Household Portfolios and Retirement Saving over the Life Cycle

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ABSTRACT

US middle-class households invested 10% more of their investable wealth in the stock market in the past two decades than they did in the 1990s, and this share is now hump-shaped in age, declining after age 50. We present a range of evidence that the Pension Protection Act (PPA) — which allowed Target Date Funds (TDFs) as default options in retirement plans — played an important role. Younger (older) workers starting at the same firm after TDFs became the default option post-PPA, invested more (less) in stocks. in line with the TDF glide path. In contrast to portfolio allocations, contribution rates changed little following the PPA.

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Classical models of economic behavior relate saving and portfolio allocations to household's preferences, risk exposures and economic circumstances. At the same time, research has shown that financial products and intermediaries are also important drivers of these behaviors, and their careful design or regulation can improve (or worsen) household saving and portfolio choices (as discussed in Campbell, 2016, for example). Perhaps the most important place where these design choices can affect households' financial well-being is in the area of retirement saving, since many investors are not financially sophisticated, employers who choose plan features have a fiduciary duty to investors, and regulation plays a large role in plan design. While there is substantial evidence that retirement plan features can increase saving or alter portfolio choices (e.g. Madrian and Shea, 2001; Choi et al., 2004), there are open questions about how persistence these effects are (e.g. Beshears et al., 2022; Choukhmane, 2021). Have the changes in retirement plan design in the U.S. altered the average saving or portfolio choices of the typical investor?

To answer this question, we relate the saving rates and portfolios of a sample of millions of U.S. middle-class retirement investors with trillions in investable wealth to the passage of the Pension Protection Act (PPA) of 2006. The PPA constitutes the most important change to the U.S. retirement savings landscape of the last three decades. We focus on the fact that the PPA allowed the use of Target Date Funds (TDFs) as default investment options in employer-sponsored retirement plans. Unlike a typical fund, TDFs invest in both stocks and bonds in age-dependent shares that approximate the optimal shares in many models of lifecycle portfolio allocation. A typical TDF maintains 90% of its assets in equity funds until roughly 20 years before retirement date, and then decreases this share as employees age to 40-50 percent in equity at target retirement date. TDFs (and similar funds) grew from managing less than $8 billion in 2000 to managing almost $6 trillion in 2021.[1]

[1]See Parker, Schoar, and Sun (2023); Parker and Sun (2023).

We have three main findings. First, the share of investable wealth held in equities by retail investors has changed significantly over the past three decades. In our sample covering 2006 to 2018, these middle and upper-middle class investors on average held over two thirds of their investable wealth in stocks, and this share is hump-shaped over the working life, increasing until age 45-50, and declining afterward until retirement. On the one hand, this lifecycle profile of the equity share of investable wealth is broadly consistent with with prescriptions of optimizing models and our analysis provides moments with which to estimates such models. However, on the other hand, this profile constitutes a significant change: households' equity shares were ten percentage points lower and largely unrelated to age during the 1990s (Ameriks and Zeldes, 2004). We show that this change in allocations has largely been implemented by households through the adoption of TDFs.

Second, we show that these changes in investor behavior were (at least) accelerated by the adoption of TDFs as defaults in retirement saving plans following this being sanctioned by the PPA of 2006. We find that younger investors enrolling in a given retirement plan just after its default switches to a family of TDFs have a larger share invested in the stock market than those enrolling at the same firm just before the change in default, consistent with the age pattern of equity shares in TDFs and low equity shares in the earlier period. The same comparison for older workers shows that TDFs lead to a lower share invested in stocks, which is again consistent with TDFs causing the share invested in stocks to decline with age. These initial impacts of defaults decline as time since enrollment passes, but this happens as more investors adopt TDFs and TDF-like strategies regardless of the default at initial enrollment.[2]

Third, in contrast to portfolio allocations, retirement saving rates have a monotone increasing life cycle pattern that is relatively stable over time and across cohorts, although the cohort born in the 1980s appears to be saving at slightly higher rates than older cohorts. Saving rates for all cohorts

[2] An effect that may partly be due to other plan features such as re-enrollment.

increase steadily with age, almost doubling between age 25 and 65, and are on average lower than those recommended by most prescriptive models of saving and wealth accumulation (e.g. Poterba, 2014; Gomes et al., 2018; Duarte et al., 2021).

In sum, our findings suggest that the regulatory changes and industry developments that led to the rise of TDFs have significantly changed the stock-bond mix of household portfolios such that the lifecycle profile is now closer to that recommended by most prescriptive models of portfolio choice. In contrast, the related changes in retirement plans that were designed to increase retirement saving seem to have had more limited effects.

These findings are based on an analysis of anonymized, account-level data from a large financial services company. The data contain the portfolios, individual trades, and detailed characteristics of millions of investors covering more than a trillion dollars in investable wealth from 2006 to 2018. We focus on a sub-sample that is reasonably representative of the "typical" American retail investor who has some retirement savings: investors with retirement savings accounts in the middle 80% of the age-adjusted distribution of retirement wealth, who we call *retirement investors* (RIs). For these investors, we observe their *investable wealth*, defined as stocks, bonds, and investment funds in retirement accounts and non-retirement brokerage accounts, and excluding bank accounts, durable goods, and housing. We also observe their (chosen and realized) retirement contribution rates, which capture the vast majority of inflows into their investable wealth.

This sample of U.S. middle-class and upper-middle class investors invests 70% of their investable wealth in the stock market on average. Tracking cohorts, the average equity share increases by 7% as people age from 25 to 50 (and move through calendar time), and then falls by the same amount from age from 50 to 65, as people reallocate financial wealth into bonds and cash-like securities.

This equity share is higher and more hump-shaped across ages than before the rise of TDFs. Using similar administrative data on retirement savings prior to 2000, Ameriks and Zeldes (2004) reports an average equity share of only 58% and no re-balancing out of equities as people aged. Our results are also different from leading survey evidence. The 2016 SCF shows an average share of only 54% of investable wealth allocated to equities in a comparable sample. Similarly, the SCF shows a reduction in equity shares with age that is only a third as large. We present several pieces of evidence that the SCF mis-estimates equity shares due to under-reporting and data processing in the assumptions related to hybrid funds such as TDFs. However, it is also the case that our sample comes from only one firm, and the equity shares in our data may partly reflect the policies of our data provider.[3] While this representativeness is an important caveat, the relative advantage for our data is that we measure equity share almost without error, which highlights the advantages of administrative data for measuring the financial behaviors of less sophisticated investors who may not fully understand the investment products which they hold.

The behavior across ten-year birth cohorts is also consistent with the increased use of TDFs changing portfolio behavior. Across cohorts, each younger cohort – more likely to be using TDFs – has higher equity shares than the prior cohort did at the same age. For example, cohorts born after 1970 have higher equity shares *at every (overlapping) age* than the previous, older cohorts. We also find – consistent with greater use of TDFs – that younger cohorts rebalance more as they age than older cohorts.[4]

Both the increased allocation to equity and the rebalancing over the life-cycle into safe assets was at least accelerated by the growth of TDFs facilitated by changes in pension law. From a pure time-series perspective, total investment in TDFs took off following the PPA of 2006. The Act sanctioned

[3] We note that in our data, the plan designs, extent of TDF take-up, and default allocations are all in line with those reported by other similar large financial services companies. And the SCF has issues with representativeness stemming from survey participation.

[4] This pattern is similar across terciles of ex-ante income, and while log income differences explain about half of the *level* differences in equity shares across people, the lifecycle pattern of income does not change the life-cycle pattern in equity shares.

the use of TDFs as "Qualified Default Investment Alternatives" (QDIA) in employer-sponsored retirement plans. The contributions of new employees who enroll in a plan and do not make an active choice are invested in the QDIA fund. Prior to the PPA, most QDIAs were money market funds (which do not hold stocks). Following the Act, employers increasingly adopted TDFs as default funds.[5]

We estimate the direct effect of having a TDF as the QDIA by comparing the portfolios of people who enroll in a retirement plan in the two years before the PPA to the portfolios of those who first enroll in the same plan in the two years after, at the same employer. Because the Act permitted but did not require employers to change the default allocation, we focus on firms that adopted TDFs as defaults in 2007 or 2008. We argue that it is plausible to assume that the change in default option does not cause employers to choose workers with different portfolio preferences or such workers to choose different employers, and so to interpret any change in portfolio as caused by the change in default option.

We find that the adoption of TDFs as the QDIA leads younger new enrollees (those aged 25-35 when they enroll) to invest 5% more of their financial wealth in the stock market, consistent with TDFs raising equity share for the young. This effect is mostly driven by lower-income workers. For older workers, the adoption of a TDF as the QDIA reduces the share of investable wealth invested in stocks, which is also consistent with a causal effect of TDFs given the lower share of equity in TDFs as they approach target retirement date. Both of these differences in default allocations decline over the five years following enrollment, as investors who did not enroll when the QDIA was a TDF adopt portfolios more like those who enrolled after the change in default. These investors may have been influenced by observing the default option of their peers or responded to advertising and other

[5] Initially, existing plan participants (existing employees) were unaffected by any change in the default, but over time many plans adopted regular automatic re-enrollment in which investors would at least observe the default if not be defaulted into it.

financial advice. Thus it appears that the sanctioning of TDFs and their implied lifecycle glide paths by the PPA, as well as their subsequent adoption by retirement plan sponsors and administrators, led to the more widespread adoption of TDFs and TDF-type strategies through many channels besides default investment funds.[6]

In the third and last part of our paper, we show that, unlike in the case of portfolio allocations, there has been little change in retirement savings behavior across cohorts over time. Measuring a person's retirement savings rate as their annual contribution to their retirement saving plans as a share of their income, average retirement saving rates across all birth cohorts average 4.5% at age 25 and 8.5% at 65 years of age.[7] This pattern does not change much across cohorts, with the exceptions that the youngest cohort, born in the 1980s, saves at a higher rate, and that, after controlling for income, younger cohorts increase saving rates just slightly faster than older cohorts as they age.[8] Finally, comparing people enrolling in plans at the same employer before and after the PPA — which included a number of provisions intended to increase savings — we find that people enrolling after the Act had similar or even lower contribution rates than those enrolling before the Act. Although we are unable to compare these savings rates to those of a similar population in the 1990s, our evidence suggests that contribution rates to retirement saving plans among our RIs have remained relatively stable despite large changes over time in both portfolio holdings and retirement plan design and regulation.

[6]Since the introduction of the PPA in 2006 was followed by the 2008 financial crisis, we provide a number of robustness checks in Section 3 to rule out that changes in market conditions are driving our results.

[7]This measure includes automatic payroll deductions or auto escalation programs, but excludes any re-balancing flows or portfolio appreciation. We also check that our main conclusions are not related to people hitting the legal limit on tax advantaged contributions in a year, which occurs for 6-9% of our sample.

[8]There is significant heterogeneity in average contribution rates across income terciles, but this pattern also stays relatively constant across birth cohorts. On average, the bottom tercile of the income distribution has an almost 2% lower contribution rate than the top tercile, but a similar increase with age (from 3.9% at 25 to 7.3% at 65, as compared to 5.7% at 25 to 9.2% at 65 for the top tercile).

Related Literature Our paper is most closely related to papers that use administrative data to measure household portfolio allocations over the lifecycle, in particular Ameriks and Zeldes (2004). Poterba and Samwick (2001) also finds significant cohort effects in portfolio allocations over the life cycle. Administrative data from Norway shows that Norwegian investors have a hump-shaped equity allocation (Fagereng, Gottlieb, and Guiso, 2017). There are substantial differences in portfolios across countries, see (Guiso, Haliassos, and Jappelli, 2003b,a), and for example Christelis, Georgarakos, and Haliassos (2013) shows that U.S. households have higher levels of stock ownership and stock market participation than most European households (49.7% versus 26%). Gomes and Smirnova (2021) estimates a lifecycle model for U.S. households and also finds a hump-shaped pattern in age.

We also contribute to a growing literature on the institutional causes of portfolio behavior. McDonald, Richardson, and Rietz (2019) studies changes in fund selection by new participants following changes in default investment funds in retirement plans in 2012. Mitchell and Utkus (2022), using Vanguard data, looks at the effect of TDFs on existing employees and new entrants under both voluntary choice and automatic enrollment plans. That paper shows that in voluntary enrollment plans, 28.4% of new entrants adopted a TDF in their 401(k) portfolios, compared to only 10.2% of existing employees. But in plans with automatic enrollment, 79% of new entrants chose a TDF. Similar but larger than our findings, TDF investors held substantially more in equity: 81% for TDF investors compared to 63% for those without TDFs. Gomes, Michaelides, and Zhang (2020) shows that TDFs improve investment performances due to a reduction in risk-taking in anticipation of lower expected returns.

Our paper also informs models of optimal portfolio choice (see the surveys Curcuru et al., 2010; Wachter, 2010). Merton (1969) and Samuelson (1969) provide canonical models in which portfolio allocations are constant over the life cycle and scale-invariant. A large body of research derives optimal portfolio choice in more complex models, the most pertinent example of which is the case where investors receive realistic stochastic, non-tradable "endowment" income over their working lives, which generally implies that investors should reduce holdings of risky assets over their life cycle, see Viceira (2001), Heaton and Lucas (2000), Campbell and Viceira (2002), Benzoni, Collin-Dufrense, and Goldstein (2007), Gomes, Michaelides, and Zhang (2020), and Storesletten, Telmer, and Yaron (2007). Other examples include non-standard utility functions, differences in risk aversion, and differences in beliefs.[9]

For the lifecycle pattern of savings rate, we relate to a large prescriptive literature concerned with what amount of saving households should be doing (e.g. Lusardi and Mitchell, 2007; Scholz, Seshadri, and Khitatrakun, 2006), and a large positive literature estimating models from saving profiles assuming optimal behavior (e.g. Gourinchas and Parker, 2002). When looking at contribution rates, Gomes et al. (2018) suggests that more than 75% of US retirement savers display a significant shortfall in their contributions relative to an optimal consumption model. Poterba, Venti, and Wise (2011) similarly shows that households have inadequate financial wealth to support retirement, and for more than 70% of households, social security is their major asset.

The rest of the paper is outlined as follows. First, in section I, we describe our data. In Section II, we discuss the equity share of portfolios. In Section III, we analyze the effect of the Pension Protection Act on portfolio allocations. Lastly, in Section IV, we analyze contribution rates.

[9]For utility functions see Carroll (2000), Wachter and Yogo (2010), and Meeuwis (2019); for risk aversion see Ameriks et al. (2015) and Ameriks et al. (2019), and for beliefs see Meeuwis et al. (2022) and Giglio et al. (2021).

I. Data

This section describes the account-level data set and how we create a subsample that we can match to a well-defined sub-population of typical American retirement investors.[10]

A. Account-level data

Our main data set contains anonymized, account-level data on financial holdings from a large US financial institution. For each investor, the data contain information on all their accounts held at the firm. For these accounts, we observe end-of-month account balances and holdings, and all inflows, outflows, and transfers at a daily frequency. We observe assets at the CUSIP level for 87% of wealth. For the remaining 13% we observe the characteristics of the fund the wealth is invested in. We aggregate accounts at the (de-identified) individual level and track each individual's portfolio. The data cover millions of investors and trillions in financial wealth. Our sample uses information from December 31, 2006 to December 31, 2018. We use the data at an annual frequency. We measure balances and holdings at the end of each calendar year and aggregate contributions over the year to calculate saving rates. When we observe joint accounts for married couples, we allocate the funds to the spouse who has more total individual assets.

We focus on *investable wealth* defined as money market funds, non-money market funds, individual stocks and bonds, certificates of deposit, quasi-liquid retirement wealth, and other managed accounts.[11] We classify fund and security holdings into equity, long-term bonds, short-term bonds, and alternative assets (e.g. real estate and precious metals). Multi-class funds, also known as Target Date Funds (TDFs) or hybrid funds, are split between equity and fixed income in proportion to the

[10] This method is closely related to Meeuwis et al. (2022)

[11] Excluded categories of financial wealth are checking and savings accounts, saving bonds, cash value of life insurance, and other financial assets.

observed equity share of the fund. Table I provides detailed variable definitions.

In addition to account-level portfolio information, we observe each investor's age, gender, zip code, and marital status (and an (imperfect) link to the partner if they also have accounts at the firm). For a subsample of the data, we also observe an anonymized employer indicator, 3-digit NAICS code of the employer's industry, employment tenure, and, for a further subsample, gross annual wage income. We annualize all income observations by scaling up part-year incomes to a full-year equivalent.

B. *Retirement investor subsample*

While these data provide a detailed view of portfolio allocations for a large number of US investors, there are two potential limitations of our data. First, while we observe a significant share of US investors, this is obviously not a randomly selected sample. In particular, most of the wealth we observe is held in retirement savings accounts and few investors have a very high net worth (as we document subsequently). We would like to understand the relationship between our sample and a similar subsample of the US population. The second potential limitation is that we do not necessarily observe all of people's investable wealth because we do not observe wealth at other institutions.[12]

In order to both minimize and evaluate the importance of these two concerns, we define a sub-sample of people that are well-represented in our data and we can confirm are broadly similar to the same sub-sample in the US population. Our firm's data mainly includes typical working Americans with retirement saving during their working lives. This allows us to define a sample of *retirement investors* (RIs) that we can compare to a similarly-defined sample in the Survey of Consumer Finances (SCF).

[12]The only concern is missing *investable* wealth. In both our data and the SCF, we exclude wealth in savings and checking accounts, as well as net housing wealth, defined benefit pension plans, etc.

First, we restrict our retirement investors sample to investors that are between 25 and 65 years of age. We exclude the youngest members of the sample because they typically have very low levels of investable wealth. By selecting 65 as the upper-bound, we avoid the issue that there is significant attrition among older investors from our data. Thus, our analysis focuses on working-age investors and so mostly on investors with labor income. Second, we drop investors with extremely high or low levels of retirement wealth, where *retirement wealth* consists of all investable wealth in retirement saving accounts of all types (excluding defined benefit plans and Social Security). We drop low wealth investors because they may simply have wealth at other institutions. We drop high wealth individuals because they are under-represented in our data. We choose our sample based on retirement wealth rather than total investable wealth because our data has incomplete coverage of non-retirement wealth (as we discuss below).

To construct our sample of RIs, we use data from the 2016 SCF to define a consistent sample of households based on retirement wealth holding. To correspond to our data, we treat couples in the SCF as two individuals. The SCF data allows us to measure retirement wealth, wage income, and age at the individual level, but non-retirement wealth is only measured at the household level, an issue we address in the following subsection. Using individuals aged 25-85 with some retirement wealth, we run quantile regressions of the log of individuals' retirement wealth (comparable to the measures in our institution's data) on a third order polynomial in age. We then drop individuals with retirement wealth below the estimated 10th percentile or above the 90th by age.[13]

Individual retirement investors make up 28% of the population of US households and 38% of the population of households aged 25-65 according to the (representative) SCF. They hold 33% (39%) of all household investable (retirement) wealth and 52% (54%) of investable (retirement) wealth

[13] For age 30, in the SCF data, the lower bound is $1,328 and the upper bound is $66,370. For age 60, the lower bound is $6,774 and the upper bound is $744,000. See Appendix Figure A.1

among households age 25-65. Approximately 33% of both retirement wealth and investable wealth is held by the top 10%. Approximately 30% of retirement wealth and investable wealth is held by those aged 66-85.

In our data, retirement investors – individuals between 25 and 65 and in the middle 80% of the distribution of retirement wealth at each age – make up 73% of accounts that we observe and hold 75% of all retirement wealth. Our sample of retirement investors contains millions of individual investors and well more than a trillion dollars in investable wealth.

C. *Descriptive statistics and comparison to SCF*

The top panel of Table II shows summary statistics for our sample of retirement investors in 2016.[14] In our RI sample, the average age is 45 years old, and the average (median) wage income is $101,384 ($74,230). About 55% of the sample are male and 70% are married. The average portfolio beta is 0.75, and nearly half of investable wealth, on average, is allocated to target date funds. The average retirement wealth is $96,000. The bottom panel of Table II shows analogous statistics for the population of US retirement investors as estimated from the 2016 SCF. The average age is 47, the average (median) wage income is a lower $66,459 ($50,000), about half are male, and a slightly higher 78% of investors are married.[15] In terms of wealth, the average investor in the SCF RI sample lives in a household with approximately $273,000 of investable wealth and has $98,000 in retirement wealth themselves (bottom panel of Table II), comparable to the average in our sample.[16]

Figure 1 shows that the distribution of retirement wealth in our RI sample lines up well with

[14]See Appendix Table A.I for the entire sample period, and Figure A.2 for the distribution of labor income.

[15]Because of the way heads of households are assigned in the SCF, about 78% of respondents are male in the SCF. When including partners, the sample is evenly split between males and females.

[16]The statistics in Table II are for our retirement sample of middle class Americans with retirement wealth. They are not representative of the assets under management for a typical firm, since we exclude the high net worth households whose wealth mostly lies outside of retirement accounts.

that of individual respondents measured by the SCF. The SCF implies a somewhat higher mass of high wealth individuals, but overall the distributions are similar, suggesting that we are missing little retirement wealth at other financial institutions. Because RIs in our sample typically have most or all of their investable wealth in retirement accounts, we conclude that our sample of RIs provides a good overview of how the investable wealth of typical U.S. retail investors is allocated.

However, Table II also shows that RIs in our data have significantly less non-retirement wealth than RIs in the SCF. Figure 2(a) shows the total investable wealth distribution for individuals in our sample compared to households in the SCF (as in Table II) and confirms that we miss non-retirement wealth for wealthier individuals/households relative to the SCF. Does our sample have less non-retirement wealth because we miss wealth held at other institutions or because our data measure *individual* wealth and so we miss some household-level wealth for partnered investors?

Our sample has less investable wealth not primarily because we do not observe wealth held at other institutions, but because the SCF measures household wealth rather than individual wealth. In our data, the sample of married households for which we observe both spouses has on average 50% more investable wealth. Figure 2(b) shows that the distributions of total household investable wealth are much more similar for this married subset of our sample and the sample of married investors in the SCF. For couples, our data matches the SCF more closely, though our sample has a slightly higher median and mean wealth than the SCF. This rough similarity holds both for married couples and separately for single individuals (see Appendix Tables A.II and A.III). We conclude that the difference in the distribution of wealth between our RI sample and that of the SCF is primarily (but not solely) driven by the unit of observation – individual investor as opposed to households.

Table II also summarizes the retirement saving behavior of our sample. The average RI designates a contribution rate of 8.1% of their income. However, because many people choose high rates that exceed the legal maximum contribution limit, the average ex-post rate is 6.4% of income. The

SCF does not measure or allow us to infer portfolio betas, employment tenure, or retirement plan contribution rates.

II. The equity shares of portfolios

A. The average equity share

Our first main result is that in our RI sample, middle-class American investors hold a large share of their portfolios in equity. The average equity share of investable wealth is 71.0% in 2016 (Table III) and the median is 77.3%. For retirement wealth, the average is 71.1% and the median is 77.7%. Figure 3(a) plots the average equity share by year and while it is higher when the stock market has done well and lower when the stock market has done poorly, the average equity share is reasonably stable over time.[17]

Table III shows that the equity shares calculated for RIs in the 2016 SCF are substantially lower, 54.5% of household investable wealth and 52% of individual retirement wealth.[18]

We hypothesize that the difference in the equity shares across the two samples arises in part because our administrative data allow us to measure investors' portfolio allocations precisely. Specifically, the SCF data are based on survey responses where people might under-report the share of their wealth invested in equity if they are unaware that TDFs allocate money into equities. The main alternative hypotheses are that our sample under-represents investors with low equity shares or that the part of people's portfolios which we do not capture at other financial institutions have lower equity shares. Five pieces of evidence point in the direction of people under-reporting equity

[17] Appendix Table A.IV shows the comparison of the 2016 SCF with our full sample from 2006-2018. The magnitudes change slightly, but the arguments that follow still hold.

[18] These figures are somewhat lower than commonly reported in the SCF because we are calculating the average equity share rather than taking the ratio of averages. Because equity shares increase with wealth, equity shares calculated as aggregate equity over aggregate wealth are larger (e.g. Bricker et al. (2016)).

allocations of TDFs in the SCF.

First, the respondents in the SCF who have some of their retirement assets in "mixed" funds report having lower than average equity shares, as shown by comparing columns (2) and (4) of Table III.[19] In the SCF, the subset of retirement investors who report having some assets in a mixed fund report an equity share of only 47%, versus 54% for all retirement investors in the SCF. We observe the exact opposite in our data: the subset of investors with TDFs has a somewhat higher equity share (77% versus 71%) consistent with the under-reporting of the equity share by SCF respondents.

