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Retirement plan wealth inequality: measurement and trends

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Abstract

Using Health and Retirement Study data linked to summary plan descriptions and W-2s, this study reports trends in retirement wealth inequality of older employees 1992–2010. The study identifies and corrects methodological flaws in past research. Retirement wealth is highly unequally distributed; the top lifetime earnings quintile holds half of all retirement wealth, the bottom quintile, only 1%. The top earnings quintile fared better in 2010 than in 1992, whereas bottom-quintile earners fared worse. But retirement wealth inequality mainly reflects inequality within earnings quintiles, resulting from inadequate savings, not outsize accumulations. Systemic flaws reduce median retirement wealth by 84%

Key words: Inequality; retirement wealth

JEL Classification: D14; D15; H55; J32

This study uses data from the Health and Retirement Study (HRS) combined with administrative tax data to create the most accurate measures possible of retirement wealth inequality in the United States. The study's technical improvements lead to novel evidence about how American workers save for their retirement. American employers, who are not required to offer a retirement plan, increasingly provided defined contribution (DC) plans instead of defined benefit (DB) pensions or chose to offer no plan.

The study aims to quantify the level and distribution of employer-sponsored retirement plan wealth from 1992 to 2010, a period coinciding with employers using DC plans to displace DB plans. We focus on workers ages 51–56 and our findings are this predictive of shortfalls in post-retirement income. We find the progressivity of the Social Security benefit formula ameliorates, whereas housing and non-retirement financial wealth adds to, the inequalities created by employer-sponsored retirement plans. We show much of the inequality in employer-sponsored retirement wealth results from a sizeable share of the population having no retirement plan wealth, most often because their employer did not sponsor a retirement plan, and less often because workers opted to not participate in their employer's plan. Policies to mandate all employers provide a retirement plan in addition to Social Security would improve American workers' financial preparedness for retirement and reduce the retirement wealth gap.

Past studies of employer-sponsored retirement wealth are flawed because they overly rely on self-reports, ignore vital information in administrative data, and assume retirement plan summary plan descriptions (SPDs) provided by employers correctly identify plan type. This study resolves conflicts and corrects errors in data interpretation and aims to make the best and most appropriate use of all available information. We document the best technical practices of synthesizing self-reported and administrative data on retirement plans in order to highlight pitfalls for unwary future scholars and policy analysts.

This study finds that employer-sponsored retirement wealth was highly unequally distributed in both 1992 and 2010, with the majority of workers unprepared for retirement in both years. We find increasing inequality of employer-sponsored retirement wealth between high and low lifetime earners. Among high earners, ratios of employer-sponsored retirement wealth to earnings increased at all points on the distribution of wealth to earnings ratios. But among low lifetime earners, ratios of employer-sponsored retirement wealth to earnings declined for all except the upper tail of the distribution of employer-sponsored retirement wealth to earnings ratios.

Section 1 describes the HRS self-reported data, the linked extracts from W-2 tax records (forms submitted by employers to the Internal Revenue Service (IRS) showing taxable pay and retirement plan contributions among other items) and SPDs, and how previous studies have addressed limitations in the data. Section 2 reviews the literature on employer-sponsored retirement wealth coverage and inequality. Section 3 explains our methodology and, in particular, how we resolved discrepancies between self-reported and administrative data. Section 4 presents results, and section 5 discusses and concludes.

1. Data – health and retirement study

The HRS is a nationally representative panel survey of older American households. The first cohort, those born 1931–41 and their spouses of any age, was first interviewed in 1992 when they were ages 51–61. The 1942–47 and 1924–30 birth cohorts were added in 1998, the 1948–53 cohort in 2004, the 1954–59 cohort in 2010, and the 1960–65 cohort in 2016.

Data for 1992–2010 entrants who gave permission can be linked to extracts from W-2 earnings records submitted by employers. For 1992–2010 participants, HRS staff also attempted to obtain SPDs from multiple sources. The HRS provides a pension estimation program (PEP) that enables researchers to calculate retirement wealth from the SPDs.

To ensure comparability across waves, we focus on employees aged 51–56 in 1992, 1998, 2004, and 2010 who first entered the panel in those years and are matched to W-2 earnings records in their current job. We exclude workers who report they were self-employed in their primary job in the year they entered the survey because our focus is on trends in wealth in employer sponsored retirement wealth. Almost all of those who are self-employed at older ages have been employees at some stage in their career, some for considerable periods. But both the lifetime self employed and those who enter self-employment at older ages likely differ from those who are employees at older ages, and are deserving of a separate study. However, we include any self-employed earnings for previous years in our replacement rate denominator and include any balances in Individual Retirement Accounts (IRAs) for the self-employed in our calculation of retirement wealth (a replacement rate expresses post-retirement income as a percent of pre-retirement earnings). We drop workers with missing or arithmetically inconsistent W-2 data and we also drop individuals who started their job less than a year before the survey because we wanted to match the W-2 to their current job in order to identify retirement plan type. This yields samples of 2,035; 592; 859; and 669 workers (see [Table 1](#)). We defer to future research analysis of the 1960–65 birth cohort, as these have not yet been linked with SPDs and W-2s.

1.1 Self-reported data

All participants who report employment are asked about retirement plan coverage and plan characteristics (such as employer and employee contributions to DC plans or expected benefits from DB plans) at their current jobs. All new entrants are also asked about their employment history and any retirement plan coverage in their previous jobs.

As we show in the next section, the self-reported data contain significant errors. While we base our estimations of retirement wealth on the self-reported data on retirement plan type and plan characteristics at the current job, we use administrative data from W-2s and SPDs to identify and correct possible discrepancies.

Table 1. Sample exclusions

	Survey year			
	1992	1998	2004	2010
New respondents in the wave	12,652	4,956	3,446	6,414
Ages 51 to 56	5,568	1,847	2,531	3,952
Employees	3,326	1,200	1,613	2,278
Started job at least a year before beginning of the survey	2,884	987	1,362	1,892
Have W-2 records	2,413	762	942	750
No errors in W-2s: final sample	2,035	592	859	669

Note: See text for discussion of common types of W-2 errors.

1.2 Forms W-2

For participants who consented, the HRS data contains information from W-2s for years starting in 1978 up to the year of consent (or onwards in some cases) that can be used to project DC plan balances, given assumed investment returns and employer contributions. W-2 information for 1978 and 1979 is incomplete and is not used in our analysis. The share of workers matched to W-2s varies from 84% in 1992 to 39% in 2010. HRS survey participants are asked repeatedly to give permission to the HRS to link their W-2s with survey information. By 2010 almost all 1992 participants have given consent. The share of those consenting to a W-2 link is lower for more recent cohorts partly because they have been asked fewer times. The HRS has created reweights for the survey sample on the basis of observable characteristics associated with the probability of providing a consent to ensure that the sample is representative after the application of sample weights. We use such HRS created sample weights but acknowledge that our results may be affected by unobserved differences between consenters and non-consenters.

The W-2 forms are submitted annually by employers to the IRS and contain information, among others, on gross pay and the employee's elective deferrals to DC plans. W-2s do not contain information on the employer's contributions to DC plans, plan balances, loans or withdrawals, or information about IRA contributions or balances. While the self-employed do not have to file W-2 forms, the dataset also contains data on self-employment income that are derived from other tax forms, but it does not contain information on their retirement contributions.

Comparing self-reported DC plan participation with W-2 and SPD data indicates significant discrepancies, which we attribute to errors in the self-reports. The errors seem to lead to lower-than-expected retirement plan balances. Forms W-2 contains a series of box entries that researchers can use to identify or infer retirement plan contributions. In 1991, only 69% of workers whose W-2 contained elective deferrals (in Box 12) reported a DC plan. Participants who misreport plan type are asked questions relevant to their self-reported plan type but the responses aren't valuable. Average self-reported 401(k) balances in the HRS are lower than those reported in Investment Company Institute, Employee Benefit Research Institute, and other household surveys (Venti, 2011). The HRS survey design likely contributes to under-reporting (Venti, 2011). Errors in self-reported data, even if random, introduce noise, inflate estimates of retirement wealth inequality, and may also overstate increases in retirement wealth inequality resulting from the displacement of DB by DC plans if the average size of the errors in self-reported estimates of DC plan balances exceeds the average size of errors in projected DB income. In contrast, our assumption that all DC participants receive the same investment return conditional on asset allocation will understate the increase in inequality.

