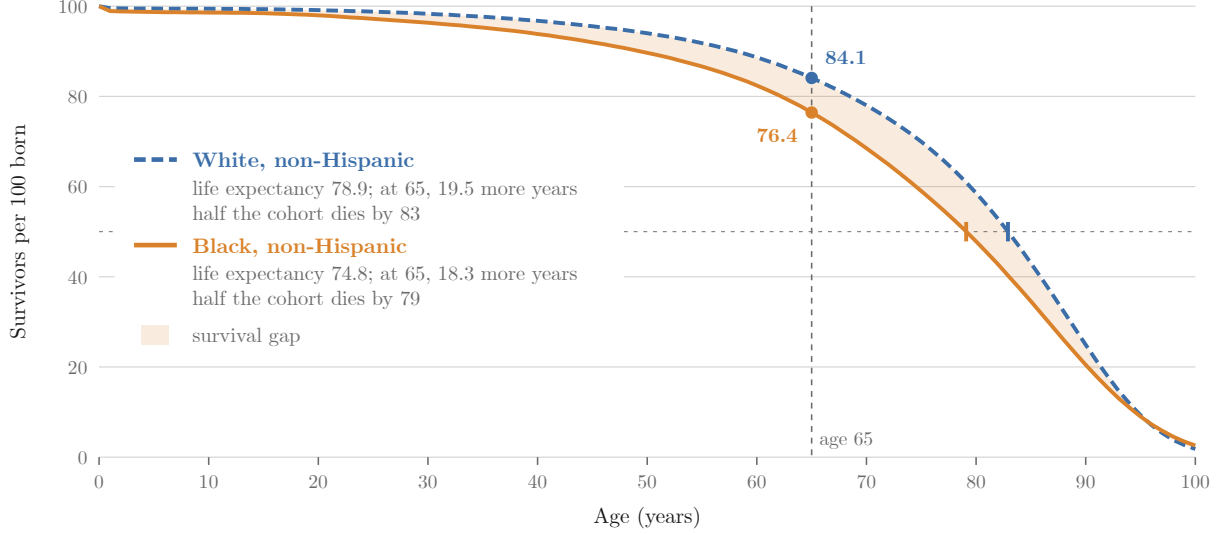


Figure 2. Survivors per 100 born, non-Hispanic White and Black populations, from the 2024 period life tables [8]. The shaded area is the survival gap. Values at 65 are the share of each birth cohort still alive; ticks on the dotted line mark the age by which half the cohort has died.

To locate the gap precisely, we decompose the difference in life expectancy at birth by age at death using the method of Arriaga [21]. For single years of age x , with survivors l_x , person-years lived L_x , and person-years remaining T_x , and superscripts B and W for the two populations, the contribution of deaths at age x to $e_0^W - e_0^B$ is

$$\Delta_x = \frac{l_x^B}{l_0} \left(\frac{L_x^W}{l_x^W} - \frac{L_x^B}{l_x^B} \right) + \frac{T_{x+1}^W}{l_0} \left(\frac{l_x^B}{l_x^W} - \frac{l_{x+1}^B}{l_{x+1}^W} \right), \quad (1)$$

with the open age interval at 100 handled by a single term. The contributions sum exactly to the gap. Of the 4.16-year difference, 3.3 years (79%) arise from deaths before age 65 and 2.3 years (56%) from deaths at working ages, 22–64 (Figure 3). Deaths at 45–64 alone contribute 1.27 years (31%); infant deaths contribute 0.52 years. Above 85 the contribution is slightly negative (−0.17 years): recorded death rates at the oldest ages are slightly lower for Black than for White Americans, which may partly reflect selective survival and the quality of data at those ages, where the life tables rely on Medicare records and smoothed death rates [8]. The decomposition also depends on which population is taken as the starting point: reversing the roles of the two populations in Equation 1 attributes 3.2 years (77%) to deaths before 65 and −0.22 years to deaths above 85, and the average of the two directions attributes 78% to deaths before 65.

This age pattern is the signature of what Geronimus called weathering: the cumulative physiological toll of chronic social and economic adversity, which ages bodies early [22]. In national data, Black adults had higher allostatic load scores than White adults at all ages, most of all at 35–64, and the difference was not explained by poverty [11]. Wealth is part of the story: in the Health and Retirement Study, the far lower asset holdings of Black adults affected not only their financial well-being but their survival, independent of income and education [23]. The composition of wealth matters too: among Black and White adults aged 25 and older, savings, stock ownership, and homeownership were associated with better health and debt with worse health,

and the health returns to assets differed by race, although the authors found no evidence that debt was more harmful to Black than to White adults [24]. Bereavement compounds the burden: in two national surveys, Black Americans were more likely than White Americans to have lost a mother, a father, or a sibling by midlife, and a child or a spouse during adulthood [25].

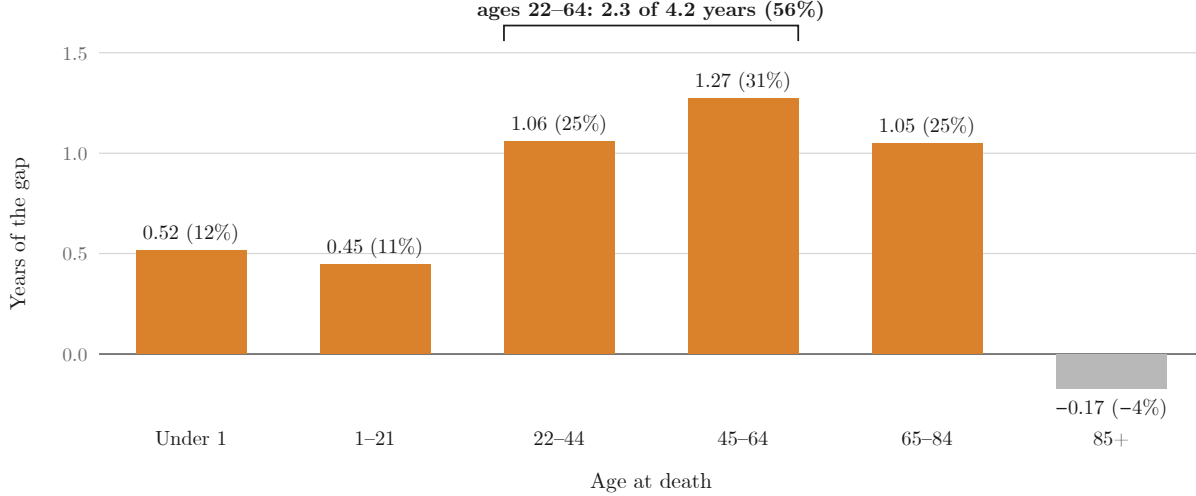


Figure 3. Contributions of deaths at each age to the 4.16-year gap in life expectancy at birth between the non-Hispanic White and Black populations in 2024, by the Arriaga decomposition (Equation 1). Percentages are shares of the total gap.

3.3 How shorter lives reach wealth

Related work. Decompositions of the Black–White gap in life expectancy by age and cause of death are standard; Harper and colleagues used one to show that the gap narrowed after 1993 because of relative declines in Black mortality from homicide, HIV, unintentional injuries, and, among women, heart disease [26]. A separate literature shows how mortality differences change what Social Security is worth: when lower earners die younger, much of the progressivity of the benefit formula is undone [27], and counting Social Security wealth alongside the assets that surveys measure reduces measured wealth inequality [28]. The race-specific evidence on Social Security that we cite is older [29]. Our contribution is to update the accounting to the 2024 life tables, to put each survival channel on the scale of observed net worth where the data allow, and to say plainly which channels cannot be put on that scale.

We now ask how the survival differences in Table 1 enter wealth when everything else is held equal. Each calculation gives both populations identical earnings, saving, returns, and benefit rules and lets only survival differ. These are accounting exercises, not causal estimates. Their purpose is to bound how much of the wealth gap the survival gap can carry through each channel.

Channel 1: age composition. Wealth rises with age into the late sixties (Figure 4A). A population whose members die younger has fewer adults at the ages when wealth peaks. To isolate this effect, we weight the 2022 age-wealth profile of all U.S. families, $w(a)$ [6], by each population’s adult person-years:

$$\bar{W}_g = \frac{\sum_{a \geq 22} w(a) L_a^g}{\sum_{a \geq 22} L_a^g}. \quad (2)$$

Because Black survival is lower, Black adult person-years tilt toward younger ages (Figure 4B), and the age-standardized wealth index is 2.5% lower using median wealth by age and 2.8% lower using mean wealth by age. Against the observed Black-to-White ratios of median wealth (15.8%) and mean wealth (15.5%), this is 1.4% of the log gap with medians and 1.5% with means; across the metrics in Table 2, which also start adulthood at 18 and measure the gap in levels, the share lies in the range 1.4–3.7%. Because the weights come from period life tables, the calculation isolates the effect of mortality on age structure; the actual Black and White adult populations also differ in age structure because of fertility and migration. The national age-wealth profile is itself shaped by differential survival, since wealthier people live longer. The compositional channel is real but small.

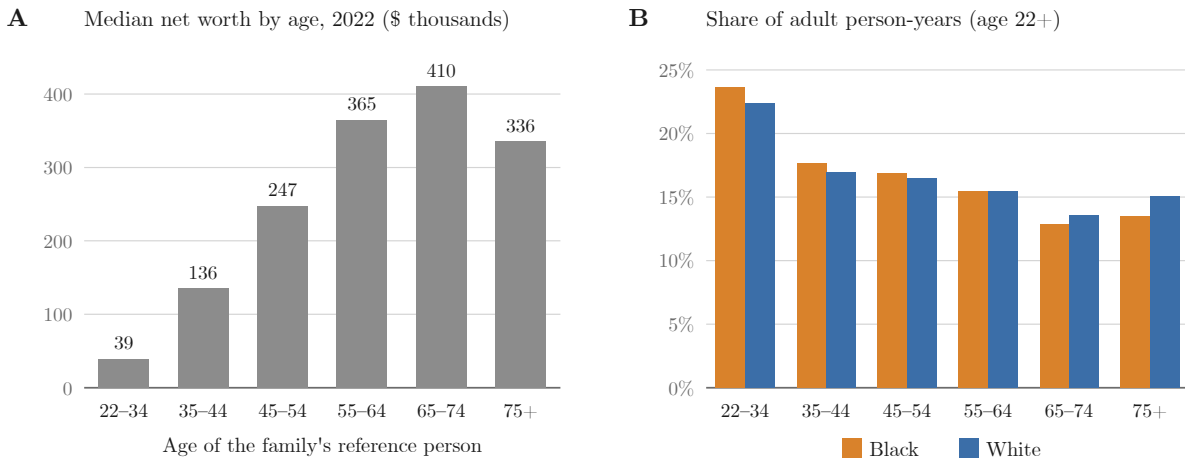


Figure 4. (A) Median family net worth by age of the reference person, 2022 Survey of Consumer Finances [6]. (B) Share of adult person-years (ages 22 and over) in each age group implied by the 2024 Black and White life tables. Weighting panel A by panel B (Equation 2) lowers the Black index by 2.5%: about 1.4% of the observed log gap.

Table 2. Sensitivity of the age-composition channel (Equation 2): the age-standardized Black–White wealth gap as a share of the observed gap, by summary statistic, starting age, and scale. The level gap is 1 minus the Black-to-White ratio. The youngest age group in the Survey of Consumer Finances is “under 35” [6], so starting at 18 or at 22 are both defensible. Weights are adult person-years from the 2024 period life tables [8], so the calculation isolates the effect of mortality on age structure; actual adult age structures also reflect fertility and migration.

Share of the observed gap	Adults 22 and older	Adults 18 and older
Log gap, medians by age	1.4%	1.6%
Log gap, means by age	1.5%	1.7%
Level gap, medians by age	3.0%	3.4%
Level gap, means by age	3.4%	3.7%

Channel 2: the annuity structure of retirement income. Social Security retirement benefits are paid for as long as the beneficiary lives. For a person alive at 22, expected years of life at 67 and older are 12.8 in the Black population and 14.9 in the White population, 14% fewer; for men the figures are 10.6 and 13.3, 20% fewer. To translate years into money, consider two workers with identical earnings who pay payroll tax from 22 through 66 while alive and receive the same benefit from 67 while alive. The ratio of the expected present value of benefits to that of contributions is

$$\text{MW}_g = \frac{\sum_{x \geq 67} v^{x + \frac{1}{2} - 22} L_x^g}{\sum_{x=22}^{66} v^{x + \frac{1}{2} - 22} L_x^g}, \quad v = (1 + r)^{-1}, \quad (3)$$

and the Black-to-White ratio of MW isolates survival. At a 2% real discount rate, a Black worker’s expected retirement benefits per dollar of contributions are 11.7% lower than those of a White worker with the same earnings, and 17.2% lower for men (Table 3). The result barely moves with the discount rate.

Table 3. Retirement-only Social Security money’s worth (Equation 3) of a Black worker relative to a White worker with identical earnings and benefits. Values below 1 mean fewer expected benefit dollars per contribution dollar. The calculation omits disability and survivor benefits. For the full program, the GAO found that Black Americans as a group receive relatively more benefits per tax dollar than White Americans because of lower lifetime earnings and higher disability rates; that comparison does not hold earnings equal [29].

Real discount rate	All	Men	Women
0%	0.887 (−11.3%)	0.830 (−17.0%)	0.921 (−7.9%)
2%	0.883 (−11.7%)	0.828 (−17.2%)	0.916 (−8.4%)
3%	0.881 (−11.9%)	0.828 (−17.2%)	0.915 (−8.5%)

Retirement benefits are not the whole of Social Security. The program also pays disability and survivor benefits, and its benefit formula replaces a larger share of earnings for lower earners. In a 2003 microsimulation of the full program for people born from 1931 to 1964, the General Accounting Office (now the Government Accountability Office) found that Black and Hispanic Americans as groups tend to receive more in benefits relative to taxes than White Americans because they have lower lifetime earnings and higher disability rates, and that these aggregate differences are small compared with the differences between high and low earners within each group [29]. That comparison does not hold earnings equal, so it should not be read as offsetting the 11.7% shortfall at equal earnings in Table 3. Examined through the retirement component alone, which depends heavily on life expectancy, Black Americans fare worse than White Americans, as the GAO also noted [29]. Section 4 models the disability and family benefits explicitly.

Table 4. Channels from survival to wealth, holding earnings, saving, returns, and benefit rules equal. Computed from the 2024 life tables [8] and the 2022 age-wealth profile [6]; comparison rows from the Survey of Consumer Finances [6, 20].

Channel and measure	Black	White	Difference	Share of observed log gap
<i>Age composition</i>				
Age-standardized wealth index, medians by age (\$ thousands)	229.3	235.3	−2.5%	1.4%
Same, means by age (\$ thousands)	997.6	1026.7	−2.8%	1.5%
<i>Working life</i>				
Years lived at 22–66, per 22-year-old	41.6	42.8	−2.9%	1.6%*
<i>Retirement annuity</i>				
Years lived at 67+, per 22-year-old	12.8	14.9	−14%	not comparable†
Retirement benefits per contribution dollar, equal earnings, $r = 2\%$			−11.7% (men −17.2%)	not comparable†
<i>Partner loss</i>				
Couple aged 30: at least one partner dies before 67	42.4%	30.7%	+11.7 points	not comparable‡
<i>For comparison</i>				
Median family net worth, 2022 (\$ thousands)	44.9	285.0	−84%	100%
Received an inheritance or gift, 2019	10.1%	29.9%	−19.8 points	

Shares are the log of the Black-to-White ratio for the channel divided by the log of $44.9 \div 285.0$, the observed ratio of median net worth; the means row uses the ratio of mean net worth, $211.5 \div 1,367.2$. Table 2 gives other metrics for the composition channel. * If net worth scaled one-for-one with expected years lived at 22–66, holding annual earnings and saving equal. † Social Security wealth is not part of the net worth that the Survey of Consumer Finances measures [6, 28], so this channel cannot be expressed as a share of the observed gap. For the full program, which also pays disability and survivor benefits, the GAO found that Black Americans as a group receive relatively more benefits per tax dollar because of lower lifetime earnings and higher disability rates; that comparison does not hold earnings equal [29]. ‡ A probability, not an amount of wealth.

Channel 3: the loss of a partner. Households pool earnings, and a death before retirement removes an earner. If two partners aged 30 face independent survival risks, the probability that at least one dies before 67 is $1 - S_m(30, 67) S_f(30, 67)$, where S denotes survival between the two ages in the sex-specific life tables. For Black couples that probability is 42.4%; for White couples, 30.7%. For couples aged 40, it is 39.3% and 28.4%. These figures assume partners of the same age whose survival is independent and follows the population life tables, which include unmarried people, who tend to die younger than married people; partners’ risks are also correlated, so the levels are approximate. Each such death is a compound wealth shock: lost earnings, funeral and end-of-life costs, and, for a surviving parent of young children, years of single-income saving.

Channel 4: working lives. For a person alive at 22, expected years lived between 22 and 66 are 41.6 in the Black population and 42.8 in the White population, 2.9% fewer (4.0% for men). Holding annual earnings equal, expected lifetime labor income falls by the same proportion; if net worth scaled one-for-one with years worked, this channel would account for about 1.6% of the log median wealth gap. This channel was enormous for cohorts born in 1900 [17]. Today it is modest, but it is concentrated in the deaths at 45–64 that Figure 3 highlights, when earnings and savings are near their peak.

Channels we do not quantify. Health shocks before death reduce employment and earnings [16]. Medical debt is more common among Black households: 28% reported it in a 2018 Census Bureau survey summarized by the Consumer Financial Protection Bureau, against 17% of White households [30]. And early, repeated bereavement strains the same family networks that provide emergency help and transfers [20, 25].

3.4 Summary of the channels

Table 4 collects the estimates. They support three conclusions.

First, shorter lives explain little of the measured wealth gap directly. The two channels that can be put on the scale of observed net worth are small: the compositional effect is about 1.4–1.5% of the log gap (1.4–3.7% across metrics), and shorter working lives account for about 1.6% if wealth scaled one-for-one with years worked. The gap is primarily a product of history and of continuing differences in income, inheritance, homeownership, and access to credit [5, 18, 19].

Second, survival differences bear on forms of wealth and risk that net worth does not record. At equal earnings, retirement benefits per contribution dollar are 11.7% lower for Black workers, and a Black couple aged 30 has a 42% rather than 31% chance of losing a partner before 67, under the assumptions above. Social Security wealth is excluded from the survey measure of net worth [6, 28], and the partner calculation is a probability, so neither can be read as a share of the observed gap. Section 4 builds a projection model that puts these channels, and bequests, in dollars.