Second, SCF respondents also appear to under-report the decline in equity shares with age, which again is correlated with TDF ownership. Households in the SCF report little rebalancing out of equity as they approach retirement relative to investors in our data. What decline there is, occurs primarily among those investors not holding TDFs. Those holding TDFs report quite flat equity shares despite the significant automatic rebalancing with age by TDFs. As a result, the difference between equity shares in our data and the SCF is the highest for young investors who hold some TDFs. These patterns are what one would anticipate if misreporting were due to a lack of understanding of how much TDFs allocate to equity for younger investors.

Third, the difference between equity shares of investors holding TDFs and investors who do not occurs primarily in retirement wealth, where the vast majority of TDFs are held, and not in non-retirement accounts. Panel B of Table III shows that RIs in the SCF reported equity shares that are about 9% lower when they hold assets in a mixed fund, while RIs in our sample report an equity share that is approximately 5% higher when they hold assets in a TDF.

[19] The SCF phrases this question as "How is it invested? Is it all in stocks, all in interest-earning assets, is it split between these, or something else?" and then offers a variety of choices. We infer that the participant has something in a target date fund if they report having a mixed allocation of assets or if they have assets in a mutual fund or ETF. Thus, the same way survey responses may misreport equity share, they may also mis-characterize investments as hybrid funds.

Fourth, it is notable that outside of retirement wealth, our investors hold significantly lower shares of their wealth in equity, either compared to their holdings in retirement accounts or compared to what SCF households report in non-retirement accounts. Consider the argument that our sample overstates equity shares because we omit non-retirement wealth that the SCF measures. This is possible because, as noted, the distribution of wealth in our sample.[20] But non-retirement assets in the SCF (Panel C of Table III), have an equity share of 73%, which is higher than in our sample (and than in SCF retirement accounts).[21] Because this part of wealth has a high equity share in the SCF, if we were able to add such wealth to our data, presumably it would further raise, not lower, the average equity share in our data.

Finally, we compare the time series of the SCF, starting in 2007, with our sample in the same years and find that the discrepancy worsens over time. While there is already a large difference between the average equity share reported in the SCF and our sample in 2007, the gap grows steadily to 2016, as does the between those with and without TDFs in their portfolios (all as displayed in Appendix Figures A.3 and A.4). These changes are consistent with the rise of TDFs, both in our sample and in the United States in general (see Figure 4 and Parker, Schoar, and Sun, 2023).

In addition, we confirm that the TDF design and recommended portfolio allocations of our data provider is in line with the other large providers in the United States. Various sub-sample analyses, described in the appendix, show that neither the unit of observation nor household composition appears to be responsible for the higher average equity shares in our data.

While we believe that this evidence supports the idea that equity shares in the SCF are underreported relative to our administrative data, we cannot completely rule out that some of the

[20] The SCF reports a somewhat larger amount of wealth held in non-retirement accounts, 13% versus 4% (Figures 1 and 2(a) and Table II).

[21] This includes equity held in trusts and mutual funds or stocks held outside of retirement accounts as a fraction of all trusts, mutual funds, stocks, bonds, and CDs held outside of retirement.

difference in measured equity shares may come either from idiosyncrasies of our sample or the wealth held at institutions other than the one we observe. In particular, our sample has a higher share of their portfolio invested in stocks than the SCF sample even when we first observe our sample before the rise of TDFs. While this suggests mismeasurement in one dataset or the other, it is unlikely to be driven by TDFs.

We conclude that, while the two samples have some differences, the typical RI – middle-class and upper-middle class investor – holds significantly more of their investable wealth in the stock market than what appears to be the case in the SCF. We now turn to the analysis of the changes in the lifecycle dynamics of portfolio holdings over time.

B. *Equity shares across ages*

B.1. The cross-section of equity shares by investor age

We first establish more strongly that, in the cross-section, averaging across people and years in our sample, the age profile of equity shares is declining in age, as shown in Figure 3(b). We check that this is not due to differences in income across ages by regressing equity share on indicator variables for age groups using the following specification:

$$y_{it} = \boldsymbol{\beta}_1^{\prime} \boldsymbol{Age}_{it} + \beta_2 Inc_{it} + \epsilon_{it} \tag{1}$$

where y_{it} is portfolio equity share, Age_{it} is a vector of three-year age group indicators and Inc_{it} is the log deviation of the individual's income in each year from the sample mean income, which is only included in some specifications.

The solid (red) line in Figure 5 plots the coefficients from the regression in (1) without the income control, which largely replicates Figure 3(b). The equity shares are approximately 74% for 25-27 year-olds and are lower at higher ages reaching approximately 55% at ages 64-65.[22] The decrease across ages is much steeper for at older ages,decreasing by 2-3% per year after age 50.

Adding the income control reduces the sample size and raises the average equity share slightly, but the pattern of equity shares across ages remains largely the same, as shown in Figure 5. The short-dashed (green) line plots the average equity share at the mean income and shows that the portfolio share of equity declines across ages slightly more before age 50, but still declines much more significantly after age 50. The effect of income is based primarily on the correlation of income and equity share within age groups rather than on average across age groups. People with higher income tend to have higher equity shares: a two standard deviation change in income is associated with a nearly 8% higher equity share (and in the regression, income explains roughly as much variation in portfolio shares as age groups). Investors in the bottom third of distribution of starting income have about a 5% lower share of their investable wealth in the stock market, but the decrease with age is similar in magnitude for each third of the distribution of initial income.[23]

Finally, it is important to note that this cross-age pattern does not appear to be driven by the passive appreciation of equity holdings for investors over time. The cross-sectional results are similar using price-constant equity shares, which measure inflows and outflows to each asset class, and ignore any change in price (see Appendix Table A.IX). The results also hold when we use the ex-ante designated equity share of dollar contributions (Appendix Table A.X)

[22] Appendix Table A.VIII reports the regression coefficients, also referenced in the next paragraph.

[23] Initial income is based up on the first (or second, if first is not available) year in which the individual enters our sample. The first tercile of initial income covers those with income below $46,000 per year, approximately. The second covers those with income $46,000-75,000. The third tercile is those with an initial income greater than roughly $75,000 per year. Appendix Table A.XI shows the results with standard errors clustered at the employer, rather than the individual, level. The statistical significance is unchanged.

B.2. The hump-shaped lifecycle profile of investor equity shares

Second, tracking the same investors over time, equity shares rise at young ages, in contrast to the cross-sectional patter just shown, and are hump-shaped over the working life.

Figure 6 plots the coefficients from analogous regressions to the specification in equation (1) but including person fixed effects, so measures the average changes in equity share across investors at each age as they age (normalized to the average equity share).[24] The baseline specification shows that young people tend to increase the equity share of their portfolios, but as they approach retirement they reduce their equity exposure. People increase their equity share by approximately 7% from age 25 to 50, then they decrease it by about the same amount from age 50 to 65. Changes in income do not drive this result. The same pattern holds when controlling for income, with a slightly higher magnitude (10% instead of 7%).[25]

This lifecycle hump-shaped pattern holds across income groups. The remaining lines in Figure 6 show results for different levels of initial income. Each group increases its equity share by 5-7% from age 25-50, and then decreases it as they age. We observe more aggressive rebalancing away from equity in the higher income groups, with the richest decreasing their shares by about 7% relative to their position at age 25-27. Those in the lowest income group decrease their equity share by only about 2%. Of course, those with higher income also start out with higher equity shares, and thus have more room to decrease them.

Due to the challenge of fully disentangling age, time, and cohort effects, we perform two additional robustness checks to verify the hump-shaped pattern. First, the hump shape pattern also holds if we model time effects as a linear function of the excess return of the S&P500 (relative to the

[24] Appendix Table A.XII shows the corresponding regression results.

[25] The coefficient on income measuring the effect of changes in income is also smaller than the coefficient on the level of income in Appendix Table A.VIII measured in the cross-section, an effect examined in detail in Meeuwis (2019).

risk-free interest rate) in the 10 years leading up to each observation, using this a proxy for time effects, similar to Malmendier and Nagel (2011) (Appendix Table A.XIII).

Second, we reconstruct the age effects and again find a hump-shaped pattern using the method of McKenzie (2006). In this procedure, the equity share is differenced across age and time within a cohort to eliminate cohort effects. Then, these first differences are differenced across time to eliminate time effects and recover the age profile between adjacent ages. This method gives a discrete approximation and point identification of the second partial derivative. First derivatives and level effects can then be recovered by assuming a normalization of some constant slope between two ages. We select a slope of zero between age 25 and 26, a minor normalization given that observed equity shares are relatively flat early in life (See Figure 3(b).) We find that the second derivatives and recovered level effects are consistent with a hump-shaped pattern over the lifecycle. We describe the method in more detail and report these results in Appendix B).

B.3. The lifecycle profiles of equity shares of different cohorts

Third we document that, across cohorts, equity shares have both risen for younger cohorts and become more hump-shaped in general, consistent with the increased use of TDFs raising the equity share of young investors and decreasing equity shares of older investors. We focus on cohorts of people born in 10-year periods, giving us five cohorts, from those born between 1943 and 1952, to those born between 1983 and 1992. Looking across ages and across cohorts reveals two patterns.

First, looking across years, Figure 7(a) shows that the three cohorts born more recently (those born around 1965, 1975, and 1985) have slightly higher equity shares to those born around 1945 and 1955 in the 2000's, that increase to fifteen to twenty percent higher equity shares by 2018. The oldest cohort start with roughly 10% less of their portfolio allocated to equity and ends the sample with 15% to 25% less than the youngest three cohorts.

Second, and more importantly, every cohort has a higher equity share at every age than all the older cohorts did at that same age (with a one year exception for the second-oldest cohort). This fact can be seen at the ages for which cohorts overlap in Figure 7(b), which shows equity share by median age for different cohorts.[26] More precisely (based on Appendix Table A.XV), at any age there is a monotone increase in average equity share before around age 40.

The left panel of Figure 8 plots our main regression coefficients (with the control for log-income) and individual effects, on subsamples of different birth year cohorts.[27] These regressions control for income and are plotted for the average income of all RIs, which (artificially) raises the equity shares of the youngest and oldest cohorts, but allows us to measure how equity shares increase within each cohort as they age, controlling for income.

As without the controls, the older cohorts allocate away from equity sooner and more quickly than younger cohorts. From ages 55-65, the 1943 cohort decreases its equity share (relative to their own shares at age 52-54) by 19%. Meanwhile, those in the 1953 cohort decreased their equity share (again, relative to their own shares at age 52-54) by only about 5%. Similarly large differences appears when comparing the 1953 cohorts to the 1963 cohorts. Those born 1953-1962 decrease their equity shares, by about 8% from age 43-52, while those born 1963-1972 actually increase their equity share by nearly 2% over the same age range.[28]

Second, among the youngest cohorts, those born more recently increase their equity shares more quickly in their earliest years of investing, by approximately 1% more from ages 25-36 than those

[26] Appendix Figure 5(b) shows that both this pattern and that shown in Figure 7(a) are also true for portfolio betas. In other words, more recent cohorts have higher-beta portfolios than older cohorts at the same age, and portfolio betas within cohort are relatively stable over time.

[27] Appendix Table A.XVI shows the corresponding regression results.

[28] Put differently, comparing the trend for the 1953 cohort from ages 43-57 we see that those born from 1953-1962 decrease equity shares at about 2-4% per year. On the other hand, the 1963 cohort, at the same age, hold their equity share almost constant until they reach age 52, when they start to decrease it by only 1-2% per year.

born 10 years earlier.

What has driven these changes in portfolio behavior? The greater investment in the stock market by the young and the decline over the latter half of working life are both consistent with an increased adoption of TDFs. As shown in Figure 4, younger cohorts are much more heavily invested in TDFs.

The right panel of Figure 8 shows evidence consistent with these changes across cohorts being driven by the rise of TDFs. Investors who begin with a high allocation of their portfolio to TDFs (75-100%) start with higher initial equity shares and exhibit much stronger rebalancing behavior than those who start life with less invested in TDFs. In contrast, those with initially low allocations to TDFs (0-25%) have a still hump-shaped, but flatter equity profile, starting with approximately 62% equity, increasing it to 70% by mid-life, and lowering it only modestly to 66% at age 65.

Before turning to more direct evidence on the role of TDFs in changing households' investment in the stock market over their lifecycles in Section III, we compare these investment patterns to those of similar investors in the 1990s.

C. Relation to portfolios during the 1990s

In this subsection, we present a final piece of direct evidence that portfolio behavior has changed over time by comparing the lifecycle portfolio holdings in our data covering 2006-2018 to the portfolio holdings in very similar administrative from the 1990s. Specifically, we replicate the central analysis from Ameriks and Zeldes (2004) which is based on administrative data from a large financial institution, where both the type of data and institution are quite similar to ours. Figure 12 in Ameriks and Zeldes (2004) focuses on a sample of households that own equity and shows that investors held less of their wealth in stocks and did not reduce their equity shares with age.

Figure 9 replicates Figure 12 from Ameriks and Zeldes (2004) and visually summarizes three main points. First, the top panel of Figure 9 shows that equity shares in more recent years are high and decline with age across investors, with a steeper slope after age 55. In contrast, in earlier data, equity shares decrease with age from age 25 to 35 and are roughly the same for all ages after 35 (Ameriks and Zeldes, 2004, Figure 12, top panel).

Second, the middle panel of Figure 9 shows that tracking cohorts as they age, equity shares are roughly independent of age during the first half of working life and then decrease with age during the second half of working life. In contrast, the middle panel of Figure 12 in Ameriks and Zeldes (2004) shows that each cohort's equity share was *upward sloping* in age in the 1990's.

Third, in the last panel of Figure 9, the solid, red line shows that equity shares are hump-shaped in age controlling for differences across cohorts. The analogous figure in Ameriks and Zeldes (2004) shows a linear upward sloping line. Controlling for differences across years, the dashed blue line shows that equity shares are decreasing, more rapidly later in life, as in a TDF glide path. The analogous figure in Ameriks and Zeldes (2004) shows a flat line.

Finally, to confirm that we are documenting a real change in behavior rather than something specific to administrative datasets or these two firms, we replicate the Ameriks and Zeldes (2004) analysis of portfolios in the SCF. We compare Figure 9 in Ameriks and Zeldes (2004) which is based on SCF data from 1989-1999 with our own version of Figure 9 based on SCF data from 2007-2016 (Appendix Figure A.6). We find the same changes as we show between the two administrative data sets, but to a slightly lesser degree.[29] Specifically, equity shares have risen in the SCF relative to the time frame studied in Ameriks and Zeldes (2004) and there is now a lifecycle pattern of rebalancing out of equity with age rather than increasing equity exposure with age.

[29]This smaller magnitude is consistent with the gap inequity shares observed between our sample and the SCF, as we discussed in relation to Table III's evidence that equity shares decline with age more in our data than in the SCF.

III. Pension regulation, TDFs, and portfolio allocations

This section provides evidence that the the rapid rise of TDFs following the Pension Protection Act (PPA) of 2006 contributed to both of the main new facts we document: that equity shares that are high earlier in life and decline steadily over the second half of investor's working lives.

The Pension Protection Act of 2006 permitted Target Date Funds to be "Qualified Default Investment Alternatives" (QDIA) in employer-sponsored, defined-contribution retirement plans. The act provided a "safe harbor provision" that clarified that the use of a TDFs as the default investment vehicles in a plan was consistent with the fiduciary responsibilities of the plan sponsor (the employer) and the plan administrator.[30] Prior to this provision, both employers and administrators faced potential legal liability for replacing existing default options — primarily safe money market funds — with TDFs. Following the PPA, plans increasingly adopted TDFs as defaults, which moved employees who passively accepted or chose the default investment out of very safe, low-return funds and into largely equity funds. Following the PPA, the availability, adoption, and use of TDFs accelerated rapidly in the U.S. Figure 4 shows the rise in our data and TDFs overall grew from managing less than $8 billion in 2000 to managing almost $6 trillion in 2021 (see the discussion in Parker, Schoar, and Sun, 2023).

A. *The short-run effect of PPA of 2006 on portfolios*

To identify the effect of TDFs on investors' portfolio allocations, we compare the lifecycle investment behavior of workers hired by a given firm just before and after 2006 at firms that switched their default investment at this time to a TDF. This analysis identifies the exogenous effect of the PPA on investors' portfolios assuming that people (employees) did not endogenously change

[30] https://www.dol.gov/agencies/ebsa/about-ebsa/our-activities/resource-center/fact-sheets/default-investment-alternatives-under-participant-directed-individual-account-plans

the jobs they take due to the introduction of the PPA or their (potential) employers response to it. This assumption seems reasonable since employees typically are not aware of these regulatory changes and base their employment decision on many other factors. Employees who joined their employers before 2006 almost exclusively entered into plans that did not have TDFs as a default option, since without the safe harbor provision of the PPA, employers found it very risky to use this option. After 2006, many employers adopted TDFs as defaults and the employees joining the firm after this change then saw a different default investment vehicle when they enrolled.

We first analyze the short term – two year – effect of the adoption of a TDF as the default investment fund. We take the sample of employees who start a new job between 2005 and 2008. The specification is:

$$y_{ift} = \beta_1 \quad D_{treated} + \beta_2 \quad D_{treated} \quad AgeEnrolled_i + \beta_3 \quad AgeEnrolled_i + \lambda_f + \epsilon_{it} \tag{2}$$

where t now indexes years since enrollment, y_{ift} is the portfolio equity share of individual i, starting at firm f, in year $t = 0$. We include all investors who enrolled between 2005-2008, including only the first two years that we observe them in the sample. $D_{treated}$ is an indicator variable equal to one if an investor starts at a retirement plan that switched to having a TDF default immediately after the PPA, in 2007 or 2008. The control group includes those who enrolled in 2005-2006.[31] The parameter λ_f is an employer fixed effect, included so that our analysis compares individuals enrolling before the Act (in 2005 or 2006) to those enrolling after (in 2007 or 2008) at the same employer. Since TDFs by definition change their target allocation for people of different ages, we also include categorical variables for 10-year age groups at enrollment and interactions of these age groups with the treatment variable. These regressions include only firm-level fixed effects and not

[31] Note there is no time fixed effect, as it would be collinear with the treatment.

individual-level fixed effects since we estimate the effect of the PPA by comparing across investors who enrolled just before and after 2006.

Note that this approach conditions on individuals who newly enroll in a retirement plan during the time period we study. Several provisions of the PPA were designed to increase enrollment, such as allowing auto-enrollment. Thus there may have been an effect on average participation rates in plans (see Beshears et al. (2010)), which raises the possibility of some change in what type of workers enroll before and after the PPA. Since we do not have information on non-participants which would allow us to directly address this concern, we instead control for the key observable characteristics that we observe, such as income and age. Moreover, previously non-participating employees are possibly the most likely to accept the default asset choice of TDFs (Choi et al. (2004)), so that prior to the PPA, they might have been defaulted into investing in safe assets.

Table IV shows the results of estimation of equation (2) restricting the sample to the two years after enrollment for each new employee. Column (1) of Table IV shows that someone aged 25 - 35 who is enrolled into a plan with a TDF default in the two years after the act (compared to those enrolled in the two years prior to the act in the same firm) has a 5.5% higher equity share during the first two years of their employment (the coefficient on the *treated* indicator variable). The effect is statistically significant and economically large relative to the average increase and decrease of average equity over the lifecycle.[32]

The coefficients on the interaction terms show that the effect of a TDF default on older individuals is to decrease their equity shares. For example, while those aged 55-65 at enrollment have 13% lower equity shares than those aged 25-34 (row 4), those treated by the change in default have equity shares that are lower again by nearly 15% more (row 7). This age pattern in the treatment

[32]Appendix Table A.XVII shows the same specification with standard errors clustered by employer rather than individual. The results continue to be statistically significant.

effect of TDFs – from positive when young to negative when old – is consistent with the change in overall behavior that Section II documents: relative to the low and (roughly) age-invariant equity profiles of the 1990's, TDFs raise the allocation to stock for younger workers and lower it for older workers. Controlling for income (column (2)) the effect on young investors declines only slightly and that the lifecycle pattern remains quite similar.

For younger investors, the effect of a TDF default is generally larger for lower income investors than for higher income investors. In Columns (3)-(4) of Table IV, we repeat the analysis from Column (1) for the subsamples of people with the lowest and highest initial income. Column (3) shows that the initial impact on equity share at young ages is almost 6%, compare to 5.5% in the full sample. The effect on those in the bottom income tercile is similar for the older age groups as in the full sample. For the highest income tercile (column (4)), the treatment effects are significantly muted. For the youngest group (people 25-35 in age) the magnitude of treatment effect on equity shares is less than 2%.

The small effect for higher income investors might be due to the fact that even in the control group, young higher-income investors have high equity shares. Second, higher-income investors might make more active decisions and thus make less use of TDFs. Consistent with the latter, the rebalancing effect of enrolling with a TDF default is much less pronounced for the highest income tercile.

These results are not driven by differences in investors' pre-existing portfolio allocations or their experience with assets or asset managers prior to enrolling with their new employer. Columns (5)-(6) display the results of the same analysis as displayed in columns (1)-(2), but conducted only on those individuals who have no other retirement assets or rollover funds prior to enrollment at our institution. It turns out that this sample restriction drops very few investors. As a result, the results are virtually unchanged from those in the first two columns, even for older new employees.

B. Medium-run impact and convergence

In order to analyze the impact of the PPA on the investment dynamics and persistence of portfolio allocation over the medium term, we now repeat the analysis above but track individuals for five years after enrollment in a retirement plan. We expand our specification to:

$$\begin{aligned} y_{it} = &\beta_1 \quad D_{treated} + \beta_2 \quad D_{treated} \quad AgeEnrolled_i + \beta_3 \quad AgeEnrolled_i \\ &+ \beta_4 \quad D_{treated} \quad \lambda_t + \beta_5 \quad \lambda_t + \lambda_f + \epsilon_{it} \end{aligned} \tag{3}$$

where the notation is the same as in equation (2) and we have added year fixed effects λ_t and interactions of these year-since-enrollment fixed effects and interactions of these fixed effects with the treatment indicator to trace out the investment trend for both the control and treatment group over time, respectively. In this specification, to study differences by age, we run separate regressions using different age groups, rather than including the full set of age fixed effects and interactions.

Column (1) of Table V confirms that the effect of the PPA on equity shares is positive even averaged over the first five years after enrollment and based on the full sample enrolled in 2005-2008.[33] This dynamic analysis shows that the difference between the treated and control group portfolios declines over time. As before, the positive effect of the PPA is much larger for the low income group than the high income group (columns 2 and 3), however, this difference shrinks to nearly zero five years after treatment.

In addition, we see that TDFs tend to raise equity shares for the young and lower equity shares for those near retirement. Column (4) shows that for those aged 25-34 at enrollment the change to a TDF default increases equity share on average by 1.5% the year of the change and rises to almost 4%

[33] Appendix Table A.XVIII shows the results only using those who enrolled in their plan in 2007 as the control group. This minimizes possible spurious correlation due to the financial crisis, as those enrolled in 2007 had at least one full year to contribute and invest prior to the financial crisis starting.

in the following two years. In the last two years we see some convergence between the treatment and control groups. But at the end of the five-year period, the treated individuals still have equity shares that are nearly 3% higher than those of the control group.

Table V further shows that for the older age groups, the effect is the opposite: the PPA decreases equity shares immediately following treatment, which is in line with the prescribed glide path of TDFs. As with the youngest group, this difference tends to decrease over time as the two groups converge. For those aged 55-65, the difference is persistent, with the treated group's equity shares still being 2% lower than the control group's five years after treatment.

The PPA also played a role in the convergence of portfolios allocations between income groups, particularly for those that were enrolled at a young age. Figure 10 plots the predicted equity shares of treatment and control groups broken out by age and income tercile.[34] Looking first at the youngest age group (25-34) in Figure 10(a), the adoption of a TDF default significantly increased equity shares for the low income group, similar to the overall pattern found in the previous section that the lowest income group has a larger increase in equity share as they age than the highest income group before age 40 (Figure 6). And again we see that the control group converges somewhat to the treatment group over time. In contrast, the effect on equity shares for the high income group is positive but much smaller.

Figure 10(b) shows the results for those enrolled from age 55-65 for high-income investors and for low-income investors. The PPA significantly decreased equity shares for both groups. Over time, the two treated groups become more similar when compared to the two untreated groups, implying a similar convergence effect of the changes in defaults facilitated by the PPA.

Finally, what role do TDFs play in accounting for the aggregate shift in the life-cycle portfolio allocation over our time period? While the regressions using PPA variation show some catch up

[34] These are estimated in by repeating columns (4) and (7) from Table V on the income subsamples.

over time even for people who are not defaulted into TDFs, we want to understand how important this effect is in the aggregate. For this purpose, we separate savings invested by TDFs from those invested by non-TDF funds or directly invested into the underlying assets. These non-TDF assets occur in two forms, first there are RIs who have a part of their savings in TDFs but another outside of TDFs. Second there are also investors who never participate in TDFs at all. We find that the allocation to equities of both of these types of non-TDF assets is much less humped shaped over the life cycle compared to TDF assets (pictured in Appendix Figure A.7). The non-TDF assets on average also have a lower fraction invested in equity.