Though well-informed participants might provide more accurate estimates of their own plan balances than researchers, we consider the estimates based on W-2s and assumed investment returns to be superior to self-reported balances. But the use of W-2 data has some limitations. Though information on elective deferrals is contained in Box 12 on the W-2, these data are not available for all participants or years. For years and participants lacking Box 12 data, previous studies have inferred

elective deferrals by comparing Box 1, earnings subject to federal income tax, which exclude elective deferrals, with Box 5, Medicare taxable earnings, which includes deferrals. However, Medicare taxable earnings were capped prior to 1994 so that the difference between Box 5 and Box 1 would understate the employer-sponsored retirement plan contributions of high earners in those years. In addition, employer-sponsored retirement plan contributions were deductible for both income tax and Medicare tax purposes prior to 1984 so that for these years Box 1 equals Box 5. Further, employee contributions to state and local DB plans are also deductible when calculating Box 1 so that a comparison of Box 5 with Box 1 will overstate state and local government workers' DC contributions. In addition, box entries are sometimes missing or inconsistent – for example on occasion Box 1 exceeds Box 5 – and we drop these observations.

Methods used by previous researchers to estimate employer-sponsored retirement plan contributions are unsatisfactory for the purposes of measuring inequality. Dushi and Honig (2010) drop workers with earnings above the Medicare earnings cap. Dropping high earners makes sense when analyzing the broad mass of the population, but less so when investigating inequality. Cunningham and Engelhardt (2002) and Dushi and Honig (2015) aim to eliminate state and local government workers from the sample but that biases estimates of retirement wealth inequality, because state and local government workers have relatively generous pensions. Dushi and Honig (2010) include state and local workers without attempting to adjust Box 5–Box 1 calculation. We include all workers and adjust Box 5–Box 1 calculation of those we identify as state and local government workers which improves on previous attempts to identify likely state and local government workers. We identify them by comparing Box 5–Box 1 calculation with Box 12 for years for which Box 12 data are available.

1.3 SPDs

In order to overcome problems with self-reports, the HRS staff sought to collect SPDs from individuals who report, sometimes in error, that they are participating in an employer-sponsored retirement plan. The SPDs summarize rules of DB, DC, stock option, and profit-sharing plans. DB plans require participation, but 401(k)-type plans are voluntary so that a correctly matched DC SPD shows a worker is eligible but not whether they participate. Although the probability of an SPD match varies with worker characteristics, the HRS has not constructed weights, similar to the W-2 weights, to deal with selection. We deal with the selectivity issue with regard to SPDs by imputing employer-sponsored retirement plan coverage and wealth using available information from self-reported data and W-2s, but acknowledge that workers matched to SPDs may differ in ways that can't be observed from those who are not matched.

Self-reports and the SPDs often conflict (see Table 2).¹ To illustrate the conflict, row three of Table 2 reports that in 1992, of workers who stated they had both DB and DC plans, 27.4% were unmatched, 35.3% were matched only to a DB SPD, 9.5% only to a DC SPD, and 27.8% to both DB and DC SPDs.

The HRS did not collect DC SPDs in 2010; hence, there is no DC match rate in that wave. The HRS data do not distinguish between workers for whom the HRS failed to obtain any SPDs, and workers whose employers stated they did not sponsor a retirement plan. The match rate in earlier years is non-random (Gustman and Steinmeier, 2004). The 20.1% of workers reporting only a DB plan who were matched to both DB and DC SPDs may be correct because they may be eligible non-participants. Gustman *et al.* (2007, 2010) attribute mismatches that cannot be explained by eligible workers not participating in worker mis-reporting. But we question their conclusion. Among individuals reporting only being covered by a DB plan, 21.8% have W-2 deferrals, revealing a DC contribution (Table 3). Among individuals matched only to a DB SPD, a larger share, 40.7% have W-2 deferrals, reflecting missing DC SPDs, so that the self-report of DB coverage is a superior measure.

¹After excluding workers not matched to SPDs, Table 2 is very close to percentages obtained from an analysis of Gustman *et al.* (2010) Table 7.2A.

Table 2. SPD type by self-reported plan type and wave

Wave	Self-reported plan type	SPD type			
		No SPD (%)	Only DB SPD (%)	Only DC SPD (%)	Both DB and DC SPDs (%)
1992	DB only	29.0	41.9	8.0	21.1
	DC only	49.2	15.9	23.5	11.4
	Both DB and DC	27.4	35.3	9.5	27.8
	Any plan	34.8	32.1	13.3	19.8
1998	DB only	44.8	13.0	5.5	36.7
	DC only	60.5	3.5	23.9	12.1
	Both DB and DC	46.4	13.5	9.7	30.4
	Any plan	51.4	9.5	13.9	25.2
2004	DB only	42.7	19.3	5.4	32.6
	DC only	72.3	6.2	13.5	8.0
	Both DB and DC	47.9	14.9	9.9	27.3
	Any plan	58.9	11.6	10.6	18.9
2010	DB only	49.8	50.2	0.0	0.0
	DC only	83.3	16.7	0.0	0.0
	Both DB and DC	60.4	39.6	0.0	0.0
	Any plan	69.5	30.5	0.0	0.0

Note: Self-reported plan types are extracted from RAND HRS. No sample weights, to provide comparability with Gustman *et al.* (2010). Sample includes all workers who joined in the relevant wave and self-report having a retirement plan in their current job.

Table 3. Percentage with non-zero W-2 elective deferrals in 1991 by self-reported plan type and SPD type in 1992 wave

Self-reported plan type		SPD type				All (%)
		No SPD (%)	Only DB (%)	Only DC (%)	Both DB and DC (%)	
Self-reported plan type	Only DB	18.3	21.8	22.7	26.1	21.8
	Only DC	40.9	39.6	51.3	52.0	44.5
	Both DB and DC	62.9	79.0	66.0	74.2	72.2
	All	37.6	40.7	46.5	49.6	42.2

Note: Sample includes all respondents with available W-2 information in 1991.

If we relied solely on the self-reports of workers with a matched SPD, we would incorrectly classify 24% of workers who have W-2 deferrals as not having a DC plan. In contrast, if we relied solely on SPDs, we would incorrectly classify 45% of workers with W-2 deferrals as not having a DC plan. We conclude that SPDs cannot be relied on to the exclusion of self-reports and W-2s.

1.4 Pension estimation program

The SPDs specify plan rules, benefit formulas, and plan changes. Since they do not contain data on individuals, the HRS created a PEP for users to estimate DB and DC wealth by combining SPD data with self-reported data on earnings and deferrals (Rohwedder, 2003). The HRS PEP has five significant drawbacks. First, when calculating DC wealth, the user must choose a constant real rate of return, common to all participants – the default rate is 2.9% in 2010 – which ignores individual differences in asset allocations and investment returns. Second, the PEP extrapolates a wage history from current year earnings after the user defines the constant rate of real wage growth common to all participants – the default is 1.1% a year in 2010. This process will misreport earnings to the extent that current year earnings are mis-reported or earnings growth differs from the assumed rate. Third, the PEP assumes a time-invariant voluntary contribution rate to 401(k)-type plans equal to the most recent self-reported contribution rate, which overstates the DC wealth of current contributors if participation rates have grown over time or workers have taken participation holidays. Even small errors in assumptions can have a dramatic effect on DC wealth estimates (Rohwedder, 2003). Fourth, the PEP disregards in-service withdrawals and 401(k) loan defaults that amount to perhaps 0.5% of

401(k) wealth a year, which is significant over a career (Munnell and Webb, 2015). Fifth, the PEP does not deduct outstanding loans. Although about 90% of active participants can take out DC loans (VanDerhei *et al.*, 2012) and about 18% of participants in plans offering loans had a loan outstanding (Vanguard, 2014), loans amounted to only 2% of plan assets. We proffer the likelihood that loans increase retirement wealth inequality but do not investigate because the HRS survey instrument does not ask about retirement plan loans.