Third, the arrows run both ways. Lower wealth predicts earlier death [2, 4, 23], and earlier death lowers what a household can accumulate. Chronic stress is a plausible common contributor to both gaps: it is associated with weathering [11, 22] and with spending and borrowing under strain (Section 7). The evidence reviewed here does not show that stress drives the racial wealth gap, whose main causes lie in the history and institutions cited above.

4 Projecting the channels net worth does not record

Section 3 put two survival channels on the scale of measured net worth and left three as ratios or probabilities: Social Security wealth, the loss of a partner, and bequests. This section builds an open projection model for those three. It asks what the Black–White survival gap is worth in dollars through each channel, for whom, and how the amounts change as death rates fall. Like Section 3, the model is accounting, not causal inference: it changes survival, and where stated earnings, while holding behavior fixed.

4.1 A projection model

Mortality. We start from the 2024 life tables for non-Hispanic Black and White men and women [8] and carry them forward with the improvement in death rates by age and sex that the 2026 Social Security Trustees Report projects to 2100 [31]:

$$q_{x,t}^g = q_{x,2024}^g \frac{q_{x,t}^{\text{SSA}}}{q_{x,2024}^{\text{SSA}}},$$

where $q_{x,t}^g$ is the probability that a member of group g aged x in year t dies before reaching $x + 1$. Under the Trustees’ intermediate assumptions this holds the Black–White gap in log death rates at its 2024 value at every age, so the gap measured in years narrows as death rates fall; their low-cost and high-cost assumptions bound the projection. A second scenario lets the gap close linearly to zero by 2050. Each cohort lives through the projected rates year by year, and the model reproduces the 2024 life expectancies exactly.

Earnings and benefits. Each worker earns the age profile of the Social Security Administration’s medium scaled worker, whose average over the highest 35 years equals the national average wage index (\$69,846.57 in 2024) [32, 33], scaled by the group’s mean earnings relative to all earners aged 25 to 64 in the Current Population Survey [34]: 1.28 for White men, 0.85 for Black men, 0.88 for White women, and 0.73 for Black women. A typical-worker variant uses median earnings instead. Benefits follow the law: the average of the highest 35 years of earnings up to the taxable maximum (fewer years for deaths before 62), the 2026 benefit formula, which is indexed to 2024 wages, claiming at the full retirement age of 67, a spousal benefit of up to half the other spouse’s benefit, and a survivor benefit equal to the deceased worker’s benefit [33, 35]. We report two measures. The retirement measure, that of version 2.0, sets retirement, spousal, and survivor benefits from 67 against the 10.6% retirement and survivors share of the payroll tax paid while alive. The full measure adds the benefits that pay out on disability and on early deaths: disabled-worker benefits; for a disabled worker’s family, 50% of the worker’s benefit for each child and for a spouse caring for a child under 16; for a deceased worker’s family, 75% for each child under 18 (19 in high school) and for a surviving parent under 60 caring for a child under 16; and the reduced widow(er)’s benefit from 60, subject to the earnings test; with the family maximum applied throughout [36, 37]. It sets them against the full 12.4% tax in years not spent on disability. Disability rates are the Social Security Administration’s December 2024 counts of disabled workers by sex and age [38] divided by the population of that sex and age, times each group’s receipt rate relative to everyone of its sex and age band in the 2025 Current Population Survey microdata, with standard errors from its replicate weights [39]. At 60 to 66, 20% of Black and 13% of White men receive them, and 21% of Black and 11% of White women. A disabled worker receives the average benefit of 2024 awards for that sex, scaled by the group’s ratio of reported benefits in the survey (\$1,794 a month for Black and \$2,305 for White men), and the ages of children in each family come from the same microdata. Claiming at 62 is a sensitivity. Amounts are in 2024 dollars, benefits are those scheduled under current law, and present values use a 2% real discount rate.

Wealth and costs. Net worth by race, age, and marital status comes from the 2022 Survey of Consumer Finances microdata, with standard errors from its 999 replicate weights and five implicates [40]. A death costs the median funeral, \$8,500 [41], and, from age 65, the out-of-pocket medical spending of the last five years of life measured in the Health and Retirement Study, a mean of \$56,400 and a median of \$33,300 [42], converted to 2024 dollars with the consumer price index [43]. Couples are a woman and a man two years older whose lives are independent. The code and every input are in the replication files.

4.2 Social Security wealth

Table 5. Social Security wealth of workers entering work in 2024, by race and sex, from the projection model.

	Black men	White men	Black women	White women
Earnings, multiple of the medium worker	0.85	1.28	0.73	0.88
Monthly benefit at 67	\$2,321	\$3,123	\$2,101	\$2,377
Alive at 67, share of those alive at 21	74.7%	83.2%	85.2%	89.7%
Receiving disability benefits at 60–66	20.1%	12.5%	21.0%	11.3%
<i>Benefits per dollar of contributions</i>				
Retirement benefits, equal earnings (medium worker)	0.81	0.92	1.00	1.05
Retirement benefits, own earnings	0.85	0.87	1.10	1.10
All benefits, equal earnings (medium worker)	0.96	0.97	1.09	1.03
All benefits, own earnings	1.00	0.89	1.26	1.08
<i>Expected present value at 21, own earnings</i>				
Retirement benefits	\$126,500	\$200,700	\$146,600	\$178,000
Disability benefits	\$26,800	\$23,100	\$31,800	\$17,000
Benefits for the worker’s children	\$12,500	\$11,400	\$7,100	\$5,000
Retirement and survivors payroll tax (10.6%)	\$148,400	\$231,600	\$133,000	\$162,400
Full payroll tax (12.4%), years not disabled	\$165,600	\$262,900	\$147,500	\$184,500
Net Social Security wealth, retirement only	−\$21,900	−\$30,800	\$13,600	\$15,600
Net Social Security wealth, all benefits	\$200	−\$27,600	\$37,900	\$15,500
Same, with White survival	\$15,700	—	\$46,200	—
Survival penalty, all benefits	\$15,500	—	\$8,200	—
Survival penalty, retirement only	\$17,600	—	\$8,800	—
Survival penalty, all benefits, undiscounted	\$59,600	—	\$28,200	—
Survival penalty, all benefits, claiming at 62	\$13,100	—	\$7,100	—
<i>Chance of living long enough to recover contributions</i>				
Equal earnings (medium worker)	41%	51%	56%	62%
Own earnings	44%	45%	61%	62%

Workers aged 21 in 2024, single, claiming at 67 unless stated; 2024 dollars; 2% real discount rate; scheduled benefits. Mortality: the 2024 life tables carried forward with the Trustees’ intermediate improvement. Earnings: the medium scaled worker times the group’s mean earnings relative to all earners aged 25–64. “With White survival” keeps the group’s own earnings, disability rates, and children. Retirement only: retirement benefits against the 10.6% retirement and survivors share of the payroll tax, so men’s net wealth is negative at this discount rate. All benefits adds disabled-worker benefits (SSA’s December 2024 disabled workers by sex and age, scaled by each group’s receipt rate rela-

tive to everyone in the 2025 Current Population Survey, at the group’s average award; at equal earnings, the average award for the worker’s sex), benefits for the worker’s children if the worker is disabled or dies (children’s ages from the same survey; the family maximum applies), and the full 12.4% tax in years not on disability. Claiming at 62: work ends at 61 and benefits are 30% lower. A couple of a woman aged 21 and a man aged 23, with spousal, survivor, children’s, and disability benefits: net household Social Security wealth \$68,700 for Black couples (\$87,000 with White survival) and \$26,400 for White couples (retirement, spousal, and survivor benefits only: −\$3,200, \$24,700, and \$6,200).

At equal earnings, survival alone means that a Black man entering work in 2024 can expect 12% less in retirement benefits per dollar of contributions than a White man entering at the same time (Table 5). With 2024 death rates held fixed the model gives 17%, the figure in Table 3; projected improvement narrows the gap in years and so the gap in money’s worth. At the two groups’ actual earnings the difference nearly disappears (0.85 against 0.87), because the benefit formula replaces a larger share of lower earnings. Counting disability and family benefits against the full tax closes the gap at equal earnings almost entirely (0.96 in benefits per dollar of tax for a Black man against 0.97 for a White man), and at actual earnings a Black man now expects more per dollar than a White man (1.00 against 0.89), because Black workers are more likely to draw disability benefits and to leave children who draw survivor benefits. The progressive formula and these benefits mask the survival penalty rather than removing it: lower lifetime earnings buy a higher replacement rate, higher disability and earlier deaths draw more of the program’s insurance, and shorter lives take part of it back. Giving Black workers White survival while keeping their own earnings, disability rates, and families isolates the penalty. Counting all benefits, for a Black man entering work in 2024 it is \$15,500 of expected Social Security wealth in present value (\$59,600 undiscounted; \$17,600 counting retirement benefits only, the measure of version 2.0); for a Black woman, \$8,200 (\$28,200); and for a Black couple, \$18,300 (\$78,200). Had everyone claimed at 62, the man’s penalty would be \$13,100. The chance of living long enough to recover one’s contributions in benefits tells the same story: at equal earnings it is 41% for Black men and 51% for White men, and at actual earnings 44% and 45%.

4.3 Counting Social Security wealth

Table 6. Net worth and Social Security wealth of older households, thousands of 2024 dollars.

Households aged 65–74	Black	White	Black ÷ White
Net worth, median (standard error)	73 (32)	570 (61)	0.13
Net worth, mean (standard error)	359 (117)	2,262 (144)	0.16
Social Security wealth at 70, median earnings	413	551	0.75
Social Security wealth at 70, mean earnings	481	671	0.72
Net worth plus Social Security wealth, medians	487	1,121	0.43
Net worth plus Social Security wealth, means	840	2,933	0.29
Survival penalty in Social Security wealth at 70	16.8–19.4	—	—
<i>Sensitivity: every household claimed at 62</i>			
Social Security wealth at 70, median earnings	297	393	0.75
Net worth plus Social Security wealth, medians	370	964	0.38
Net worth plus Social Security wealth, means	703	2,741	0.26
Couples / single men / single women	43% / 8% / 49%	53% / 19% / 28%	

Households aged 65–74	Black	White	Black ÷ White
Families sampled	96	645	

Net worth: 2022 Survey of Consumer Finances, households whose reference person is 65–74, race of the reference person, converted to 2024 dollars; estimates average the five implicates, and standard errors combine the 999 replicate weights with the imputation variance. Social Security wealth: expected present value at 70 of the household’s remaining retirement, spousal, and survivor benefits under the projection model, for a couple or a single person in the survey’s proportions, using each group’s median (typical) or mean earnings, claimed at 67. The first sum adds median net worth to the Social Security wealth of median earners; neither is a median of the sum. The survival penalty is the gain if the same households had White survival. Claimed at 62: own benefits 30% and spousal benefits 35% below the full amounts, and survivor benefits limited to the larger of 82.5% of the deceased’s benefit and the deceased’s reduced benefit; most households claim between the two ages.

For the typical older Black household, Social Security wealth is worth about 6 times its net worth; for the typical older White household, the two are of similar size. Among households aged 65 to 74, median net worth was \$73,000 for Black households (standard error \$32,000) and \$570,000 for White households (\$61,000), in 2024 dollars, while the Social Security wealth of a typical-earning household of each group at 70 is \$413,000 and \$551,000 (Table 6). Counting it raises the Black-to-White ratio of typical wealth from 0.13 to 0.43 and of mean wealth from 0.16 to 0.29, consistent with evidence that adding Social Security wealth reduces measured wealth inequality [28]; had every household claimed at 62, the typical ratio would rise to 0.38. Because older Black households depend more on this asset, its survival penalty bears more heavily on them: at 70, shorter remaining lives cost Black households \$16,800 to \$19,400 of expected Social Security wealth, about 4% of it. This counts only the survival gap after 70; for workers who are 21 today the penalty also includes the higher chance of dying before benefits begin (Table 5). The Black estimates rest on 96 sampled families, hence their wide standard errors.

4.4 The loss of a partner

For couples aged 30 and 32 in 2024, the model projects that 39% of Black couples and 28% of White couples will lose a partner before the woman turns 67, and that 26% of Black women and 18% of White women will be widowed by then, spending on average 3.5 and 2.3 years widowed before 67 (Table 7). Section 3’s 42% and 31% are higher because they hold 2024 death rates fixed; Table 7 also shows partners of the same age. The expected present value of the earnings a household loses when a partner dies before 65 is \$135,300 for Black couples and \$126,800 for White couples, whose higher earnings make each death more costly. With White survival, Black couples would lose \$89,900: shorter lives add \$45,450 to their expected loss.

Table 7. The loss of a partner: probabilities and expected costs for couples aged 30, from the projection model.

Couples aged 30 and 32 in 2024	Black	Black, White survival	White
Monthly benefits at 67, woman / man	\$2,101 / \$2,321	\$2,101 / \$2,321	\$2,377 / \$3,123
<i>Before the woman turns 67</i>			
A partner dies	39.0%	27.9%	27.9%
The woman is widowed	26.1%	18.3%	18.3%
The man is widowed	12.9%	9.7%	9.7%
Years the woman spends widowed	3.5	2.3	2.3

Couples aged 30 and 32 in 2024	Black	Black, White survival	White
<i>Expected present value at 30</i>			
Earnings lost to a partner's death before 65	\$135,300	\$89,900	\$126,800
Funeral and end-of-life costs, all deaths	\$36,700	\$38,000	\$38,000
Survivor benefits above own benefit, from 67	\$7,800	\$7,100	\$25,300
Reduced survivor benefits, 60 to 66, after the earnings test	\$15,300	\$11,100	\$12,700
Benefits for children and for a parent caring for them	\$24,000	\$15,400	\$18,900
All survivor benefits	\$47,100	\$33,600	\$56,900
Survivor benefits from 60 and 67, without the earnings test*	\$30,600	\$23,500	\$46,300
Disability benefits for the partners and their children	\$80,500	\$83,500	\$54,300
<i>Sensitivity: a partner dies before the woman turns 67</i>			
Partners the same age	36.4%	—	25.9%
2024 death rates held fixed	45.3%	—	33.0%
Black death rates converge to White by 2050	30.2%	—	—

A woman aged 30 and a man aged 32 in 2024, both alive, with independent lives and each group's mean earnings; 2024 dollars; 2% real discount rate. "Black, White survival" keeps Black earnings. Lost earnings run from the year after a death through the deceased partner's 64th year while the other partner is alive. From 67 a survivor receives the larger of the deceased's benefit and their own. From 60 to 66 a survivor may draw 71.5% to 100% of the deceased's benefit; the earnings test withholds \$1 for every \$2 the survivor earns above \$24,480. Children under 18 (19 in high school) receive 75% of the deceased's benefit each, and a surviving parent under 60 caring for a child under 16 receives 75%, subject to the earnings test and the family maximum; children's ages come from married couples of the same group and age in the 2025 Current Population Survey. All survivor benefits is the sum of the three rows above it. Disability benefits: each partner's disability receipt rate by age (Table 5), with benefits of 50% of the disabled partner's benefit for children and for a spouse caring for a child under 16. * An upper bound: every widowed partner draws 71.5% of the deceased's benefit at 60, rising to 100% at 67, ignoring the earnings test.

Survivor insurance replaces part of the loss, through three kinds of benefit. Children under 18 and a surviving parent caring for a child under 16 draw benefits while the children are young: their expected value is \$24,000 for Black couples and \$18,900 for White couples. A surviving partner may draw a reduced survivor benefit from 60, subject to the earnings test: \$15,300 and \$12,700. And from 67 the survivor receives the larger of the two partners' benefits, which is worth most when one partner earned much more than the other; Black partners' benefits are lower and closer together (\$2,101 and \$2,321 a month) than White partners' (\$2,377 and \$3,123), so this part is worth \$7,800 to Black couples and \$25,300 to White couples. In all, survivor benefits are worth \$47,100 to Black and \$56,900 to White couples and replace 35% and 45% of their expected lost earnings. The benefits that pay out on deaths before 67 are larger for Black couples (\$39,300 against \$31,600), and the extra survivor benefits that higher mortality brings Black couples, \$13,500, offset 30% of the \$45,450 that their shorter lives add to lost earnings. Social Security's survivor insurance therefore pays less, and replaces less of the loss, where widowhood comes earliest. Disability benefits for the partners and their children add \$80,500 for Black and \$54,300 for White couples. Children's ages for these families come from 816 Black and 8,937 White married couples in the survey microdata.

4.5 Bequests

Shorter lives change when children inherit more than how much. A child born in 2024 to Black parents aged 28 and 30 expects to inherit from the last surviving parent at about 60, and at about 61 if the parents had White survival (Table 8). The expected estate, measured by the net worth of unmarried households of the parent’s age less funeral and end-of-life costs, is \$23,200 at the median and \$114,500 at the mean, and nearly the same with White survival (\$22,700 and \$113,400). For a child of White parents aged 30 and 32 it is \$291,400 and \$850,600. The bequest gap is a gap in parents’ wealth, not in their lifespans. What shorter lives do change is the risk of losing both parents early: 8.5% of Black children are projected to lose both parents before 45, against 4.4% with White survival and 5.8% of White children, whose parents are older when they are born [44]. These estimates rest on small samples of unmarried Black households (86 families aged 65 and older), and the wealth of living households overstates that of decedents, who are poorer on average [23].

Table 8. Inheritance from the last surviving parent, from the projection model.

Child born in 2024	Black parents	Black parents, White survival	White parents
Parents’ ages at the birth, mother / father	28 / 30	28 / 30	30 / 32
Child’s expected age when the last parent dies	60.0	61.5	59.4
Has lost both parents by 30	1.3%	0.6%	0.8%
Has lost both parents by 45	8.5%	4.4%	5.8%
<i>Expected estate, 2024 dollars</i>			
From median net worth	\$23,200	\$22,700	\$291,400
From mean net worth	\$114,500	\$113,400	\$850,600
<i>Present value at the child’s age 30</i>			
From median net worth	\$13,500	\$12,500	\$164,100
From mean net worth	\$65,600	\$62,200	\$480,800
<i>Unmarried households aged 65 and older, 2022 survey, thousands of 2024 dollars</i>			
Net worth, median (standard error)	64 (22)	—	336 (32)
Net worth, mean (standard error)	177 (61)	—	919 (67)
Families sampled	86	—	361
<i>Sensitivity: child’s expected age when the last parent dies</i>			
2024 death rates held fixed	56.4	—	56.4
Black death rates converge to White by 2050	61.3	—	—

Parents: the mother is the group’s mean age at a birth in 2023, the father two years older, with independent lives. The estate is the net worth of unmarried households of the surviving parent’s age (2022 Survey of Consumer Finances, ages 18–44, 45–64, and 65 and older, in 2024 dollars), less the median funeral and, from 65, end-of-life medical spending, and not below zero. “Black parents, White survival” keeps Black parents’ ages and wealth. Present values discount at 2% from the child’s 30th birthday. Assumes a single child and no taxes or transfers before death.