In conclusion, middle-class and upper-middle class working-age American investors with retirement wealth now hold a large share of their financial wealth in equity and reduce the share as they age, following a concave rather than a linear lifecycle pattern. This is relatively new behavior, not visible prior to 2000. This large change appears to be due to the combination of industry development and regulatory approval of TDFs as defaults in retirement saving plans. The new portfolio behavior follows the prescription embedded in TDFs investment strategies, to invest mostly in stocks when young and to decrease this share significantly in the second half of working life as retirement approaches.

IV. Contribution Rates

This section presents an analysis of the average contribution rates that investors make to their retirement plans over their working lives.[35] The analysis, which mirrors our analysis of portfolio composition, shows three main results. First, contribution rates increase linearly with age, increasing by 4-6% over the working life. Second, and more importantly, unlike portfolio behavior, this behavior has been relatively stable over time, with the exception that the youngest cohort saves

[35] The measure of contribution rates includes only the employee's own saving, not employer contributions.

slightly more than the rest. Third, the economic response of average contribution rates to the PPA of 2006 was minimal, and point estimates suggest that changes in plan features shortly after the Act actually decreased saving slightly. Thus, we conclude that investors' own contribution rates were less sensitive than equity shares to the changing regulatory environment (and to investment trends) over time.

A. Realized Contribution Rates

We measure realized contribution rate as the percentage of an individual's annual income that has been invested into a retirement account over the previous year, not including employer contributions, calculated at the end of each calendar year.

Figure 11(a) presents the coefficients from estimation of equation (1) with realized contribution rates as the dependent variable.[36] The baseline specification shows that, in the cross-section, contribution rates increase monotonically with age, from about 4.6% at age 25 to 8.5% at age 65. The remaining lines show that contribution rates increase by a similar 4% over the working life when controlling for income in two different ways. First, the coefficient on current log-income deviation from the average implies that each 1% deviation in income from the average is associated with a nearly two percentage point increase in reported contribution rate. Instead, looking across initial income groups, those in the highest income group save nearly 2% more, on average, than those in the lowest income group at every age. The increases over the lifecycle, however, are parallel: each group increases its total saving rate by about 3.5% from age 25-65.

The average behavior of investors as they age similarly steadily increases across ages but at faster rate. Figure 11(b) shows the regression coefficients of realized contribution rate on age group indicators, including a person fixed effect which effectively include a cohort effects. In the baseline

[36] Appendix Tables A.XIX, A.XXI, and A.XXII show the regressions that are plotted in the figures and discussed in the text of this subsection. Appendix Table A.XX shows cross-sectional results split by cohort and TDF ownership group.

results, contribution rates increase by just over 5% over the lifecycle, the same increase as in the cross-sectional age pattern. We then add a control for log income which does little to change the age effects nor the R-squared of the regression. This confirms that, when controlling for the person fixed effect, income is less important for determining contribution rates and that increasing savings rates with age are unlikely to be due to income profiles.

Splitting investors by initial income, all income groups also show a similar lifecycle pattern, though those with higher incomes have higher contribution rates overall. Comparing the highest to lowest income group, we see parallel increases of 4.6% and 5.1% over working life in average contribution rates. The average contribution rate of the middle initial income group increases by a slightly larger 6.2%. These differences in contribution rates across cohorts in part relate to contribution limits set by the IRS, as we analyze in the next subsection.

Turning to changes in behavior across cohorts, while younger cohorts contribute less than older cohorts at every age, each cohort contributes roughly the same amount as the previous cohort did at the same age (Figures 12(a) and 12(b)). The one exception is the youngest cohort, which is on a slightly higher saving trajectory than all the older cohorts. Thus, relative to the portfolio changes characterized in the previous section, contribution rates are relatively stable over time, and they do not exhibit the differences and gaps in the share of investable wealth invested in the stock market that Figure 7(b) showed across cohorts.

As we did for portfolios (in Figure 8), we run regressions that control for income broken out by cohort. Figure 13(a) confirms that each cohort increases its savings rate with age, but younger cohorts increase their contribution rate at a slightly faster pace than older cohorts. These regressions control for income and are plotted for the average income of all RIs, which (artificially) raises the level of the saving rates of the youngest and oldest cohorts, but allows us to measure how saving rate increase within each cohort as they age, controlling for income. For example, comparing the

1983 to 1973 cohort, we see that 28-30 year-olds born from 1983-1992 increase their contribution rate by 0.81%, relative to at age 25-27, while 28-30 year-olds born from 1973-1982 increase it by 0.52%. A similar pattern holds when differencing across ages for the other age groups that are common to multiple cohorts. In summary, although older cohorts start at a higher savings rate due to age, the younger cohorts increase their rate slightly faster as they age, even when controlling for income.

Finally, the stable pattern of saving behavior holds regardless of the share of TDFs initially held by the investor, although investors with large initial investments in TDFs increases their savings rates by more than other investors. Figure 13(b) breaks out the within-person results by initial TDF share. Investors with intermediate investments in TDFs have the highest level contribution rates. Investors with TDF shares below of 25% increase their contribution rates over their working lives by a large amount, 6.6%, or about 1.5 to 2% more than the 4.9% to 4.6% increase of the two other groups that start with a larger allocation to TDFs.

Thus far, we have limited our discussion of contribution rates to *realized* contribution rates: the percentage of income that is actually saved for retirement, ex-post (on a year-by-year basis). However, there is a distinction between the realized rate of savings and the designated or *reported* rate of savings that investors decide upon ex-ante. The difference between reported and realized contribution rates is the result of retirement contribution limits, set by the IRS. [37] Depending on their income and reported contribution rate, some people will hit their maximum contribution before the end of the year, and thus their actual *realized* contribution will be less than what they designated at the beginning of the year. This may occur if someone has a very high income, or if someone sets a very high contribution rate.

We address this discrepancy with two different analyses, both of which confirm our main results.

[37] https://www.irs.gov/newsroom/401k-contribution-limit-increases-to-19500-for-2020-catch-up-limit-rises-to-6500

First, we condition our analysis on an indicator variable equal to one if an individual hits their (age-dependent) contribution limit in that year. We find that 6-9% of our sample with available income data max out on their contribution in a given year (Appendix Table A.XXIII). Our second method of addressing the discrepancy between realized and reported contribution rates is by simply repeating our analysis on the *reported* contribution rate rather than the realized rate. Each approach largely confirms our results using realized rates, as we present in Online Appendix C.

B. The Effect of the Pension Protection Act of 2006

Our results so far suggest that the Pension Protection Act of 2006, which included several provisions designed to encourage savings in retirement funds (Beshears et al., 2010), had only a modest impact on actual retirement saving rates by age or across cohorts of savers.[38] In this subsection, we present evidence that the immediate effects of the PPA on retirement saving rates were, if anything, negative.

We replicate the difference-in-difference analysis of subsection A but comparing the retirement saving rates of new enrollees at the same employer in the two years before and after the PPA of 2006. Unlike in our analysis of portfolios, we designate anyone enrolled during 2007-2008 as a treated investor, regardless of whether or not their plan's default investment allocation changed and estimate equations (2) and (3) with reported contribution rate as the dependent variable.[39]

[38] Note that we only look at employee saving, not employer matching, thus we do not measure the impact that the PPA may have had on employer matching incentives. It is possible that the PPA had a larger effect on saving levels inclusive of employer matching.

[39] In our analysis of portfolios equity shares, only those who were enrolled in a plan that changed its default investment to a TDF after the PPA are considered treated. In that case, we measured the effect of TDF default allocation, induced by the PPA on portfolio allocation. In the case of contribution rates, we want to measure the impact of the PPA overall. The PPA had a significant number of provisions intended to increase savings rates, but we are not able to isolate those plan features in our regressions, due to data limitations. Hence, we simply designate anyone enrolled in a plan from 2007-2008 as a treated investor, regardless of which plan features changed following the PPA.

First, as shown in column (1) of Table VI, those enrolling at an employer after PPA 2006 have lower contribution rates in the two years following enrolment. The effect starts at a large -0.43% of income for those age 25-35, and becomes increasingly negative with age, reaching -1.2% for those age 55-65. The negative sign, magnitude, and pattern are similar when controlling for income (column (2)) and across income groups (Columns (3)-(4)). Finally, this decrease in saving is similar for those with no other retirement assets at the institution prior to enrollment, as shown in columns (5)-(6). This result implies that the finding is not driven by those who have some wealth at the institution prior to enrolling in a new plan.

Tracing out the effect over the five years following enrollment, the PPA had only a transitory negative effect on average contribution rates and it is largest for the oldest investors. We repeat our analysis tracking investors for five years after they enroll and including interactions of individual indicator variables for each year after treatment with an indicator for being treated by the PPA (enrolled in 2007 or 2008, versus 2005 or 2006). As shown in Table VII, Column (1), the PPA has a negative initial effect on contribution rates, but the magnitude decreases over time and is essentially zero five years after treatment. Column (3) shows that the decrease in retirement contribution rates is slightly more persistent for investors with higher (initial) income. Splitting the result by age group, columns (4)-(7) shows that the effect is negative for each age group, and largest in magnitude and most persistent for the older age groups. For example, those aged 55-65 when enrolling after PPA have contribution rates that are 1.3% lower than those enrolling before during the year they enroll, a difference that declines to 0.5% after five years. In contrast, those in the age group 25-34 enrolling after PPA contributed only -0.7% less of their income the year of enrollment and -0.1% five years after enrollment relative to those that enrolled just before PPA.

It is possible that the interaction terms are picking up some of the differences in year fixed effects and that saving rates are lower for the treatment group due to the timing of the financial crisis. However, Appendix Table A.XXIV shows that the results are similar if we include only those enrolled in 2007, rather than 2007-2008. This alleviates some concern about possible spurious effects on saving rates due to the financial crisis, as those enrolled in 2007 had at least one full year to contribute and invest (compared to two to three full years for the control group) prior to the start of the financial crisis. Moreover, the income control in column (1) indicates that the results hold even for those who did not experience significant changes in income due to the financial crisis.

Figure 14 shows the predicted contribution rates for those in the youngest and oldest age group, split out by those in the lowest and highest income tercile.[40] Looking first at those aged 25-34 in Figure 14(a), the PPA significantly decreased contribution rates for both income groups, initially by about 0.7-0.9 percentage points.[41] However, the difference between the treated and control groups converges to zero over time.

For those enrolled when aged 55-65, investors with lower incomes are more affected by the PPA, as shown in Figure 14(b). The treated group with high incomes decreases their contribution rate by about 0.7 percentage points following treatment. For the lower income group, the immediate effect is larger: 1.3 percentage points. For both income groups, the difference between treated and control after five years is nearly zero.

As in the analysis of asset allocations, we only observe individuals who are enrolled in a retirement plan, and the provisions of the PPA may have changed who enrolled, so that the same caveats that we discussed in Section A apply to this analysis. In particular, the concern is that our controls, including income, may not fully account for the fact that households pushed into

[40] These are estimated by repeating columns (4) and (7) from Table VII on the income subsamples.

[41] The reason that both the treatment and control group decrease their contribution rate over the five-year time period following enrollment is that the five-year period that we analyze happens to take place during the Great Recession and its aftermath. This pattern is consistent with the fact that contribution rates increase with age (Appendix Table A.XXV (cross-section) and A.XXVI (within-person)) and at the same time contribution rates decreased uniformly across birth cohorts from 2007-2009 (Appendix Figure A.8).

participating post-PPA may be those who would be inclined to save less once participating.

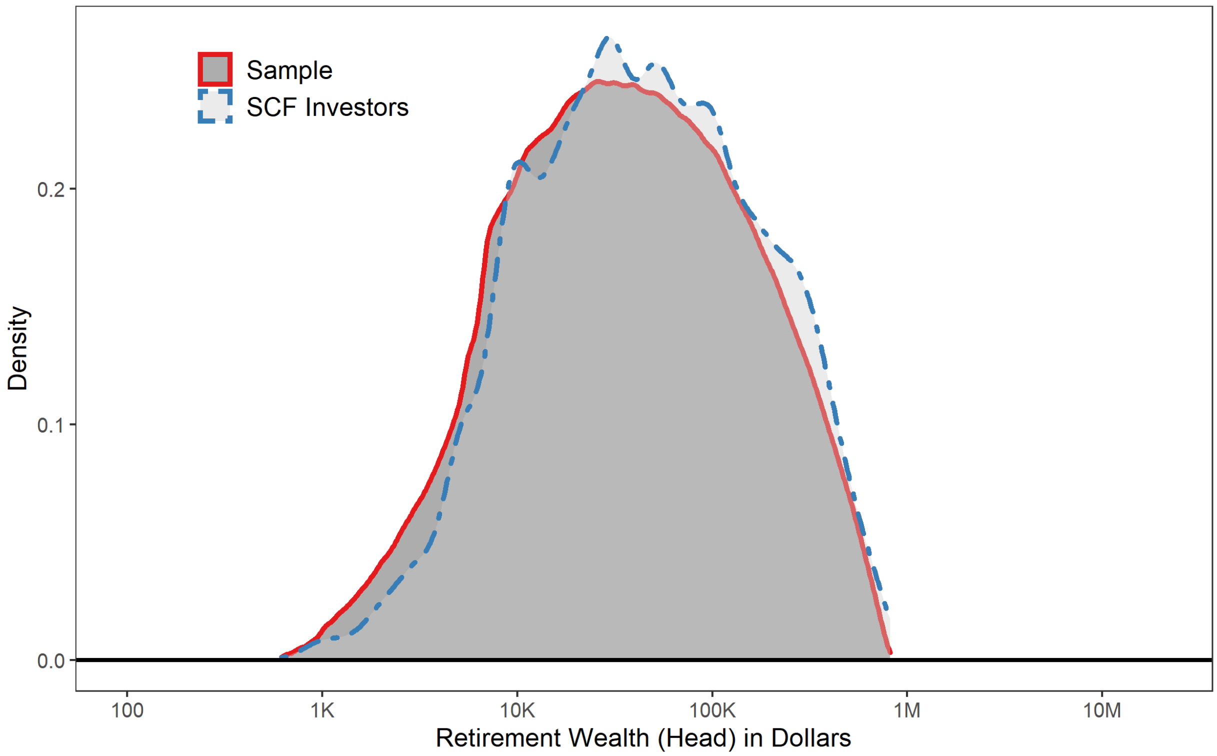
V. Conclusion

The results in this paper show that the portfolios of typical retirement investors in the U.S. have changed significantly over the last few decades. Investors hold more of their investable wealth in the stock market than they did in the 1990s, and they reduce the share of their portfolio invested in the stock market as they age when they used to maintain a relatively constant share as they aged. These two changes are consistent with the rise of new retirement savings products, such as TDFs, and the advent of new regulations, such as the PPA of 2006. We show that the adoption of TDFs as default investments in employer-sponsored retirement plans has a causal effect on portfolios in the direction of the observed changes in portfolio holdings and rebalancing for workers over the life cycle, particularly those with lower incomes. But the causal effects decline significantly over the following five years, as individuals in the control group who are not defaulted into TDF start catching up to the treatment group. Thus rather than being ”undone” over time the default allocation was associate with a larger shift in portfolio allocation in the 2000s.

Did the PPA and the rise of TDFs fundamentally change investor behavior, or would investors have adopted the hump shaped allocation to risky assets over the life cycle even without the changes in regulations? On the one hand, greater dissemination of prescriptive, model-based portfolio advice and a recognition of the equity premium, might over time have led to this shift in investor behavior even absent the PPA. On the other hand, the Act, by sanctioning TDFs as default investment options, appears to have been a critical catalyst in making higher equity allocations acceptable advice for retail investor portfolios. The timing of the effect and initial concentration in employers after they switched to TDFs as defaults, is certainly consistent with this second interpretation. In addition, the PPA seems to have led the investment advice industry (many of whom, like retirement plan sponsors, have a fiduciary duty to their investors) to recommend TDF-like investment strategies more broadly. We see that at the cohort level investors did not reverse the default allocations but rather moved even their active portfolio decisions in the direction of the allocation implied by the TDF glide path. In either case, these changes in behavior may have also contributed to greater stability in asset class returns through automatic contrarian rebalancing, as suggested in Parker, Schoar, and Sun (2023).

Finally, we show that the lifecycle pattern of retirement contribution rates has been relatively stable across cohorts, with the exception of the youngest cohort, suggesting that the PPA-sanctioned changes in the design of retirement saving plans had little effect on retirement contribution rates for most of the population, relative to the effects on portfolio choices.

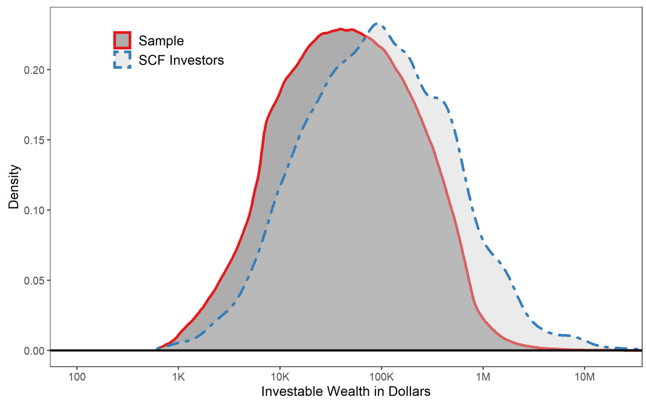
Figure 1: Individual Retirement Wealth Distribution in Firm Data and the SCF in 2016



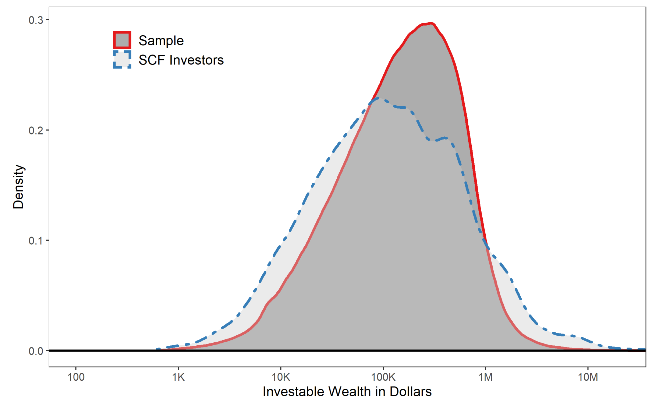
Notes: This figure plots the distribution of retirement wealth in the sample of retirement investors (RIs) versus the distribution of retirement wealth for RIs in the SCF in 2016. Retirement wealth is defined as any wealth in retirement saving accounts of all types (excluding defined benefit plans and Social Security).

Figure 2: Investable Wealth Distribution in Firm Data and the SCF in 2016

((a)) Investable wealth, individual versus household



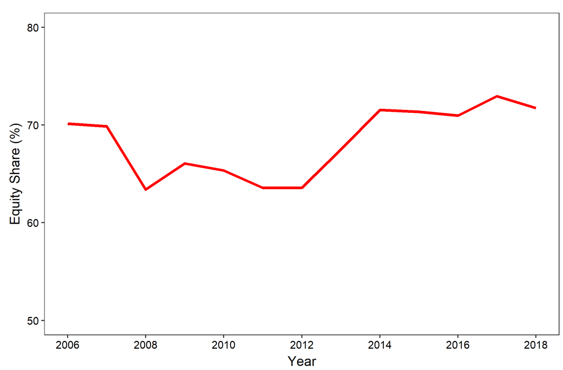
((b)) Investable wealth, household versus household



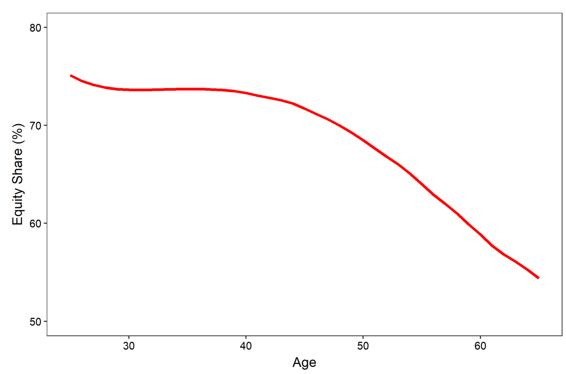
Notes: This figure plots the distribution of investable wealth of retirement investors (RIs) versus the distribution of investable wealth for RIs in the SCF in 2016. The left panel shows individual investable wealth in our sample versus household investable wealth in the SCF. The right panel shows household investable wealth in our sample for the subset of households in which we observe both spouses versus household wealth in the SCF for the subsample of investors who are married. Investable wealth is defined as money market funds, non-money market funds, individual stocks and bonds, certificates of deposit, quasi-liquid retirement wealth, and other managed accounts.

Figure 3: Portfolio Equity Share by Year and Age

((a)) Equity Share by Year



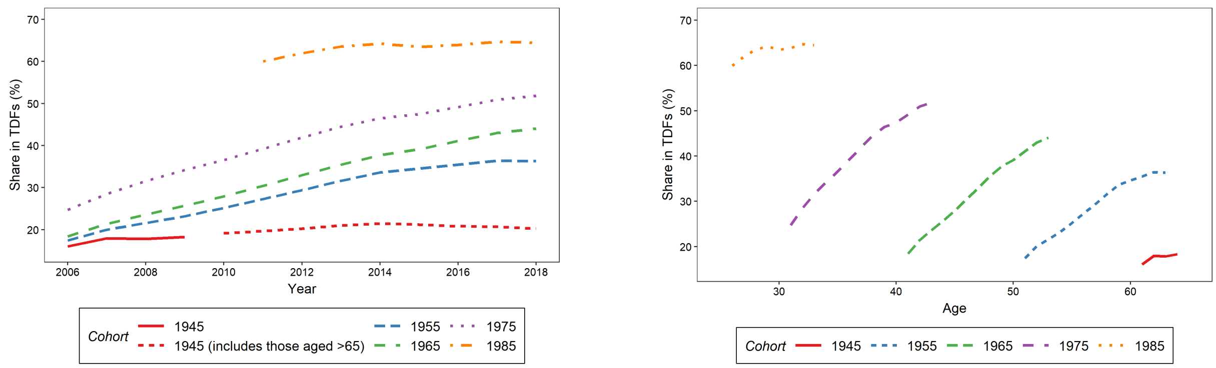
((b)) Equity Share by Age



Notes: This figure shows the portfolio equity share in our sample. The left panel shows the equity share for the entire sample, averaged by year. The right panel shows the equity share averaged by age. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The sample is our full set of retirement investors (RI).