To correct the first three problems and coding anomalies, Cunningham, Engelhardt, and Kumar (2007) (CEK) created their own PEP to estimate DC wealth for 1992 and 1998. Their PEP uses W-2 data on earnings and elective deferrals; uses the plan adoption and amendment dates indicated in the SPD to determine a person's eligibility for certain plan features; and incorporates a user-defined time-varying rate of return. Convinced by CEK's findings that the HRS PEP systematically overstates DC wealth, we use their methods.

The HRS PEP calculates the expected present value of DB wealth – DB benefits are typically a function of current or recent salary, age, and years of service – by combining self-reported data with plan rules obtained from the SPDs and assumed mortality and interest rates. Wealth is discounted back to the present and we prorate between past and anticipated future service. The HRS PEP allows users to calculate DB wealth with normal or early retirement formulas within a user-defined age range. These calculations introduce the following measurement errors. First, reporting errors in self-reported earnings will be reflected in DB wealth estimates. Second, older workers often experience earnings declines (Rohwedder, 2003), whereas the HRS PEP assumes a constant rate of real wage growth right up to retirement. As benefits are typically based on final salary or the average of the last few years' salary, the HRS PEP probably overstates DB wealth, except for those near retirement.² Third, the HRS PEP does not incorporate the risk of premature job-separation, which can substantially reduce DB wealth. Almost half of workers retire before they expect (Munnell *et al.*, 2015).

We replace self-reported earnings data with W-2 data. While modeling wage trajectories and the risk of premature job-separation of DB participants is beyond the scope of this study, we instead make ad-hoc adjustments for risk by discounting future benefits at the corporate bond interest rate rather than at the risk-free Treasury bond interest rate.

For 2010, the HRS PEP allows researchers to impute DB wealth to workers without DB SPDs. Using this option, Fang *et al.* (2016) assign DB coverage to all workers either matched to a DB SPD or who self-report DB coverage. Their approach will overstate total DB coverage when workers covered only by DC plans misreport being covered by a DB plan.

2. Previous literature on retirement plan coverage and wealth inequality

Previous studies of employer-sponsored retirement wealth focus on coverage, contribution rates and asset allocations, retirement wealth, and comparing wealth accumulation under DB and DC regimes.

2.1 Studies of coverage

Self-reported data from the Current Population Survey (CPS) reveal that only about 50% of full time private sector workers participate in an employer-sponsored retirement plan at any point in time, with the participation rate trending down (Munnell and Bleckman, 2014).³ Workers move in and out of coverage, so the share ever covered is higher. Lower-income workers are less likely to participate, with the socioeconomic pension coverage gap mainly reflecting lower eligibility rates among low earners (Karamcheva and Sanzenbacher, 2010; Wu and Rutledge, 2014).

²We assume that the Rohwedder (2003) calculations are conditional on labor market participation but not conditional on remaining with the same employer.

³The Current Population Survey question changed in 2014, so that post-2013 coverage is not comparable with coverage in previous years.

An alternative approach to relying solely on self-reported data, designed to address mis- and under-reporting, is to combine self-reported data with data from W-2s (Dushi *et al.*, 2011). But workers who report participating in a DC plan but do not have W-2 deferrals could have a DC plan that does not require employee contributions, could have mistakenly reported their DB plan as DC, or could have no retirement plan coverage. Assuming they have no employer-sponsored retirement plan coverage yields coverage rates in line with self-reported data, whereas assuming they are participating in some other plan type yields higher coverage rates. We conclude the CPS data represent a lower bound to a range of coverage estimates.

Another approach is to rely solely on IRS Statistics of Income data, classifying workers as covered if employer-sponsored retirement plan elective deferrals are shown in Box 12 of the W-2 or if Box 13 has been ticked, indicating active participation in any type of employer-sponsored retirement plan (Brady, 2017). These data show a participation rate that is consistently 4–6 percentage points higher than the comparable CPS participation rate.⁴ Box 13 is not included in the HRS W-2 dataset and we therefore cannot use their approach.

2.2 Studies of contribution rates and asset allocations

Conditional on participation, the average DC employee contribution rate is 6.5% of salary (Brady, 2017). Contribution rates are higher for older workers but vary little with earnings. High earners and younger workers are more likely to hold equities but differences in mean equity shares are modest. The mean share in company stock declined from 11% in 2007 to 6% in 2016 and there is substantial individual-level heterogeneity in investment allocations, with significant shares of participants with equity allocations of zero or 100% (VanDerhei *et al.*, 2018). As equity returns have exceeded those on bonds, differences in asset allocation likely contribute to inequality.

Conditional on the employee participating, higher earners receive larger employer matches as a percent of salary (Saad-Lessler *et al.*, 2018). Given that employee contribution rates vary little with earnings; this likely reflects differences in the generosity of match formulas.

2.3 Studies of retirement wealth

Studies of retirement wealth (IRA, DB, and DC wealth, excluding the expected present value of anticipated Social Security benefits) typically use Survey of Consumer Finances (SCF), Survey of Income and Program Participation (SIPP), and HRS data. Studies typically include IRA account balances because although IRAs are not employer sponsored, most IRA wealth represents rollovers from DC plans, not direct contributions. We do not regard the HRS age restriction as a significant drawback because we measure the distribution of retirement wealth of households approaching retirement. The CPS asks about employer-sponsored retirement plan coverage but not wealth. The SCF contains a high-wealth sub-sample to investigate the upper tail of the wealth distribution, but the lack of either a panel or a link to administrative data makes it unsuitable for describing the relationship between retirement wealth and lifetime earnings.⁵ And the SCF likely suffers from the same level of misreporting of pension type as the HRS does.

Two consistent findings emerge. First, employer-sponsored retirement wealth is highly unequally distributed, although less unequally distributed than non-retirement financial wealth (Wolff, 2015; Devlin-Foltz *et al.*, 2015a, 2015b). Using 2014 SIPP data and a broader sample, Ghilarducci *et al.* (2017) report that one third of workers nearing retirement have no employer-sponsored retirement

⁴The study headline participation rate of 77% is obtained by focusing solely on a highly select group – workers ages 45–64 with an Adjusted Gross Income of \$30,000 or more.

⁵Towards the end of the SCF interview, after detailed income components have been summed to arrive at a total, respondents are asked if that total income is higher than, lower than, or about the same as their income in a ‘usual’ year. Most respondents say their reported income is in fact about normal. But our analysis of HRS data indicates only a modest correlation between current and lifetime income.

wealth. Government Accountability Office (GAO, 2014) reports that 1% of IRA holders with balances in excess of \$1 million hold 22% of IRA wealth. Employer-sponsored retirement wealth is also more unequally distributed than current period earnings (Mitchell and Moore, 1997) and total wealth varies enormously even within lifetime earnings deciles (Venti and Wise, 1998).

Second, although DC wealth was substantially more unequally distributed than DB wealth in all years, the displacement of DB by DC plans has not been associated with a significant increase in retirement wealth inequality (Wolff, 2015; Devlin-Foltz *et al.*, 2015a, 2015b; Munnell *et al.*, 2016b).

Although higher-income earners have lower replacement rate targets, their lower Social Security replacement rates mean they need to accumulate larger multiples of their earnings. Including Social Security wealth, the ratios of mean and median employer-sponsored retirement wealth to earnings vary little by lifetime earnings decile. The ratio of DC wealth to lifetime earnings is higher in the upper lifetime earnings deciles; whereas the ratio of DB wealth to lifetime earnings is lower (Poterba *et al.*, 2007, using 2000 HRS data). But this pattern masks enormous differences in wealth, conditional on lifetime earnings (Venti and Wise, 1998, using 1992 HRS data and focusing on total wealth excluding Social security and financial wealth excluding retirement accounts). Most inequality in employer-sponsored retirement wealth stems from differences in outcomes within lifetime earnings groups.