4.6 Forecasts to 2075

Under the intermediate assumptions with the 2024 gap held in proportion, life expectancy rises for both groups and the gap in years narrows slowly: for men from 5.4 years in 2024 to 4.8 in 2050 and 4.2 in 2075, and for women from 3.1 to 2.6 and 2.05 (Figure 5). The penalties shrink more slowly still (Table 9). For Black men entering work in 2054, the Social Security penalty is \$13,900, against \$15,500 for those entering in 2024; across the Trustees’ low-cost and high-cost assumptions the 2024 figure ranges from \$13,500 to \$16,500. The share of couples aged 30 who lose a partner before 67 falls from 39% to 32% for Black couples who are 30 in 2054, and from 28% to 22% for White couples. Falling mortality alone does not close these gaps. If Black death rates instead converged to White rates by 2050, the Social Security penalty for today’s 21-year-olds would nearly vanish (−\$200), because most of it arises at ages they would reach after 2050; couples aged 30 today would still bear \$24,300 of their \$45,450 partner-loss penalty, because the excess deaths before 2050 fall in their working years.

Table 9. Forecasts by the year a cohort starts, under each mortality scenario.

Year the cohort starts	2024	2034	2044	2054
<i>Black men aged 21: Social Security survival penalty</i>				
Intermediate	\$15,500	\$15,000	\$14,400	\$13,900
Low-cost	\$16,500	\$16,400	\$16,300	\$16,100
High-cost	\$13,500	\$12,400	\$11,200	\$10,300
Converging by 2050	−\$200	\$0	\$0	\$0
Intermediate, retirement benefits only	\$17,600	\$17,000	\$16,200	\$15,600
<i>Black women aged 21: Social Security survival penalty</i>				
Intermediate	\$8,200	\$7,700	\$7,100	\$6,700
Converging by 2050	\$100	\$0	\$0	\$0
<i>Couples aged 30: a partner dies before the woman turns 67</i>				
Black, intermediate	39%	36%	34%	32%
White, intermediate	28%	26%	24%	22%
Black, converging by 2050	30%	27%	24%	22%
<i>Black couples aged 30: survival penalty in expected lost earnings</i>				
Intermediate	\$45,500	\$43,500	\$40,600	\$37,800
Converging by 2050	\$24,300	\$9,400	\$1,300	\$0
Offset by survivor benefits, intermediate	\$13,500	\$13,000	\$12,200	\$11,500

Penalties are the gain in expected present value, at the cohort’s starting age, if the cohort had White survival with its own earnings, disability rates, and children; 2024 dollars, 2% real discount rate. Social Security penalties count all benefits (Table 5) unless stated. The offset is the extra survivor benefits (Table 7’s “All survivor benefits”) that Black couples receive because of their higher mortality. Intermediate, low-cost, and high-cost are the Trustees’ mortality assumptions applied to the 2024 race-sex life tables with the 2024 gap in log death rates held constant (the low-cost assumptions have the slowest decline in death rates). “Converging by 2050” closes the gap in log death rates linearly between 2024 and 2050. Amounts are rounded to the nearest \$100; the text gives the 2024 couples’ penalty as \$45,450, the difference of the unrounded entries of Table 7.

What the model adds. Through the channels that net worth does not record, the survival gap is worth tens of thousands of dollars to each Black household: \$8,200 to \$18,300 of Social Security wealth in present value, and \$45,450 of expected lost earnings for a couple, of which survivor insurance replaces about 30%. These sums are large next to the median net worth of Black families, about \$48,100 in 2024 dollars, and small next to the White–Black gap in it, about \$257,400 [6]. They confirm the conclusion of Section 3 from a second direction. The racial wealth gap is primarily a product of history and of continuing differences in income, inheritance, homeownership, and access to credit; shorter lives impose an additional, measurable tax on the assets that Black households depend on most, and the tax persists for as long as the survival gap does.

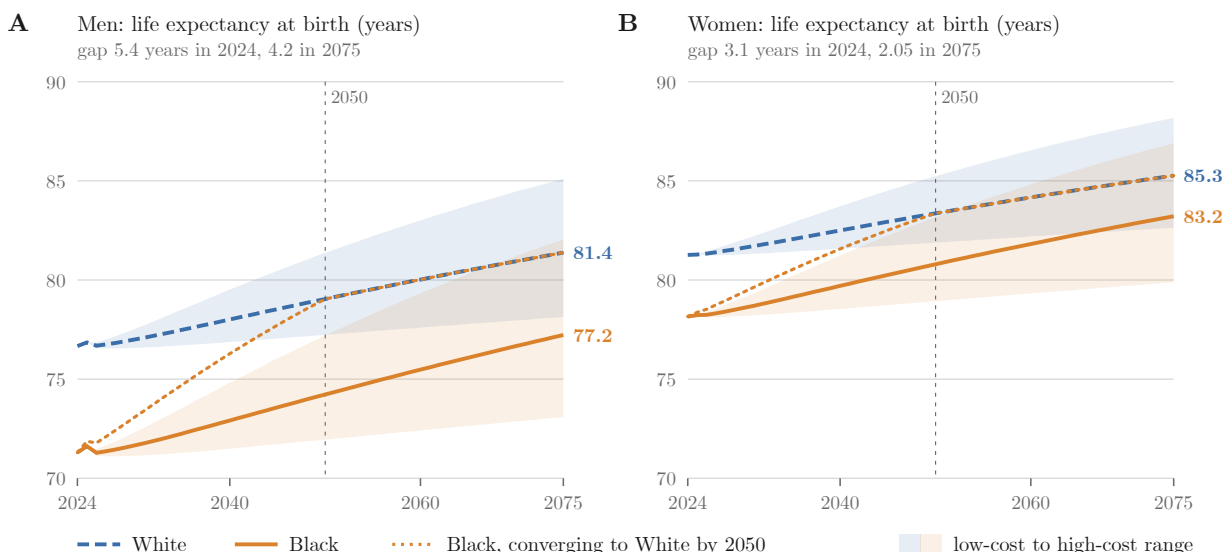


Figure 5. Projected period life expectancy at birth, 2024–2075, for non-Hispanic Black and White men (A) and women (B): the 2024 life tables [8] carried forward with the improvement in death rates in the 2026 Trustees Report [31]. Lines use the intermediate assumptions with the 2024 gap in log death rates held constant; shaded bands span the low-cost and high-cost assumptions; the dotted line lets the Black rates converge to the White rates by 2050. The Trustees’ death probabilities are lower in 2025 than in 2026, hence the early rise and dip.

5 What it would take to close the gap

Sections 3 and 4 measured what shorter lives cost. This section asks the question in reverse: what would close the Black–White wealth gap, how quickly, and what closing it would add to the economy and to Black lives. We answer it with a microsimulation that starts from the households of the 2022 Survey of Consumer Finances and follows them and their descendants to 2100, simulating 10 million households for each path, and checks it by running it forward from the surveys of 1989 and 1992. Like the rest of Part I, the model is accounting under stated assumptions. It shows what each lever would do if it were achieved, not whether any policy would

achieve it. Its headline specification lets each group’s base saving rate differ; a sensitivity with one saving schedule for both groups is the only specification under which every single lever and combination was run, and results that come from it are labeled so.

5.1 A microsimulation of household wealth

Households. Each simulated household begins as a non-Hispanic Black or White household drawn, with its survey weight, from the 2022 Survey of Consumer Finances [40]. Each year its net worth changes as

$$W_{i,t+1} = W_{i,t} (1 + r_{i,t}) + (s_g(p_i) - \phi_g) Y_{i,t} - c_a W_{i,t}^+ - D_{i,t} + T_{i,t},$$

where $Y_{i,t}$ is income other than interest, dividends, and capital gains, set by the household’s rank p_i in the national income distribution, an age profile, and real wage growth; $s_g(p_i)$ is the share of that income saved, which rises with income rank from a base rate fitted for each group g ; ϕ_g is the share of income given as support to relatives and friends outside the household, measured in the survey at 1.28% of income for Black and 1.05% for White households under 67 (20% and 14% give any) [40]; c_a is consumption out of positive wealth, which after 67 draws wealth down over the expected remaining lifetime; $D_{i,t}$ is the cost of deaths in the household, including an end-of-life and estate-settlement cost at the last death; and $T_{i,t}$ is gifts and inheritances received. The model runs in wage-indexed dollars. Real wages grow at their 1969–2019 average of 0.78% a year in the calibration and on the 2026 Trustees Report’s intermediate path in the projections: 1.76% a year from 2025 to 2034 and 1.14% thereafter [31]. Results are in real 2024 dollars.

Returns. The return $r_{i,t}$ follows the household’s portfolio. For each group, age band, and wealth band, the survey gives the dollars held in stocks, businesses, real estate, and safe assets, and we apply the long-run U.S. real returns estimated by Jordà and colleagues: 8.46% a year on equities including dividends, 4.19% in capital gains on businesses and 0.90% on real estate, and 1.92% on safe assets, with the year-to-year volatility they report [45], plus a persistent household-specific component. Where a cell holds fewer than 15 sampled families, as 26 of the 84 cells do, it pools the group’s age bands within its wealth band (20 cells) or, where that is still too few, uses the other group’s portfolios at the same age (6 cells: the top wealth band, \$2 million or more, of Black households in every age band). Black homeowners with mortgages earn 2.3 percentage points a year less on their homes, a gap Kermani and Wong trace to foreclosures and short sales rather than to slower appreciation [46].

Lives and families. Deaths follow the race-, sex-, and age-specific probabilities of Section 4, adjusted for wealth: within each group, death rates after 40 fall with household wealth in proportion to the hazard ratios of Machado and colleagues (0.80, 0.68, and 0.60 for the second, third, and top wealth quartiles relative to the lowest) [13], of which only a share is treated as causal. In each run that share is drawn between 0 and one sixth of their logarithm: Swedish lottery wins rule out causal effects on 10-year mortality one sixth as large as the cross-sectional gradient [47], and inheritances in the Health and Retirement Study have no substantial effect on health [48]. When its head reaches about 55, a household forms a successor household, standing for its children, whose income rank follows the intergenerational equations of Chetty and col-

leagues, in which a Black child’s expected rank is 12.6 percentiles below that of a White child whose parents had the same income [49]. Parents with substantial wealth give a gift when the successor forms, and education debt falls with parents’ wealth. When the last member of a household dies, its estate, net of an end-of-life and settlement cost and of a share that leaves the households modeled, is split equally among the parents’ living children, whose number is drawn from the survey’s distribution by race (a mean of 2.8 for Black and 2.1 for White households aged 55 to 74); the successor takes one share and households of the same race and generation, standing for its siblings, take the others.

Calibration. Eleven parameters, chiefly the saving schedule, the drawdown of wealth in retirement, and the size of gifts and estates, are chosen so that under unchanged conditions the model’s balanced-growth steady state reproduces median and mean net worth by age for both groups in the 2022 survey, and the share of households that have ever received \$10,000 or more in inheritances and gifts, by age, measured as the survey asks it (Table 10). In the headline specification each group’s base saving rate is fitted separately: 9.0% of income at the median income rank for Black households and 10.5% for White households. The lower Black rate goes in the direction of the survey, in which Black households under 65 were less likely than White households to have spent less than their income in three of five income quintiles, but it is a residual that absorbs whatever the model leaves out, not a measured saving rate: version 2.0, with a different treatment of inheritances and no wage growth, fitted a higher Black rate (5.9% against 3.5%), and in panel data racial differences in saving rates are not significant once income is controlled [50]. We therefore also report a sensitivity with one saving schedule for both groups (10.4% at the median rank, ten parameters). It fits the survey worse (a loss of 3.88 against 2.66, with one parameter fewer) and its backcast fails more often (Section 5.2), which is why it is not the headline. The calibration implies consumption out of wealth of 2.4% a year, against the 3.2 cents per dollar estimated for stock wealth [51], a figure it did not target. Its largest problem is inheritances. Splitting estates among children brings receipt near the survey, 4.8% of Black and 29.8% of White households against 6.5% and 26.2% (version 2.0: 50.4% and 78.1%), but only with an end-of-life and settlement cost of up to \$636,000 at the last death and a further 92% of each remaining estate leaving the households modeled; White recipients receive a median of \$174,000 against \$157,000 in the survey. Real estates do not shrink that much; the wedge more plausibly stands in for transfers the survey does not record and for late-life spending the model lacks. The one-schedule calibration needs a smaller wedge (\$518,000 and 43%) but overstates receipt (10.1% and 37.2%). The headline calibration understates White mean wealth in five of six age bands and overstates the Black median by more than a tenth in three, at 65–74 by a factor of 2.0. In its steady state the ratio of median wealth over all ages is 0.20, against 0.16 in the survey (0.25 with one saving schedule): the calibration targets wealth by age within each group, not the overall ratio, and does not reproduce the gap it starts from.

Table 10. Calibration of the wealth microsimulation (headline specification): the model’s steady state against

the survey.

Age of the reference person	Black, survey	Black, model	White, survey	White, model
<i>Net worth, median / mean, thousands of 2024 dollars</i>				
25–34	7 / 51	7 / 47	91 / 274	44 / 362
35–44	44 / 141	61 / 136	229 / 740	196 / 686
45–54	83 / 270	112 / 239	337 / 1,284	367 / 1,140
55–64	150 / 328	149 / 305	493 / 2,097	543 / 1,343
65–74	69 / 358	134 / 339	579 / 2,262	612 / 1,622
75+	167 / 324	59 / 283	438 / 1,971	514 / 1,778
<i>Inheritances and gifts of \$10,000 or more ever received (survey standard errors in parentheses)</i>				
All households	6.5% (0.8%)	4.8%	26.2% (0.8%)	29.8%
Ages 18–44	2.7% (0.9%)	2.7%	13.7% (1.1%)	16.3%
Ages 45–64	6.9% (1.7%)	5.4%	25.2% (1.5%)	30.8%
Ages 65+	13.5% (2.3%)	6.8%	39.2% (1.5%)	41.7%
Median received, recipients (thousands)	84	67	157	174
<i>Not targeted</i>				
Net worth zero or negative	17.1%	19.0%	5.8%	5.1%

Survey: 2022 Survey of Consumer Finances, non-Hispanic Black and White households; transfers from the full public data set, each converted from its year of receipt to 2024 dollars, with standard errors from the replicate weights. Model: the balanced-growth steady state under unchanged conditions (real wages growing 0.78% a year), averaged over the last 20 of 150 simulated years, in the headline specification. Calibrated parameters (loss 2.66): a base saving rate of 9.0% of non-capital income for Black and 10.5% for White households at the median income rank, each fitted separately, rising by 28 points from the lowest to the highest rank, less measured support to relatives outside the household (1.28% of income for Black and 1.05% for White households under 67); consumption out of wealth of 2.4% a year before 67; gifts at household formation of 37% of a parent's wealth above \$2.2 million; an end-of-life and settlement cost of up to \$636,000 at the last death; estates net of a further 92% share that leaves the households modeled; and household-specific returns on risky assets with a standard deviation of 1.9 points. Not targeted: the Black-to-White ratio of median net worth over all ages is 0.16 in the survey and 0.20 in this steady state (0.25 with one saving schedule for both groups, 10.4% at the median rank, whose calibration has a loss of 3.88).

Uncertainty. Each path is simulated 500 times with 20,000 households, half Black and half White, reweighted to the population. Each run draws the long-run asset returns, the housing gap, the causal share of the wealth–mortality link, the cost of debt, and the Trustees' low-cost, intermediate, or high-cost mortality from ranges around their estimates, and a different sequence of market returns. Markets, each group's households, and each group's heirs draw from separate random streams, so paths are compared run by run and a lever that acts only on Black households leaves every White household's path unchanged. For each year we report the median across runs, a pointwise median rather than a single run, and the 5th to 95th percentiles across runs. These ranges contain the drawn parameters and Monte Carlo variation only; the calibrated parameters and the survey targets are held fixed, so they are not confidence intervals. The Monte Carlo standard error of a 2100 median ratio is at most 0.003 in the headline specification and 0.007 with one saving schedule. Where we date a closing in the median run, it is the run whose 2100 ratio is the median. In all, the analysis simulates about 803 million households.

5.2 Validation against earlier surveys

Fit to the targets is not validation, so we ran the model forward from the households of the 1989 and 1992 surveys through the realized conditions of each later year (S&P 500, house-price, and Treasury-bill returns, real wage growth, and historical death rates), with the calibration unchanged, and compared it with each later survey (Table 11). The pass criteria were written down before any run, with the one-schedule calibration in mind; they named 1989 as the start and 1992 as a check, but noted in advance that the 1989 survey’s small Black sample made 1992 the more reliable test, and we treat it as the primary one. The headline specification was chosen after both backcasts had been seen, so for that choice the backcast is evidence of fit, not a test made in advance.

Table 11. Validation: the model run forward from earlier surveys under realized conditions, against each later survey.