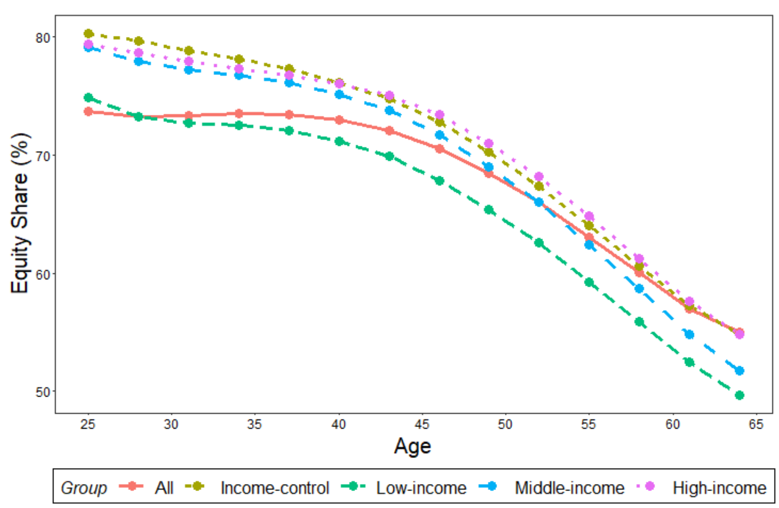
Figure 4: Target Date Fund Share by Birth Cohort

((a)) TDF Share by Birth Cohort and Year **((b))** TDF Share by Birth Cohort and Age



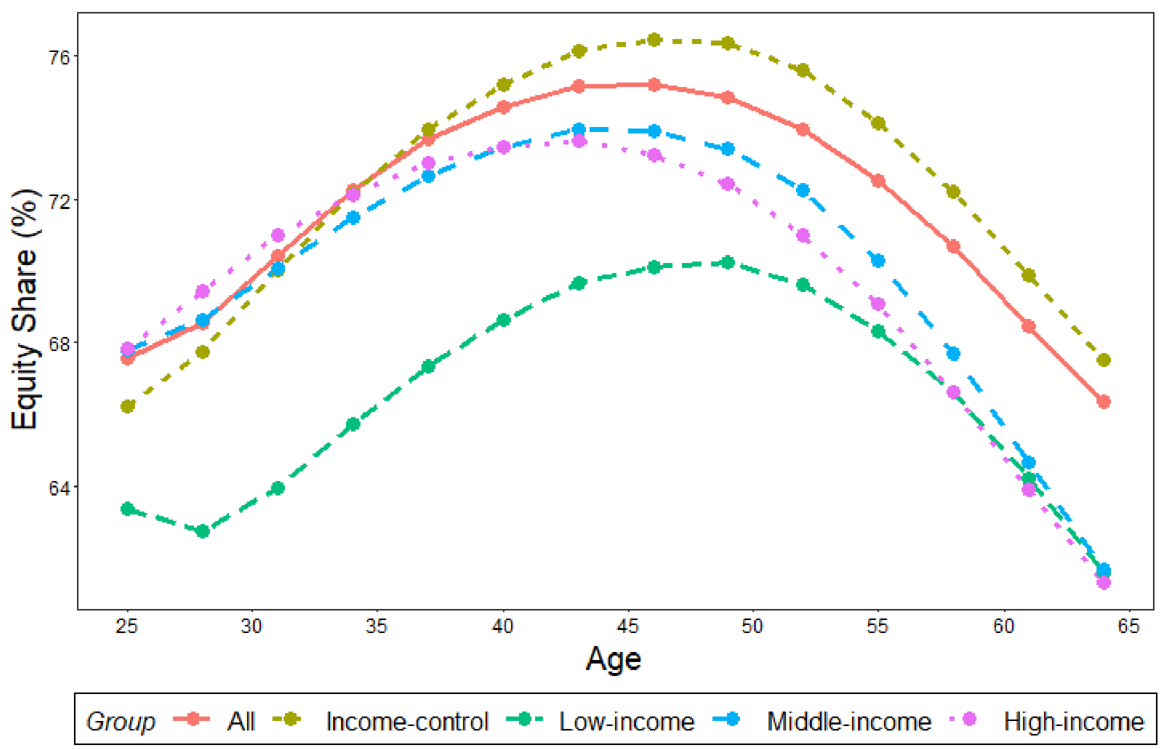
Notes: These figures show the share of the portfolios that is invested in Target Date Funds (TDF) averaged by birth year cohorts. The left panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The right panel shows the averages by age, where age is the median age of the cohort. TDFs are mutual funds that maintain a given portfolio share of assets invested in different asset classes, where the shares change with the number of years until 'target date,' the expected retirement date of the investor. A cohort is defined as having been born in the three-year period centered around the year indicated. The sample is our full set of retirement investors (RI).

Figure 5: Regression Coefficients from Cross-Sectional Regressions of Equity Share on Age, Full Sample and by Income Terciles



Notes: This figure plots the regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The baseline specification, "All", shows the coefficients for the regression of equity share on age group dummies. We then add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. The other lines show results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018.

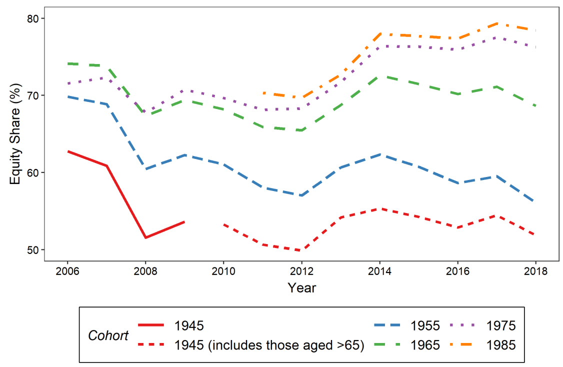
Figure 6: Regression Coefficients from Within-Person Regressions of Equity Share on Age, Full Sample and by Income Terciles



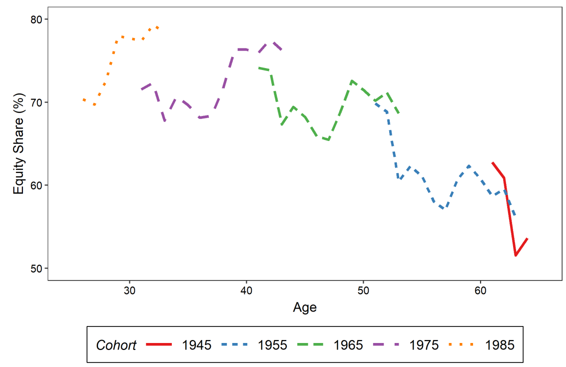
Notes: This figure plots the regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The baseline specification, "All", shows the coefficients for the regression of equity share on age group dummies. We then add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. The other lines show results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018.

Figure 7: Portfolio Equity Share by Birth Cohort

((a)) Equity Share by Birth Cohort and Year

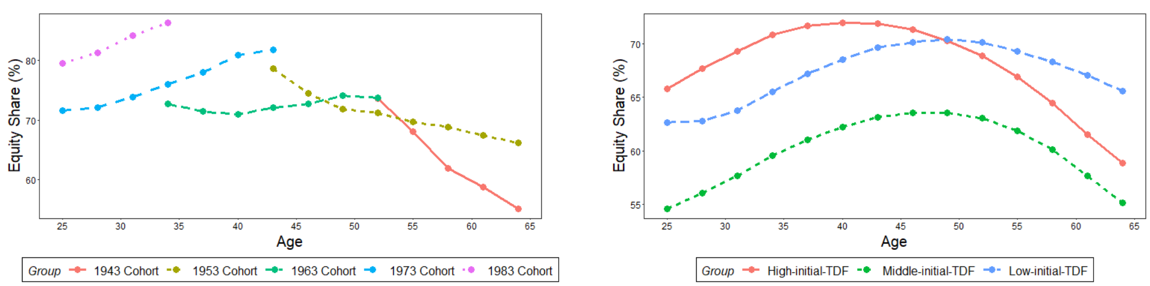


((b)) Equity Share by Birth Cohort and Age



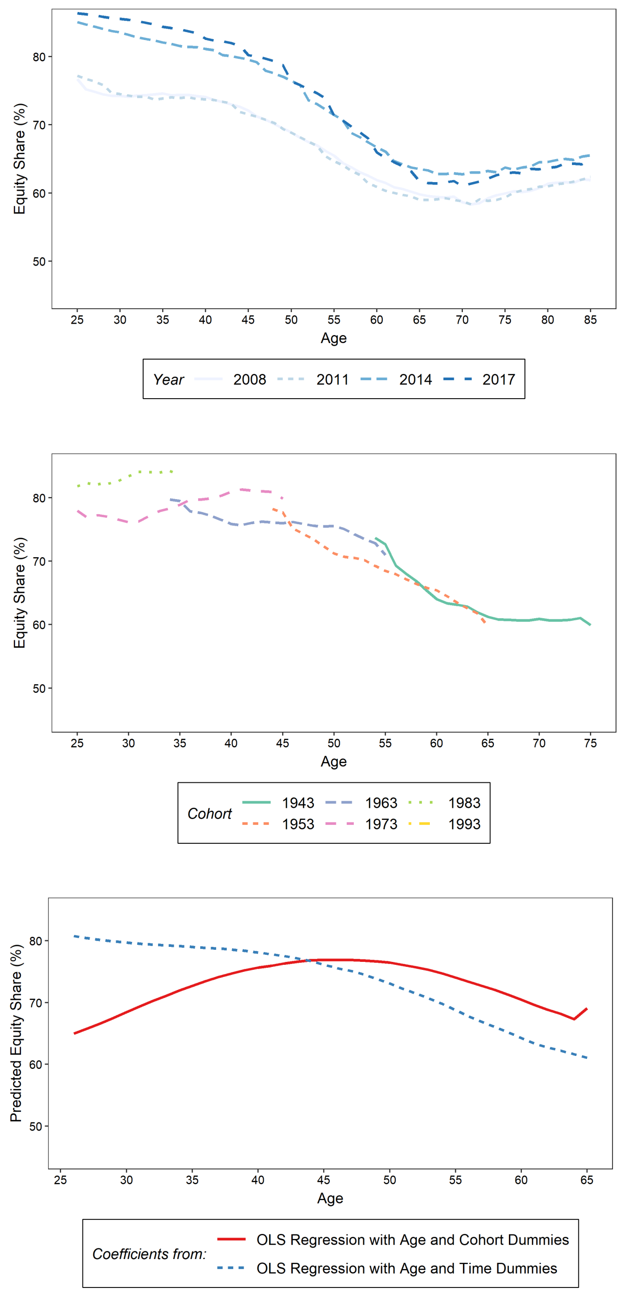
Notes: These figures show the portfolio equity share averaged by birth year cohorts. The left panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The right panel shows the averages by age, where age is the median age of the cohort. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. A cohort is defined as having been born in the three-year period centered around the year indicated. The sample is our full set of retirement investors (RI).

Figure 8: Regression Coefficients from Within-Person Regressions of Equity Share on Age, by Cohort and TDF Share



Notes: These figures plot the regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The left figure shows the results including age-group controls and a control for log income, broken out by birth cohort groups. A cohort is defined as having been born in the ten year period beginning with the year indicated. The right figure shows the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018.

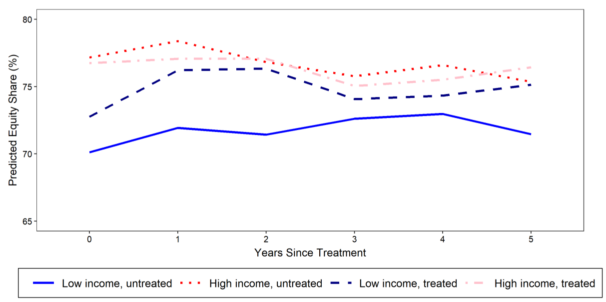
Figure 9: Equity Share Among Equity Owners



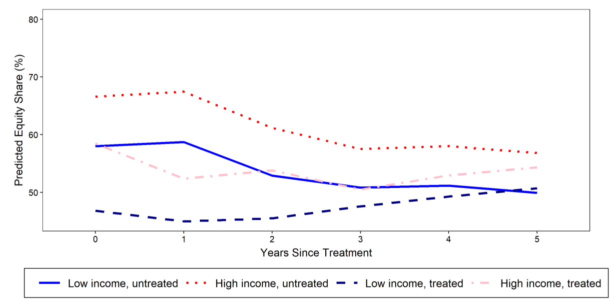
Notes: This figure replicates the results shown in Figure 12 of Ameriks and Zeldes (2004). The top figure shows the observed equity share by age in four different years of our sample. The middle figure shows the observed equity share by age in each cohort in our sample. A cohort is defined as having been born in the ten-year period beginning with the year indicated. The bottom figure shows the predicted values from a regression of equity share on indicator variables for age and either cohort or time. We obtain the predicted values by adding the median cohort or year coefficient, respectively, to each age coefficient. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The sample is our set of retirement investors (RI) who own at least some equity.

Figure 10: Predicted Equity Share: Pension Protection Act

((a)) Age Enrolled 25-34



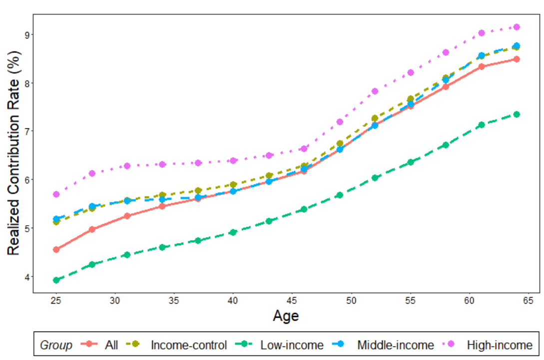
((b)) Age Enrolled 55-65



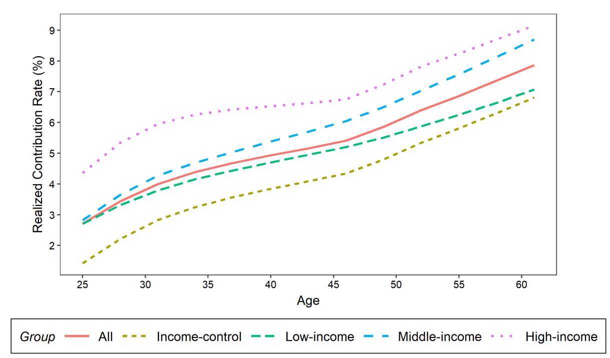
Notes: These figures show the predicted equity share for those treated by the Pension Protection Act of 2006 and those not treated by the act, split out by age and income groups. The left panel shows the results for those aged 25-34 when enrolled. The right panel shows the results for those aged 55-65 when enrolled. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The sample is our set of retirement investors (RI) who were enrolled between 2005-2008.

Figure 11: Regression Coefficients Realized Contribution Rate on Age, Full Sample and by Income Terciles

((a)) Cross-sectional Regressions



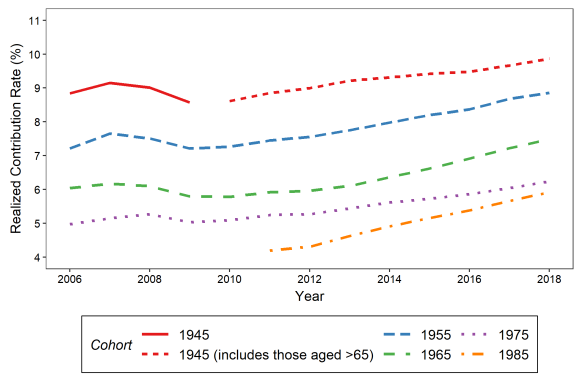
((b)) Within-person Regressions



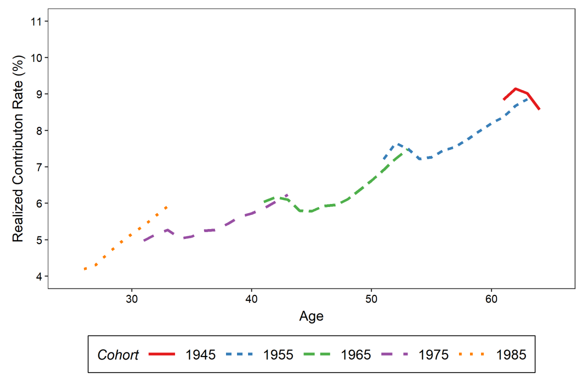
Notes: These figures plot the regression coefficients of realized contribution rate on a set of demographic controls. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. The baseline specification, "All", shows the coefficients for the regression of realized contribution rate on age group dummies. We then add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. The other lines show results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The figure on the right includes a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018.

Figure 12: Realized Contribution Rate by Birth Cohort

((a)) Cohort Realized Contribution Rate by Year



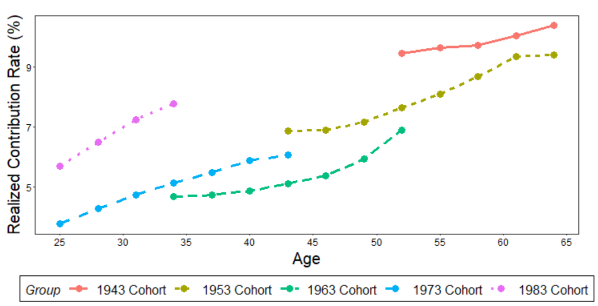
((b)) Cohort Realized Contribution Rate by Age



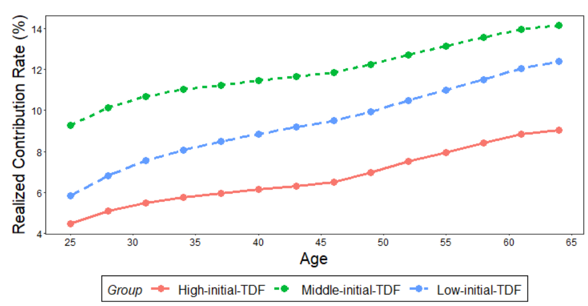
Notes: These figures show the realized contribution rate averaged by birth year cohorts. The top panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The bottom panel shows the averages by age, where age is the median age of the cohort. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. A cohort is defined as having been born in the three-year period centered around the year indicated. The sample is our full set of retirement investors (RI).

Figure 13: Regression Coefficients from Within-Person Regressions of Realized Contribution Rate on Age

((a)) By Cohort



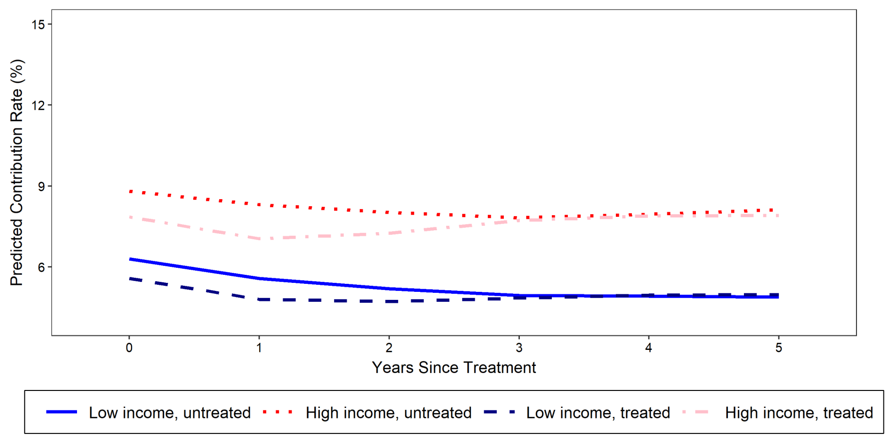
((b)) By TDF Share



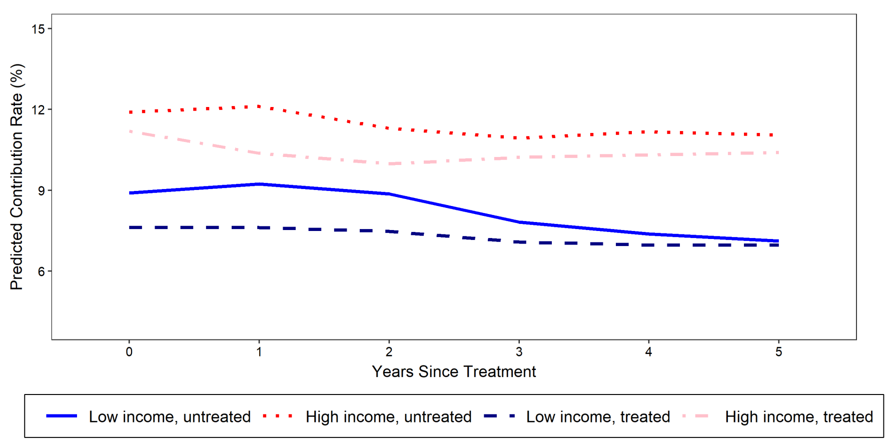
Notes: These figures plot the regression coefficients of annual individual realized contribution rate on a set of demographic controls. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. The left figure shows the results including age-group controls and a control for log income, broken out by birth cohort groups. A cohort is defined as having been born in the ten year period beginning with the year indicated. The right figure shows the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018.

Figure 14: Predicted Contribution Rate: Pension Protection Act

((a)) Age Enrolled 25-34



((b)) Age Enrolled 55-65



Notes: This figure shows the predicted contribution rate for those treated by the Pension Protection Act of 2006 and those not treated by the act, split out by age and income groups. The top panel shows the results for those aged 25-34 when enrolled. The bottom panel shows the results for those aged 55-65 when enrolled. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The sample is our set of retirement investors (RI) who were enrolled between 2005-2008.

Table I: Definitions of key variables

Variable	Definition
Investable wealth	The dollar value of the following assets, measured at the end of each calendar year and summed across retirement funds, individual brokerage accounts, and accounts managed by a financial advisor: money market mutual funds, non-money market funds (including mutual funds and ETFs), individual stocks and bonds, certificate of deposits, and trusts. The measure excludes bank accounts (checking and saving), savings bonds, cash value of life insurance, durable goods, and housing.
Retirement wealth	The dollar value of all wealth in retirement saving accounts of all types, measured at the end of each calendar year. This includes 401K and 403B plans, IRAs, and other Thrift plans. It excludes defined benefit plans and social security.
Non-retirement wealth	The dollar value of all investable wealth that is not retirement wealth, measured at the end of each calendar year. It includes individual stocks, bonds, money market mutual funds, and non-money market funds (including mutual funds and ETFs), certificates of deposit and trusts that are not held in retirement accounts.
Labor income	The dollar value of gross labor/wage income (pre-tax) earned by the head of household, annualized by scaling up part-year incomes to a full-year equivalent. In the SCF, the sum of wages from the head of household's first and second job and self-employment income. Both measures exclude rental income, dividends, royalties, and any income that is not payment for labor. When included in regressions, we normalize income by taking the log deviation of labor income from the RI sample average in the same year.
Retirement Share of Wealth	Total retirement wealth divided by total investable wealth at the end of each calendar year.
Target Date Funds (TDF)	Mutual funds that maintain a given portfolio share of assets invested in different asset classes, where the shares change with the number of years until 'target date,' the expected retirement date of the investor, sometimes referred to as "hybrid", "combination", "auto-rebalancing", or "mixed" funds.
TDF Share of Investable Wealth	Total dollar value of TDFs in the portfolio divided by total investable wealth at the end of each calendar year.
Employment Tenure	The number of years that an employee has been working for their current employer, available for a subset of our sample for which labor income is available.
Equity share of retirement wealth	The percentage share of the retirement wealth at the end of each calendar year that is invested in equities and equity-like securities such as individual stocks, equity mutual funds, and the equity component of blended funds (TDFs and auto-rebalancing funds).

Definitions of key variables, continued

Variable	**Definition**
Equity share of investable wealth	The percentage share of investable wealth at the end of the calendar year that is invested in equities and equity-like securities such as individual stocks, equity mutual funds, and the equity component of blended funds (TDFs and auto-rebalancing funds).
Equity share of non-retirement wealth	The percentage share of non-retirement wealth at the end of the calendar year that is invested in equities and equity-like securities such as individual stocks, equity mutual funds, and the equity component of blended funds (TDFs and auto-rebalancing funds).
Long-term bonds (fixed income)	Bond funds, long-term government and corporate bonds, and the portion of funds that invest across asset classes (TDFs and auto-rebalancing funds) that is not allocated to equity.
Short-term bonds (cash-like securities)	Money market mutual funds, short-term treasury bonds, and CDs.
Market betas	Using all available return data from 2006 to 2018, we estimate betas from monthly regressions of excess asset returns on excess market returns. We require at least 24 monthly return observations. We set the market beta of short-term bonds to zero. We use the estimated beta on a corresponding ETF as a proxy for individual betas on agency bonds (ticker: AGZ), municipal bonds (MUB), TIPS (TIP), gold (IAU), silver (SLV), and platinum (PPLT). For mixed-asset funds, we account for time variation in betas due to a changing equity share of the portfolio (especially for lifecycle funds) by assuming that the fund market beta is affine in the fund equity share with a fund-specific intercept and a common slope. We estimate the common slope in a pooled regression that includes all mixed-asset funds in an investor's portfolio.
Reported contribution rate	The elected retirement saving rate as a fraction of labor income in employment-based accounts, reported at a monthly frequency. We use the value reported in January for our annual data. This is available only for the subset of the sample for which labor income is observed. The measure excludes employer contributions.
Realized contribution rate	The sum of all flows into retirement accounts in a given year, as a fraction of annual realized labor income. This is calculated only for the subset of the sample for which labor income is observed. The measure excludes employer contributions.

Table II: Characteristics of Sample of Retirement Investors in 2016

Retirement Investors				
	Summary Statistics			
	Mean	Median	SD	Percentage of RI Sample with Observed Data
Age (Years)	45.38	46	11.28	100%
Female	0.46	0	0.50	94.0%
Married	0.72	1	0.45	89.5%
Labor Income ($)	101,384	74,230	195,060	41.0%
Investable Wealth ($)	116,938	38,394	367,156	100%
Retirement Wealth ($)	95,654	35,451	155,237	100%
Retirement Share of Wealth (%)	96.3	100	13.9	100%
Portfolio Beta	0.75	0.84	0.32	86.9%
TDF Share of Invest. Wealth (%)	47.9	37.3	44.7	99.6%
Employment Tenure (Years)	10.50	7.94	9.17	60.0%
Reported Contribution Rate (%)	8.1	6.0	7.3	53.2%
Realized Contribution Rate (%)	6.4	5.5	5.3	47.1%
Retirement Investors - Survey of Consumer Finance				
	Summary Statistics			
	Mean	Median	SD	Number of Observations
Age	46.78	47	10.63	3130
Female	0.50	0	0.50	3130
Married	0.78	1	0.39	3130
Labor Income (Individual, $)	66,459	50,000	1,129,486	3130
Labor Income (Household, $)	101,349	77,000	1,445,913	1889
Investable Wealth (Household, $)	273,282	72,000	17,019,097	1889
Retirement Wealth (Household, $)	193,568	76,830	659,727	1889
Retirement Wealth (Individual, $)	97,658	41,500	155,503	3130
Retirement Share of Investable Wealth (Individual, %)	65.32	76.19	38.43	3130
Retirement Share of Investable Wealth (Household, %)	87.81	100.00	31.33	1889

Notes: This table presents summary statistics on demographics, wealth, and portfolio allocations for our Retirement Investor (RI) sample in 2016 and a comparable sample of the 2016 Survey of Consumer Finance (SCF). Detailed definitions for retirement wealth and investable wealth are provided in Table I. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. Market betas are obtained by regressing monthly fund or security excess returns on the value-weighted CRSP market excess return over the period 2007–2017 with at least 24 observations. Income is the labor income of the respondent in 2015. The sample is not representative of the assets under management of our financial service firm, since by design we drop the highest and lowest income groups.