The study most similar to ours is Munnell *et al.* (2016b), which analyzed household HRS data from 1992, 1998, 2004, and 2010 and sorted households by quartile of educational attainment (not lifetime earnings), relied solely on the self-reported data, and did not examine the distribution of employer-sponsored retirement wealth within quartiles. Consistent with previous research, the Munnell, Hou, Webb, and Li study found that DC wealth was more skewed towards the top quartile of educational attainment than DB wealth, but that the distribution of total employer-sponsored retirement wealth by education quartile barely changed over the 18-year period, notwithstanding the displacement of DB by DC wealth.

2.4 Comparing wealth accumulation under DB and DC plans

DC wealth of pre-retirees falls far short of DB wealth (Munnell *et al.*, 2016b; Ghilarducci *et al.*, 2017). Some of the disparity likely reflects the immaturity of the DC system – older workers have not had a lifetime of exposure. But leakages, high fees, and portfolios not located on the efficient market frontier also contribute to the failure of DC plans to live up to their promise (Tang *et al.*, 2010; Munnell and Webb, 2015), as does non-participation by eligible workers.

In contrast, a well-functioning DC system might engender greater wealth accumulation than a DB system, because job-changers are not penalized. Using HRS data on earnings histories and job-separations, Poterba *et al.* (2006) compare retirement wealth in DB and DC plans. They randomly assign participants first a DB plan and then a DC plan. They assume that vested DB participants receive a deferred pension on job-separation based on their salary at the date of separation. The DC simulations assume zero leakages, and no periods of non-participation. They find that even in risk-adjusted terms, DC plans almost always dominate private sector DB plans.

The Poterba *et al.* (2006) assumption of zero leakages and 100% participation will likely understate DC wealth inequality as will the assumption that all participants earn the same investment returns. Even with these restrictive assumptions, they find that DC plans produce greater inequality (as measured by the ratio of the 90th to the 50th percentile of the wealth distribution) than DB plans.

More generally, those approaching retirement in 1992 were not living in a ‘golden age’ of pensions, due to patchy DB coverage and erosion of benefits by inflation and pre-retirement job-loss (Kolodrubetz and Landay, 1973). In addition, low earners get lower benefits from ‘integrated’ DB plans – employers count Social Security benefits as part of the total benefit, which can also foster between-group inequality.

3. Methodology

We define employer-sponsored retirement wealth as the sum of DB and DC wealth from current and past jobs, including profit sharing and money purchase plans, and IRA wealth. We focus on

individuals, not households, to permit a straightforward categorization of plan type and to avoid the complications associated with household formation and dissolution. We use only individuals matched to W-2s and reweight by the inverse of the probability of a W-2 match.

Money is fungible, and households can tap non-retirement financial wealth and non-financial wealth to fund post-retirement consumption. DC wealth may be a better substitute than DB wealth for taxable financial assets in the household's portfolio. As the wealthy are more likely to hold significant non-retirement financial wealth, asset relocation in a mostly DC system may contribute to increases in retirement wealth inequality. Households may also offset DC wealth accumulation with mortgage borrowing (Engen and Gale, 1997). We defer the above issues to future research.

We include all tax-deferred and tax-advantaged accounts that appear to be designed for retirement savings, as well as the expected present value of DB pensions. Thus, we include profit sharing plans, but exclude health savings accounts, even though they are a tax efficient means of saving money to cover post-retirement health care costs.

3.1 DB wealth from current job

We use the HRS PEP to calculate the expected present value of current job DB wealth for plans for which DB SPDs are available. We consider the W-2 earnings data more reliable than self-reported data and therefore modify the HRS PEP to calculate DB wealth using W-2 earnings data. We discount at the AAA corporate bond interest rate (7.92% in 1992, 6.40% in 1998, 5.46% in 2004, and 4.53% in 2010) and pro-rate to past service. Friedberg and Webb (2005) show employees' retirement timing decisions are influenced by DB wealth accrual. We assume employees retire when first eligible for normal retirement benefits, an age at which the expected present value of benefits often peaks. We did not use a constant interest rate across years because we want to preserve within-wave comparability with DC wealth, the value of which reflects prevailing interest rates. We use the HRS PEP default real wage growth assumptions of 0.96 to 1.1% a year to retirement.

We assume no DB SPDs were erroneously matched and that if the HRS matched a DC plan, which indicates the HRS successfully identified and contacted the employer, but did not match a DB plan, the worker is not covered by a DB plan, regardless of self-reported plan type. We impute DB coverage for those without any SPDs using a donor pool of those matched to any SPDs and a comprehensive set of covariates that include self-reported plan type and characteristics associated with a SPD match. Importantly, to create an appropriate joint distribution of DB and DC coverage, the set of covariates includes a variable indicating whether the worker made W-2 elective deferrals.

Our approach will likely create an upward bias to DB coverage because those with DB SPDs are more likely to have DB plans than those without (conditioning on covariates).⁶ We adjust the coverage rate by recoding as DC those who report being covered only by a DC plan and have W-2 elective deferrals. After this adjustment, we obtain an overall DB coverage rate that matches that observed in the self-reported data, although the identities of covered workers differ.

3.2 DB wealth from past jobs

While some SPDs from previous jobs are available for the 1992 and 1998 waves, the HRS did not collect SPDs for past jobs in 2004 and 2010. The match rate is low – in 1992, only 26% of workers reporting that they anticipated future benefits from a DB plan from a past job were matched to an SPD. We therefore use Gustman *et al.* (2014) estimates of DB wealth from past jobs, including DB pensions in payment, based on self-reported data. In 1992, only 9.4% of workers had DB wealth from past jobs

⁶In some cases, the absence of an SPD reflects the inability of the HRS staff to contact or obtain information from the employers. In other cases, the employer might have informed the HRS that they did not sponsor any retirement plans for employees of the relevant class, in which case the true but unobserved probability of DB coverage will be zero. This categorization was not retained by the HRS.

(including DB pensions in payment) so that any errors in self-reported data will have only a modest effect on total retirement wealth.

3.3 DC wealth from current jobs

To calculate current job DC wealth resulting from employee contributions, we combine W-2 data on gross pay and elective deferrals with self-reported data on hire date and DC plan asset allocation and Ibbotson (2018) data on market returns by asset class.

We rely on W-2 Box 12 data, where available. For workers for whom Box 12 data are available for 1991 onwards, we estimate pre-1991 deferrals by comparing the 1991 Box 12 entry with the 1991 difference between Box 5 and Box 1. If Box 12 equals zero, we assume the difference between Box 5 and Box 1 in all previous years represents employee DB contributions. If Box 12 equals Box 5 minus Box 1, we assume the difference between Box 5 and Box 1 represents DC elective deferrals. In all other cases, we make an apportionment. We experimented with using SPDs to identify employee contributions to DB plans but found that this approach could only explain a small part of the difference between Box 12 and Box 5 minus Box 1.⁷

Box 5 minus Box 1 calculation cannot be applied prior to 1984 because Social Security and Medicare taxes were calculated on earnings net of elective deferrals. We assume zero employee contributions in 1981 and linearly interpolate coverage rates between 1981 and 1984, the first year for which data are available. For workers with earnings above the taxable maximum in any of the years 1984 to 1990 or 1991, we impute iteratively, working back from the most recent year, using data from time $t + 1$ to impute time t to capture serial correlation in deferrals.

For workers for whom Box 12 data were not collected in 1991 or afterwards, we impute employee contributions using Box 5 and Box 1 data from a donor pool of workers whose DC contributions were based on the methodology described above. The W-2s contain the most accurate information on employee contributions; therefore we disregard the self-reported data when it contradicts.

For employer contributions, we considered and rejected using matched or imputed SPDs. The DC SPD match rate is low in earlier years and likely biased in favor of larger plans, and DC SPDs were not collected in 2010, which means DC wealth for that wave must be constructed solely from self-reports. Also, DC plan type – profit sharing, money purchase, 401(k), etc. – needed to impute SPDs, is often missing or likely misreported.

We use a worker being matched to a DC SPD as one indicator of a worker having a DC plan, regardless of what a worker self-reported as their plan type. But we don't use SPD information to calculate DC wealth from employer contributions. Instead, we use self-reported data to calculate employer DC contributions.