Survey wave	Survey	From 1992, headline	From 1992, one saving schedule	From 1989, one saving schedule
<i>Black-to-White ratio of median net worth (model minus survey in parentheses)</i>				
1992	0.14	—	—	0.07 (−0.07)
1995	0.14	0.18 (+0.03)	0.19 (+0.05)	0.07 (−0.07)
1998	0.16	0.15 (−0.01)	0.17 (+0.01)	0.06 (−0.10)
2001	0.16	0.13 (−0.02)	0.16 (+0.00)	0.06 (−0.09)
2004	0.14	0.13 (−0.01)	0.16 (+0.02)	0.08 (−0.07)
2007	0.12	0.12 (+0.00)	0.16 (+0.04)	0.07 (−0.05)
2010	0.12	0.10 (−0.02)	0.15 (+0.02)	0.07 (−0.06)
2013	0.09	0.10 (+0.01)	0.15 (+0.05)	0.07 (−0.02)
2016	0.10	0.13 (+0.03)	0.18 (+0.08)	0.08 (−0.02)
2019	0.13	0.13 (+0.01)	0.19 (+0.06)	0.07 (−0.05)
2022	0.16	0.14 (−0.02)	0.19 (+0.04)	0.06 (−0.09)
<i>Criteria fixed before the runs</i>				
Waves within ± 0.03 of the survey ratio		9 of 9	4 of 9	2 of 10
Black median, 2022 (thousands)	47	31	38	13*
White median, 2022 (thousands)	305	226*	202*	208*
Growth of the Black median to 2022	$\times 2.15$ / $\times 4.45$	$\times 1.40^*$	$\times 1.75$	$\times 1.19^*$
Growth of the Black mean to 2022	$\times 2.12$ / $\times 2.21$	$\times 1.33^*$	$\times 1.30^*$	$\times 1.17^*$
Growth of the White median to 2022	$\times 1.97$ / $\times 1.71$	$\times 1.46^*$	$\times 1.30^*$	$\times 1.17^*$
Growth of the White mean to 2022	$\times 2.95$ / $\times 2.55$	$\times 1.15^*$	$\times 1.01^*$	$\times 0.88^*$

Backcasts start from the households of the 1992 or 1989 Survey of Consumer Finances and replay each later year’s realized S&P 500, house-price, and Treasury-bill returns, real wage growth, and historical death rates, with each specification’s calibration unchanged (200 runs of 20,000 households). Headline: each group’s base saving rate fitted separately (Table 10). One saving schedule: the sensitivity with one base saving schedule for both groups; only it was run from 1989. Survey: all five implicates, non-Hispanic Black and White households, 2024 dollars. Model values are me-

dians across runs. Growth: survey growth from 1992 (from 1989 after the slash), model growth from the same start. The criteria, written down before any backcast ran and before the headline specification was chosen, were: the model ratio within 0.03 of the survey ratio at every wave from the second after the start; each group's 2022 median inside the survey's 95% interval; and each group's real growth in median and mean net worth within 25% of the survey's. * Fails its criterion.

From 1992 the headline specification keeps the ratio within 0.03 of the survey at all 9 waves tested. Its 2022 Black median, \$31,000, is inside the survey's 95% interval around \$47,000, but Black median wealth grows by a factor of 1.40 against 2.15 in the survey, outside the criterion. With one saving schedule for both groups, the model keeps the ratio within 0.03 at only 4 of 9 waves: it follows the ratio until 2004 but overstates it by 0.04–0.08 in four of the five waves from 2007 to 2019 (all but 2010), missing the depth of the Great Recession's losses for Black households, although its Black median grows by a factor of 1.75. Both specifications fail on White wealth: from 1992 the White median grows by a factor of 1.46 in the headline specification and 1.30 with one saving schedule, against 1.97 in the survey, and the White mean by 1.15 and 1.01 against 2.95. The model gives all households one rate of consumption out of wealth and holds the income distribution at its starting shape, so large fortunes do not compound at realized returns and the rise in top incomes is missing. It therefore probably understates the growth of White wealth and overstates the ratio under current conditions. From 1989, run only with one saving schedule, the model passes at only 2 of 10 waves: the 1989 survey's Black sample is 307 families, and its ratio of 0.06 becomes 0.14 in 1992, a jump no model of accumulation reproduces. Receipt of inheritances in the backcasts' 2022 is low by construction (2.6% and 13.5% with one saving schedule), because households start with no record of past receipt.

5.3 Under current conditions, the gap does not close

If today's conditions persist, the ratio of median Black to median White household wealth, 0.14 in the model's 2024, is 0.13 in 2050, 0.17 in 2075, and 0.21 in 2100, with 90% of runs between 0.16 and 0.27 (Figure 6). This path is largely the model converging toward its own balanced-growth steady state, whose median ratio under unchanged conditions is 0.20 (0.20 to 0.22 across five simulation seeds) at the calibration's wage growth of 0.78% a year, above the survey's 0.16. With one saving schedule the steady state is 0.25 (0.23 to 0.25) and the 2100 ratio 0.26. The level the ratio reaches by 2100 is therefore a property of the calibration, not a forecast that the gap narrows, and the model cannot attribute the movement to younger cohorts; because the backcasts understate the growth of White wealth, the path is probably optimistic. White wealth does not keep pace with wages: White household wealth is \$136 trillion in 2024, \$131 trillion in 2050, and \$140 trillion by 2075, while real wages grow by a factor of 1.90, and Black household wealth goes from \$3.5 trillion to \$5.0 trillion. Relative to wages, the White median falls by 18% by 2100 and the Black median rises by 22%, so part of the movement in the ratio comes from White wealth falling relative to wages, which the backcasts, in which White wealth grows far too slowly, suggest is a weakness of the model rather than a forecast. Version 2.0, without wage growth, showed the ratio falling to 0.11 by 2050.

5.4 One lever at a time

Table 12 applies each lever alone. Single levers were run only with one saving schedule for both groups (the table’s lower block), so how each would differ in the headline specification is not known; for the one combination run under both, equal conditions, the headline gives 0.90 by 2100 against 1.01. Earnings parity, in which Black workers reach the White income distribution by 2040 and Black children’s mobility matches White children’s, is the largest single lever: the median ratio rises to 0.38 by 2050 and 0.65 by 2100. It works slowly because higher earnings raise wealth only through saving and, over generations, through gifts and inheritances. Parity in mobility alone, which reaches only children, takes longer still (0.51 by 2100). Equal returns, which give Black households White portfolios and remove the housing-distress gap, raise the ratio to 0.38 by 2100. Survival parity barely moves median wealth (0.27); its value runs through Social Security, partners, and years of life (Section 4 and below) more than through net worth. Baby bonds of up to \$50,000 for children born from 2025 reach 0.27. A one-time transfer of \$250,000 to each Black household in 2030 lifts the ratio to 0.93 at once, but under unchanged conditions it decays to 0.26 by 2100, as Derenoncourt and colleagues found for transfers made without changing the conditions of accumulation [5]. Structural models reach the same conclusion: in a general-equilibrium model, one-time transfers have only transitory effects unless the earnings gap closes [9], and in a model in which exclusion has left Black dynasties pessimistic about risky returns, transfers that close today’s average gap do not produce long-run convergence [10].

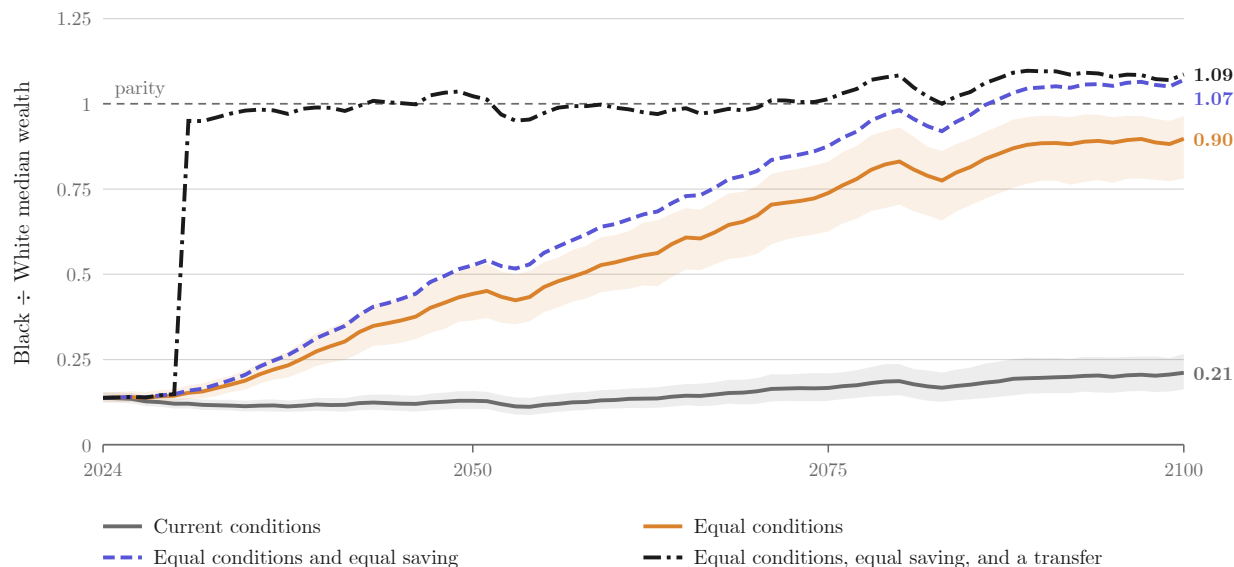


Figure 6. Black-to-White ratio of median household wealth, 2024–2100, under four paths in the headline specification, in which each group’s base saving rate is fitted separately: in each year, the median across 500 runs of 20,000 households each. Shaded bands span the 5th to 95th percentiles across runs for current and for equal conditions. Equal conditions: earnings and mobility parity by 2040, equal returns by 2035, and survival parity by 2050, with Black households keeping their lower saving. Equal saving: Black households’ base saving rate and support to relatives reach the White ones by 2035. Transfer: \$250,000 to each Black household in 2030.

Table 12. The Black-to-White ratio of median household wealth under each path, in the headline specification and with one saving schedule for both groups.

Path	2050	2075	2100	First reaches 0.5	Closed from*	Closed in 2100†
<i>Headline: each group's base saving rate fitted separately (9.0% Black, 10.5% White)</i>						
Current conditions	0.13	0.17 (0.13–0.21)	0.21	after 2100	after 2100	0%
Equal conditions, Black households keeping their lower saving	0.44	0.74 (0.63–0.83)	0.90	2057	after 2100	48%
Equal conditions and equal saving	0.53	0.88 (0.75–0.99)	1.07	2049	2077	99%
Equal conditions, equal saving, and the transfer	1.02	1.01 (0.91–1.10)	1.09	2030	2030	100%
<i>Sensitivity: one base saving schedule for both groups (10.4%), the only specification run for single levers</i>						
Current conditions	0.16	0.21 (0.15–0.27)	0.26	after 2100	after 2100	0%
Earnings and mobility parity by 2040	0.38	0.57 (0.42–0.72)	0.65	2067	after 2100	1%
Mobility parity only, by 2040	0.19	0.34 (0.25–0.43)	0.51	2096	after 2100	0%
Equal returns by 2035	0.20	0.28 (0.22–0.35)	0.38	after 2100	after 2100	0%
Survival parity by 2050	0.16	0.21 (0.16–0.27)	0.27	after 2100	after 2100	0%
Baby bonds, up to \$50,000	0.16	0.22 (0.17–0.30)	0.27	after 2100	after 2100	0%
One-time transfer of \$250,000, 2030	0.41	0.24 (0.19–0.34)	0.26	2030	after 2100	0%
Equal conditions	0.49	0.82 (0.64–0.96)	1.01	2051	2085	82%
Equal conditions and equal family support	0.50	0.84 (0.65–0.98)	1.04	2050	2084	87%
Equal conditions, equal family support, and baby bonds	0.50	0.84 (0.66–0.98)	1.03	2050	2084	86%
Equal conditions, equal family support, and the transfer	0.96	0.95 (0.78–1.07)	1.06	2030	2068	91%

Median across 500 runs of 20,000 households each (10 million simulated households per path), in each year; in parentheses, the 5th to 95th percentile across runs, which reflects the parameters and market sequences drawn in each run, not the calibration or survey sampling error. Each specification has its own calibration. Levers phase in linearly from 2025. Earnings and mobility parity: Black workers reach the White income distribution at the same within-group rank by 2040 and children's income ranks follow the White intergenerational equation. Equal returns: Black households hold White portfolios at the same age and wealth, without the housing-distress gap, by 2035. Survival parity: Black death rates converge to White rates by 2050. Equal conditions combines these three. Equal saving: Black households' base saving rate and support to relatives reach the White ones by 2035; with one saving schedule only support differs (equal family support). Baby bonds: up to \$50,000 at household formation, falling with parents' income rank, for children born from 2025. Transfer: \$250,000 to each Black household in 2030. * The median, across runs, of the first year from which a run's median ratio stays at or above 0.9 through 2100. † Share of runs in which the ratio is at least 0.9 in 2100.

5.5 What closes the gap

Only combinations close the gap. In the headline specification, equal conditions (earnings and mobility parity by 2040, equal returns by 2035, and survival parity by 2050) raise the median ratio to 0.44 by 2050, 0.74 by 2075, and 0.90 by 2100 (90% of runs between 0.78 and 0.96) if Black households keep their lower saving and their support to relatives. The ratio is at least 0.9 in 48% of runs in 2100, and the median run does not stay at or above 0.9 by 2100. Equal conditions stop the forces that keep the gap open but leave the initial difference in wealth, and the difference in saving, to be worked off across generations. Equal saving is therefore a separate lever: if Black households' base saving rate and their support to relatives also reach the White ones by 2035, the ratio reaches 0.53 by 2050, 0.88 by 2075, and 1.07 by 2100, at least 0.9 in 99% of runs; half the runs stay at or above 0.9 from 2077 or earlier, and the median run does so from 2076. Because the saving gap is a fitted residual, not a measured behavior (Section 5.1), what would move it, and whether it reflects saving at all rather than something the model leaves out, is unknown. With one saving schedule for both groups, equal conditions reach 1.01 by 2100 (82% of runs at or above 0.9), and 1.04 with equal family support as well; without the end-of-life cost in that calibration, the latter reach 1.12. With the one-time transfer added to equal conditions and equal saving, half the runs close the gap from 2030, when the transfer is paid, and the median run from 2054; the gap stays closed, and 100% of runs are closed in 2100 (with one saving schedule, half the runs close from 2068). To find the smallest steps that suffice, we screened the combinations of levers and reran the most promising at full size, 10 million households each (Table 13). The screen was run only with one saving schedule for both groups, so whether the same combinations suffice in the headline specification is not known. The smallest combinations that do are, by 2050, earnings parity by 2060, equal returns, and a \$500,000 transfer; by 2075, the same; by 2100, earnings parity by 2060 and equal returns. Without a transfer, earnings parity and equal returns close the gap by 2100 only at the edge of the criterion, in 84% (parity by 2035), 88% (parity by 2045), and 92% (parity by 2060) of full-size runs. Earlier parity raises the ratio sooner (0.51 in 2050 with parity by 2035, against 0.39 with parity by 2060) but ends lower in 2100 (1.01 against 1.09), so these shares do not rise with earlier parity. The criterion has no upper bound, and the closing combinations overshoot parity, with median ratios of 1.07–1.33.

Table 13. The smallest combinations of levers that close the gap, by target year (one saving schedule for both groups).

Gap closed by	Smallest combinations of levers	Runs that close	Median ratio then
2050	Earnings parity by 2060; equal returns; a \$500,000 transfer	96%	1.32
	Earnings parity by 2060; equal returns; survival parity; a \$500,000 transfer	97%	1.33
2075	Earnings parity by 2060; equal returns; a \$500,000 transfer	96%	1.09
	Earnings parity by 2060; equal returns; survival parity; a \$500,000 transfer	97%	1.10
2100	Earnings parity by 2060; equal returns	92%	1.09
	Earnings parity by 2060; equal returns; survival parity	93%	1.10

Gap closed by	Smallest combinations of levers	Runs that close	Median ratio then
	Earnings parity by 2045; equal returns; a \$250,000 transfer	93%	1.07

One base saving schedule for both groups, the only specification under which the grid was run. Grid search over 256 combinations: earnings parity with equal family support (none, or by 2035, 2045, or 2060), equal returns, survival parity, baby bonds (\$0, \$25,000, \$50,000, or \$100,000), and a one-time transfer in 2030 (\$0, \$100,000, \$250,000, or \$500,000 per Black household), screened with 48 runs of 8,000 households each. For each target year, the screened combinations were then rerun in the table’s order with 500 runs of 20,000 households each (10 million households per combination), skipping any that closed the gap in fewer than 70% of screening runs; 17 combinations were rerun in all, and the table reports those runs. A combination closes the gap by a year when, in at least 90% of runs, the median ratio is at least 0.9 in that year and stays there at each later checkpoint through 2100; combinations are ranked by the number of levers, then by the size of the transfer and the endowment, and each kind is shown once, with the latest parity year that passes. The criterion has no upper bound: the median ratio in the last column shows how far a combination overshoots.

Table 14 divides the change in the median ratio among four levers by their Shapley values, each lever’s added effect averaged over every order in which the levers could be added, computed run by run from the screening grid, which was run with one saving schedule for both groups. By 2100, earnings parity contributes +0.51 and equal returns +0.24, although equal returns alone add only +0.11. That gap does not mean the levers amplify each other. Each lever raises Black wealth by roughly a constant factor, so a lever moves the ratio more once another lever has raised Black wealth: on the ratio, the four levers together add 1.47–1.60 times the sum of their effects alone between 2050 and 2100, but on the logarithm of the ratio they add 0.88–1.03 times that sum, close to additive. The independent re-implementation of Section 5.8 finds the same in log wealth. Survival parity contributes 0.00. The transfer contributes +0.35 in 2050 but +0.01 by 2100. That earnings dominate agrees with the general-equilibrium model of Aliprantis, Carroll, and Young [9] and with Barsky and colleagues’ estimate that differences in earnings account for about two thirds of the Black–White gap in mean wealth [52].

Table 14. Shapley values of four levers for the Black-to-White ratio of median wealth (one saving schedule for both groups).

Lever	2050	2075	2100
<i>Shapley value: mean contribution to the median ratio (5th–95th percentile across runs)</i>			
Earnings and mobility parity, with equal family support	+0.29 (+0.22 to +0.37)	+0.45 (+0.32 to +0.57)	+0.51 (+0.44 to +0.59)
Equal returns	+0.17 (+0.11 to +0.22)	+0.20 (+0.14 to +0.27)	+0.24 (+0.16 to +0.32)
Survival parity	0.00 (−0.01 to +0.02)	0.00 (−0.01 to +0.02)	0.00 (−0.01 to +0.02)
One-time transfer of \$250,000	+0.35 (+0.25 to +0.48)	+0.08 (+0.02 to +0.14)	+0.01 (0.00 to +0.04)
<i>Effect of the lever alone, for comparison</i>			
Earnings and mobility parity, with equal family support	+0.24	+0.36	+0.39
Equal returns	+0.05	+0.07	+0.11
Survival parity	0.00	0.00	0.00
One-time transfer of \$250,000	+0.24	+0.04	0.00

Lever	2050	2075	2100
<i>Median ratio</i>			
No lever	0.16	0.20	0.26
All four levers	0.99	0.97	1.03

Computed run by run from the screening grid (48 runs of 8,000 households per combination; every combination uses the same random streams), with earnings parity by 2035, equal returns by 2035, survival parity by 2050, and the transfer in 2030. A lever’s Shapley value is its added effect on the median ratio averaged over every order in which the levers could be added; the four values sum to the difference between all four levers and none. The effect alone is the lever added to current conditions. The grid was run only with one base saving schedule for both groups, and its earnings lever also brings Black households’ support to relatives to the White rate. On the ratio, the four levers together add 1.47–1.60 times the sum of their effects alone (2050 to 2100); on the logarithm of the ratio, 0.88–1.03 times: each lever scales Black wealth by a factor, so effects that are close to additive in log wealth compound in the ratio.