Table III: Average Share of Equity in Portfolios Among Retirement Investors

	All Retirement Investors		Retirement Investors with Hybrid Fund (e.g. TDF) in Retirement Account	
Panel A: All Investable Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	71.0	54.5	76.6	46.9
Age 25-34	77.6	59.1	84.8	49.6
Age 35-44	76.0	55.9	82.2	47.9
Age 45-54	71.2	53.8	74.7	45.5
Age 55-65	60.5	51.2	61.2	45.4
Respondents		54.3		47.0
Partners		54.8		46.9
Panel B: Retirement Wealth	Main Sample (Individuals)	SCF (Individuals)	Main Sample (Individuals)	SCF (Individuals)
All RIs	71.1	51.7	76.7	42.1
Age 25-34	77.7	56.2	85.0	44.2
Age 35-44	76.2	54.1	82.4	43.5
Age 45-54	71.4	50.5	74.8	40.2
Age 55-65	60.6	48.0	61.2	41.2
Respondents		52.1		43.3
Partners		50.8		39.8
Panel C: Non-Retirement Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	51.1	73.4	53.2	73.2
Age 25-34	52.0	87.5	53.0	86.9
Age 35-44	53.5	68.9	55.5	68.3
Age 45-54	51.1	74.5	52.9	73.6
Age 55-65	48.8	69.6	50.8	69.6
Respondents		73.9		74.4
Partners		72.7		71.2

Notes: This table presents the share of equity in the portfolio allocations for various samples of our Retirement Investors (RI) sample in 2016 and the comparable RI sample of the 2016 Survey of Consumer Finance (SCF). Panel A shows equity shares of total investable wealth at the individual level in our sample and the household level in the SCF. Panel B shows equity shares of retirement wealth, at the individual level in both datasets. Panel C shows equity shares of non-retirement wealth at the individual level in our sample and the household level in the SCF. The figures in Panel C are conditional on owning some non-retirement wealth, which is approximately 40% of the SCF RI sample and 16% of our RI sample. The first two columns show the means for the full sample of RIs in each dataset. The last two columns show the means for the subsample of the RI sample that has some of their retirement assets in a target date fund (TDF). Investable wealth is defined as money market funds, non-money market funds, individual stocks and bonds, Retirement wealth is defined as any wealth in retirement saving accounts of all types (excluding defined benefit plans and Social Security). certificate of deposits, quasi-liquid retirement wealth, and other managed accounts. The equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets.

Table IV: Regressions of Equity Share on Automated Investment Allocation: Average Effect Two Years After Entering Sample

	Portfolio equity share					
	(1) All	(2) All	(3) Bottom Income Tercile	(4) Top Income Tercile	(5) No prior non-retirement wealth + no rollover assets	(6) No prior non-retirement wealth + no rollover assets
Treated	0.0552	0.0533	0.0599	0.0186	0.0578	0.0555
	(0.0007)	(0.0008)	(0.0011)	(0.0024)	(0.0007)	(0.0008)
Age 35-44	-0.0134	-0.0271	-0.0339	-0.0112	-0.0140	-0.0272
	(0.0006)	(0.0007)	(0.0013)	(0.0012)	(0.0006)	(0.0007)
Age 45-54	-0.0700	-0.0875	-0.1011	-0.0627	-0.0720	-0.0887
	(0.0007)	(0.0008)	(0.0015)	(0.0014)	(0.0007)	(0.0009)
Age 55-65	-0.1325	-0.1502	-0.1658	-0.1254	-0.1352	-0.1520
	(0.0012)	(0.0014)	(0.0026)	(0.0023)	(0.0013)	(0.0015)
Age 35-44 x Treatment	-0.0581	-0.0542	-0.0508	-0.0366	-0.0600	-0.0549
	(0.0014)	(0.0016)	(0.0024)	(0.0041)	(0.0015)	(0.0017)
Age 45-54 x Treatment	-0.1029	-0.0885	-0.0717	-0.0809	-0.1042	-0.0895
	(0.0018)	(0.0021)	(0.0030)	(0.0050)	(0.0018)	(0.0021)
Age 55-65 x Treatment	-0.1479	-0.1314	-0.1235	-0.1173	-0.1495	-0.1322
	(0.0032)	(0.0038)	(0.0055)	(0.0091)	(0.0033)	(0.0038)
Log income		0.1031				0.1072
		(0.0012)				(0.0013)
Constant	0.7352	0.7476	0.7180	0.7353	0.7335	0.7468
	(0.0003)	(0.0004)	(0.0006)	(0.0003)	(0.0003)	(0.0004)
Firm Fixed Effect?	Y	Y	Y	Y	Y	Y
% of Total Sample	1.3	0.9	0.3	0.3	1.2	0.9
% of Sample Enrolled 2005-2008	18.1	12.8	5.0	3.9	17.0	12.2
R-squared	0.1543	0.1502	0.2266	0.1044	0.1620	0.1565

Notes: This table presents regression coefficients of annual household portfolio equity shares on a treatment dummy for being enrolled into a plan with a target date fund (TDF) as the default after the Pension Protection Act of 2006. We set this treatment dummy equal to one for those enrolled in their firm's retirement plan in 2007 or 2008 when that plan had a TDF as a default and zero for those enrolled in 2005 or 2006. Columns (1)-(2) show the results for the first two years of data after the individual enters our sample. Columns (3)-(4) repeat column (1) for those in the lowest and highest tercile of initial income, respectively. Columns (5)-(6) repeat columns (1)-(2) including only individuals who had no prior retirement wealth before enrollment and no rollover assets of any kind. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. Log income, when included, is the log deviation of the individual's current income from the average income of the RI sample. The sample is our set of retirement investors (RI) who enrolled in their plan from 2005-2008. Standard errors, in parentheses, are clustered at the household level.

Table V: Regressions of Equity Share on Automated Investment Allocation: Long-run Effect

	Portfolio equity share						
	(1) Full Sample	(2) Bottom Income Tercile	(3) Top Income Tercile	(4) Age Enrolled 25-34	(5) Age Enrolled 35-44	(6) Age Enrolled 45-54	(7) Age Enrolled 55-65
Year of x Treatment	0.0198	0.0463	0.0071	0.0161	-0.0263	-0.0584	-0.0618
	(0.0023)	(0.0036)	(0.0051)	(0.0022)	(0.0066)	(0.0092)	(0.0171)
1 Year After x Treatment	0.0430	0.0655	-0.0065	0.0295	-0.0154	-0.0750	-0.1321
	(0.0011)	(0.0015)	(0.0029)	(0.0011)	(0.0036)	(0.0068)	(0.0097)
2 Years After x Treatment	0.0683	0.0861	0.0287	0.0363	0.0186	-0.0181	-0.0515
	(0.0009)	(0.0013)	(0.0025)	(0.0011)	(0.0028)	(0.0050)	(0.0116)
3 Years After x Treatment	0.0032	0.0254	-0.0269	0.0005	-0.0261	-0.0268	-0.0524
	(0.0010)	(0.0015)	(0.0021)	(0.0013)	(0.0018)	(0.0025)	(0.0046)
4 Years After x Treatment	-0.0244	-0.0185	-0.0292	0.0003	-0.0173	-0.0274	-0.0410
	(0.0010)	(0.0015)	(0.0019)	(0.0013)	(0.0014)	(0.0020)	(0.0039)
5 Years After x Treatment	0.0036	0.0104	-0.0055	0.0257	0.0099	-0.0060	-0.0201
	(0.0010)	(0.0015)	(0.0023)	(0.0014)	(0.0016)	(0.0022)	(0.0043)
1 Year After	0.0087	0.0209	0.0126	0.0136	0.0133	0.0096	0.0088
	(0.0009)	(0.0018)	(0.0013)	(0.0012)	(0.0014)	(0.0016)	(0.0026)
2 Years After	-0.0194	0.0022	-0.0201	0.0067	-0.0207	-0.0445	-0.0564
	(0.0010)	(0.0019)	(0.0014)	(0.0012)	(0.0015)	(0.0017)	(0.0029)
3 Years After	-0.0272	0.0046	-0.0383	0.0142	-0.0282	-0.0675	-0.0876
	(0.0010)	(0.0019)	(0.0015)	(0.0013)	(0.0016)	(0.0018)	(0.0030)
4 Years After	-0.0221	0.0074	-0.0334	0.0243	-0.0209	-0.0629	-0.0810
	(0.0010)	(0.0019)	(0.0015)	(0.0013)	(0.0016)	(0.0018)	(0.0031)
5 Years After	-0.0348	-0.0091	-0.0459	0.0134	-0.0373	-0.0824	-0.0955
	(0.0011)	(0.0020)	(0.0016)	(0.0014)	(0.0017)	(0.0019)	(0.0034)
Log income	0.0487						
	(0.0012)						
Constant	0.7279	0.6751	0.7473	0.7255	0.7432	0.7059	0.6374
	(0.0010)	(0.0020)	(0.0014)	(0.0013)	(0.0015)	(0.0017)	(0.0028)
Firm Fixed Effect?	Y	Y	Y	Y	Y	Y	Y
% of RI Sample	1.6	0.5	0.5	0.8	0.6	0.4	0.1
% of Sample Enrolled 2005-2008	22.4	7.8	7.1	11.9	8.2	5.8	1.9
R-squared	0.0969	0.1727	0.0716	0.1537	0.1013	0.0942	0.1181

Notes: This table presents regression coefficients of annual household portfolio equity shares on being treated with the Pension Protection Act (PPA) of 2006. "Year of" means the year the individual enrolled in their retirement plan and "x years after" is x years after they enrolled in the plan. Each column includes year dummies for each year after enrollment, and interactions of these dummies with the treatment dummy. The treatment dummy is equal to one if the individual enrolled in 2007 or 2008 to a plan that switched to having a target date fund as the default following the PPA and zero if they enrolled in 2005 or 2006. The full sample is those enrolled from 2005-2008 who otherwise meet the RI sample criteria. The bottom (top) income tercile includes those whose initial income is in the lowest (highest) tercile. Columns (4)-(7) break out the result for all individuals enrolled from 2005-2008 by age at enrollment. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. Log income, when included, is the log deviation of the individual's current income from the average income of the RI sample. Standard errors, in parentheses, are clustered at the household level.

Table VI: Regressions of Reported Contribution Rate on the Pension Protection Act: Average Effect Two Years After Entering Sample

	Reported contribution rate					
	(1) All	(2) All	(3) Bottom Income Tercile	(4) Top Income Tercile	(5) No prior non-retirement wealth + no rollover assets	(6) No prior non-retirement wealth + no rollover assets
Treated	-0.0043	-0.0034	-0.0028	-0.0073	-0.0042	-0.0034
	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0001)	(0.0001)
Age 35-44	0.0117	0.0084	0.0103	0.0077	0.0112	0.0082
	(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0001)	(0.0001)
Age 45-54	0.0239	0.0203	0.0204	0.0211	0.0229	0.0196
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0002)
Age 55-65	0.0406	0.0367	0.0339	0.0406	0.0389	0.0354
	(0.0003)	(0.0003)	(0.0005)	(0.0005)	(0.0003)	(0.0003)
Age 35-44 x Treatment	-0.0023	-0.0026	-0.0015	-0.0002	-0.0021	-0.0024
	(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0002)
Age 45-54 x Treatment	-0.0045	-0.0047	-0.0028	-0.0029	-0.0038	-0.0042
	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0002)	(0.0002)
Age 55-65 x Treatment	-0.0077	-0.0083	-0.0058	-0.0078	-0.0067	-0.0075
	(0.0004)	(0.0004)	(0.0007)	(0.0008)	(0.0004)	(0.0004)
Log income		0.0314				0.0307
		(0.0002)				(0.0002)
Constant	0.0619	0.0623	0.0508	0.0705	0.0613	0.0621
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Firm Fixed Effect?	Y	Y	Y	Y	Y	Y
% of Total Sample	1.9	1.4	0.6	0.4	1.8	1.3
% of Sample Enrolled 2005-2008	27.5	20.3	7.9	6.1	25.9	19.3
R-squared	0.1737	0.1915	0.1718	0.1242	0.1726	0.1888

Notes: This table presents regression coefficients of reported contribution rate on a treatment dummy for being enrolled into a plan following the Pension Protection Act (PPA) of 2006. We set this treatment dummy equal to one for those enrolled in their firm's retirement plan in 2007 or 2008 and zero for those enrolled in 2005 or 2006. Columns (1)-(2) show the results for the first two years that we observe the individual in our sample. Columns (3)-(4) repeat column (1) for those in the lowest and highest tercile of initial income, respectively. Columns (5)-(6) repeat columns (1)-(2) including only individuals who had no prior retirement wealth before enrollment and no rollover assets of any kind. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. Log income, when included, is the log deviation of the individual's current income from the average income of the RI sample. The sample is our set of retirement investors (RI) who enrolled in their plan from 2005-2008. Standard errors, in parentheses, are clustered at the household level.

Table VII: Regressions of Reported Contribution Rate on the Pension Protection Act: Long-run Effect

	Reported contribution rate						
	(1) Full Sample	(2) Bottom Income Tercile	(3) Top Income Tercile	(4) Age Enrolled 25-34	(5) Age Enrolled 35-44	(6) Age Enrolled 45-54	(7) Age Enrolled 55-65
Year of x Treatment	-0.0085	-0.0092	-0.0092	-0.0069	-0.0088	-0.0093	-0.0127
	(0.0002)	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0005)	(0.0009)
1 Year After x Treatment	-0.0116	-0.0098	-0.0140	-0.0087	-0.0119	-0.0143	-0.0167
	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0003)	(0.0006)
2 Years After x Treatment	-0.0072	-0.0074	-0.0091	-0.0055	-0.0071	-0.0101	-0.0124
	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0003)	(0.0005)
3 Years After x Treatment	-0.0026	-0.0034	-0.0033	-0.0014	-0.0029	-0.0056	-0.0071
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0003)	(0.0005)
4 Years After x Treatment	-0.0012	-0.0016	-0.0026	-0.0007	-0.0025	-0.0054	-0.0072
	(0.0001)	(0.0002)	(0.0003)	(0.0001)	(0.0002)	(0.0003)	(0.0006)
5 Years After x Treatment	-0.0003	0.0001	-0.0028	-0.0009	-0.0023	-0.0042	-0.0051
	(0.0001)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)	(0.0007)
1 Year After	-0.0041	-0.0064	-0.0036	-0.0062	-0.0034	0.0029	0.0017
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0006)
2 Years After	-0.0092	-0.0093	-0.0093	-0.0094	-0.0114	-0.0050	-0.0075
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0007)
3 Years After	-0.0126	-0.0125	-0.0123	-0.0116	-0.0156	-0.0104	-0.0142
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0007)
4 Years After	-0.0130	-0.0135	-0.0117	-0.0112	-0.0163	-0.0113	-0.0149
	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0004)	(0.0007)
5 Years After	-0.0133	-0.0145	-0.0111	-0.0113	-0.0170	-0.0127	-0.0171
	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0004)	(0.0008)
Log income	0.0424						
	(0.0002)						
Constant	0.0806	0.0698	0.0982	0.0706	0.0826	0.0891	0.1047
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0003)
Firm Fixed Effect?	Y	Y	Y	Y	Y	Y	Y
% of RI Sample	2.5	0.9	0.8	1.3	0.9	0.6	0.2
% of Sample Enrolled 2005-2008	35.7	12.7	11.3	18.7	12.6	8.7	2.9
R-squared	0.1509	0.1169	0.0846	0.1367	0.1201	0.1096	0.1423

Notes: This table presents regression coefficients of reported contribution rate on being treated with the Pension Protection Act (PPA) of 2006. "Year of" means the year the individual enrolled in their retirement plan and "x years after" is x years after they enrolled in the plan. Each column includes year dummies for each year after enrollment, and interactions of these dummies with the treatment dummy. The treatment dummy is equal to one if the individual enrolled in 2007 or 2008, after the PPA, and zero if they enrolled in 2005 or 2006. The full sample is those enrolled from 2005-2008 who otherwise meet the RI sample criteria. The bottom (top) income tercile includes those whose initial income is in the lowest (highest) tercile. Columns (4)-(7) break out the result for all individuals enrolled from 2005-2008 by age at enrollment. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. Log income, when included, is the log deviation of the individual's current income from the average income of the RI sample. Standard errors, in parentheses, are clustered at the household level.

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Internet Appendix for

"Household Portfolios and Retirement Saving over the Life Cycle"*

by

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A. Appendix: Comparing Married Investors in our Sample and the SCF

In section A, we present several pieces of evidence that TDF equity shares are misreported in the SCF relative to the shares in our sample of administrative data. In this Appendix section, we re-do this analysis for the sub-samples of only married investors, and only single investors.

For the sample of married investors, we find similar conclusions to those of our main analyses. Appendix Table A.V) presents the analyses for these sub-samples — married investors in the SCF and investors in our data for which we observe both spouses. By restricting to married investors, we are comparing groups of individuals with very similar gender compositions.

We also find similar patterns in the sample of all single investors in the SCF and in our sample (Appendix Table A.VI), although with the one exception: single investors who hold TDFs in their retirement accounts have higher non-retirement equity shares than all single investors (columns (2) and (4) of Panel C of Table A.VI). This fact suggests that the non-retirement wealth that we do not observe of single investors, likely has a higher equity share than the retirement wealth we do observe.

Lastly, the residuals from a regression of portfolio equity share on gender, wealth, and birth-year fixed effects shows the same patterns again in the residuals, further indicating that the results are not driven by differences in sample composition (Appendix Table A.VII).

B. Appendix: Disentangling Age, Cohort, and Time Effects

In section B.2, we briefly discuss the implementation of the method outlined in McKenzie (2006) to identify age, time, and cohort effects. Our results show that the hump-shape pattern we find over the lifecycle is robust to using this method of identifying age effects. Here, we first outline the method and then discuss our implementation of it in more detail.

The McKenzie (2006) method involves first and then second differencing across the variable of interest (equity shares in our case), to eliminate the two other effects (cohort and time when looking at the age profile). The second derivatives are identified without any normalization. For example, to calculate the second derivative in age, one first differences across age and time within a cohort to eliminate cohort effects. Then, these first differences are differenced across time to eliminate time effects and recover the age profile between two adjacent ages (see McKenzie (2006) equation (10)). The second derivatives are then recovered by regressing these second differences on age (see McKenzie (2006) equation (12)). A similar procedure is followed to identify the second derivatives of time and cohort (see McKenzie (2006) equations (18), (19) and (25), (26), respectively.)

To identify the first derivatives, one then must choose a normalization of the age slope for two adjacent ages. By assuming a first derivative of some constant between two ages, the entire first derivative profile of age is recovered by adding the calculated second derivatives beginning at that point. This constant can also be used to fully recover the cohort and time profiles by subtracting out the assumed age effect from the observed change in the outcome variable; the remainder is the implied normalized cohort or time effect for that observations (see McKenzie (2006) equations (28) and (29)).

More normalizations are required to recover the level effects. By restricting two of the effects, the third is implicitly normalized (see McKenzie (2006), equation (4)). For example, if one sets the first time and cohort effect equal to zero, the remaining level effects are recovered from second derivatives. Then, one can difference these effects from the observed outcome variable to recover the level age effects (see McKenzie (2006), equation (35)).

The results for the equity share are shown in Figure B.1. Second derivatives of age, cohort, and time, respectively, are shown in the top panel. The second derivatives in age are consistent with an increasing equity share in the first half of life which later decreases. The Wald test on the coefficients fails to reject that they are all equivalent (F=1.76, p=.0047), meaning that a true hump-shape (parabola) is possible. The second derivatives of age and corresponding confidence intervals are shown in Figure B.2.

To recover first derivatives, we assume that the age effects are equivalent at age 25 and 26 based on the flat profile in the equity share observed at early ages (see 7(b)). The left middle panel of Figure B.1 shows that the age profile begin to decrease around age 50, consistent with our earlier findings. Note that if a different normalization were chosen, say that the change in equity between age 25 and 26 were large, then the equity profile would not begin to decline until much later in life. The normalization choice is made based on the observed equity shares and pattern of little change early in life.

To recover level effects, we then assume that the time effect in 2006 is zero and that the cohort effect of 1980 is zero. These assumptions only effect the levels, not the shape of the effects shown in the bottom three panels of Figure B.1. They are chosen such that the average level of the recovered equity share is similar to our actual observed average. As shown in the bottom left panel, the equity share is indeed hump-shaped in age over the lifecycle.

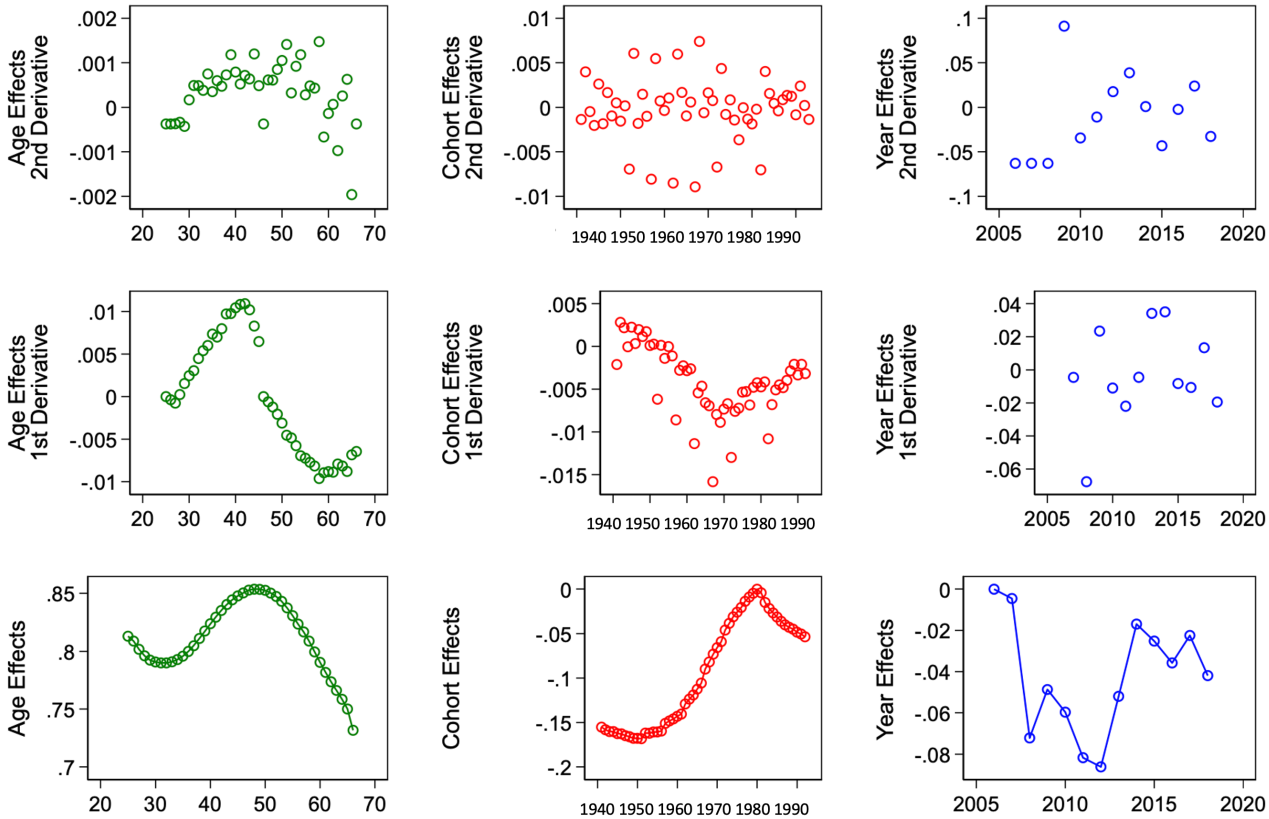


Figure B.1: Second Derivative, First Derivative, and Level Effects of Age, Cohort, and Time Identified by the McKenzie (2006) Method

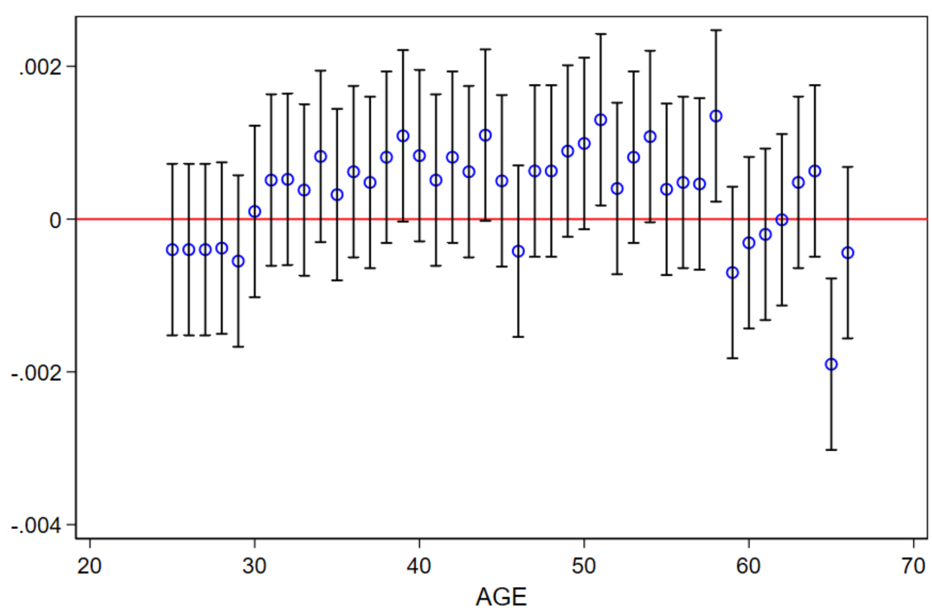


Figure B.2: Second Derivative of Age Profile

C. Appendix: Analysis of Reported Contribution Rates

In Section A we focused our analysis of contribution rates to *realized* contribution rates: the percentage of income that is actually saved for retirement, ex-post (on a year-by-year basis). However, as we noted, the realized rate of savings may not be equal to the designated or *reported* rate of savings that investors decide upon ex-ante, due to retirement contribution limits set by the IRS. Depending on their income and reported contribution rate, some people will hit their maximum contribution before the end of the year, and thus their actual *realized* contribution will be less than what they designated at the beginning of the year. This may occur if someone has a very high income, or if someone sets a very high contribution rate. We address this discrepancy in two ways, both of which confirm the results of the previous subsection.