To provide consistency with actual and imputed data, we impute employer contributions to DC plans for workers who did not report employer contributions, but may have them. These workers include those who (1) say they have a DB plan but are not assigned a DB plan, or are matched to a DC SPD, (2) don't have W-2 contributions, are not assigned a DB plan, and report no employer contribution, and (3) those who say they have a DC plan but don't answer the subsequent questions.

3.4 DC wealth from past jobs and IRA wealth

When workers leave their jobs they can withdraw their 401(k) plan balance, roll the money into an IRA, leave the money invested in the old plan, or, more rarely, move their 401(k) into a new employer's 401(k). (Very few choose multiple options [Vanguard 2014]). HRS participants are asked how much was in their account when they left their employer, which of the above options they chose, and if they rolled over the balance into an IRA or left it in the original plan, how much is in the account now.

⁷Cunningham and Engelhardt (2002) identified voluntary contributions by comparing mandatory contributions specified in the SPD with the difference between Box 5 and Box 1. We believe their approach overstates voluntary contributions.

The HRS collected DC SPDs for some previous jobs. We choose not to use W-2s and SPDs to calculate current wealth from past jobs for two reasons. First, significant leakages and transfers likely occur not only at job separation but also after they get a new job. Second, most DC wealth is now held in IRAs, not in 401(k)s (Munnell and Webb, 2015), especially among older workers who have changed jobs several times during their career. These IRAs commingle rollovers from possibly several past jobs with direct contributions. Using W-2 and SPD data to estimate current wealth from past jobs would create a new issue – how to calculate the share of the IRA balance that related to that past job. We consider that, even with reporting error, the self-reported current account balance will generally be a more accurate measure of current DC wealth from past jobs than calculations based on SPDs and W-2s. We therefore use imputed values of IRA wealth from the RAND HRS Longitudinal File. We use Gustman *et al.* (2014) data constructed using self-reported data on DC wealth from previous jobs, not rolled over to IRAs.

3.5 DC investment returns

In 1992, 1998, and 2004, participants in 401(k) type plans report whether the money in each of their accounts is invested mostly in stocks, mostly in interest earning assets, or is about evenly split. In 2010, they are asked to report the percentages invested in stocks. We impute missing asset allocations for 2010. For 1992, 1998, and 2004, we considered but rejected assuming that individuals giving the same response to the asset allocation question had the same asset allocation, because this assumption would suppress heterogeneity in asset allocations and thus in investment returns. Instead, we imputed asset allocations by randomly drawing from the 2010 allocations lying in the range zero to 40% stocks for those who reported they were mostly in bonds in their primary DC plan, the range 40–60% for those who reported they were about evenly split, and 60–100% for those who reported they were mostly in stocks. Data on changes in investment allocations are only available for 2004 and 2010. To ensure consistency in treatment across waves, we further assume that participants never changed their asset allocations and that they rebalanced annually. We do not attempt to introduce heterogeneity in investment returns, conditional on asset allocation, because we lack data on the individual funds in the accounts.

3.6 Assigning lifetime earnings quintiles

Detailed records of earnings from employment and self-employment are available from 1978, but those for 1978 and 1979 are incomplete. Summary earnings are available from 1951, but these data are capped at Social Security maximum taxable earnings. In the 1970s, up to 37% of workers earned in excess of the maximum in any year (Fang *et al.*, 2016). To ensure comparability between 1992, 1998, 2004, and 2010, we use the last 12 years' CPI-indexed earnings as our denominator, 1980–1991 for 1992, 1986–1997 for 1998, and so on. We rejected imputing earnings above the maximum, assessing that the estimation errors associated with the imputation process and loss of consistency between waves would more than outweigh the benefit of including earnings at younger ages in the average.

3.7 Theil calculations

The Theil index is one of the commonly used measures of inequality and is defined as follows:

$$Theil_t = \frac{1}{n_t} \sum_{i=1}^{n_t} \left(\frac{wealth(i)_t}{m_t} \log \left(\frac{wealth(i)_t}{m_t} \right) \right) \quad (1)$$

where $wealth(i)_t$ is the wealth of worker i at year t , n_t is the total number of workers in year t , and m_t is the average wealth of all workers in year t . We recode the log of zero as zero. The Theil index is one of

a family of generalized entropy (GE) measures. Other GE measures avoid using logarithms but are excessively sensitive to the upper part of the wealth distribution and to the presence or absence of large wealth-holders in particular years.

The Theil index has the advantage over the Gini coefficient of being additive across different subgroups in the population, that is, the Theil index of overall wealth dispersion can be decomposed in the between-group and within-group components of dispersion. Dispersion between-groups equals total dispersion, $Theil_t$ minus within-groups dispersion, $Dwin_t$.

The within earnings group dispersion of wealth for the Theil index for year t is defined as follows:

$$Dwin_t = \sum_{c=1}^{n_c} \left[\frac{m_{c,t} n_{c,t}}{m_t n_t} \right] Theil_{c,t} \quad (2)$$

where $m_{c,t}$ is the average wealth of earnings group c at time t and $n_{c,t}$ is the number of individuals in earnings group c at time t .

Although the Theil coefficient takes the value zero when there is perfect equality, it otherwise lacks the straightforward representation of the Gini coefficient. It also suffers from the disadvantage of the Gini coefficient in that it does not indicate where dispersion occurs within the distribution. Therefore, we rely on tabulations of selected percentiles of relevant distributions for much of our analysis.

4. Results

Our first key finding is that the top earnings quintile holds half of all employer-sponsored retirement wealth, a share that is almost unchanged from 1992 to 2010 (Table 4). The bottom quintile has barely 1% of the total.

Our second key finding is that inequality in employer-sponsored retirement wealth mainly reflects the difference between the common plight of low to moderate earners with very little wealth and the more substantial but still often inadequate wealth of higher earners, not the outsize accumulations of the few. Among workers aged 51–56 in 2010 – the first group to spend their careers in a mostly DC system – 18.6% had no employer-sponsored retirement wealth, almost unchanged from 17.5% in 1992 (Table 5).

Workers in lower earnings quintiles are more likely to have no employer-sponsored retirement wealth. In 2010, 51.2% of bottom quintile workers had zero wealth, compared with 2.2% of top quintile workers. In the bottom quintile, the share of workers with no wealth increased from 45.4% to 51.2% between 1992 and 2010, indicative of a strengthening of the correlation between lifetime earnings and retirement plan coverage.

This divergence in wealth accumulation between earnings quintiles is reflected across the percentiles of the wealth distribution. In 2010, median retirement wealth in 2010 dollars was \$294,700 in the top earnings quintile, up from \$175,500 in 1992. But 2010 median employer-sponsored retirement wealth was zero in the bottom earnings quintile, down from \$1,900 in 1992. Corresponding numbers for the 75th percentile of the wealth distribution are \$505,400 (2010) and \$315,100 (1992) for the top earnings quintile and \$7,800 (2010) and \$18,700 (1992) for the bottom. Except among high earners, wealth is in general no higher in 2010 than in 1998, a sobering finding given that people are living longer, post-retirement health care costs are rising, lifetime earnings are generally increasing, and financial returns are generally lower. The question arises: are wealth accumulations adequate? One approach to determining the adequacy of retirement savings is to compare accumulations with the amounts households would have accumulated had they chosen an ‘optimal’ savings plan such that the marginal utility of current consumption equaled the expected discounted marginal utilities of consumption in each subsequent period. Those who experience economic misfortune may nonetheless suffer a decline in living standards in retirement even though they saved optimally. An example of this type of analysis is Scholz *et al.* (2006). An alternative way to determine retirement wealth adequacy

Table 4. Share of total employer-sponsored retirement wealth by earnings quintile and top 10% of earners 1992–2010

Lifetime earnings quintile	1992	1998	2004	2010
Q1	0.03	0.02	0.01	0.01
Q2	0.06	0.09	0.07	0.06
Q3	0.15	0.16	0.17	0.14
Q4	0.27	0.26	0.27	0.29
Q5	0.49	0.48	0.48	0.50
Top 10% of earners	0.31	0.30	0.30	0.29

Note: Cross-wave Social Security weights.