Three implications follow within the model. Transfers last only when the forces that widen the gap stop: unequal pay and opportunity, and unequal access to diversified assets that do not have to be sold in distress. The initial difference in wealth is worked off slowly through children’s endowments, which do not close the gap this century, or quickly through a capital transfer of \$250,000 to \$500,000 per Black household, about \$3.8 trillion to \$7.6 trillion in all. And closing the survival gap barely moves the wealth ratio but accounts for most of the gains in years of life.

5.6 What closing the gap would add

Table 15 compares current and equal conditions in the headline specification, with Black households keeping their lower saving. By 2050, equal conditions would add about \$7.6 trillion to Black household wealth, and \$22.8 trillion by 2075 (\$25.6 trillion with equal saving as well; \$20.7 trillion with one saving schedule and equal family support), in real 2024 dollars on a path where real wages grow by a factor of 1.43 between 2024 and 2050 (version 2.0, without wage growth: \$10.8 trillion by 2075). Black household income before 67 would be \$1.97 trillion a year higher by 2050, or \$1.38 trillion in 2024 wage terms, 4.7% of 2024 gross domestic product [53]. How much of that is added output rather than redistribution depends on effects the model does not include. The added wealth alone would support about \$242 billion a year in consumer spending at the measured propensity to consume out of wealth [51]. Through survival parity and the wealth–mortality link, life expectancy at 40 would rise by 2075 from 40.5 to 43.2 years for Black men and from 44.9 to 46.2 years for Black women. Survival parity, which is imposed rather than produced by any lever, accounts for most of that gain. How much wealth adds depends on the share of the wealth–mortality gradient treated as causal: in runs with one saving schedule and that share fixed at zero, one sixth, and one half, earnings parity alone adds 0.00, 0.16, and 0.48 years to Black men’s life expectancy at 40 (version 2.0, with a share between a quarter and three quarters: 0.5), survival parity alone adds 2.7, 2.5, and 2.0, and equal conditions with equal family support give 43.2, 43.1, and 42.9 years. The death rate of Black adults aged 25 to 64 would fall from 341 to 229 per 100,000, the share of Black couples aged 30 who lose a partner before 67 from 32% to 23%, and the share of Black children who lose both parents by 45 from 6.3% to 3.2%.

Table 15. What equal conditions would add: Black household wealth, income, spending, and years of life.

Black households and adults	2050, current	2050, equal	2075, current	2075, equal
<i>Wealth and income, trillions of 2024 dollars</i>				
Household wealth	3.7	11.4	5.0	27.8
Household income before 67, per year	1.43	3.40	2.25	4.30
Added wealth*	—	7.6	—	22.8
Added wealth with equal saving as well*	—	8.5	—	25.6
Added income, share of 2024 GDP*‡	—	4.7%	—	3.7%
Added spending from added wealth, per year†	—	242 bn	—	729 bn
<i>Life and family</i>				
Life expectancy at 40, men	38.1	41.1	40.5	43.2
Life expectancy at 40, women	42.9	44.5	44.9	46.2
Deaths at ages 25–64, per 100,000 a year	437	294	341	229
Die between 25 and 65, men	22.5%	15.1%	18.4%	12.2%
Couple aged 30 loses a partner before 67	38.5%	27.7%	32.1%	22.7%
Child loses both parents by 45	9.0%	4.8%	6.3%	3.2%

Headline specification (each group’s base saving rate fitted separately). Current: current conditions. Equal: equal conditions, that is, earnings and mobility parity by 2040, equal returns by 2035, and Black death rates converging to White rates by 2050, with Black households keeping their lower saving and their support to relatives; equal saving also brings both to the White schedule by 2035. Real 2024 dollars on a path where real wages grow as the 2026 Trustees Report projects (by a factor of 1.43 from 2024 to 2050). Medians across runs; in both paths mortality also falls with household wealth through the hazard ratios of Machado et al., of which a share drawn between 0 and one sixth in each run is treated as causal. Life outcomes are period measures from the death probabilities applied to household heads and partners in the simulation. * Median of run-by-run differences from current conditions (both paths draw markets and White households from the same random streams). † A marginal propensity to consume of 3.2 cents per dollar of wealth per year; a demand-side estimate that ignores any offsetting change in policy. ‡ Income added in that year divided by real wage growth since 2024, against 2024 GDP.

5.7 Where the gains would land

The microsimulation is national, so it does not say where its gains would arise. To show where they would be largest, we apportion them to the 50 states and the District of Columbia. For each state, the 2020–2024 American Community Survey Public Use Microdata Sample gives the number of households headed by a non-Hispanic Black person and the mean income of non-Hispanic Black and of non-Hispanic White households, the groups of the national model [54]. From these we compute, for each state, the income its Black households would add if their mean income reached that of White households in the same state, and divide the national gains among the states in proportion to that shortfall. The states’ shares do not depend on the specification; the dollar amounts below apportion the gains of equal conditions with equal family support under one saving schedule for both groups (\$20.7 trillion by 2075), the national figure the state view was built on, rather than the headline’s \$22.8 trillion. This is an apportionment, not a state-level simulation: it assumes that the gains would arise where today’s shortfall is, and it ignores migration and differences between states in prices, growth, and returns.

The gains would follow the Black population. The Census Bureau’s South region, home to 59% of Black households, would receive 57% of the national gain, and ten states would receive 61% (Table 16). Texas, New York, and Georgia lead; Texas alone would gain about \$2.1 trillion in Black household wealth by 2075. Relative to the size of their economies, the gains would be largest in Mississippi and the District of Columbia, where the added income in 2050, in 2024 wage terms, would equal about 19% of their 2024 gross domestic product [55], against 4.7% for the nation. Apportioning by each state’s share of Black households instead gives almost the same ranking (Spearman correlation 0.98); weighting by the income gap raises states where that gap is wider per household, such as New York, California, and New Jersey. Counting Black householders of any ethnicity, as the published summary tables do and version 2.0 of this paper did, moves no state’s share by more than 0.4 percentage points (the largest change is in New York; Spearman correlation 0.998). The survey’s 80 replicate weights put the 90% margin of error of each of the ten largest shares at 0.2 percentage points or less. Estimates for the nine states with the fewest Black households (Alaska, Idaho, Maine, Montana, New Hampshire, North Dakota, South Dakota, Vermont, and Wyoming) are imprecise, and the replication data flag them.

Table 16. Where the gains would land: the ten states with the largest apportioned gains under equal conditions (one saving schedule for both groups).

State	Black households (thousands)	Wealth added by 2075 (billions)	Share of the national gain	Income added in 2050, share of 2024 state GDP
Texas	1,404	2,068	10.0%	4.9%
New York	989	1,570	7.6%	4.5%
Georgia	1,253	1,527	7.4%	11.5%
California	787	1,396	6.8%	2.3%
Florida	1,136	1,357	6.6%	5.3%
North Carolina	879	1,077	5.2%	8.4%
Illinois	676	1,060	5.1%	6.0%
Maryland	704	950	4.6%	11.6%
Virginia	622	896	4.3%	7.8%
New Jersey	423	745	3.6%	5.9%
These ten states	8,872	12,644	61.2%	7.5%
United States	15,342	20,665	100.0%	4.7%

An apportionment of the national gains under equal conditions with equal family support and one saving schedule for both groups (Table 12, lower block), not a state-level simulation; the shares do not depend on the specification, the dollar amounts do. Each state’s share is the household income its Black households would add if their mean household income equaled that of White non-Hispanic households in the same state: Black households times the difference in mean income (aggregate household income divided by households), from the 2020–2024 American Community Survey 5-year Public Use Microdata Sample, for householders who are Black alone or White alone, both not Hispanic [54]. Wealth added by 2075 and income added in 2050 are that share of the national totals, in 2024 dollars; the last column divides the state’s income added in 2050 by its current-dollar GDP in 2024 [55], and the national row by U.S. GDP. The 90% margin of error of each share, from the survey’s 80 replicate weights, is at most 0.2 percentage points in these ten states. Apportioning by each state’s share of Black households instead gives a Spearman rank correlation of 0.98 with this ranking; counting Black householders of any ethnicity, from Summary File tables B11001B and B19025B as in version 2.0, gives 0.998.

What the microsimulation adds. The wealth gap is not a fixed sum to be paid off once. It is a flow, sustained by unequal earnings, unequal returns, and unequal lives acting on an unequal starting point. The model puts dates and dollars on what it would take to stop the flow and close the stock, and on what closing it would return. Its numbers depend on its assumptions, above all on whether the two groups save alike at equal income, and all of them are in the replication files.

5.8 An independent replication

Before this version, we built a second model of the same question from the same primary data, with separate code written independently of the first and without reading the first model’s output until the second had been specified, calibrated, and run, and compared the two using version 2.0 of this paper. It is a re-implementation of the question, not of the code: an annual accounting model with cells by race, age, and income rank, seven calibrated parameters, 120 paired draws, and four levers defined differently from ours (survival parity; parity in the receipt of inheritances and in family help in emergencies; equal access to assets, including portfolios, leverage, and housing returns; and parity in high-cost interest, fees, and stress spending), with earnings parity as a reference path. Its inputs reproduce ours: 12 of 12 entries of Table 1 that it recomputed from the life tables agree to the printed precision, and it puts the age-composition channel at 1.39–1.56% of the log wealth gap, with medians and with means by age, against 1.39–1.54% in Section 3. Its levers are additive in log wealth: all four together closed 0.94–0.99 times the sum of what each closed alone at horizons from 2035 to 2100 (5th to 95th percentiles across draws from 0.82 to 1.34), the same near-additivity our grid shows on the logarithm of the ratio (Section 5.5). Combinations are needed because no single lever is large enough, not because levers amplify each other. Its calibrated saving residual has the sign opposite to version 2.0’s: Black households save less (11.8% against 15.9% at the median rank), where version 2.0 found them saving more. That the sign follows the specification is why this version treats the saving gap as a fitted residual and equal saving as a separate lever. A one-time transfer fades in it too: \$200,000 per Black household in 2030 closes 70% of the log gap by 2035 and 0.5% by 2100 under unchanged conditions. Its equal-access lever is the largest after earnings (about 25% of the log gap by 2075), and the lever on high-cost interest, fees, and stress spending is small: about \$109 per Black household a year in 2050 and 0.7% of the log gap by 2075. Like ours, it finds that survival parity barely moves median wealth and that earnings parity is the largest lever (a ratio of 0.90 by 2100). It was run against version 2.0, not this version; its outputs are summarized in the replication files.

6 Quality of life in the later years

Longevity counts years; people live in them. In 1980 Fries argued that if the onset of chronic illness could be postponed faster than death, illness would be compressed into a short period at the end of life [56]. Whether that happens for a given person depends heavily on resources.

Healthy years. In harmonized data from England and the United States, the socioeconomic disadvantage in disability-free life expectancy was largest for wealth: at age 50, people in the poorest group could expect seven to nine fewer years without disability than those in the richest

[57]. Among Americans aged 54–64, those in the poorest wealth quintile had more than three times the ten-year risk of disability of those in the richest (48% versus 15%) [3]. Racial gaps extend to healthy years: in life-table models built from 1990 census data, Black Americans lived the fewest years of the major racial groups and spent a high proportion of them with a chronic health problem [58].

Money in later life. Under the Census Bureau’s official measure, 9.8% of Americans aged 65 and older were poor in 2025. Under the Supplemental Poverty Measure, which subtracts out-of-pocket medical spending and accounts for taxes and benefits, the rate was 15.4%, the highest of any age group, and medical expenses alone raised the older-adult rate by 3.8 percentage points [59]. Poverty in later life is unequal by race: under the official measure, 17.3% of Black adults aged 65 and older were poor in 2020–2022, more than twice the rate among older White adults, 7.7% [60]. Social Security lifted 20.9 million people aged 65 and older out of poverty under the supplemental measure in 2025 [59], which is why the annuity channel in Section 3 matters.

Decisions in later life. Financial mistakes follow a U-shape over the life cycle; across ten kinds of credit decisions, they are least costly around age 53 and become more common with age thereafter [61]. Financial trouble can also precede a dementia diagnosis: Medicare beneficiaries living alone who were later diagnosed with Alzheimer disease or a related dementia were slightly more likely than similar beneficiaries to miss credit payments as early as six years before diagnosis (7.7% versus 7.3%), and the difference grew after diagnosis [62]. The early difference is small, so a missed payment says little about any one person; the finding argues for consent-based safeguards, such as a trusted contact, rather than for inferring anyone’s health from their spending.

Connection. Across 148 studies, people with stronger social relationships had a 50% greater likelihood of survival over the follow-up periods studied, an effect comparable to quitting smoking [63]. Wealth buys more than care; it sustains participation in family and community life.

On this evidence, a good later life requires enough wealth to compress illness into the end of life rather than spread it across decades; protection from costly mistakes and exploitation as cognition changes; and the autonomy and connection that make long life worth having. All three are distributed unequally by wealth and therefore by race.

7 Stress spending: the everyday mechanism

Chronic stress shortens lives through the body. It may also drain wealth through behavior; one everyday route is spending that soothes a state rather than serves a goal. We use *stress spending* for purchases whose timing and content are better explained by the buyer’s momentary state (sadness, exhaustion, anxiety, depletion) than by their plans. This is a construct for research, not a validated measure.

7.1 Emotion carries over into prices

Incidental emotions, unrelated to the purchase at hand, change what people will pay. In experiments with real goods and money, induced sadness raised the prices people chose to pay and lowered the prices at which they would sell, reversing the usual endowment effect [64]; sad participants who were also self-focused spent more on the same item [65]. Shopping can also repair

mood. Making purchase decisions reduced residual sadness by restoring a sense of personal control [66], and unplanned treats bought to repair a bad mood were not, on average, followed by regret or guilt [67]. A product that treated every comfort purchase as pathology would therefore be wrong as well as unkind. The target is the pattern that hurts: repeated, escalating, regretted spending.

7.2 The body sets the stage

In a laboratory study, one night without sleep moved healthy volunteers' risky choices away from avoiding losses and toward pursuing gains, with matching changes in brain activity [68]. Heart rate variability (HRV) is linked to activity in brain regions that regulate emotion and threat and is widely used as a marker of stress and regulatory capacity [69]. Sleep debt, lower HRV, and higher resting heart rate, each measured against a person's own baseline, are therefore plausible but unvalidated indicators of the moments when self-regulation is hardest: the studies above used laboratory sleep deprivation and brain imaging, and none of the work we cite shows that consumer-device measures of sleep or heart rate predict regretted spending.

7.3 Scarcity narrows attention

Prompting people to think about a costly financial problem reduced cognitive performance among lower-income participants but not among higher-income ones, and the same sugarcane farmers performed worse before harvest, when poor, than after it [70]. Scarcity focuses attention on the present problem and leads people to over-borrow against the future [71]. Financial stress can impair the very capacities needed to escape it. Some of this literature has not held up, however: an audit that repeated 20 studies of the psychological consequences of scarcity found considerable variation in how well they replicated, with some strong successes and some clear failures [72].

7.4 Mental health and money move together

In a self-selected online survey of 5,413 people in the United Kingdom with lived experience of mental health problems, 93% said they had spent more than usual when unwell, 92% found financial decisions harder, and 59% had taken out a loan they otherwise would not have [73]. A meta-analysis found that people with unsecured debt had about three times the odds of a mental disorder (odds ratio 3.24), although the direction of causation is unclear [74], and among 8,400 young American adults, high debt relative to assets was associated with higher perceived stress and depression, worse self-rated health, and higher diastolic blood pressure [75].

7.5 Products can make it worse

After states legalized online sports betting, betting spread quickly and savings fell as risky bets crowded out investment; among financially constrained households, credit card debt and overdrafts rose and available credit fell [76]. Always-on access to speculative or compulsive spending is not neutral for households under strain.

7.6 The loop, and where to break it

Together these findings describe a loop (Figure 1): adversity raises stress; stress, sleep loss, and low mood change what people buy; unplanned spending and debt raise financial strain; and financial strain is itself a chronic stressor that wears down the body. The loop can be interrupted at several points. Income support, debt relief, and health care act on its largest drivers. A smaller point of intervention is the moment just before the next purchase, when a little context, a little friction, or a commitment made in a calmer moment might change what happens next. Defaults [77], precommitment to future behavior [78], and self-chosen commitment devices [79] have changed financial behavior in other settings; whether the same tools, timed by context, can interrupt stress spending is untested.

8 Other wealth gaps where the same forces may operate

The mechanisms in Sections 2–7 are not specific to race. Wherever savings must stretch over more years than they can cover, wherever stress is chronic, and wherever products profit from moments of weakness, wealth gaps can open. This section summarizes published evidence on eight such gaps; Table 17 lists the evidence for each, with its year and measure, and the mechanism behind it. It does not estimate how much each mechanism contributes to any gap (Section 9).

Women: more years, fewer dollars. Women live longer. In 2024, life expectancy at 65 was 20.8 years for women and 18.4 for men, and a woman alive at 22 can expect 16.7 years of life at 67 and older against 13.4 for a man, 25% more [8]. Those years must be funded from smaller balances. Among unmarried householders, women had less median wealth than men under 35, at 35–54, and at 65 and over; unmarried women under 35 held a median of \$8,040, 30.9% of their male counterparts’ wealth [80]. Older women are more often poor: in 2020–2022, 11.0% of women aged 65 and over were below the official poverty line, against 8.5% of men [60]. The partner channel in Section 3 adds to the burden. If both partners are 30 and their risks are independent, the 2024 life tables give the woman a 59% chance of outliving the man (64% if he is two years older), so the longest stretch of later life is most often funded by a woman alone.

Hispanic Americans: long lives, thin buffers. Hispanic Americans live longer than non-Hispanic White Americans (81.8 years at birth against 78.9 in 2024) [8], a pattern described in 1986 as an epidemiologic paradox because it coexists with lower incomes [81]. Their wealth does not match their longevity. In 2022 the typical Hispanic family held \$61,600, about 22% of the typical White family’s \$285,000 [6]; 15.5% of Hispanic households had zero or negative wealth [80]; and among middle-aged families, 28% of Hispanic families held a retirement account, against 65% of White families [20]. A Hispanic 22-year-old can expect 17.5 years of life at 67 and older, 18% more than a White 22-year-old, to be financed with a fraction of the savings. Older Hispanic adults are poor at more than twice the rate of older White adults (17.4% against 7.7%) [60]. Here longevity is an advantage that the wealth gap turns into a risk: outliving one’s savings.