First, we condition our analysis on an indicator variable equal to one if an individual hits their contribution limit in the given year. We set this indicator to one if the investor's *reported* contribution rate times their income is larger than the allowed amount by the IRS in that year.[*] We find that 6-9% of our sample with available income data max out on their contribution in a given year. We then conduct our analysis again using a specification that controls for hitting the contribution limit:

$$y_{it} = \beta_1 \quad D_{maxout} + \beta_2 \quad D_{maxout} \quad Age_{it} + \beta_3 \quad Age_{it} + \epsilon_{it} \tag{B.1}$$

where y_{it} is the realized contribution rate. D_{maxout} is an indicator equal to one if the individual investor, i, maxes out on their retirement contribution, as described above, in a given year. Age_{it} are indicators for ten-year age groups. In some specifications, we also include a control for the deviation of the investor's current income from the average.

In the cross-section, retirement contribution rates increase by under 3% over the working life when controlling for hitting the contribution limit and whether controlling for income or not (Table A.XXIII). Note that the coefficient on maximizing retirement contributions is positive implying that on average investors that contribute a larger share of their incomes are more likely to be hitting the legal limits. The coefficients on the interaction terms between hitting the cap and age show that the cap on contributions lowers realized contributions most strongly for those at prime earning age (age 35-54, Columns (1) and (2)). Columns (3)-(4) show results replacing the indicator

[*]Base contribution limits increased from $15,000 in 2006 to $18,000 in 2017. In addition, contribution limits for individuals older than 50 are higher by a "catch-up" contribution amount that rose from $5,000 in 2006 to $6,000 in 2017. We use the age- specific limit in the corresponding year to calculate the limit for each investor.

variable in equation with *max out ever*, an indicator equal to one if the individual maxes out on their contribution during any year that we observe them in the sample (before or after the current year). The cross-sectional patterns lie between those without any control for maximizing retirement contributions and those withe contemporaneous control in Columns (1) and (2).[†]

Our second method of addressing the discrepancy between realized and reported contribution rates is by repeating our analysis on the *reported* contribution rate rather than the realized rate. The reported contribution rate is the percentage of income that the individual designates to their retirement account at the beginning of each year.

Using designated rather than realized contribution rate largely confirm our results using realized rates.[‡] In the cross-section, designated savings increases monotonically with age from about 6% to 10% over the lifecycle (Table A.XXV). Hence, reported contribution rates are about 1% higher than the realized rates observed in Table A.XIX, confirming that some individuals set a rate that is too high and hence save at a rate lower than anticipated. Column (2) of Table A.XXV shows the same age pattern controlling for log income. As before, the coefficient on income implies that each 1% deviation of income from the average is associated with a nearly 5 percentage point increase in reported contribution rate. Note that income has significantly more explanatory power for designated contribution rates (adding income doubles the R-squared) than for realized rates, consistent with the contribution cap distorting an otherwise relatively stable desired contribution rate over the income distribution. We also find cross-sectional patterns in designated contribution rates across different cohorts and different TDF allocations that are similar to those for realized contribution rates (Appendix Table A.XXVII).[§]

Finally, and most importantly, the baseline results including a person fixed effect, shown in Table A.XXVI confirm that individuals increase their contribution with age at a magnitude that explains nearly all of the aggregate variation. Similar to realized contribution rates, higher reported contribution rates are not driven by people earning higher incomes as they age (column (2)). Each cohort behaves similarly, but younger cohorts increase their contributions at a slightly quicker pace (Appendix Table A.XXIX, columns (1)-(5)). Additionally, those with the lowest allocation to TDFs

[†]This is verified in Appendix Figure A.9, which shows that those aged 35-54 are much more likely to max out on their contribution than those aged 25-34 and those aged 55-65.

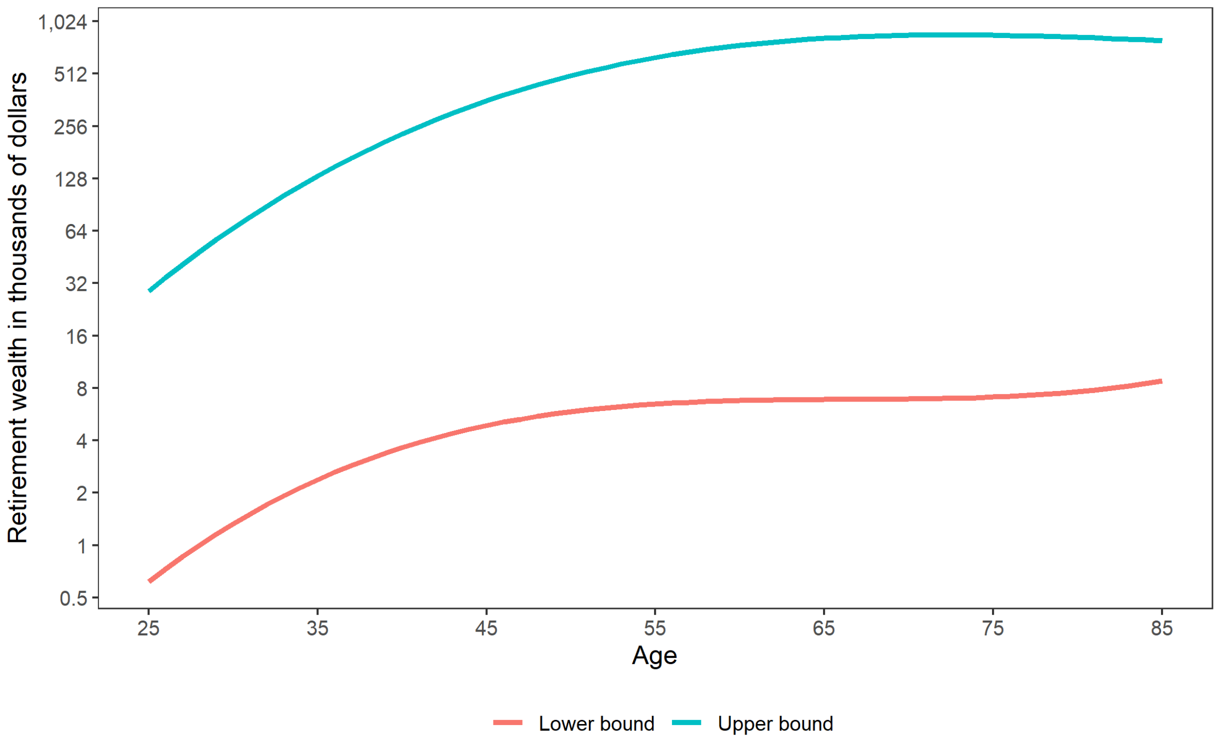
[‡]Tables in the Appendix.

[§]Appendix Table A.XXVIII also shows that the significance remains when standard errors are clustered at the employer, rather than individual, level.

(column (8)) increase their contribution rate by more than those with higher allocations to TDFs at every age. All these results are consistent with conclusions in the main body of the paper, where we use realized contribution rates to conduct analogous analysis.

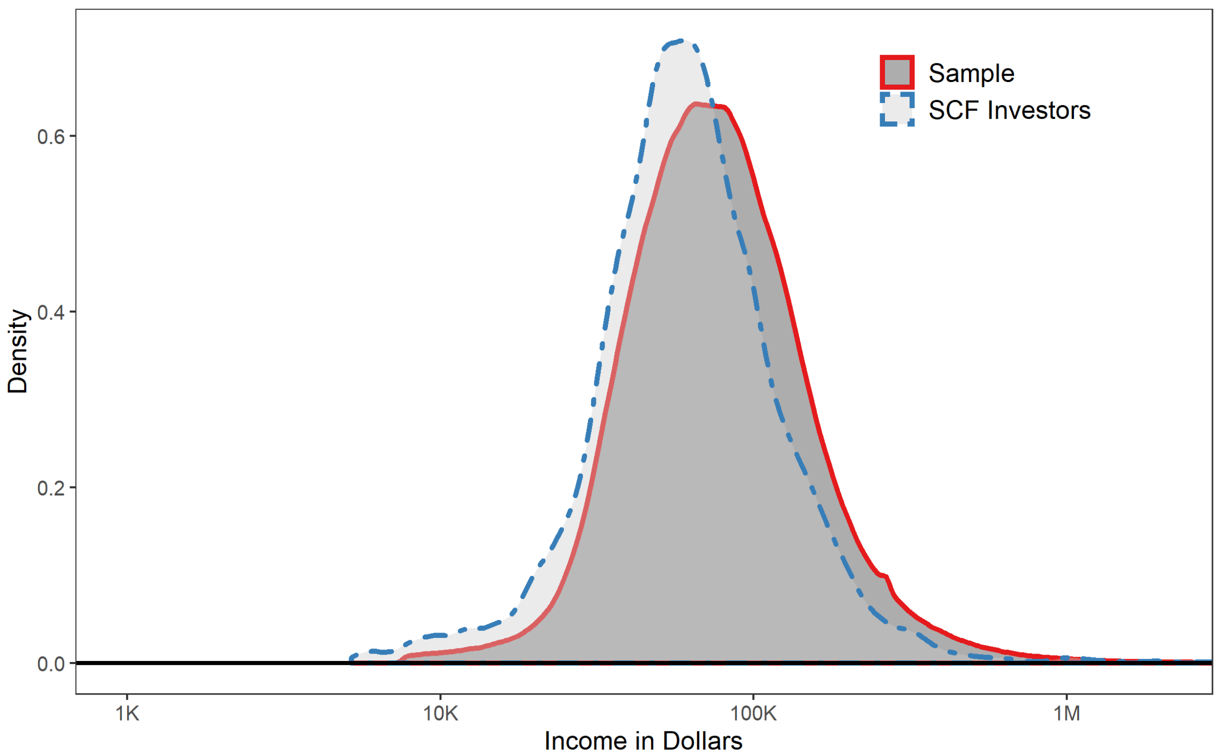
D. Appendix Figures

Figure A.1: Retirement Wealth Cutoffs



Notes: This figure shows the cutoffs on retirement wealth that are used to determine our retirement investor (RI) sample, described in Section B. The cutoffs are determined by running quantile regressions of log of individual's retirement wealth on a third order polynomial in age in the 2016 Survey of Consumer Finance. We then drop individuals with retirement wealth below the estimated 10th percentile or above the 90th by age.

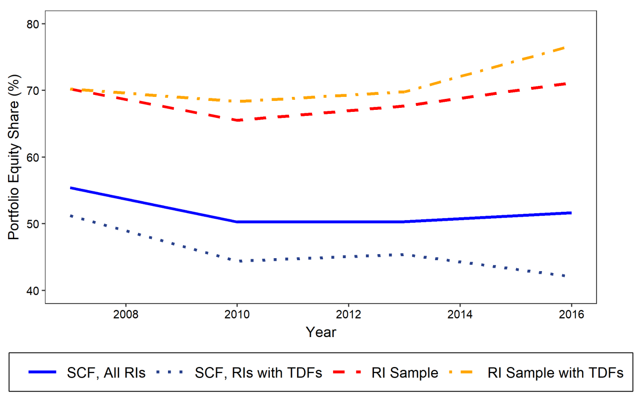
Figure A.2: Individual Labor Income Distribution in Firm Data and the SCF in 2016



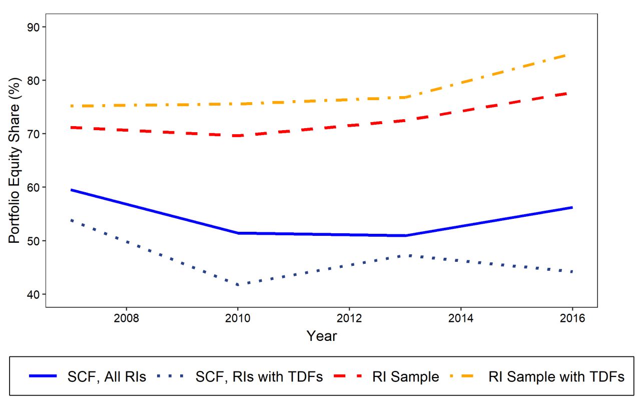
Notes: This figure plots the distribution of labor income in the sample of retirement investors (RIs) versus the distribution of labor income for RIs in the SCF in 2016.

Figure A.3: Equity share of retirement wealth

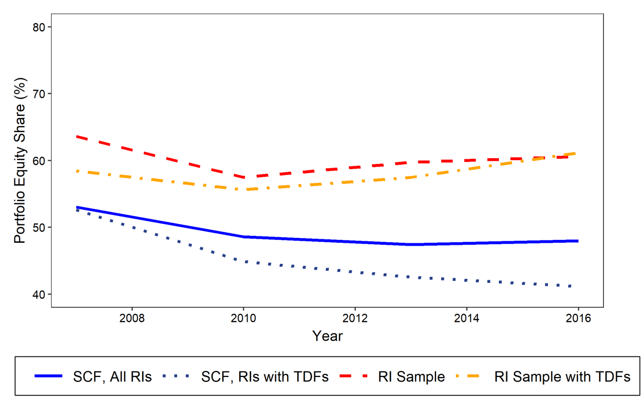
((a)) All ages



((b)) Age 25-34



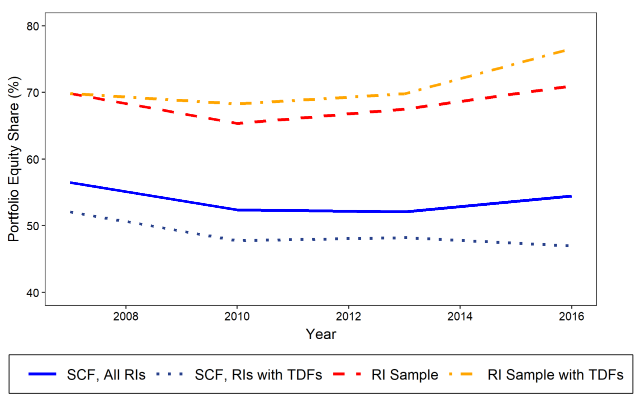
((c)) Age 55-65



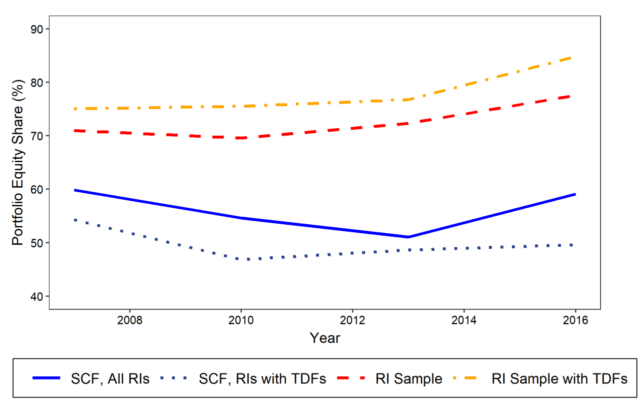
Notes: These figures show the portfolio equity share of retirement wealth over time. The SCF data is every three years, in 2007, 2010, 2013, and 2016. We show the same years in our sample. We also show the equity share for all RIs and for RIs who hold some assets in a TDF separately. Panel a shows all RIs, aged 25-65. Panel b shows RIs aged 25-34. Panel c shows RIs aged 55-65.

Figure A.4: Equity share of investable wealth

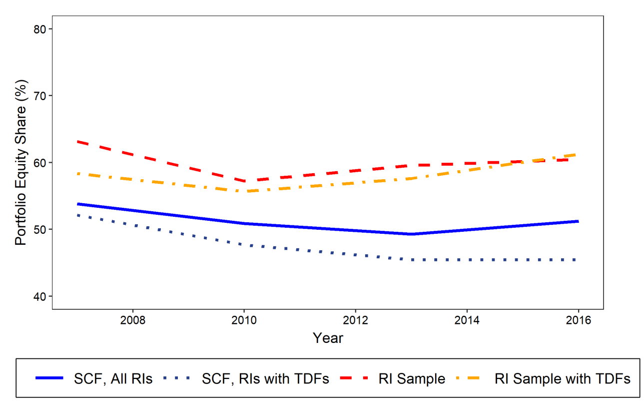
((a)) All ages



((b)) Age 25-34



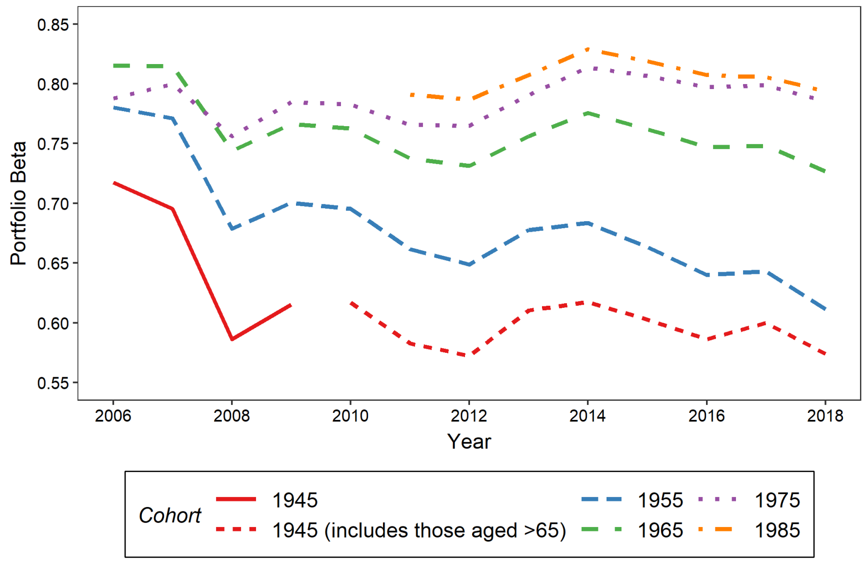
((c)) Age 55-65



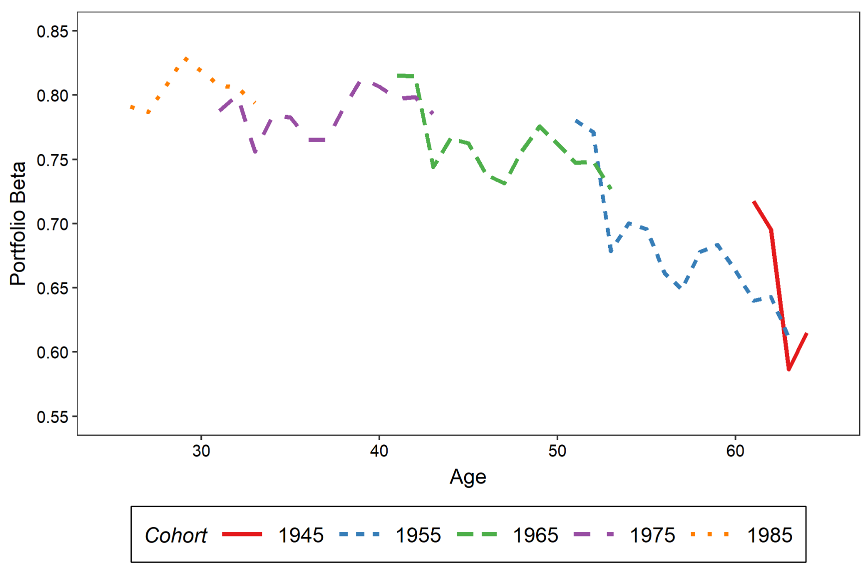
Notes: These figures show the portfolio equity share of investable wealth over time. The SCF data is every three years, in 2007, 2010, 2013, and 2016. We show the same years in our sample. We also show the equity share for all RIs and for RIs who hold some assets in a TDF separately. Panel a shows all RIs, aged 25-65. Panel b shows RIs aged 25-34. Panel c shows RIs aged 55-65.