Table 5. Values of total employer-sponsored retirement wealth at its 10th, 25th, 50th, 75th, and 90th percentiles for each earnings quintile in 1992, 1998, 2004, and 2010

Year	Lifetime earnings quintile	Percentile					Share with no wealth (%)
		P10	P25	P50	P75	P90	
1992	Q1	\$0	\$0	\$1,900	\$18,700	\$37,600	45.4
	Q2	\$0	\$0	\$18,000	\$43,800	\$77,700	26.0
	Q3	\$500	\$17,800	\$45,900	\$99,800	\$176,600	9.5
	Q4	\$11,800	\$39,800	\$93,100	\$162,500	\$263,800	5.4
	Q5	\$34,200	\$79,500	\$175,500	\$315,100	\$492,900	1.2
	All	\$0	\$8,000	\$40,900	\$122,200	\$257,000	17.5
1998	Q1	\$0	\$0	\$1,800	\$13,500	\$42,300	47.8
	Q2	\$0	\$13,700	\$35,200	\$75,500	\$184,500	10.8
	Q3	\$3,500	\$33,000	\$81,400	\$179,100	\$247,200	7.0
	Q4	\$29,400	\$85,600	\$145,600	\$270,800	\$391,000	5.4
	Q5	\$67,600	\$150,300	\$279,600	\$441,900	\$828,100	1.2
	All	\$0	\$13,700	\$76,700	\$214,600	\$385,300	14.2
2004	Q1	\$0	\$0	\$100	\$18,700	\$37,600	49.9
	Q2	\$0	\$3,500	\$24,700	\$80,800	\$179,800	21.4
	Q3	\$5,600	\$39,200	\$96,100	\$238,700	\$429,200	7.4
	Q4	\$15,200	\$53,200	\$198,200	\$374,300	\$585,000	7.0
	Q5	\$55,500	\$162,900	\$336,300	\$609,100	\$915,000	2.0
	All	\$0	\$10,900	\$68,300	\$258,400	\$522,000	17.3
2010	Q1	\$0	\$0	\$0	\$7,800	\$40,500	51.2
	Q2	\$0	\$100	\$20,000	\$69,300	\$110,600	24.1
	Q3	\$300	\$19,000	\$75,700	\$137,900	\$273,300	9.4
	Q4	\$4,100	\$50,000	\$170,100	\$355,800	\$488,900	6.9
	Q5	\$97,000	\$144,200	\$294,700	\$505,400	\$837,800	2.2
	All	\$0	\$4,300	\$67,000	\$191,800	\$426,700	18.6

Note: All amounts are in \$2010. Cross-wave Social Security weights.

is to construct a simple spreadsheet-based life-cycle model that abstracts from risk and calculates the wealth required to maintain pre-retirement living standards (Skinner, 2007; Munnell *et al.*, 2016a; Fidelity, 2018). The results obtained with a spreadsheet are highly sensitive to assumptions regarding the age of retirement, investment returns, home ownership, health care costs, etc. Older households should have larger ratios of employer-sponsored retirement wealth to earnings because they have fewer remaining years to contribute to retirement plans and earn investment returns and higher earners should have larger wealth to earnings ratios because they will receive lower Social Security replacement rates. Fidelity (2018) proposes target financial wealth to labor market earnings ratios of six at age 50, seven at age 55, and ten at age 67, whereas Skinner (2007) proposes lower financial wealth to earnings ratios at retirement that would imply substantially lower target wealth to earnings ratios at younger ages. In each case, the studies do not distinguish between retirement and non-retirement financial wealth. Skinner (2007) also reports dollar savings targets by age for hypothetical households, calculated using ESPlanner, sophisticated retirement planning software. Age 55 targets calculated using both his model and ESPlanner vary considerably, depending on circumstances and assumptions. For example, ESPlanner assigns a married couple homeowner with two children and

making \$68,000 a year a target of less than 1.5 times earnings, whereas a single renter making \$136,000 has a target of 7.6 times earnings.

Table 6 reports selected percentiles of the distribution of the ratio of total employer-sponsored retirement wealth to earnings, by earnings quintile, in 1992, 1998, 2004, and 2010. Median wealth to earnings ratios range from zero in the bottom earnings quintile to 2.43 in the top earnings quintile in 2010. While acknowledging the considerable heterogeneity in preferences, circumstances, and ages in our sample – as well as our focus on individuals, not households – we consider it unlikely that most workers have adequate retirement wealth.

We investigated whether these disparities in wealth originating in employer-sponsored retirement plans might be offset by Social Security wealth. In the United States, almost all workers are covered by Social Security, a pay-as-you-go program funded by employer and employee payroll taxes. The benefit formula gives higher replacement rates to workers with lower lifetime earnings. We calculated Social Security wealth in the same way as we calculate DB wealth. We calculate the expected present value at the current age of projected Social Security benefits, assuming a retirement age of 65, and pro-rating to past and anticipated service. Given our focus on individuals, not households, we exclude the expected present value of spousal and survivor benefits. We assume population average mortality for the relevant birth cohort and the customary three percent real interest rate. The Social Security benefit formula is based on the 35 highest years wage-indexed earnings. The W-2 data used to determine retirement plan contributions only extend as far back as 1980, so we rely on summary earnings records going back to 1951.

Table 7 reports selected percentiles of the distribution of the ratio of the sum of Social Security and total retirement wealth to earnings, by earnings quintile, in 1992, 1998, 2004, and 2010. Adding Social Security wealth almost eliminates the share with zero retirement wealth and increases the median wealth of the bottom quintile by more than the top quintile, reflecting the progressivity of the Social Security benefit formula. Median wealth of the bottom quintile increases from zero to 3.18 times earnings whereas median wealth of the top quintile increases from 2.43 to 3.81 times earnings. But all workers, and especially low earners appear far off track from the wealth they need to accumulate to achieve (say) a 60–80% replacement rate, inclusive of Social Security. In results that are not reported, we calculate Gini coefficients of the sum of Social Security and employer pension wealth and find they exceed estimates for European countries reported in [Olivera \(2019\)](#).

In results that are not reported but which are available from the authors on request, we calculate wealth to earnings ratios inclusive of non-retirement financial wealth. Wealth to earnings ratios increase only slightly even at the 90th percentile of the wealth distribution of an earnings quintile, reflecting the concentration of non-retirement financial wealth. We then add housing equity, the value of the house, minus any mortgages secured thereon, to the sum of Social Security, retirement, and non-retirement financial wealth. Home-owners receive imputed rent and are better off than renters with the same level of financial assets ([Brady, 2010](#)). The value of a house can be decomposed into the expected present values of the flow of imputed rent and the eventual sale proceeds. Households rarely downsize except in response to a precipitating shock ([Venti and Wise, 2004](#)), and although the expected present value of the eventual sale proceeds can be tapped through a reverse mortgage, take-up is extremely low. While recognizing that an argument can be made for including only the expected present value of the flow of imputed rent, we include total housing equity. Adding housing equity increases median wealth to earnings ratios by about equal percentages in each earnings quintile. Again using the distribution of wealth to earnings ratios as our inequality yardstick, adding housing wealth increases inequality among low earnings quintiles, because some have very substantial and others zero housing wealth relative to their meager non-housing wealth. But adding housing wealth decreases inequality among high earnings quintiles because almost all have at least some housing wealth and housing wealth is less unequally distributed than financial wealth.