American Indian and Alaska Native people: the shortest lives. In 2024, American Indian and Alaska Native people had the lowest life expectancy of any racial or ethnic group in the life tables, 71.1 years, and only 65.4% of a birth cohort survives to 65 [8]. Older American

Indian and Alaska Native adults are poor at the same rate as older Hispanic adults, 17.4% [60]. The survival channels in Section 3 are larger for this population: under 2024 death rates, an American Indian or Alaska Native 22-year-old would have a 64.2% chance of reaching 67 (White: 82.7%) and could expect 11.6 years of life after 67, 22% fewer than a White 22-year-old. Old-age mortality for this population is modeled in the life tables, which adds uncertainty [8]. Yet the Census Bureau’s wealth report and the Survey of Consumer Finances both fold American Indian and Alaska Native households into a combined “other” category [6, 80], so the wealth gap is poorly measured. A gap that is not measured is hard to close; we flag it rather than estimate it.

Table 17. Wealth gaps that the mechanisms in Sections 2–7 may widen, with the year and measure of each source. Sources differ in years, measures, and populations, and the table does not decompose any gap (Section 9).

Gap	Evidence	Mechanism
Women	Women 65+ poor at 11.0% vs. 8.5% of men, 2020–2022 [60]; 16.7 vs. 13.4 expected years at 67+ per 22-year-old, 2024	More years to fund from smaller balances; most surviving partners are women
Hispanic Americans	Median family wealth \$61,600 in 2022, 22% of White [6]; 17.5 expected years at 67+ per 22-year-old, 2024	Long lives funded from thin savings
American Indian and Alaska Native people	Life expectancy 71.1 in 2024; 64.2% of 22-year-olds reach 67; older-adult poverty 17.4%, 2020–2022 [60]	Shorter lives: the survival channels in Section 3, at greater magnitude; wealth poorly measured
Disability and mental health	Working-age poverty 25.3% vs. 11.4%, 2023 [82]; 93% in a self-selected U.K. survey said they spent more when unwell [73]	Higher costs and lower incomes; money harder to manage when unwell
Gambling harm	Credit scores fell about 0.7 points with any legal sports betting and about 12 points where online betting was added [83]	Always-available betting; debt
Penalty fees	9% of accounts paid 79% of overdraft and NSF fees [84]	Fees concentrated where buffers are thinnest
Values-based exclusion	Religious reasons cited as a barrier to accounts, mainly in the Middle East, North Africa, and South Asia, 2011 data [85]	Saving outside the financial system
Age	Under-35 median family wealth \$39,000 in 2022 [6]; costly mistakes more common among younger and older adults [61]; missed payments slightly more common years before a dementia diagnosis [62]	Inexperience; cognitive change

Disability and mental health. In 2023, 25.3% of working-age people with disabilities lived in poverty, against 11.4% of those without [82]. Poor mental health and money problems are closely linked: in the self-selected U.K. survey described in Section 7, 93% of people with lived experience of mental health problems said they had spent more than usual when unwell [73], and un-

secured debt is associated with about three times the odds of a mental disorder [74]. Money can be harder to manage when one is unwell, and the Money and Mental Health Policy Institute has called for ways to help people avoid what it calls “financial self-harm” [73].

Gambling harm. Where sports betting has been legalized, household finances have measurably worsened. In credit-report data on roughly 7 million consumers, average credit scores fell by about 0.7 points where any legal sports betting became available and by about 12 points where online or mobile betting was added in states that already allowed retail betting, alongside increases in bankruptcy filings, debt sent to collections, credit card delinquencies, and auto loan delinquencies [83]; among financially constrained households, savings fell and credit card debt and overdrafts rose [76].

Penalty fees: the scarcity tax. Fees concentrate on households with the least slack. In data from large banks, the 9% of accounts with more than ten overdraft or nonsufficient-funds transactions a year paid 79% of all such fees [84]. Combined with scarcity’s toll on attention [70, 71], small, avoidable shortfalls become a steady drain on the households with the least wealth.

Values-based exclusion. Some households avoid interest-bearing products, or particular industries, for religious or ethical reasons. Evidence on how much this keeps people out of the financial system comes from outside the United States and is dated: in 2011 survey data, religious reasons were among the barriers people reported for not having an account, most often in the Middle East and North Africa and in South Asia, and Demirgüç-Kunt and Klapper estimated that products compatible with religious beliefs could raise account ownership there by up to 10 and 5 percentage points respectively, while cautioning that such analysis cannot support causal statements [85]. When the only savings products conflict with a household’s values, saving may happen in cash or not at all.

Age. Families headed by someone under 35 held a median of \$39,000 in 2022 [6], and costly financial mistakes are more common among both younger and older adults than in middle age [61]. In later life, missed payments become slightly more common years before a diagnosis of dementia [62].

Across these gaps the pattern matches Section 3. Longer or shorter lives change how far wealth must stretch, chronic stress drains it, and products that profit from hard moments can widen gaps fastest among those with the least room for error. Any product aimed at these mechanisms should be evaluated for harm as well as benefit in exactly these households.

9 Threats to validity

Table 18 lists the main threats to the results of Sections 3 to 5, what this version did about each, what changed as a result, and what remains. Four matter most for the headline. First, whether Black and White households save alike at equal income: the headline specification, which fits the survey and its history better, has Black households saving less, and under equal conditions it gives 0.90 by 2100 unless saving also equalizes (1.07); with one saving schedule for both groups the same conditions give 1.01. The saving gap is a fitted residual, and the headline was chosen after the backcasts were seen. Second, the model fits the survey’s inheritance receipt only by removing most estate wealth. Third, it reproduces the history of the Black median from 1992 better than that of White wealth, whose growth it understates, so the current-conditions

path is probably optimistic. Fourth, that path largely converges toward the calibration’s steady state (0.20), which is above the survey’s ratio, so its level in 2100 is a property of the calibration. The single levers, the combinations, the Shapley values, the runs with fixed causal shares, and the state view were run only with one saving schedule. The ranges reported for the microsimulation contain the drawn parameters and Monte Carlo variation, not the uncertainty of the calibration or of the survey samples, and the calibration may not be fully converged. The reviews in Sections 2, 6, 7, and 8 rest largely on observational studies, and several of the sources they cite were checked against their abstracts rather than their full texts; the replication files list them.

Table 18. Threats to validity: what each threat is, what version 2.1 did about it, what changed, and what remains.

Threat	What we did	What changed	What remains
Saving rates absorb what the model leaves out	Each group’s base saving rate fitted separately (headline); one schedule for both groups kept as a sensitivity; equal saving treated as a separate lever	Equal conditions reach 0.90 by 2100 if Black households keep their lower saving (9.0% against 10.5%) and 1.07 if saving also equalizes; with one schedule, 1.01	The separate fit is the headline because it fits the survey better (loss 2.66 against 3.88) and backcasts better (9 of 9 waves against 4); the choice was made after both backcasts were seen, and the fitted gap is a residual, not measured behavior
Inheritances reach too many or too few households	Estates split among children; receipt measured as the survey asks it and targeted by age	Receipt of \$10,000 or more: 4.8% Black, 29.8% White (survey 6.5%, 26.2%; version 2.0: 50.4%, 78.1%)	Matching needs an end-of-life and settlement cost of up to \$636,000 and a 92% estate leak (one schedule: \$518,000 and 43%)
No growth; one cross-section	Trustees’ real wage growth; backcasts from 1989 and 1992 against fixed criteria	Wealth no longer falls on the current path; from 1992 the ratio is within 0.03 of the survey at 9 of 9 waves (4 of 9 with one saving schedule)	White and top-end growth is far too slow (White mean $\times 1.15$ against $\times 2.95$), so the current-conditions ratio is probably too high
Current-conditions path mistaken for a forecast	Steady state of each calibration computed and reported	Under current conditions the ratio moves toward the calibration’s steady state (0.20; 0.21 by 2100), above the survey’s 0.16	The 2100 level is a property of the calibration; no path starts from the survey’s own ratio in steady state
Wealth is assumed to lengthen lives	Causal share of the gradient bounded by lottery evidence (0 to one sixth); runs with the share fixed at 0, one sixth, and one half	Earnings parity adds 0.00, 0.16, or 0.48 years to Black men’s life expectancy at 40 (version 2.0: 0.5)	Survival parity is imposed, not produced by any lever
Social Security omitted the benefits paid on early deaths and disability	Disability, children’s, young parents’, and early widow(er)’s benefits, the earnings test, and the family maximum added; claiming at 62 as a sensitivity	A Black man’s survival penalty falls from \$17,600 to \$15,500; survivor benefits offset 30% of the partner-loss penalty	Remarriage, children living apart from a parent, and payable rather than scheduled benefits

Threat	What we did	What changed	What remains
Draws not paired across paths	Separate random streams for markets and for each group’s households and heirs; each run keeps its own mortality draw	White households’ paths are identical across paths, run by run; version 2.0 showed \$1.1 trillion of White wealth “added” by equal conditions in 2100	—
Bands mistaken for confidence intervals	Each statistic defined; Monte Carlo standard errors reported; the median run identified	Monte Carlo standard error of the 2100 median ratio at most 0.003 (one schedule: 0.007)	Calibration and survey sampling error are not in the bands; the calibration is not shown to be converged (a refinement cut its loss from 3.67 to 2.66)
Levers judged one at a time	Shapley decomposition over the combinations grid (one saving schedule); an independent re-implementation	Equal returns are worth +0.24 of the 2100 ratio by Shapley value against +0.11 alone; in log wealth the levers are close to additive	The grid, the closing combinations, and the Shapley values were not run under the headline specification
“Closing” rewards overshoot	Median ratios reported beside each closing combination	Closing combinations reach median ratios of 1.07–1.33	No upper bound or other threshold tested
State view counted Black householders of any ethnicity	Non-Hispanic groups from the ACS microdata, with replicate-weight margins of error	Rank correlation with version 2.0’s shares 0.998	An apportionment, not a state simulation
Small samples of older Black households	Sample sizes and standard errors reported	Black calibration targets at 65–74 and 75+ rest on 93 and 45 families; 26 of 84 portfolio cells borrow pooled or other-group portfolios	Not pooled across survey waves
Life-table accounting (Section 3)	Arriaga decomposition in both directions; the composition channel under several metrics (Table 2)	—	Period tables, which describe one year rather than a cohort; one national age-wealth profile; other quantities held equal to isolate survival
Couples, careers, and mortality trends (Sections 4 and 5)	Partners of the same age as a sensitivity (Table 7)	—	Independent lives on population tables; Section 4’s careers are stylized and without wage growth; the Trustees’ improvement is not race-specific; no feedback from Black wealth to prices or others’ incomes
Evidence in Sections 2, 6, 7, and 8	Full texts checked where open	—	Mostly observational; a narrative, not systematic, review; stress-spending evidence largely from laboratories and self-reports

Version numbers refer to this paper’s versions; every figure is computed from the replication files. The life tables adjust for the misclassification of race on death certificates, which adds uncertainty [8].

10 Conclusion

Years and dollars are linked in both directions: wealth buys time, and time builds wealth. In the 2024 life tables, most of the Black–White gap in life expectancy arises from deaths before 65. The channels through which that survival gap can be measured directly in net worth, the age structure of the adult population and the length of working lives, account for only about 1.4–1.5% and 1.6% of the log wealth gap. Through the channels net worth does not record, the survival gap is worth more. In an open projection model anchored to the Social Security Trustees’ assumptions, shorter lives cost a Black worker entering employment today \$8,200 to \$15,500 of expected Social Security wealth in present value, counting disability and family benefits, add \$45,450 to a Black couple’s expected loss of earnings to a partner’s death, and make it nearly twice as likely that a Black child loses both parents before 45. Survivor benefits replace about 30% of that added loss, and bequest gaps reflect parents’ wealth rather than their lifespans. Falling mortality shrinks these penalties slowly. If Black death rates converged to White rates by 2050, the Social Security penalty would nearly vanish, but about half the partner-loss penalty would remain, because it accrues in working years before 2050. A microsimulation of household wealth shows what closing the gap would take. Under current conditions it does not close; the ratio of median wealth is 0.21 in 2100, close to the calibration’s own steady state, and probably lower in reality, since the model understates the past growth of White wealth. No single lever closes it by 2100. In the specification that fits the survey best, Black households save less at equal income, and equal earnings, mobility, returns, and survival raise the across-run median ratio to 0.90 by 2100, at least 0.9 in 48% of runs. Equal saving is a separate lever: with it the ratio reaches 1.07. With one saving schedule for both groups, the same conditions reach 1.01. A capital transfer closes the gap from 2030 once those conditions and equal saving hold; alone, it fades. Equal conditions would add about \$22.8 trillion to Black household wealth by 2075 and, mostly through survival parity, years of life. An independent re-implementation with separate code reproduces the inputs and finds the levers additive in log wealth: combinations are needed because no single lever is large enough, not because the levers amplify each other. The racial wealth gap remains primarily a product of history and of continuing differences in income, inheritance, homeownership, and access to credit; in the model, it persists until those differences end.

Company technical note: why we exist, what the model asks of the product, the Understanding engine, and a planned evaluation

Part II is written by The Understanding Company about its own product, Vueni, which has not launched. It describes a design and a plan, not research findings, and Part I does not depend on it.

11 Why we exist

The Understanding Company exists because we think one moment that matters for financial health is invisible to the institutions that hold people's money. A bank sees an amount, a merchant, and a time. It does not see that a purchase came at 11:48 p.m. after a night with two hours less sleep than usual, that it is the third order of the evening, or that the last order from this merchant went back. A health app sees the sleep and the heart rate but not the purchase. Each holds half of the story, and neither acts on it.

We believe financial health is a health behavior and should be designed like one. That means treating the moment before a purchase as a moment of care: understanding why someone is spending, not only what; offering friction the person chose in advance; and protecting essential purchases. It also means taking seriously the evidence in Sections 2–8: chronic stress and thin buffers are associated with shorter lives, wealth and years compound together, and the burden of both falls hardest on households with the least room for error. Vueni does not target any racial, ethnic, gender, or disability group, and none of these characteristics is an input to any of its models.

Our product, Vueni, is a card and account built on seven commitments:

1. **Understanding, not judgment.** Every signal Vueni acts on is shown to the member in plain language (“Short sleep · 2h 12m below your usual”). An unexplained score reads as judgment; an explained one reads as understanding.
2. **Act before, not after.** Vueni's interventions take effect ahead of the next purchase, while a choice can still be made, rather than arriving as a lecture after the money is gone.
3. **Essentials protected.** Groceries, pharmacy, fuel, transit, utilities, insurance, and medical care are never flagged, and Calm Mode's limit is set above the member's typical large essential purchase (Section 13.5), so that most essential purchases go through; any declined essential purchase is counted as a harm (Section 14).
4. **The member is in charge.** Calm Mode is off, suggest, or auto, chosen by the member, and the default is suggest. A guardrail the member sets has a cooldown before it can be switched off: a commitment chosen in a calm moment for a hard one.
5. **Privacy by architecture.** Health data is reduced to three numbers on the phone, raw samples never leave it, and health data is never used for credit, underwriting, or advertising.
6. **Values-aware, not values-imposing.** Values mode lets members choose guardrails, interest-free savings, and a giving rule that fit their beliefs. Vueni does not certify any product as

meeting a religious standard.

7. Measure outcomes and publish them. Section 14 sets out what we plan to measure and report, including results that do not flatter us.

Table 19 lists the mechanisms from Part I that these features are aimed at. The features are matched to mechanisms, not to groups.

Table 19. Mechanisms from Part I and the Vueni features aimed at them. Features are matched to mechanisms, not to groups: Vueni does not target any racial, ethnic, gender, or disability group, and the engine does not use these characteristics as inputs or attempt to infer any health condition, disability, or cognitive decline. None of these features has been evaluated (Section 14).

Mechanism	Evidence in Part I	Vueni feature (optional for the member)
Long horizons to fund from thin savings	Sections 3, 6, and 8	Cash-flow forecast; Pots (named savings goals)
Shortfalls that trigger penalty fees	Section 8	Forecast warning before a projected shortfall
Stress, sleep loss, and low mood shifting purchases	Section 7	Stress score with its reasons shown; Smart Nudges; Calm Mode limits and pauses (suggest mode by default)
Buy-and-return loops	Section 7	Return-window reminders
Always-available gambling and speculation	Sections 7 and 8	Values guardrails: network blocks, detection, and a seven-day cooldown
Savings products that conflict with a household’s values	Section 8	Values mode: an interest-free savings option and a giving rule the member chooses; no religious certification
Harder financial decisions early and late in adult life	Sections 6 and 8	Smart Nudges; accountability partners the member chooses

We are not a bank: Vueni’s accounts, cards, and money movement are provided through Whop’s financial infrastructure and its partners. Nor do we claim that a card can close a racial wealth gap built over centuries. Our hypothesis is narrower: that a product that understands stress, buffers shocks, and helps people keep what they earn can improve everyday quantities, such as unplanned debt, regretted purchases, and savings that survive a bad month. Section 14 describes how we plan to test it.

12 What the model asks of the product

Section 5 shows which levers close the wealth gap and what each is worth. Most belong to employers, schools, health systems, and governments: earnings, mobility, survival, transfers, and endowments. A consumer financial product can reach four, all of which matter most for households with thin buffers: the share of income saved; the share lost to high-cost interest [86], fees, and stress spending; whether a shock forces the distressed home sale behind the Black–White gap in housing returns [46]; and whether savings earn diversified returns. Vueni is built around these four (Table 19). This section uses the microsimulation to set targets for them.

12.1 Effects we assume and must test

We have not measured Vueni’s effects (Section 14). For planning we assume that an active member raises saving by 2 percentage points of income, halves high-cost interest, cuts stress spending by half a percent of income, halves the housing-distress gap through emergency buffers, and earns half a percentage point more on positive wealth, and that 90% of members remain active each year. The saving assumption is small next to the effects of automatic enrollment and commitment devices in workplace and field settings [77–79]; the others are hypotheses that the evaluation in Section 14 is designed to test. Eligibility does not depend on race: households under 67 whose net worth is below the national median for their age.