Figure A.5: Portfolio Beta by Birth Cohort

((a)) Portfolio Beta by Birth Cohort and Year

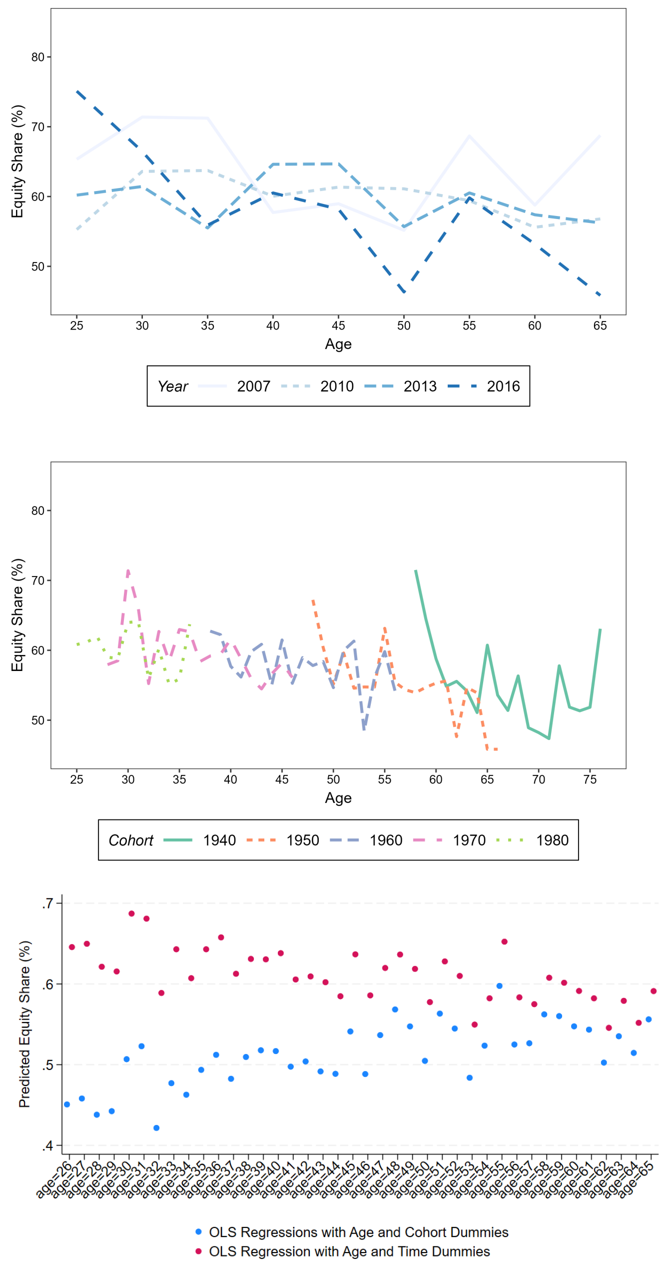


((b)) Portfolio Beta by Birth Cohort and Age



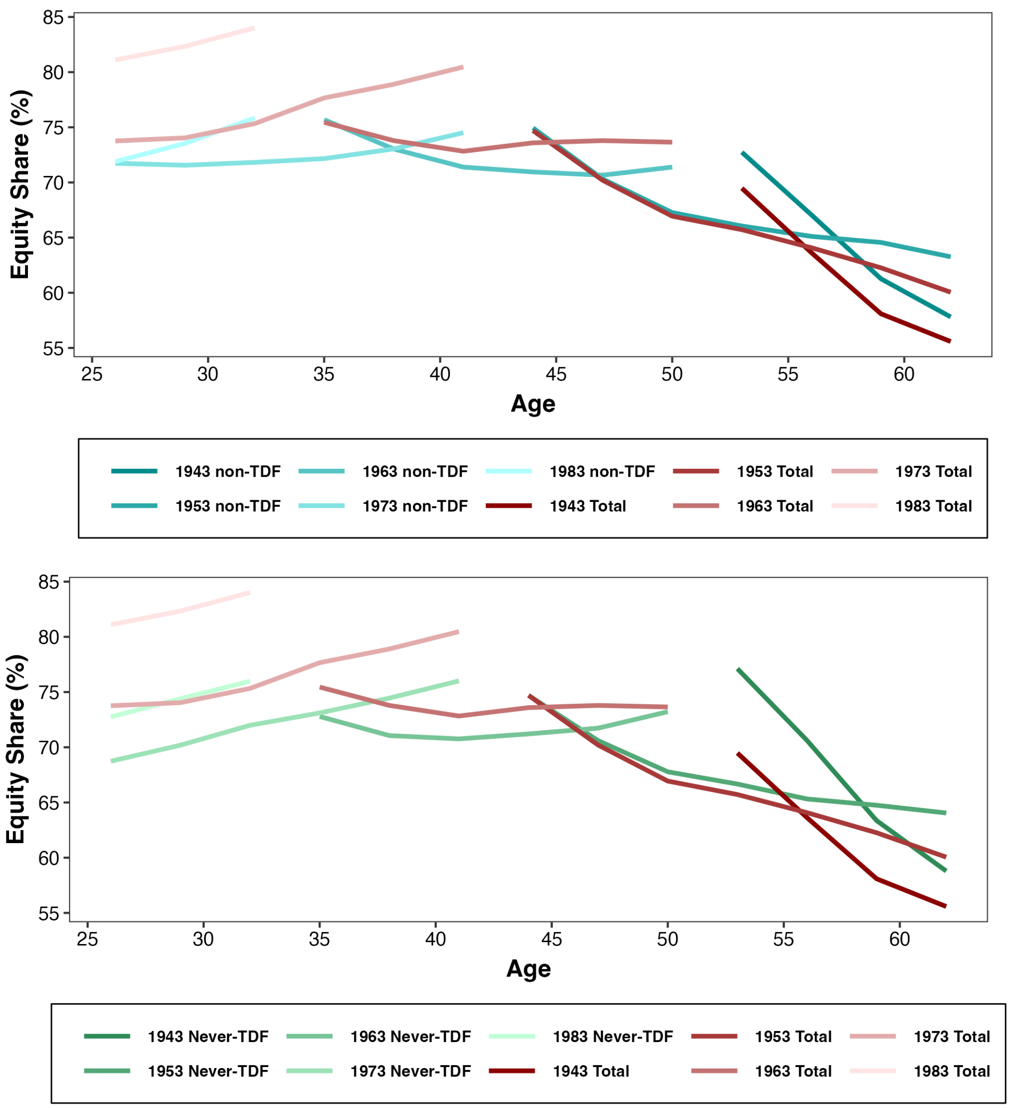
Notes: These figures show the portfolios betas averaged by birth year cohorts. The top panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The bottom panel shows the averages by age, where age is the median age of the cohort. Portfolio betas are CAPM market betas calculated from all available return data from 2006-2018. A cohort is defined as having been born in the three-year period centered around the year indicated. The sample is our full set of retirement investors (RI).

Figure A.6: Equity Share Among Equity Owners (SCF)



Notes: This figure replicates the results shown in Figure 9 of Ameriks and Zeldes (2004) using the SCF from 2007, 2010, 2013, and 2016. The top figure shows the observed equity share by age in each year. The middle figure shows the observed equity share by age in each cohort in our sample. A cohort is defined as having been born in the ten-year period beginning with the year indicated. The bottom figure shows the predicted values from a regression of equity share on indicator variables for age and either cohort or time. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The sample is all SCF investors who own at least some equity.

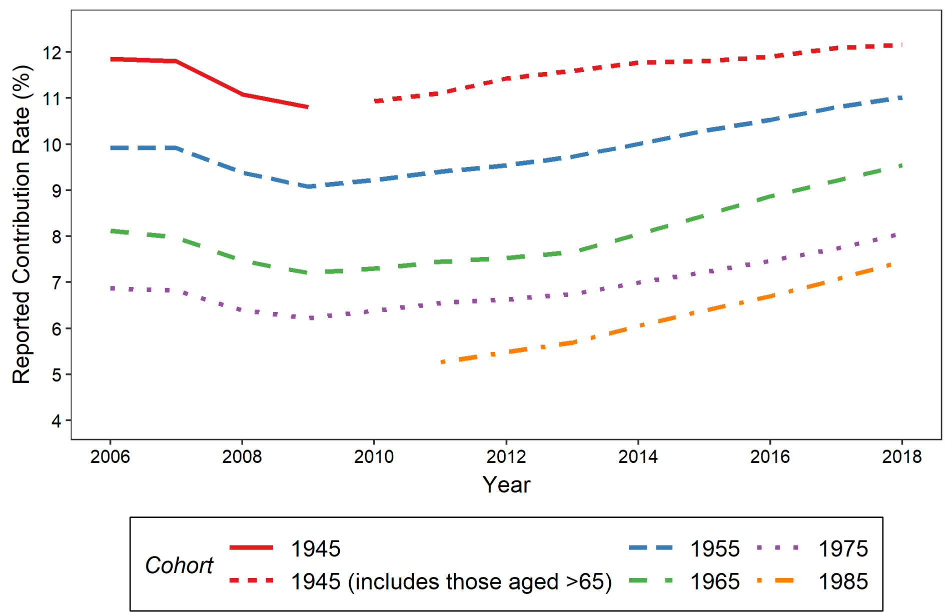
Figure A.7: Equity Share of Non-TDF Assets



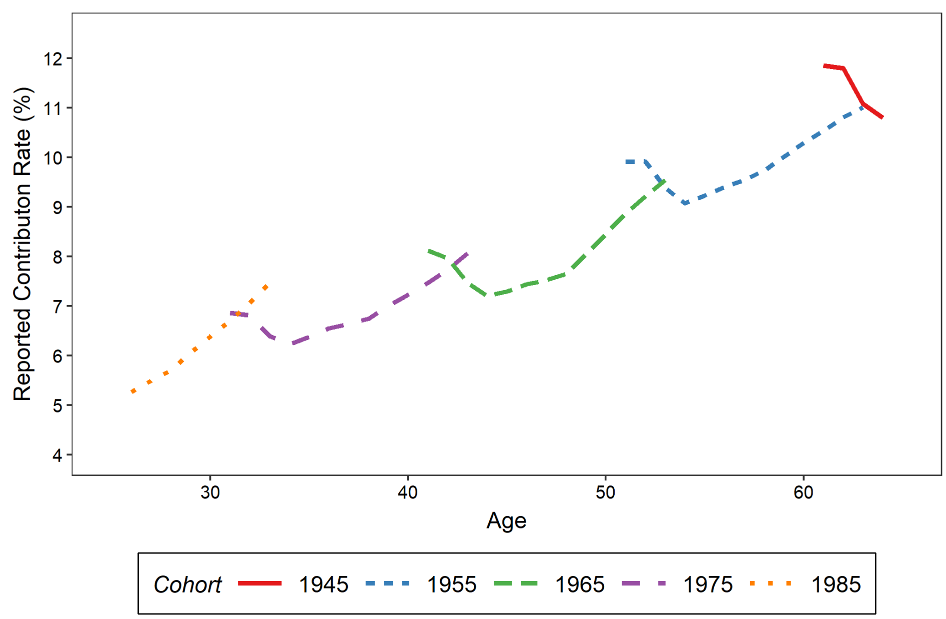
Notes: These figures show the non-TDF portfolio equity share averaged by birth year over the sample period. Each line follows one age cohort as indicated in the chart. The left panel plots the equity share of RI's total assets compared to the equity of non-TDF assets that RIs hold who have at least some assets invested in TDFs. The right panel plots the equity share of the assets held by RIs who do not invest at all into TDFs compared to the total assets of the entire RI sample.

Figure A.8: Reported Contribution Rate by Birth Cohort

((a)) Reported Contribution Rate

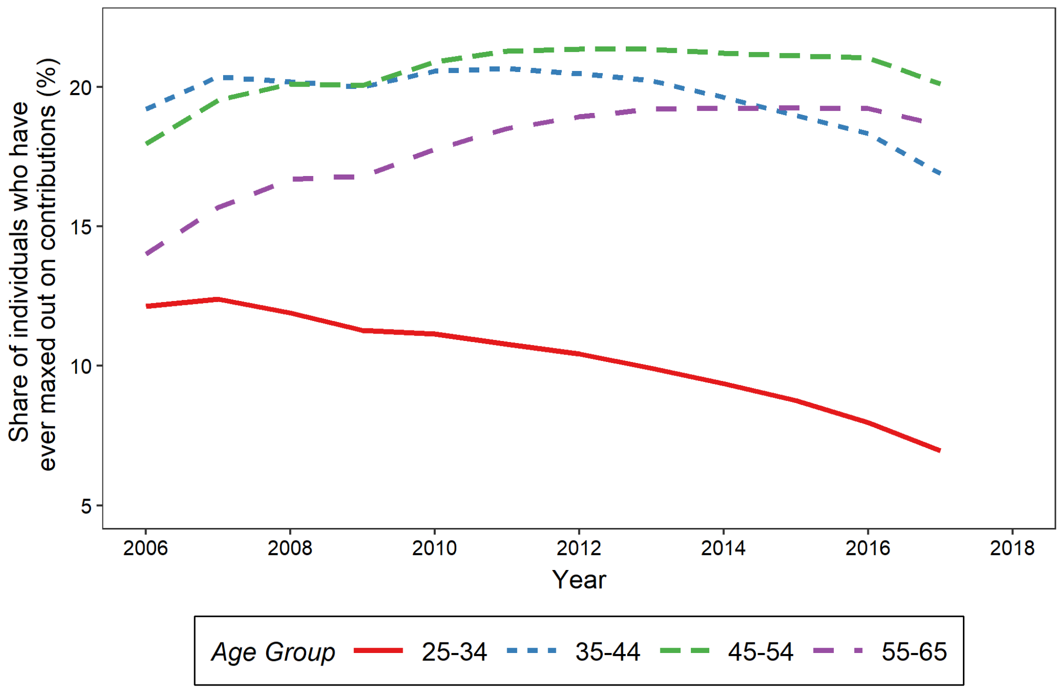


((b)) Reported Contribution Rate



Notes: These figures show the reported contribution rate averaged by birth year cohorts. The left panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The right panel shows the averages by age, where age is the median age of the cohort. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. A cohort is defined as having been born in the three-year period centered around the year indicated. The sample is our full set of retirement investors (RI).

Figure A.9: Incidence of Maxing Out on Contribution Limits, by Age Group



Notes: This figure shows the percentage of investors that have ever hit their contribution limit in a given year, split by age groups. Maxing out is defined as when an individual exceeds the dollar amount that is allowed for 401(k) contributions in a year, set by the IRS. The sample is our full set of retirement investors (RI) which have income data available.

E. Appendix Tables

Table A.I: Characteristics of Sample of Retirement Investors

	Retirement Investors			
	Summary Statistics			
	Mean	Median	SD	Percentage of RI Sample with Observed Data
Age (Years)	45.38	46	11.01	100.0%
Share Female (%)	45.0	0	49.7	93.4%
Share Married (%)	73.8	100	44.0	88.6%
Labor Income ($)	94,044	69,506	214,798	44.5%
Employment Tenure (Years)	10.77	8.09	9.12	58.2%
Investable Wealth ($)	100,365	36,114	318,490	100%
Retirement Wealth ($)	81,349	32,922	131,540	100%
Retirement Share of Wealth (%)	96.1	100	14.5	100%
Portfolio Beta	0.75	0.84	0.34	85.7%
TDF Share of Invest. Wealth (%)	38.4	15.3	42.9	99.3%
Reported Contribution Rate (%)	8.0	6.0	7.2	49.1%
Realized Contribution Rate (%)	6.3	5.3	6.4	44.9%

Notes: This table presents summary statistics on demographics, wealth, and portfolio allocations for our Retirement Investor (RI) sample from 2006-2018. Detailed definitions for retirement wealth and investable wealth are provided in Table I. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. Market betas are obtained by regressing monthly fund or security excess returns on the value-weighted CRSP market excess return over the period 2007–2017 with at least 24 observations. Income is the labor income of the head of household in 2015. The sample is not representative of the assets under management of our financial service firm, since by design we drop the highest and lowest income groups.

Table A.II: Characteristics of Sample of Retirement Investors - Married Subsample

Retirement Investors				
	Summary Statistics			
	Mean	Median	SD	Percentage of Married RI Sample with Observed Data
Age (Years)	49.48	51	10.30	100%
Share Female (%)	48.2	0	50	94.9%
Share Married (%)	100	100	0	100%
Labor Income ($)	113, 105	83, 213	202, 430	34.5%
Employment Tenure (Years)	12.56	10.18	9.95	49.2%
Investable Wealth (Individual, $)	188, 503	75, 410	492, 778	100%
Investable Wealth (Household, $)	285, 085	126, 205	669, 449	100%
Retirement Wealth ($)	143, 681	66, 425	200, 599	100%
Retirement Share of Wealth (%)	96.7	100	12.9	100%
Portfolio Beta	0.73	0.81	0.33	88.0%
TDF Share of Invest. Wealth (%)	36.4	11.9	42.1	99.7%
Reported Contribution Rate (%)	9.8	8	8.7	43.5%
Realized Contribution Rate (%)	7.7	6	6.4	37.7%
Retirement Investors - Survey of Consumer Finance				
	Summary Statistics			
	Mean	Median	SD	Number of Observations
Age	46.87	47.00	10.48	2556
Female (%)	46.20	0.00	49.99	2556
Married (%)	100.00	100.00	0.00	2556
Labor Income (Individual, $)	68,380	51,000	1,203,245	2556
Labor Income (Household, $)	123,272	96,000	1,662,971	2556
Investable Wealth (Household, $)	230,238	53,300	13,136,895	2556
Retirement Wealth (Household, $)	225,166	94,000	718,051	2556
Retirement Wealth (Individual, $)	105,481	46,000	710,051	2556
Retirement Share of Investable Wealth (Individual, %)	58.35	56.60	37.23	2556
Retirement Share of Investable Wealth (Household, %)	86.55	100.00	34.04	2556

Notes: This table presents summary statistics on demographics, wealth, and portfolio allocations for a subsample or our Retirement Investors (RI) sample who are married and for whom we observe both partners in our data set. We use 2016 data to compare with the 2016 Survey of Consumer Finance (SCF), in which we include only married investors here. Detailed definitions for retirement wealth and investable wealth are provided in Table I. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. Market betas are obtained by regressing monthly fund or security excess returns on the value-weighted CRSP market excess return over the period 2007–2017 with at least 24 observations. Income is the labor income of the respondent in 2015. The sample is not representative of the assets under management of our financial service firm, since by design we drop the highest and lowest income groups.

Table A.III: Characteristics of Sample of Retirement Investors - Single Subsample

Retirement Investors				
	Summary Statistics			
	Mean	Median	SD	Percentage of Single RI Sample with Observed Data
Age (Years)	42.43	41	11.56	100%
Share Female (%)	49.6	0	50.0	98.1%
Share Married (%)	0	0	0	100%
Labor Income ($)	83,344	63,346	129,726	42.2%
Employment Tenure (Years)	9.58	6.74	8.56	61.9%
Investable Wealth ($)	83,535	25,156	284,098	100%
Retirement Wealth ($)	69,227	23,547	122,048	100%
Retirement Share of Wealth (%)	93.6	100	18.0	100%
Portfolio Beta	0.76	0.85	0.32	89.7%
TDF Share of Invest. Wealth (%)	53.2	60.3	45.2	99.7%
Reported Contribution Rate (%)	7.3	6.0	6.5	56.0%
Realized Contribution Rate (%)	5.9	5.0	4.8	50.0%
Retirement Investors - Survey of Consumer Finance				
	Summary Statistics			
	Mean	Median	SD	Number of Observations
Age (Respondent)	46.43	47.00	11.12	574
Share Female (%)	61.9	100	48.9	574
Share Married (%)	0	0	0	574
Labor Income (Respondent, $)	59,725	50,000	710,967	574
Investable Wealth (Household, $)	133,613	42,900	6,409,202	574
Retirement Wealth (Respondent, $)	82,806	35,000	124,628	574
Retirement Share of Wealth (%)	89.7	100	26.5	574

Notes: This table presents summary statistics on demographics, wealth, and portfolio allocations for a subsample or our Retirement Investors (RI) sample who are not married and for whom we observe only one member in the household. We use 2016 data to compare with the 2016 Survey of Consumer Finance (SCF), in which we include only unmarried investors here. Detailed definitions for retirement wealth and investable wealth are provided in Table I. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. Market betas are obtained by regressing monthly fund or security excess returns on the value-weighted CRSP market excess return over the period 2007–2017 with at least 24 observations. Income is the labor income of the respondent in 2015. The sample is not representative of the assets under management of our financial service firm, since by design we drop the highest and lowest income groups.

Table A.IV: Average Share of Equity in Portfolios Among Retirement Investors - Full Sample versus 2016 SCF

	All Retirement Investors		Retirement Investors with Hybrid Fund (e.g. TDF) in Retirement Account	
Panel A: All Investable Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	68.6	54.5	73.0	46.9
Age 25-34	73.9	59.1	80.7	49.6
Age 35-44	73.2	55.9	77.7	47.9
Age 45-54	68.6	53.8	70.5	45.5
Age 55-65	59.6	51.2	59.2	45.4
Panel B: Retirement Wealth	Main Sample (Individuals)	SCF (Individuals)	Main Sample (Individuals)	SCF (Individuals)
All RIs	68.9	51.7	73.1	42.1
Age 25-34	74.1	56.2	80.8	44.2
Age 35-44	73.4	54.1	77.9	43.5
Age 45-54	68.9	50.5	70.6	40.2
Age 55-65	59.8	48.0	59.1	41.2
Panel C: Non-Retirement Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	54.1	73.4	54.3	73.2
Age 25-34	53.6	87.5	53.9	86.9
Age 35-44	55.5	68.9	56.5	68.3
Age 45-54	53.9	74.5	54.5	73.6
Age 55-65	50.1	69.6	51.5	69.6

Notes: This table presents the share of equity in the portfolio allocations for various samples of our Retirement Investors (RI) sample and the comparable RI sample of the 2016 Survey of Consumer Finance (SCF). Panel A shows equity shares of total investable wealth at the individual level in our sample and the household level in the SCF. Panel B shows equity shares of retirement wealth, at the individual level in both datasets. Panel C shows equity shares of non-retirement wealth at the individual level in our sample and the household level in the SCF. The figures in Panel C are conditional on owning some non-retirement wealth, which is approximately 43% of the SCF RI sample and 16% of our RI sample. The first two columns show the means for the full sample of RIs in each dataset. The last two columns show the means for the subsample of the RI sample that has some of their retirement assets in a target date fund (TDF). Investable wealth is defined as money market funds, non-money market funds, individual stocks and bonds, Retirement wealth is defined as any wealth in retirement saving accounts of all types (excluding defined benefit plans and Social Security). certificates of deposit, quasi-liquid retirement wealth, and other managed accounts. The equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets.

Table A.V: Average Share of Equity in Portfolios Among Retirement Investors - Married Subsample

	All Retirement Investors		Retirement Investors with Hybrid Fund (e.g. TDF) in Retirement Account	
Panel A: All Investable Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All Ris	69.0	55.2	73.9	47.3
Age 25-34	77.0	59.3	84.4	50.0
Age 35-44	76.1	56.0	81.7	48.0
Age 45-54	71.0	54.6	74.3	46.5
Age 55-65	61.5	52.8	61.9	45.7
Respondents		55.5	0.0	47.7
Partners		54.8	0.0	46.9
Panel B: Retirement Wealth	Main Sample (Individuals)	SCF (Individuals)	Main Sample (Individuals)	SCF (Individuals)
All Ris	69.4	52.1	74.1	41.9
Age 25-34	77.2	56.4	84.6	44.4
Age 35-44	76.4	54.0	82.0	42.8
Age 45-54	71.5	50.8	74.6	40.3
Age 55-65	61.7	49.2	61.9	40.9
Respondents		53.2	0.0	43.7
Partners		50.8	0.0	39.8
Panel C: Non-Retirement Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	52.0	73.3	54.0	72.1
Age 25-34	53.1	89.9	53.5	86.2
Age 35-44	55.3	68.5	57.3	66.5
Age 45-54	52.7	75.0	54.3	74.2
Age 55-65	49.9	69.5	51.5	68.8
Respondents		74.0	0.0	72.7
Partners		72.7	0.0	71.2

Notes: This table presents the share of equity in the portfolio allocations for various samples of our Retirement Investors (RI) sample in 2016 and the comparable RI sample of the 2016 Survey of Consumer Finance (SCF). From our sample, this table shows summary statistics for the subset of investors who are married and for whom we observe both partners in our data set. In the SCF, this table shows only summary statistics of married investors. Panel A shows equity shares of total investable wealth at the individual level in our sample and the household level in the SCF. Panel B shows equity shares of retirement wealth, at the individual level in both datasets. Panel C shows equity shares of non-retirement wealth at the individual level in our sample and the household level in the SCF. The figures in Panel C are conditional on owning some non-retirement wealth, which is approximately 48% of the SCF married RI sample and 18% of our married RI sample. The first two columns show the means for the full sample of RIs in each dataset. The last two columns show the means for the subsample of the RI sample that has some of their retirement assets in a target date fund (TDF). Investable wealth is defined as money market funds, non-money market funds, individual stocks and bonds, Retirement wealth is defined as any wealth in retirement saving accounts of all types (excluding defined benefit plans and Social Security). certificate of deposits, quasi-liquid retirement wealth, and other managed accounts. The equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets.

Table A.VI: Average Share of Equity in Portfolios Among Retirement Investors - Single Subsample

	All Retirement Investors		Retirement Investors with Hybrid Fund (e.g. TDF) in Retirement Account	
Panel A: All Investable Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	71.6	51.9	78.3	45.6
Age 25-34	77.4	58.4	85.0	48.5
Age 35-44	74.9	55.4	82.2	47.8
Age 45-54	70.4	51.3	74.5	43.0
Age 55-65	59.5	45.6	60.5	44.5
Panel B: Retirement Wealth	Main Sample (Individuals)	SCF (Individuals)	Main Sample (Individuals)	SCF (Individuals)
All RIs	71.8	50.2	78.4	42.5
Age 25-34	77.6	55.7	85.2	43.5
Age 35-44	75.1	54.5	82.4	45.8
Age 45-54	70.5	49.7	74.6	40.0
Age 55-65	59.6	43.7	60.5	42.1
Panel C: Non-Retirement Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Household)
All RIs	51.2	73.6	53.5	78.4
Age 25-34	52.3	81.2	54.0	88.3
Age 35-44	53.8	71.9	56.1	81.4
Age 45-54	50.6	71.6	52.3	71.0
Age 55-65	48.0	70.6	49.4	74.8

Notes: This table presents the share of equity in the portfolio allocations for various samples of our Retirement Investors (RI) sample in 2016 and the comparable RI sample of the 2016 Survey of Consumer Finance (SCF). From our sample, this table shows summary statistics for the subset of investors who are single and for whom we observe only one member of the household. In the SCF, this table shows only summary statistics of non-married investors. Panel A shows equity shares of total investable wealth at the individual level in our sample and the household level in the SCF. Panel B shows equity shares of retirement wealth, at the individual level in both datasets. Panel C shows equity shares of non-retirement wealth at the individual level in our sample and the household level in the SCF. These figures are conditional on owning some non-retirement wealth, which is approximately 33% of the SCF RI single sample and 15% of our RI single sample. The first two columns show the means for the full sample of RIs in each dataset. The last two columns show the means for the subsample of the RI sample that has some of their retirement assets in a target date fund (TDF). Investable wealth is defined as money market funds, non-money market funds, individual stocks and bonds, Retirement wealth is defined as any wealth in retirement saving accounts of all types (excluding defined benefit plans and Social Security). certificate of deposits, quasi-liquid retirement wealth, and other managed accounts. The equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets.