We also compare wealth accumulations with the amounts workers aged 51–56 in 2010 would have accumulated under a well-functioning DC system. We assume all workers had contributed 6% of salary with a 50% employer match to a 50:50 stock/bond fund. Median retirement wealth for the top

Table 6. Employer-sponsored wealth to earnings ratios at its 10th, 25th, 50th, 75th, and 90th percentiles for each earning quintile in 1992, 1998, 2004, and 2010

Year	Lifetime earnings quintile	Percentile				
		P10	P25	P50	P75	P90
1992	Q1	0.00	0.00	0.25	1.56	3.79
	Q2	0.00	0.00	0.71	1.66	2.96
	Q3	0.01	0.46	1.18	2.50	4.16
	Q4	0.23	0.78	1.64	2.87	4.94
	Q5	0.38	0.97	1.97	3.42	5.09
1998	Q1	0.00	0.00	0.10	0.94	2.69
	Q2	0.00	0.44	1.05	2.14	5.09
	Q3	0.06	0.59	1.73	3.47	5.00
	Q4	0.49	1.20	2.17	3.52	5.17
	Q5	0.53	1.33	2.57	3.65	5.32
2004	Q1	0.00	0.00	0.01	1.44	3.16
	Q2	0.00	0.15	0.80	2.77	6.50
	Q3	0.17	0.85	2.32	6.12	10.10
	Q4	0.28	0.88	3.16	5.96	10.16
	Q5	0.62	1.63	3.37	5.35	9.02
2010	Q1	0.00	0.00	0.00	0.44	1.80
	Q2	0.00	0.00	0.73	2.15	3.82
	Q3	0.01	0.39	1.51	2.64	5.14
	Q4	0.07	0.79	2.37	4.97	6.78
	Q5	0.75	1.21	2.43	4.72	8.24

Note: Cross-wave Social Security weights.

Table 7. Employer-sponsored retirement plan and Social Security wealth to earnings ratio at its 10th, 25th, 50th, 75th, and 90th percentiles for each earning quintile in 1992, 1998, 2004, and 2010

Year	Lifetime earnings quintile	Percentile				
		P10	P25	P50	P75	P90
1992	Q1	1.17	2.45	3.73	6.32	10.27
	Q2	1.86	2.42	2.93	3.87	5.63
	Q3	1.8	2.28	3.01	3.95	5.87
	Q4	1.83	2.31	3.06	4.34	6.33
	Q5	1.48	2.07	3.03	4.34	6.18
1998	Q1	1.67	2.58	3.47	5.36	7.16
	Q2	1.91	2.3	3.05	4.22	6.47
	Q3	1.63	2.3	3.05	4.78	6.41
	Q4	1.77	2.58	3.38	4.59	6.21
	Q5	1.31	2.35	3.52	4.41	5.94
2004	Q1	1.18	1.99	2.92	4.39	6.28
	Q2	1.9	2.27	3.07	4.61	8.19
	Q3	2.21	2.77	4.58	8.18	11.85
	Q4	1.77	2.53	4.47	6.57	11.88
	Q5	1.73	2.7	4.05	6.53	9.85
2010	Q1	1.8	2.38	3.18	4.59	6.84
	Q2	1.74	2.12	2.76	4.16	5.44
	Q3	1.53	2.1	3.09	4.43	6.31
	Q4	1.55	2.31	3.69	6.14	8.25
	Q5	1.47	2.22	3.81	5.71	9.08

Note: Cross-wave Social Security weights.

lifetime earnings quintile would have been 2.7 times that observed in the data (\$769,800 vs. \$294,700). The median in the bottom lifetime earnings quintile would have been \$154,200, compared with the zero wealth they have now. Median retirement wealth of older workers would have been \$417,000 rather than \$67,000, so that the median worker falls 84% short.

Some households accumulate extremely large employer-sponsored retirement account balances, not only by thrift or good fortune, but also by investing in high return asset classes such as private equity

that are unavailable to most investors (GAO, 2014). Our sample size is insufficient to make meaningful statements about the extremities of the upper tail of the retirement wealth distribution and our methodology will also likely understate account balances in the tail because it assumes market returns. Instead, we rely on the GAO study, while acknowledging that it also understates wealth in the tail because it includes only IRA wealth, not 401(k) or DB wealth. Our analysis of the GAO study shows that only 0.02% of IRA holders have balances in excess of \$5 million, and these accounts contain only 2.7% of all IRA dollars. Thus, these very large accounts have a negligible effect on overall retirement wealth inequality, although they represent an abuse of retirement tax exemptions which are intended to encourage saving for retirement, not dynastic wealth accumulation.

Our third key finding is that, surprisingly, inequality in employer-sponsored retirement wealth, as measured by the Theil index, has not increased significantly between 1992 and 2010, among either those with some retirement wealth or all workers. Although DC wealth is more unequally distributed than DB wealth in each wave, neither the difference between DB and DC inequality nor the shift away from DB to DC wealth for these cohorts been large enough to substantially increase inequality among workers with retirement wealth. Nor has the decline in lifetime retirement plan coverage been large enough to increase retirement wealth inequality among all workers.

Inequality is lowest among workers with both a DB and DC plan and highest among workers with just a DC plan (see Table 8). In 1992, the Theil indices for DC only, DB only, and both DB and DC wealth were 0.703, 0.623, and 0.438, and in 2010, 0.724, 0.583, and 0.381. Inequality was greater for all workers than for workers with employer-sponsored retirement wealth, reflecting the inclusion of zeros in the former measure. In 1992, the Theil indices of retirement wealth inequality for all workers and all workers with retirement wealth were 0.794 and 0.602, and in 2010, 0.819 and 0.613.

We acknowledge the limitations of using a single number, the Theil index, to characterize an entire distribution. The Theil might place excessive weight on holders of very small account balances that are economically not very significant, even for the account holders. We are reassured our interpretations are correct because we obtain similar results with the Gini index, a GE(0) index which places greater emphasis on the bottom of the wealth distribution and a GE(2) index which places greater emphasis on the top of the wealth distribution.

We report coverage trends because it helps us understand why the Theil index of retirement wealth inequality has not changed much. Table 9 reports the shares of workers with DB (with or without DC), DC (with or without DB), both DB and DC, or any employer-sponsored retirement wealth from their current job (upper panel) and current or past job (lower panel). The share with DB plans from a current or past job declined by 10.7 percentage points, from 57.1% to 46.4%, and the share with DC plans increased by 4.5 percentage points, from 66.5% to 71.0%. Offsetting these trends, the share of workers with both DB and DC plans decreased by 4.9 percentage points, from 40.9 to 36.0%. These changes were not large enough to increase overall retirement wealth inequality, given the small difference between DB and DC wealth inequality.

Our fourth key finding is that among holders of employer-sponsored retirement wealth, inequality within earnings quintiles substantially exceeds inequality between quintiles. Table 10 excludes respondents with no employer-sponsored retirement wealth, unlike Tables 6 and 7 results, and reports selected percentiles of wealth to earnings ratios, by earnings quintile for each wave.

In 1992, the 90th percentile of the wealth to earnings ratio within each earnings quintile was ten to 12 times the 10th percentile. In the bottom earnings quintile, the wealth to earnings ratio was 5.86 at the 90th percentile compared with 0.26 at the 10th percentile. In the top earnings quintile, the corresponding ratios were 5.09 and 0.48. In contrast, wealth to earnings ratios varied little between earnings quintiles particularly in the upper part of the wealth distribution. The 90th percentiles of the top and bottom earnings quintiles had almost identical wealth to earnings ratios of 5.09 and 5.86, respectively (the 75th percentiles were 3.42 and 3.25 respectively). Theil indices for wealth to earnings ratios of individuals with any retirement wealth similarly show that most inequality reflects inequality within earnings quintiles. In 2010, total inequality was 0.426, comprising 'within quintile inequality' of 0.374 and 'between quintile inequality' of 0.052.

Table 8. Theil index of employer-sponsored retirement wealth inequality by year and plan

Year	DC only	DB only	DB & DC	All workers	Any retirement plan
1992	0.703	0.623	0.438	0.794	0.602
2010	0.724	0.583	0.381	0.819	0.613

Note: Cross-wave Social Security weights. In both 1992 and 2010, wealth of DC participants was significantly more unequally distributed than that of DB participants, with participants in both DB and DC plans having the lowest level of inequality. None of the changes between 1992 and 2010 are statistically significant.

Table 9. Percentage with employer-sponsored retirement wealth from current and previous jobs

	Year	DB (%)	DC (%)	Both (%)	Any plans (%)
Only current job	1992	53.6	45.1	27.4	71.2
	2010	45.6*	61.5*	30.9	76.2*
Current and previous job	1992	57.1	66.5	40.9	82.7
	2010	46.4*	71.0*	36.0**	81.4

Note: Cross-wave Social Security weights. * and ** indicate significance of differences between 1992 and 2010 at 5% and 1% levels.