12.2 Reach targets

Table 20 and Figure 7 show what these assumptions imply. Reaching half of eligible households, about 17 million households in 2030, 4.1 million of them Black, would add about \$5,900 to the wealth of the median Black household by 2050 (90% interval, \$5,900–\$6,000) and raise the median ratio by 0.011; reaching every eligible household would raise it by 0.021. With equal conditions and equal family support (one saving schedule), the same half reach would add \$13,900 to the median Black household and 0.015 to the ratio. Among the levers of Section 5 the product is small: its Shapley value for the 2100 median ratio, computed with the six levers of the screening grid, is 0.00, and added to equal conditions with equal family support, under one saving schedule for both groups, it moves the 2100 ratio from 1.04 to 1.03, within simulation error. The product cannot close the gap; it can narrow it and speed the work of the levers that can. Our targets follow from the model: reach half of eligible households by 2030, keep nine in ten active each year, and demonstrate the assumed effects in a randomized evaluation before claiming them.

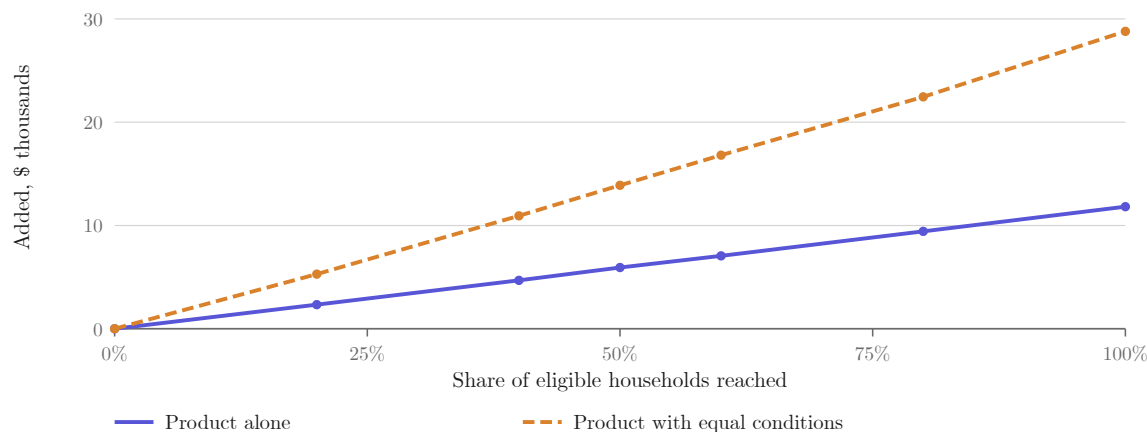


Figure 7. Wealth added to the median Black household by 2050, in thousands of 2024 dollars, against the share of eligible households the product reaches, alone and with equal conditions, under the planning assumptions of Section 12.1: medians of run-by-run differences in 1,000 runs of 12,000 households for each level of reach.

Table 20. Product reach and the wealth gap: planning targets from the microsimulation.

Eligible households reached	Adopters, 2030 (millions)	Black adopters, 2030	Median Black wealth added, 2050	Ratio change, 2050	With equal conditions
20%	6.8	1.7	\$2,300 (\$2,300–\$2,400)	+0.004	+0.006
40%	13.6	3.3	\$4,700 (\$4,600–\$4,800)	+0.009	+0.012
50%	17.1	4.1	\$5,900 (\$5,900–\$6,000)	+0.011	+0.015
60%	20.5	5.0	\$7,000 (\$7,000–\$7,200)	+0.013	+0.018
80%	27.3	6.6	\$9,400 (\$9,300–\$9,500)	+0.017	+0.024
100%	34.1	8.3	\$11,800 (\$11,700–\$12,000)	+0.021	+0.031

Eligible: households under 67 with net worth below the national median for their age (both races). Adopters raise saving by 2 points of income, halve high-cost interest, cut stress spending by 0.5% of income, halve the housing-distress gap, and earn 0.5 points more on positive wealth; 90% remain active each year. These effects are assumptions for planning (Section 12.1), not estimates. Effects are medians of run-by-run differences from no product, in 1,000 runs of 12,000 households for each level of reach; in parentheses, a 90% bootstrap interval for that median; the last column adds the product to equal conditions.

13 The harness and the models

This section describes the Understanding engine as it exists in our codebase on October 1, 2026. The engine is pure, deterministic TypeScript: given the same member snapshot, it returns the same scores, matches, cycles, and interventions. It is covered by 45 unit tests, and every spending-related number in the app screens on our website (scores, cycles, forecasts, suggestions) is computed by the engine on a synthetic member rather than typed by hand. The iOS app that will supply health signals is not yet built, the engine has not been evaluated with members, and every weight below was set by hand. We report them so that they can be criticized. The engine does not use race, ethnicity, gender, or disability as inputs, and it does not attempt to infer any health condition, disability, or cognitive decline. Some of its inputs, such as health signals, time of day, and merchant category, are correlated with those characteristics and with shift work and income, so Section 14.2 plans an audit for disparate impact.

13.1 Constraints that shaped the design

Three facts about the platform shaped the engine. First, the card platform reports transactions after authorization and offers no real-time approve-or-decline hook, so the engine cannot stop a purchase in flight; it acts ahead of the next one by adjusting the card’s per-purchase limit, pausing the card briefly, or scheduling a reminder. Second, the card program declines some merchant categories at authorization by default, including the gambling codes; gambling-adjacent merchants that code themselves differently, such as sweepstakes casinos and prediction markets, can be detected only after the charge. Third, health data must stay on the phone. The iOS app will compute three deltas against the member’s own 14-day baseline (minutes of sleep below baseline, percent change in overnight HRV, and percent change in resting heart rate) and send only those; the server route accepts nothing else.

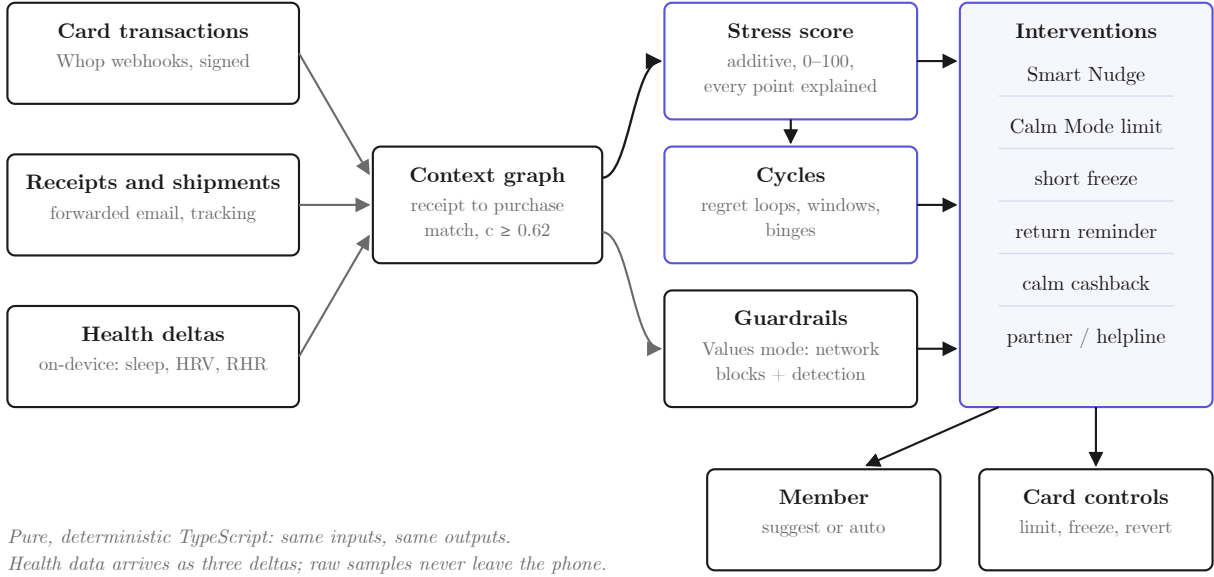


Figure 8. The Understanding engine. A card transaction anchors a context graph of receipts, shipments, and health deltas. Explainable scores and named cycles drive a ladder of interventions, which the member accepts (suggest mode) or is told about (auto mode). Values guardrails run alongside.

13.2 The context graph and receipt matching

A card transaction is the anchor; receipts, shipments, and health signals attach to it (Figure 8). Receipts arrive by email forwarding. A rule-based parser extracts the total, order number, items, return window, and tracking numbers; emails it cannot parse are reserved for a language-model extraction pass with the same output schema. A receipt is matched to the transaction it paid for by a weighted confidence

$$c = 0.50 s_{\text{amount}} + 0.35 s_{\text{merchant}} + 0.15 s_{\text{time}}, \quad (4)$$

where s_{amount} is 1 for an exact match to the cent, declines linearly to 0.4 at a 3% difference (absorbing tax, tips, and split shipments), and is 0 beyond; s_{merchant} is a bigram similarity after stripping payment-processor prefixes; and s_{time} declines linearly to 0 at three days. A match requires $c \geq 0.62$; otherwise the engine reports no match rather than guessing.

13.3 The stress score

For each purchase t , the version-0 stress score is additive:

$$S_t = \min \left(100, \sum_{k \in \mathcal{K}_t} p_k m_k \right), \quad m_k = \begin{cases} \beta(b_t) \sigma(a_t), & k \in \mathcal{C}, \\ 1, & \text{otherwise,} \end{cases} \quad (5)$$

where $\mathcal{K}_t$ is the set of factors present, p_k are the points in Table 21, and $\mathcal{C}$ is the set of contextual factors (time of day, sleep debt, HRV, and resting heart rate). The bucket weight β is 0 for essential merchant categories, 0.5 for uncategorized ones, and 1 for discretionary ones, and the

size weight σ is 0.5 for purchases under \$15 and 1 otherwise. Context therefore never adds points to an essential purchase and counts for less on a small coffee after a bad night. An essential purchase can still earn the non-contextual points for an unusually large amount or for a merchant with past returns, at most 22 points, which is below the elevated threshold, so essentials are never flagged. Health factors apply only when the latest signal was observed no more than 18 hours before the purchase or up to one hour after it. Scores of 35 and above are *elevated*; 60 and above, *high*. The model is deliberately simple: every point traces to a reason the member can see, so the explanation is the model. It is a heuristic built from the evidence in Section 7, not a validated measure of stress spending.

Table 21. Factors and points in the version-0 stress score (Equation 5). Starred factors are contextual and are multiplied by the bucket weight β and size weight σ , so they never count on essential purchases. “Buying fast” applies only to discretionary purchases.

Factor	Condition	Points
Late night*	11 p.m. to 4 a.m., member’s local time	18
Late evening*	9 to 11 p.m.	8
Short sleep*	≥ 90 / ≥ 45 minutes below 14-day baseline	16 / 8
HRV down*	$\leq -15\%$ / $\leq -8\%$ against baseline	16 / 8
Resting heart rate up*	$\geq +8\%$ / $\geq +4\%$ against baseline	10 / 5
Buying fast	1 / 2 / ≥ 3 earlier discretionary purchases in 24 hours	4 / 10 / 14
Impulse category	department stores, apparel and shoes, electronics, digital goods, beauty, gifts, online catalogs	10
Comfort purchase	restaurants, bars, fast food and delivery, liquor, tobacco	6
Bigger than usual	$\geq 2.5 \times$ the member’s median purchase in the same bucket (5+ prior)	10
Returned here before	1 / ≥ 2 refunds at a similar merchant in 120 days	8 / 12

13.4 Cycles

Stress spending is rarely a single purchase. The engine names three recurring shapes back to the member. A *regret loop* is two or more stressed purchases (score of at least 35) refunded within 45 days. A *recurring window* is three or more stressed purchases on the same weekday and in the same part of the day (mornings, afternoons, evenings, or nights, with purchases after midnight counted with the previous evening) across at least two weeks. A *binge* is three or more stressed purchases within six hours.

Table 22. The intervention ladder. In suggest mode (the default) the member accepts each limit or pause; in auto mode it applies and the member is told why. Every limit and pause reverts automatically. None of these responses has been evaluated with members (Section 14).

Trigger	Response	Rationale
Elevated purchase (35–59) in the last two hours	Smart Nudge only	Light prompts preserve choice; reminder messages have changed saving behavior in field experiments [87]
High-stress purchase (60+) in the last two hours	Per-purchase limit (Equation 6) until 8 a.m.	One night without sleep shifted risky choices toward seeking gains in a laboratory study [68]
High-stress purchase within a binge, if enabled	Three-hour pause	Self-chosen commitment devices raise follow-through [79]
Known recurring window	Calm Mode offered an hour before it opens	Commit before the hard moment, as in Save More Tomorrow [78]
Stressed purchase with a return window	Reminder three days before the window closes	Regret that can still be undone; breaks buy-regret-return loops
Seven days without a high-stress purchase	1% cashback for seven days	Rewards calm rather than only restricting stress
Values guardrail match	Network decline, or pause, partner, and support	Self-excluders generally report benefits, though programs are under-used [88]

13.5 Interventions and Smart Nudges

Interventions follow a ladder that matches the strength of the response to the strength of the evidence (Table 22). When the most recent purchase, made within the past two hours, is high-stress, Calm Mode proposes, or in auto mode applies, a per-purchase limit until 8 a.m. local time; if the member has enabled it and the purchase is part of a binge, it proposes a three-hour pause instead. The limit is

$$L = \max \left(F, 5 \lceil 1.1 Q_{0.9}(E)/5 \rceil \right), \quad (6)$$

where $Q_{0.9}(E)$ is the member’s essential purchase at the 90th-percentile rank (with the member’s n essential purchases sorted from smallest, the one in position $\lfloor 0.9n \rfloor + 1$, which is the largest when $n \leq 10$) and F is a floor of \$50. An elevated purchase triggers only a Smart Nudge, a short in-app or push message such as “Heavier day than usual. Want to sleep on the next one?” When a recurring window is known, Calm Mode is offered an hour before it opens. Stressed purchases with a stated return window generate a reminder three days before it closes. A week without a high-stress purchase earns a week of 1% cashback. Every limit and pause reverts automatically.

13.6 Forecast

A cash-flow forecast identifies recurring flows (paychecks, rent, subscriptions) as three or more flows with the same counterparty at a weekly, biweekly, or monthly cadence whose amounts vary by less than 15%, and projects the balance for 30 days. Remaining spending is modeled as

independent daily draws from the last 60 days of history, so the 80% band widens with the square root of the horizon d :

$$\hat{B}_d = B_0 + d\hat{\mu} + R_d + X_d, \quad \hat{B}_d \pm 1.2816\hat{\sigma}\sqrt{d}, \quad (7)$$

where $\hat{\mu}$ is the mean daily discretionary flow over the last 60 days (negative, because only outflows enter it), $\hat{\sigma}$ its standard deviation, R_d the sum of recurring flows due by day d , and X_d the sum of known one-off flows such as pending refunds.

13.7 Values guardrails

Members can turn on guardrails for gambling, alcohol, tobacco and vaping, adult content, and crypto and trading apps. Enforcement has two tiers, which the product never blurs: *network blocks*, where the card program declines a merchant category at authorization, and *detection*, where the engine recognizes a merchant after the charge and then pauses the card, notifies an accountability partner the member chose, or surfaces support resources such as a problem-gambling helpline. Switching a guardrail off takes effect only after a cooldown (seven days for gambling, two to three days for the others), so the guardrail is a commitment chosen in a calm moment rather than a setting undone in a hard one. Self-exclusion programs built on a similar idea are under-used and do not stop all gambling, although participants generally report benefits, including less gambling [88].

13.8 A worked example

Figures 9 and 10 show the engine’s output on the synthetic member behind our website: 23 days of card transactions (September 12 to October 4, 2026, New York time; the synthetic dates run past this paper’s date), three receipts, and six health signals for “Alex,” whose Sunday nights are hard. Groceries, pharmacy, and fuel score 0 even after short nights. A \$6.50 coffee the morning after a poor night scores 25, below the elevated threshold, because context counts half on small tickets. The engine finds all three cycles: a regret loop (two stressed purchases totaling \$306, both returned within 45 days), a recurring window (Sunday nights: six stressed purchases across four Sundays, \$566), and a binge (three purchases in six hours, \$244). At 11:48 p.m. on the fourth Sunday, a \$128 order from a merchant whose previous order Alex had sent back scores 83. The engine matches the order-confirmation email to the charge with confidence 1.0, proposes a \$125 per-purchase limit until 8 a.m. (110% of \$112.45, the largest of Alex’s nine essential purchases, which the rule in Equation 6 selects when there are ten or fewer, rounded up to \$5), and schedules a return reminder three days before the stated return window closes.

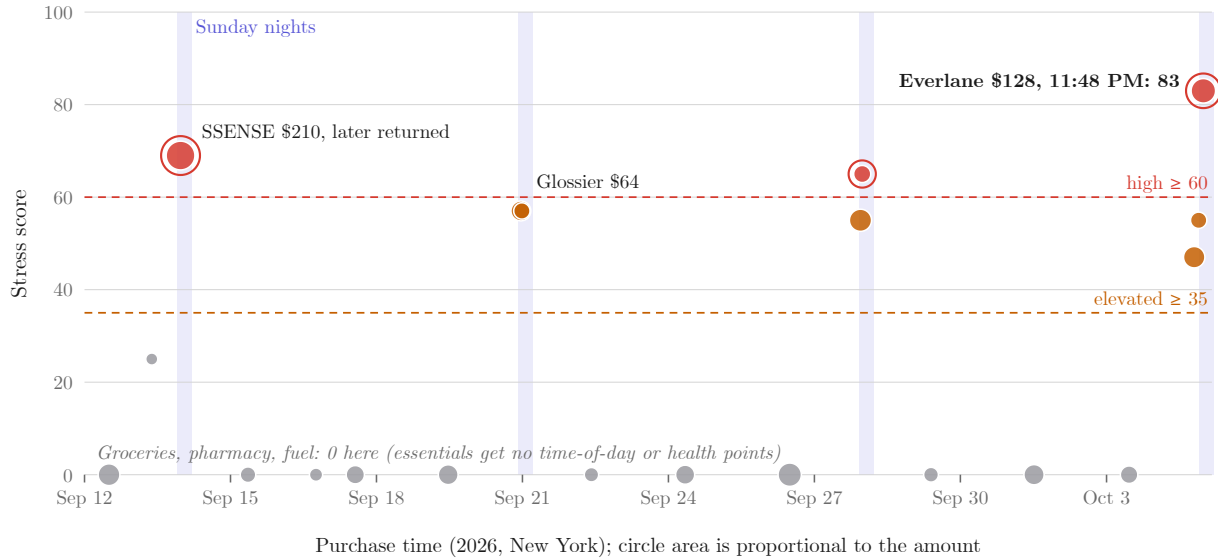


Figure 9. Twenty-three days of the synthetic member through the engine. Each circle is a purchase, colored by level (grey calm, orange elevated, red high, with an outer ring on high). Shaded columns are Sunday nights, the recurring window the engine detects. Essential purchases get no time-of-day or health points; in this example all of them score 0.