Table 10. Employer-sponsored wealth to earnings ratio at its 10th, 25th, 50th, 75th, and 90th percentiles of those with non-zero retirement wealth for each earnings quintile in 1992, 1998, 2004, and 2010

Year	Lifetime earnings quintile	Percentile				
		P10	P25	P50	P75	P90
1992	Q1	0.26	0.65	1.42	3.25	5.86
	Q2	0.26	0.58	1.11	2.30	3.50
	Q3	0.26	0.67	1.33	2.69	4.88
	Q4	0.41	0.90	1.81	3.07	5.18
	Q5	0.48	0.99	2.01	3.42	5.09
1998	Q1	0.14	0.39	0.94	2.39	4.23
	Q2	0.29	0.62	1.26	2.22	5.33
	Q3	0.29	0.80	1.79	3.61	5.07
	Q4	0.76	1.28	2.38	3.58	5.37
	Q5	0.63	1.38	2.57	3.65	5.32
2004	Q1	0.18	0.55	1.44	2.73	3.89
	Q2	0.27	0.49	1.52	3.62	8.84
	Q3	0.46	1.23	2.96	6.17	10.44
	Q4	0.50	1.28	3.54	6.09	10.16
	Q5	0.73	1.78	3.37	5.93	9.10
2010	Q1	0.04	0.18	0.46	1.70	3.80
	Q2	0.11	0.43	1.56	2.43	4.15
	Q3	0.20	0.60	1.84	2.70	5.49
	Q4	0.38	0.93	2.50	5.00	7.36
	Q5	0.83	1.24	2.54	4.72	8.24

Note: Cross-Wave Social Security Weights.

Our fifth key finding is that the Theil index of inequality hides increasing disparities in wealth accumulation between high and low earners. Between 1992 and 2010, ratios of employer-sponsored retirement wealth to earnings increased for workers in the top earnings quintile at all points in the wealth distribution and decreased at all points of the wealth distribution for those in the bottom quintile of the earnings distribution. Thus, in the top earnings quintile, the 10th percentile of the wealth distribution increased from 0.48 to 0.83 times earnings, the median from 2.01 to 2.54 times earnings, and the 90th percentile from 5.09 to 8.24 times earnings (Table 10). Although wealth to earnings ratios approximately doubled across the distribution, the size of the increase was, of course, much greater at the top of the distribution. In contrast, in the bottom earnings quintile, the 10th percentile of the wealth to earnings ratio declined from 0.26 to 0.04, at the median from 1.42 to 0.46, and at the 90th percentile from 5.86 to 3.80.

The increase in inequality in the bottom quintile does not reflect an increase in participation, so that workers who previously had nothing now have something. In fact, the share with no retirement wealth increased from 45.5% in 1992 to 51.2% in 2010.

However, the question then arises: if low earners have fared badly relative to high earners, why has the Theil index of overall inequality of employer-sponsored retirement wealth not increased among retirement plan participants between 1992 and 2010? A decomposition of the 1992 and 2010 Theil indices for workers with any retirement wealth of 0.602 and 0.613 reported in [Table 8](#) reveals that an increase in between-group inequality from 0.231 to 0.267 was offset by a decrease in within-group inequality from 0.371 to 0.346. But the within-group inequality measure aggregates inequality within all groups, placing greater weight on inequality in higher earnings quintiles because of their greater wealth. When we calculate Theil inequality measures within earnings quintiles, we find that inequality in the bottom earnings quintile increased from 1.203 in 1992 to 1.410 in 2010. In contrast, wealth inequality in the top quintile declined from 0.423 in 1992 to 0.315 in 2010 ([Table 11](#)). Consistent with the tabulations of selected percentiles of the wealth distribution, the Theil index shows increases in inequality both within the bottom earnings quintile and between earnings quintiles. However, these increases are offset by decreasing inequality within the top earnings quintile.

5. Discussion

5.1 Key findings

Before beginning this study, we hypothesized the displacement of DB by DC plans over the period 1992–2010 would be associated with increases in retirement wealth inequality between lifetime earnings quintiles. We reasoned low and moderate earners are more exposed to economic shocks, causing fluctuations in contributions to DC plans (Dushi and Iams, 2015), more pre-retirement withdrawals and gaps in coverage (Ghilarducci *et al.*, 2019); are less well-equipped to make complex financial decisions required of DC participants (Lusardi and Mitchell, 2013); have lower employer matches (Ghilarducci *et al.*, 2018b); and invest more conservatively (Agnew *et al.*, 2003).

We were uncertain whether the shift to DC would have increased retirement wealth inequality within earnings quintiles. We reasoned on the one hand, the shift to DC plans may have boosted inequality within earnings quintiles because people with the same earnings have different preferences to participate (Clark *et al.*, 2014), investment returns, economic shocks, and financial literacy, factors that affect DC but not DB wealth accumulation. On the other hand, the switch to DC may reduce within-group inequality if DC plans help workers with low job tenures accumulate wealth better than DB plans that require vesting periods. But most DC plans impose a waiting period before workers are eligible for a match or even to participate so that job changers often have significant gaps in accumulation (GAO, 2016).

We found overall retirement wealth inequality was little changed over the period 1992–2010 even though DC wealth is more unequally held than DB wealth. In part, this reflected already high levels of inequality in 1992 – with the top quintile of lifetime earners holding half the wealth and striking levels of inequality within that group. Workers approaching retirement in 1992 had spent their careers in a mostly DB system. For many at all earnings levels, it was not a golden age. But the lack of a significant increase in inequality also reflects the fact that even in 2010, many older workers were still covered by DB plans from a current or past job.

We found enormous variations in employer-sponsored retirement wealth among workers with similar lifetime earnings. We interpret these variations not as resulting from differences in preferences, but as the outcome of a retirement system that fails to work even for higher earners. Thus, although only 2.2% of employees age 51–56 in 2010 in the top quintile did not have any retirement wealth in their current and past jobs, almost a quarter of households in the top earnings decile will be unable to maintain their standard of living if they retire at age 65 (Munnell *et al.*, 2013).

Table 11. Employer-sponsored retirement wealth inequality by earnings quintile

Year	Measure	Lifetime earnings quintile				
		Q1	Q2	Q3	Q4	Q5
1992	Theil	1.203	0.776	0.647	0.512	0.423
1998	Theil	1.220	0.667	0.432	0.290	0.305
2004	Theil	1.118	0.782	0.465	0.430	0.344
2010	Theil	1.410	0.699	0.504	0.446	0.315

Note: Cross-Wave Social Security Weights.

5.2 Broader lessons

Policy options to increase the retirement wealth of low earners include mandating retirement savings plans (Ghilarducci and James, 2018), taking steps to lower fees (GAO, 2012), allowing people to make additional Social Security contributions (Ghilarducci *et al.*, 2018a), eliminating or reducing opportunities for pre-retirement withdrawals, and targeting retirement plan tax expenditures on low earners. Although financial education can help some workers (Lusardi *et al.*, 2017), it must overcome strong behavioral biases (Laibson, 1997) and it may be more effective to change the system to accommodate the workers we have rather than to attempt to change the workers to accommodate the current system.

The use of inaccurate data on retirement wealth and retirement plan coverage may bias estimates of the impact of retirement wealth and wealth accrual on the retirement decision. To illustrate, Chan and Stevens (2004) use SPDs to determine whether workers are well informed about the retirement incentives they face and report differences in behavior between the well informed and those they presume to be misinformed. But the use of SPDs may result in workers being incorrectly assigned to the two groups.

5.3 Future research

Further research should investigate between-cohort inequalities. Provided benefit formulas are not changed, DB plans provide all cohorts with similar replacement rates, although cohorts may suffer differentially from the effects of inflation. In contrast, differences in lifetime investment returns can result in different birth cohorts retiring with substantially different DC account balances (Cannon and Tonks, 2004), although low account balances may be somewhat offset if the declines in asset prices reflect increases in risk premia, increasing anticipated returns, and thus sustainable drawdown rates.

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