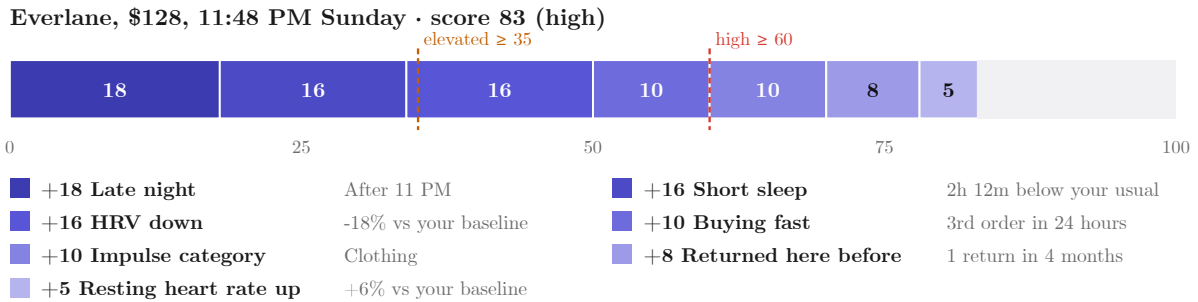


Figure 10. The explanation shown to the member for the 11:48 p.m. purchase. Each segment is one factor from Table 21; the sum is the score.

13.9 The engineering harness

The engine is a set of pure functions composed by a single entry point, `understand(member)`, which matches receipts, scores purchases, detects cycles, and plans interventions. Card events arrive by signed webhooks (verified under the Standard Webhooks scheme and deduplicated), receipts by an inbound-email route, and health deltas by an authenticated route that discards any field other than the three deltas. In auto mode, interventions execute through the card platform’s API; in suggest mode they are shown to the member first. A scheduled job reverts every temporary limit and pause. The 45 unit tests cover receipt parsing, matching, scoring, cycle detection, intervention planning, guardrails, giving calculations, and webhook verification.

13.10 From hand-set weights to learned models

The version-0 weights are priors, chosen from the literature in Section 7 and from product judgment. Once members consent to outcome measurement, we plan to learn per-member weights. Our candidate is a generalized additive logistic model of the probability that a purchase is later regretted, with regret labeled by returns of the item, by the member’s own answers in the app, and by declined Calm Mode suggestions treated as disagreement. An additive model keeps the property we care about most: each prediction decomposes into per-factor contributions that can be shown to the member. Member-level random effects let the model learn that Sunday nights are hard for one person and Friday afternoons for another; monotonicity constraints keep explanations sensible (more sleep debt never lowers a score); and thresholds will be set to bound the rate of interventions on purchases members later endorse. Race, ethnicity, gender, disability, and direct stand-ins for them, such as names or neighborhoods, will not be features. Other features, including health signals and time of day, are correlated with these characteristics, so any learned model would face the same audit as version 0 (Section 14.2). Language models will be used where language is the task, such as extracting receipts and answering members’ questions, not to score people.

14 Planned evaluation and ethics

14.1 What we plan to measure

We plan to register the design and the outcomes in Table 23 in a public registry before launch. Members who opt in to Calm Mode would be randomized, for a fixed period, between suggest mode and a holdout in which scores are computed but no interventions are shown, and analyzed by intention to treat. New intervention types would roll out in steps so that each can be evaluated against the others.

Status. This is a plan, not a registered protocol. Nothing has been registered and no registry has been chosen; no institutional review board or other independent ethics committee has reviewed the design; and the sample size, minimum detectable effects, unit of randomization, stopping rules for harm, data-retention periods, and consent language have not been set. Members assigned to the holdout would not receive interventions they might expect from Calm Mode, so the consent language would need to say so plainly before randomization.

14.2 Fairness

Because the burden of stress spending is unequal, its benefits and harms might be too. We plan to report outcomes by income band and age band and, for members who choose to share them, by self-reported gender, race and ethnicity, disability, and shift work, the last because the time-of-day factor may fall more often on people who work at night. These answers would be collected only for auditing and stored apart from every decision system. We would check that interventions do not fire more often for some groups than others at equal underlying risk, that the essentials floor protects lower-income members, whose essential purchases are smaller, and that the calm-week cashback does not pay less to members whose health signals differ because of illness, disability, or medication.

14.3 Privacy, autonomy, and paternalism

Health data is sensitive. Whether the Federal Trade Commission’s Health Breach Notification Rule [89] or state consumer health-data laws apply to Vueni is a legal question that this paper does not settle; we treat health deltas as sensitive in storage, logs, and analytics regardless. Members can turn Calm Mode off at any time; suggest mode is the default; every intervention explains itself and reverts automatically; and the only friction that persists is friction the member chose in advance. We will not sell data, use health data for credit or advertising, or optimize for engagement.

Table 23. Planned outcomes for a randomized evaluation of Calm Mode (suggest mode against a scored-but-silent holdout). To be registered before launch; not yet registered.

Outcome	Measure	Role
Regretted spending	Dollar value of stressed purchases later returned or marked as regretted	Primary
Financial distress	Overdraft, declined-payment, and late-payment events	Primary
Savings	90-day change in savings balances	Primary
Use of the tool	Calm Mode acceptance and override rates; recurrence of named cycles	Secondary
Wellbeing	Self-reported financial stress on a validated scale; sleep and HRV trends for members who share them	Secondary
Harms	Declined essential purchases (target: zero), complaints, opt-outs, spending displaced to other cards	Harm
Equity	All of the above by income band and age band and, for members who choose to share them, by self-reported gender, race and ethnicity, disability, and shift work	Audit

14.4 What we will publish

We will publish the registered protocol; the outcome results, whether or not they favor the product; the distribution of interventions across groups; and every change to the model’s weights and thresholds.

Part II has described what we built, how it works, and how we plan to learn whether it helps. We invite scrutiny of all three.

Data and code for Part II. The reach targets of Section 12 are computed by `wealthsim.mjs` (its reach phase) in the replication files, under the planning assumptions stated there. The worked example of Section 13 is the Understanding engine’s output on a synthetic member, included in the replication files as `engine-demo.json`; the engine’s source code is proprietary.

Data and code availability

Life tables: National Center for Health Statistics, *United States Life Tables, 2024*, spreadsheet tables at https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/NVSR/75-05/. Mortality projections: Social Security Administration, Office of the Chief Actuary, death probabilities from the 2026 Trustees Report at <https://www.ssa.gov/oact/Downloadables/CY/>. Earnings: U.S. Census Bureau, Current Population Survey, 2025 Annual Social and Economic Supplement, table PINC-03, at <https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-pinc/pinc-03.2024.html>. Wealth: Board of Governors of the Federal Reserve

System, Survey of Consumer Finances, summary extract and replicate weights at <https://www.federalreserve.gov/econres/scfindex.htm>. States: U.S. Census Bureau, American Community Survey 2020–2024 5-year Public Use Microdata Sample at <https://www2.census.gov/programs-surveys/acs/data/pums/2024/5-Year/> and Summary File at https://www2.census.gov/programs-surveys/acs/summary_file/2024/table-based-SF/, and U.S. Bureau of Economic Analysis, GDP by state (table SAGDP2) at <https://apps.bea.gov/regional/zip/SAGDP.zip>. Social Security disability: Social Security Administration, *Annual Statistical Report on the Social Security Disability Insurance Program, 2024*, and the Current Population Survey 2025 public-use microdata at <https://www2.census.gov/programs-surveys/cps/datasets/2025/march/>. Validation: the 1989–2019 Survey of Consumer Finances summary extracts and the 2022 full public data set (same address as above), the Federal Reserve’s Distributional Financial Accounts, realized market and house-price returns, and consumer prices, with their sources listed in the replication files. Every number in Sections 3, 4, 5, and 8 that is not quoted from a source is computed by the replication files published with this paper at <https://theunderstanding.company/research:analysis.py> for the life-table accounting, `projection.py` and `cps_micro.py` for the projection model, `wealthsim_inputs.py`, `backcast_inputs.py`, and `wealthsim.mjs` for the microsimulation and its validation (Node.js; on a 6-core laptop the calibration took about 40 minutes and the runs behind the published results about 1.9 hours), `wealthsim_steady.mjs` for the steady state of each calibration, `cross-check.json` for the outputs of the independent re-implementation of Section 5.8 (its code is not included), `states.py` for the state view, and their public inputs (the largest survey files are downloaded by the scripts).

Disclosures

Competing interests. The authors are with The Understanding Company, which is developing Vueni, a consumer financial product that has not launched; no outcome data exist. The company would benefit if the product succeeds, so readers should weigh our interpretation accordingly. Sections 1–10 do not describe or evaluate the product. Nothing here is financial, medical, or legal advice. The paper was prepared with the assistance of AI tools, which were used to draft text, write the analysis code, and check citations; the authors are responsible for its content. All quantitative results in Sections 3, 4, 5, and 8 that are not quoted from a source were computed from public data with the files named above. On October 1, 2026, each reference in version 1.0 was checked, with AI assistance, against the publisher’s record, PubMed, PubMed Central, OpenAlex, or the issuing agency’s own document. That check found three claims that did not match their sources, three sources cited for claims they do not support, and one superseded reference; version 1.1 corrects them (see Version history), and the references added since were checked the same way on the same day, except the two state data sources of Section 5.7, which were read from the Census Bureau and the Bureau of Economic Analysis on October 2, 2026; the data and parameter sources of the projection model were read from the issuing agencies. On October 2, 2026, every reference was checked again: each DOI against its Crossref record and each web address by opening it. Two references now cite their published versions, the poverty figures for older Americans come from the Census Bureau’s 2025 report, whose supplemental-measure estimates use the thresholds the Bureau of Labor Statistics corrected in July 2026, and figures that had been checked only against abstracts were checked against full texts where these were open. The structural-model and causal-evidence references added in version 2.1 were checked against Crossref and their published abstracts. Some sources were checked against their abstracts only; the replication files list them.

Version history

Version 2.1 (October 2, 2026) revises the microsimulation and the Social Security model, adds a validation and an independent replication, and changes the microsimulation’s headline specification; several headline numbers change.

- Microsimulation, saving: each group’s base saving rate is still fitted separately, now less measured support to relatives outside the household, and the fit reverses version 2.0’s: Black households save less (9.0% against 10.5%; version 2.0: 5.9% against 3.5%). This is the headline specification because it fits the survey better than one saving schedule for both groups (a loss of 2.66 against 3.88) and its backcast from 1992 keeps the ratio within 0.03 of the survey at 9 of 9 waves (one schedule: 4); the choice was made after both backcasts were seen. One saving schedule (10.4%) is kept as a labeled sensitivity and is the only specification under which the single levers, the combinations grid, the Shapley values, the fixed causal shares, and the state view were run. “Equal conditions” now means equal earnings and mobility, returns, and survival, with Black households keeping their lower saving; equal saving is a separate, named lever. Version 2.0’s equal conditions lowered Black saving and reached 0.91 by 2100; keeping Black saving gave 1.29.
- Microsimulation, inheritances: estates are split among the parents’ living children; receipt of \$10,000 or more is measured as the 2022 survey asks it and targeted by age; an end-of-life and settlement cost is calibrated. Modeled receipt falls from 50.4% (Black) and 78.1% (White) to 4.8% and 29.8%, against 6.5% and 26.2% in the survey.
- Microsimulation, growth and corrections: real wages grow as the 2026 Trustees Report projects; survey incomes, stated in 2022 dollars, were converted as if in 2021 dollars, overstating them by 8%; markets and each group’s households and heirs now draw from separate random streams (version 2.0 showed \$1.1 trillion of White wealth “added” by equal conditions in 2100, now zero), and survival-parity runs keep each run’s own mortality draw. The causal share of the wealth–mortality gradient is bounded by lottery evidence (0 to one sixth, from a quarter to three quarters), with runs at fixed shares.
- Effect on the headline numbers: under current conditions the 2050 ratio is 0.13 (was 0.11) and the 2100 ratio 0.21 (was 0.23); under equal conditions, with Black households keeping their saving, the 2100 ratio is 0.90 (was 1.29), with 48% of runs closed; with equal saving as well it is 1.07, with 99% of runs closed (version 2.0’s equal conditions, which also equalized saving: 0.91 and 51%); with equal saving and the transfer the gap closes from 2030 (was 2074); Black wealth added by 2075 is \$22.8 trillion (was \$10.8 trillion); income added in 2050 is 4.7% of 2024 GDP in 2024 wage terms (was 5.0% in unadjusted dollars); earnings parity adds 0.00 to 0.48 years to Black men’s life expectancy at 40 through wealth (was 0.5). With one saving schedule, a combination without a transfer now closes the gap by 2100 (Table 13).
- New: a validation that runs the model forward from the 1989 and 1992 surveys against criteria fixed in advance (Section 5.2, Table 11); the steady state of each calibration, toward which the current-conditions path converges (Section 5.3); an independent re-implementation with separate code, run against version 2.0, which reproduces the inputs and finds the levers additive in log wealth (Section 5.8); Shapley values of the levers (Table 14), with wording that implied the levers amplify each other removed; one saving schedule as sensitivity rows in Table 12; definitions of every reported statistic, the median run, and Monte Carlo standard errors; and a comparison with structural models. Income added is set against GDP in 2024 wage terms, in Section 5.6 and in Table 16.
- Social Security (Section 4): disability benefits, benefits for children and young surviving parents, the reduced widow(er)’s benefit from 60 under the earnings test, and the family maximum are added, against the full payroll tax, with claiming at 62 as a sensitivity. A Black man’s survival penalty is \$15,500 (was \$17,600, now the retirement-only figure), a Black woman’s \$8,200 (was \$8,800), and a Black couple’s \$18,300 (was \$27,900). Survivor benefits offset 30% of the partner-loss penalty (version 2.0 gave 15% as an upper bound), so survivor insurance “pays less, and replaces less of the loss,” rather than “the least,” where widowhood comes earliest. Tables 5, 6, 7, and 9 gain rows.
- States (Section 5.7): non-Hispanic Black and White householders from the 2020–2024 ACS microdata, with replicate-weight margins of error, replace Black householders of any ethnicity; the ranking is nearly unchanged (Spearman correlation 0.998).
- Facts and references: every reference was re-checked against Crossref and every web address opened; two references cite their versions of record; the 2025 poverty report replaces the 2024 one; the samples behind the

older Black targets (93 and 45 families) and the 26 portfolio cells that borrow other portfolios are disclosed; rounded differences agree with the figures printed beside them. Ten references were added.

- Structure: Part I no longer depends on Part II. The product’s rows in Tables 12 and 13 moved to Section 12, the subtitle, abstract, introduction, captions, and data statement no longer refer to Part II, the “steps” of Section 5.5 are stated as implications of the model, and the list of limitations is replaced by a table of threats to validity (Table 18).

Version 2.0 adds a projection model; Part I’s other results are unchanged.

- New Section 4: an open projection model of Social Security wealth with spousal and survivor benefits, the loss of a partner, and bequests, with forecasts to 2075 under the Social Security Trustees’ mortality assumptions (Tables 5–9 and Figure 5). Later sections are renumbered, and the abstract, introduction, Section 3.4, limitations, and conclusion report its results.
- New Section 5: a microsimulation of household wealth, calibrated to the 2022 Survey of Consumer Finances and run for 10 million households per path, that projects the gap to 2100 under current conditions and under each lever, finds the smallest combinations that close it, and estimates what closing it would add in wealth, income, spending, and years of life (Tables 10–15 and Figure 6).
- New Section 5.7 (5.6 in version 2.0): where the gains of equal conditions would land, apportioning the national gains to the 50 states and the District of Columbia with the 2020–2024 American Community Survey and GDP by state (Table 16); two references were added.
- New Section 12 in Part II: product targets from the microsimulation (Table 20 and Figure 7). Later sections are renumbered.
- The conflict-of-interest statement moved from page 1 to the Disclosures section.
- New data: the 2026 Trustees Report death probabilities, Social Security benefit-formula parameters and scaled earnings factors, Current Population Survey earnings for 2024, the 2022 Survey of Consumer Finances microdata with replicate weights, funeral, end-of-life, consumer-price, and maternal-age sources, and, for the microsimulation, long-run asset returns, housing returns by race, intergenerational mobility by race, and the consumption response to wealth; sixteen references were added.

Version 1.1 corrected version 1.0 as follows.

- Gambling (Section 8 and Table 17): credit-score effects now come from the published version of Hollenbeck, Larsen, and Proserpio (about 0.7 points with any legal sports betting and about 12 points where online betting was added), replacing figures from their April 2025 working paper.
- Section 3.2: removed a claim, attributed to Boen, Keister, and Aronson, that unsecured debt harmed young Black adults’ health more than White adults’; their study of adults 25 and older reports no such difference.
- Social Security (abstract, Section 3.3, Tables 3 and 4, Section 9): the GAO (2003) finding concerns the full program and lower lifetime earnings; it is no longer described as offsetting the shortfall at equal earnings.
- Abstract, Introduction, and Sections 3.4 and 10: the interpretation is restated within what the accounting shows. Table 4 now gives each channel’s share of the wealth gap where one can be computed, and Table 2 gives the composition channel under other metrics.
- Citations corrected or qualified: Glei et al. and Makaroun et al. (Section 1), Derenoncourt et al. (Section 1), Machado et al. (Section 2), Nicholas et al. (Sections 6 and 8), Gainsbury (Section 13 and Table 22), Madrian and Shea (replaced by Karlan et al. in Table 22), Venkatraman et al. (Table 22), and Baker et al. (identified as a working paper that has since been published).
- Structure: product material moved into a separately labeled Part II (Sections 11–14); the table that paired product features with demographic groups was replaced by one that pairs features with mechanisms (Table 19); a conflict-of-interest statement was added on page 1.
- The statement that the engine uses no proxy for protected characteristics was replaced with an accurate one, and the evaluation in Section 14 is now described as a plan that has not been registered or reviewed.

- Added: related work (Section 3.3), the reversed Arriaga decomposition, a partner age-gap sensitivity, survival figures for American Indian and Alaska Native people, the older Black poverty rate, a replication caveat for research on scarcity, and corrections to the engine description (essential purchases, the health-signal window, the forecast mean, the percentile used for the limit, and the length of the worked example).

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