Table A.VII: Average Residual Share of Equity in Portfolios Among Retirement Investors

	All Retirement Investors		Retirement Investors with Hybrid Fund (e.g. TDF) in Retirement Account	
Panel A: All Investable Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	0.0011	-0.0082	0.0497	-0.0861
Age 25-34	0.0050	0.0032	0.0790	-0.0916
Age 35-44	0.0027	-0.0057	0.0653	-0.0886
Age 45-54	0.0024	-0.0047	0.0393	-0.0867
Age 55-65	-0.0051	-0.0199	0.0051	-0.0781
Panel B: Retirement Wealth	Main Sample (Individuals)	SCF (Individuals)	Main Sample (Individuals)	SCF (Individuals)
All RIs	0.0011	-0.0110	0.0494	-0.1102
Age 25-34	0.0052	-0.0039	0.0796	-0.1242
Age 35-44	0.0027	-0.0007	0.0656	-0.1101
Age 45-54	0.0025	-0.0123	0.0386	-0.1156
Age 55-65	-0.0051	-0.0216	0.0034	-0.0911
Panel C: Non-Retirement Wealth	Main Sample (Individuals)	SCF (Households)	Main Sample (Individuals)	SCF (Households)
All RIs	0.0004	-0.0049	0.0195	-0.0075
Age 25-34	0.0032	0.0269	0.0141	0.0249
Age 35-44	0.0009	-0.0390	0.0219	-0.0449
Age 45-54	-0.0002	0.0200	0.0186	0.0141
Age 55-65	-0.0007	-0.0169	0.0221	-0.0170

Notes: This table presents the residuals from a regression of the equity share on gender, investable wealth, and birth year cohort. We use the share of equity in the portfolio allocations for various samples of our Retirement Investors (RI) sample in 2016 and the comparable RI sample of the 2016 Survey of Consumer Finance (SCF). Panel A shows residuals of equity shares of total investable wealth at the individual level in our sample and the household level in the SCF. Panel B shows residuals of equity shares of retirement wealth, at the individual level in both datasets. Panel C shows residuals of equity shares of non-retirement wealth at the individual level in our sample and the household level in the SCF. The figures in Panel C are conditional on owning some non-retirement wealth, which is approximately 43% of the SCF RI sample and 16% of our RI sample. The first two columns show the means for the full sample of RIs in each dataset. The last two columns show the means for the subsample of the RI sample that has some of their retirement assets in a target date fund (TDF). Investable wealth is defined as money market funds, non-money market funds, individual stocks and bonds, Retirement wealth is defined as any wealth in retirement saving accounts of all types (excluding defined benefit plans and Social Security), certificate of deposits, quasi-liquid retirement wealth, and other managed accounts. The equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets.

Table A.VIII: Cross-Sectional Regressions of Equity Share, Full Sample and by Income Terciles

	Portfolio equity share				
	(1) All Observations	(2) All Observations	(3) First Tercile of Initial Income	(4) Second Tercile of Initial Income	(5) Third Tercile of Initial Income
Age 25-27	0.7366	0.8031	0.7489	0.7915	0.7943
	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0005)
Age 28-30	0.7326	0.7964	0.7321	0.7797	0.7865
	(0.0001)	(0.0002)	(0.0003)	(0.0002)	(0.0004)
Age 31-33	0.7331	0.7888	0.7272	0.7724	0.7790
	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0003)
Age 34-36	0.7348	0.7816	0.7253	0.7674	0.7730
	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0003)
Age 37-39	0.7344	0.7731	0.7208	0.7614	0.7681
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Age 40-42	0.7296	0.7615	0.7118	0.7515	0.7607
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
Age 43-45	0.7209	0.7479	0.6990	0.7383	0.7509
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
Age 46-48	0.7053	0.7280	0.6787	0.7172	0.7341
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
Age 49-51	0.6844	0.7022	0.6542	0.6903	0.7102
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
Age 52-54	0.6598	0.6738	0.6263	0.6602	0.6818
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0002)
Age 55-57	0.6304	0.6402	0.5923	0.6244	0.6482
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Age 58-60	0.6002	0.6063	0.5593	0.5869	0.6121
	(0.0001)	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 61-63	0.5702	0.5730	0.5250	0.5486	0.5765
	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0004)
Age 64-65	0.5496	0.5482	0.4969	0.5173	0.5485
	(0.0002)	(0.0003)	(0.0005)	(0.0005)	(0.0005)
Log income		0.0761			
		(0.0003)			
Person fixed effect?	N	N	N	N	N
% of RI Sample	93.4	40.9	15.8	16.7	16.2
R-squared	0.0379	0.0751	0.0553	0.0744	0.0609

Notes: This table presents regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The baseline specification in column (1) shows the coefficients for the regression of equity share on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.IX: Cross-Sectional Regressions of Price Constant Equity Share, Full Sample and by Income Terciles

	Price constant portfolio equity share				
	(1) All Observations	(2) All Observations	(3) First Tercile of Initial Income	(4) Second Tercile of Initial Income	(5) Third Tercile of Initial Income
Age 25-27	0.7357 (0.0002)	0.8061 (0.0002)	0.7433 (0.0003)	0.7941 (0.0003)	0.8012 (0.0006)
Age 28-30	0.7317 (0.0002)	0.7984 (0.0002)	0.7296 (0.0003)	0.7811 (0.0003)	0.7894 (0.0004)
Age 31-33	0.7313 (0.0001)	0.7894 (0.0002)	0.7244 (0.0003)	0.7722 (0.0003)	0.7794 (0.0003)
Age 34-36	0.7327 (0.0001)	0.7813 (0.0002)	0.7229 (0.0003)	0.7666 (0.0003)	0.7716 (0.0003)
Age 37-39	0.7327 (0.0001)	0.7725 (0.0002)	0.7193 (0.0003)	0.7607 (0.0003)	0.7660 (0.0003)
Age 40-42	0.7281 (0.0001)	0.7606 (0.0002)	0.7108 (0.0003)	0.7509 (0.0003)	0.7584 (0.0003)
Age 43-45	0.7203 (0.0001)	0.7473 (0.0002)	0.6992 (0.0004)	0.7384 (0.0003)	0.7489 (0.0003)
Age 46-48	0.7054 (0.0001)	0.7278 (0.0002)	0.6795 (0.0004)	0.7179 (0.0003)	0.7331 (0.0003)
Age 49-51	0.6844 (0.0001)	0.7016 (0.0002)	0.6549 (0.0004)	0.6906 (0.0003)	0.7091 (0.0003)
Age 52-54	0.6595 (0.0001)	0.6726 (0.0002)	0.6264 (0.0004)	0.6596 (0.0003)	0.6802 (0.0003)
Age 55-57	0.6297 (0.0001)	0.6383 (0.0002)	0.5919 (0.0004)	0.6228 (0.0003)	0.6458 (0.0003)
Age 58-60	0.5988 (0.0001)	0.6038 (0.0002)	0.5585 (0.0004)	0.5845 (0.0004)	0.6087 (0.0003)
Age 61-63	0.5690 (0.0002)	0.5705 (0.0003)	0.5240 (0.0004)	0.5459 (0.0004)	0.5731 (0.0004)
Age 64-65	0.5477 (0.0002)	0.5454 (0.0003)	0.4956 (0.0006)	0.5144 (0.0005)	0.5444 (0.0005)
Log income		0.0743 (0.0003)			
Person fixed effect?	N	N	N	N	N
% of RI Sample	80.0	34.0	13.3	14.2	13.8
R-squared	0.0386	0.0781	0.0544	0.0769	0.0629

Notes: This table presents regression coefficients of annual individual price-constant portfolio equity shares on a set of demographic controls. The price-constant portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets, ignoring any changes in the price of these assets. These hypothetical portfolio shares track the inflows and outflows into these assets and are insensitive to passive appreciation. The baseline specification in column (1) shows the coefficients for the regression of equity share on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.X: Cross-Sectional Regressions of Equity Share of Contributions, Full Sample and by Income Terciles

	Portfolio equity share			
	(1) All Observations	(2) First Tercile of Initial Income	(3) Second Tercile of Initial Income	(4) Third Tercile of Initial Income
Age 25-27	0.8112	0.8011	0.8234	0.8272
	(0.0001)	(0.0002)	(0.0002)	(0.0004)
Age 28-30	0.8032	0.7929	0.8139	0.8148
	(0.0001)	(0.0002)	(0.0002)	(0.0003)
Age 31-33	0.7967	0.7847	0.8063	0.8053
	(0.0001)	(0.0002)	(0.0002)	(0.0003)
Age 34-36	0.7901	0.7747	0.7985	0.7989
	(0.0001)	(0.0003)	(0.0002)	(0.0003)
Age 37-39	0.7818	0.7596	0.7891	0.7930
	(0.0001)	(0.0003)	(0.0003)	(0.0003)
Age 40-42	0.7698	0.7410	0.7754	0.7845
	(0.0001)	(0.0003)	(0.0003)	(0.0003)
Age 43-45	0.7537	0.7195	0.7571	0.7724
	(0.0001)	(0.0004)	(0.0003)	(0.0003)
Age 46-48	0.7315	0.6943	0.7327	0.7528
	(0.0001)	(0.0004)	(0.0003)	(0.0003)
Age 49-51	0.7035	0.6656	0.7031	0.7254
	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 52-54	0.6733	0.6354	0.6722	0.6956
	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 55-57	0.6385	0.5986	0.6369	0.6618
	(0.0002)	(0.0004)	(0.0004)	(0.0003)
Age 58-60	0.6047	0.5649	0.6023	0.6285
	(0.0002)	(0.0004)	(0.0004)	(0.0004)
Age 61-63	0.5740	0.5342	0.5688	0.5976
	(0.0002)	(0.0005)	(0.0005)	(0.0005)
Age 64-65	0.5514	0.5087	0.5431	0.5738
	(0.0003)	(0.0007)	(0.0007)	(0.0007)
Person fixed effect?	N	N	N	N
% of RI Sample	93.4	15.8	16.7	16.2
R-squared	0.0817	0.1049	0.0938	0.0672

Notes: This table presents regression coefficients of annual equity share of contributions on a set of demographic controls. The equity share of contributions is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds that an investor delegates for his contributions in a given year. The baseline specification in column (1) shows the coefficients for the regression of equity share on age group dummies. Columns (2)-(4) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XI: Cross-Sectional Regressions of Equity Share, Full Sample and by Cohort, SEs Clustered at the Employer Level

	Portfolio equity share						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All Observations	All Observations	1943 Cohort	1953 Cohort	1963 Cohort	1973 Cohort	1983 Cohort
Age 25-27	0.7366	0.8031				0.7376	0.8110
	(0.0120)	(0.0018)				(0.0003)	(0.0002)
Age 28-30	0.7326	0.7964				0.7404	0.8234
	(0.0087)	(0.0014)				(0.0003)	(0.0001)
Age 31-33	0.7331	0.7888				0.7533	0.8401
	(0.0077)	(0.0012)				(0.0002)	(0.0001)
Age 34-36	0.7348	0.7816			0.7545	0.7766	0.8406
	(0.0061)	(0.001)			(0.0025)	(0.0002)	(0.0002)
Age 37-39	0.7344	0.7731			0.7379	0.7890	
	(0.0100)	(0.0010)			(0.0016)	(0.0005)	
Age 40-42	0.7296	0.7615			0.7283	0.8047	
	(0.0092)	(0.0015)			(0.0007)	(0.0005)	
Age 43-45	0.7209	0.7479		0.7470	0.7359	0.8038	
	(0.0110)	(0.0015)		(0.0121)	(0.0009)	(0.0010)	
Age 46-48	0.7053	0.7280		0.7020	0.7379		
	(0.0102)	(0.0011)		(0.0033)	(0.0006)		
Age 49-51	0.6844	0.7022		0.6694	0.7365		
	(0.0087)	(0.0014)		(0.0016)	(0.0011)		
Age 52-54	0.6598	0.6738	0.6948	0.6572	0.7226		
	(0.0106)	(0.0011)	(0.0011)	(0.0008)	(0.0004)		
Age 55-57	0.6304	0.6402	0.6363	0.6408			
	(0.0090)	(0.0017)	(0.0019)	(0.0009)			
Age 58-60	0.6002	0.6063	0.5809	0.6226			
	(0.0153)	(0.0021)	(0.0005)	(0.0013)			
Age 61-63	0.5702	0.5730	0.5558	0.6005			
	(0.0220)	(0.0038)	(0.0011)	(0.0021)			
Age 64-65	0.5496	0.5482	0.5430	0.5733			
	(0.0662)	(0.0076)	(0.0015)	(0.0192)			
Log income		0.0761	0.1017	0.0959	0.0724	0.0572	0.0526
		(0.0016)	(0.0010)	(0.0010)	(0.0006)	(0.0005)	(0.0005)
Person fixed effect?	N	N	N	N	N	N	N
% of RI Sample	93.4	40.9	3.1	10.9	11.5	10.3	5.0
R-squared	0.0379	0.0751	0.0220	0.0226	0.0291	0.0154	0.0095

Notes: This table presents regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The baseline specification in column (1) shows the coefficients for the regression of equity share on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the employer level.

Table A.XII: Within-Person Regressions of Equity Share, Full Sample and by Income Terciles

	Portfolio equity share				
	(1) All Observations	(2) All Observations	(3) First Tercile of Initial Income	(4) Second Tercile of Initial Income	(5) Third Tercile of Initial Income
Age 25-27	0.6758	0.6624	0.6336	0.6777	0.6784
	(0.0004)	(0.0006)	(0.0009)	(0.0009)	(0.0010)
Age 28-30	0.6854	0.6775	0.6273	0.6862	0.6945
	(0.0004)	(0.0005)	(0.0009)	(0.0008)	(0.0009)
Age 31-33	0.7042	0.7003	0.6395	0.7006	0.7099
	(0.0003)	(0.0005)	(0.0009)	(0.0008)	(0.0008)
Age 34-36	0.7227	0.7219	0.6572	0.7149	0.7213
	(0.0003)	(0.0005)	(0.0009)	(0.0008)	(0.0007)
Age 37-39	0.7370	0.7394	0.6735	0.7267	0.7302
	(0.0003)	(0.0005)	(0.0008)	(0.0008)	(0.0007)
Age 40-42	0.7460	0.7519	0.6864	0.7344	0.7348
	(0.0003)	(0.0005)	(0.0008)	(0.0007)	(0.0007)
Age 43-45	0.7517	0.7613	0.6968	0.7397	0.7364
	(0.0003)	(0.0004)	(0.0008)	(0.0007)	(0.0006)
Age 46-48	0.7519	0.7647	0.7011	0.7391	0.7325
	(0.0003)	(0.0004)	(0.0007)	(0.0007)	(0.0006)
Age 49-51	0.7486	0.7637	0.7026	0.7344	0.7242
	(0.0002)	(0.0004)	(0.0007)	(0.0006)	(0.0006)
Age 52-54	0.7397	0.7559	0.6964	0.7227	0.7102
	(0.0002)	(0.0004)	(0.0006)	(0.0006)	(0.0005)
Age 55-57	0.7253	0.7412	0.6833	0.7029	0.6907
	(0.0002)	(0.0004)	(0.0006)	(0.0006)	(0.0005)
Age 58-60	0.7071	0.7220	0.6661	0.6771	0.6664
	(0.0002)	(0.0003)	(0.0005)	(0.0005)	(0.0005)
Age 61-63	0.6845	0.6987	0.6420	0.6465	0.6389
	(0.0001)	(0.0002)	(0.0004)	(0.0004)	(0.0004)
Age 64-65	0.6635	0.6752	0.6159	0.6168	0.6132
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Log income		0.0365			
		(0.0003)			
Person fixed effect?	Y	Y	Y	Y	Y
% of RI Sample	93.4	40.9	15.8	16.7	16.2
R-squared	0.7561	0.7742	0.7742	0.7372	0.6876

Notes: This table presents regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The baseline specification in column (1) shows the coefficients for the regression of equity share on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XIII: Cross-Sectional Regressions of Equity Share on Age Groups and Cohort, Controlling for Past Excess Market Returns

	Portfolio equity share	
	Full Sample	Full Sample
Age 25-27	0.6477	0.6473
	(0.0009)	(0.0019)
Age 28-30	0.6534	0.6527
	(0.0009)	(0.0019)
Age 31-33	0.6668	0.6615
	(0.0009)	(0.0018)
Age 34-36	0.6867	0.6791
	(0.0009)	(0.0018)
Age 37-39	0.6976	0.6871
	(0.0009)	(0.0018)
Age 40-42	0.6992	0.6870
	(0.0009)	(0.0018)
Age 43-45	0.6988	0.6880
	(0.0008)	(0.0018)
Age 46-48	0.6935	0.6848
	(0.0008)	(0.0018)
Age 49-51	0.6787	0.6688
	(0.0008)	(0.0018)
Age 52-54	0.6602	0.6502
	(0.0008)	(0.0018)
Age 55-57	0.6377	0.6282
	(0.0008)	(0.0018)
Age 59-61	0.6094	0.5984
	(0.0008)	(0.0018)
Age 61-63	0.5812	0.5691
	(0.0008)	(0.0018)
Age 64-65	0.5587	0.5468
	(0.0008)	(0.0018)
1943 Cohort	-0.0470	-0.0439
	(0.0008)	(0.0018)
1953 Cohort	-0.0398	-0.0253
	(0.0008)	(0.0018)
1963 Cohort	-0.0131	-0.0160
	(0.0008)	(0.0018)
1973 Cohort	0.0134	0.0634
	(0.0009)	(0.0019)
1983 Cohort	0.0681	0.1313
	(0.0009)	(0.0019)
Log income		0.0783
		(0.0003)
Log excess return of past 10 years	0.0185	0.0219
	(0.0000)	(0.0000)
% of RI Sample	93.4	40.9
R-squared	0.0446	0.0905

Notes: This table presents regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. The baseline specification in column (1) shows the coefficients for the regression of equity share on age group dummies, birth-year cohort dummies, and a return for the previous 10 year's excess market return. The excess return is the average of the yearly return of the SP500 relative to one-year interest rates in the 10 years prior to the observation year. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XIV: Within-Person Regressions of Equity Share of Contributions, Full Sample and by Income Terciles

	Portfolio equity share			
	(1) All Observations	(2) First Tercile of Initial Income	(3) Second Tercile of Initial Income	(4) Third Tercile of Initial Income
Age 25-27	0.7210 (0.0001)	0.7148 (0.0001)	0.7357 (0.0002)	0.7328 (0.0003)
Age 28-30	0.7459 (0.0001)	0.7389 (0.0002)	0.7594 (0.0003)	0.7609 (0.0005)
Age 31-33	0.7725 (0.0002)	0.7669 (0.0003)	0.7841 (0.0004)	0.7841 (0.0007)
Age 34-36	0.7971 (0.0002)	0.7942 (0.0004)	0.8062 (0.0004)	0.8043 (0.0008)
Age 37-39	0.8177 (0.0003)	0.8182 (0.0005)	0.8251 (0.0005)	0.8204 (0.0008)
Age 40-42	0.8331 (0.0003)	0.8375 (0.0006)	0.8397 (0.0006)	0.8326 (0.0009)
Age 43-45	0.8442 (0.0003)	0.8523 (0.0006)	0.8507 (0.0006)	0.8415 (0.0009)
Age 46-48	0.8498 (0.0003)	0.8618 (0.0007)	0.8564 (0.0006)	0.8449 (0.0009)
Age 49-51	0.8507 (0.0004)	0.8667 (0.0007)	0.8575 (0.0007)	0.8434 (0.0010)
Age 52-54	0.8445 (0.0004)	0.8638 (0.0008)	0.8514 (0.0007)	0.8365 (0.0010)
Age 55-57	0.8329 (0.0004)	0.8538 (0.0009)	0.8394 (0.0008)	0.8255 (0.0010)
Age 58-60	0.8187 (0.0004)	0.8416 (0.0009)	0.8251 (0.0008)	0.8122 (0.0011)
Age 61-63	0.8020 (0.0005)	0.8264 (0.0010)	0.8078 (0.0009)	0.7972 (0.0011)
Person fixed effect?	Y	Y	Y	Y
% of RI Sample	93.4	15.8	16.7	16.200
R-squared	0.8218	0.8674	0.8242	0.7766

Notes: This table presents regression coefficients of annual equity share of contributions on a set of demographic controls. The equity share of contributions is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds that an investor delegates for his contributions in a given year. The baseline specification in column (1) shows the coefficients for the regression of equity share on age group dummies. Columns (2)-(4) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XV: Cross-Sectional Regressions of Equity Share on Age Groups by Cohort and TDF Share

	Portfolio equity share							
	(1) 1943 Cohort	(2) 1953 Cohort	(3) 1963 Cohort	(4) 1973 Cohort	(5) 1983 Cohort	(6) Initial TDF Share 75-100 %	(7) Initial TDF Share 25-75 %	(8) Initial TDF Share 0-25 %
Age 25-27				0.7376	0.8110	0.6868	0.7321	0.7963
				(0.0005)	(0.0002)	(0.0006)	(0.0007)	(0.0002)
Age 28-30				0.7404	0.8234	0.6958	0.7347	0.7857
				(0.0003)	(0.0002)	(0.0004)	(0.0005)	(0.0002)
Age 31-33				0.7533	0.8401	0.7094	0.7326	0.7758
				(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0002)
Age 34-36			0.7545	0.7766	0.8406	0.7244	0.7321	0.7669
			(0.0005)	(0.0002)	(0.0003)	(0.0003)	(0.0004)	(0.0002)
Age 37-39			0.7379	0.7890		0.7336	0.7284	0.7532
			(0.0003)	(0.0002)		(0.0002)	(0.0003)	(0.0002)
Age 40-42			0.7283	0.8047		0.7357	0.7204	0.7330
			(0.0002)	(0.0002)		(0.0002)	(0.0003)	(0.0002)
Age 43-45		0.7470	0.7359	0.8038		0.7320	0.7103	0.7089
		(0.0006)	(0.0002)	(0.0003)		(0.0002)	(0.0003)	(0.0003)
Age 46-48		0.7020	0.7379			0.7205	0.6947	0.6763
		(0.0003)	(0.0002)			(0.0002)	(0.0003)	(0.0003)
Age 49-51		0.6694	0.7365			0.7025	0.6766	0.6411
		(0.0003)	(0.0002)			(0.0002)	(0.0003)	(0.0003)
Age 52-54	0.6948	0.6572	0.7226			0.6800	0.6566	0.6070
	(0.0010)	(0.0002)	(0.0003)			(0.0002)	(0.0003)	(0.0003)
Age 55-57	0.6363	0.6408				0.6531	0.6319	0.5687
	(0.0005)	(0.0002)				(0.0002)	(0.0003)	(0.0003)
Age 58-60	0.5809	0.6226				0.6230	0.6056	0.5346
	(0.0004)	(0.0002)				(0.0002)	(0.0004)	(0.0003)
Age 61-63	0.5558	0.6005				0.5928	0.5773	0.5035
	(0.0004)	(0.0003)				(0.0002)	(0.0004)	(0.0004)
Age 65-65	0.5430	0.5733				0.5720	0.5564	0.4796
	(0.0004)	(0.0006)				(0.0003)	(0.0005)	(0.0005)
Log income	0.1017	0.0959	0.0724	0.0572	0.0526			
	(0.0010)	(0.0005)	(0.0005)	(0.0005)	(0.0005)			
Person fixed effect?	N	N	N	N	N	N	N	N
% of RI Sample	3.1	10.9	11.5	10.3	5.0	39.5	7.9	10.1
R-squared	0.0220	0.0226	0.0291	0.0154	0.0095	0.0228	0.0523	0.2024

Notes: This table presents regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. Columns (1)-(5) show the results including age-group controls and a control for log income, broken out by birth cohort groups. Log income is measured as the log deviation of the individual's income from the average income of the RI sample. A cohort is defined as having been born in the ten-year period beginning with the year indicated. Columns (6)-(8) show the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). The sample is our full RI sample from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XVI: Within-Person Regressions of Equity Share on Age Groups by Cohort and TDF Share

	Portfolio equity share							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1943 Cohort	1953 Cohort	1963 Cohort	1973 Cohort	1983 Cohort	Initial TDF Share 75-100 %	Initial TDF Share 25-75 %	Initial TDF Share 0-25 %
Age 25-27				0.7153	0.7953	0.6582	0.5457	0.6264
				(0.0006)	(0.0004)	(0.0007)	(0.0011)	(0.0009)
Age 28-30				0.7208	0.8122	0.6765	0.5607	0.6276
				(0.0004)	(0.0004)	(0.0006)	(0.0010)	(0.0008)
Age 31-33				0.7379	0.8420	0.6930	0.5769	0.6378
				(0.0004)	(0.0003)	(0.0005)	(0.0009)	(0.0008)
Age 34-36			0.7268	0.7594	0.8629	0.7085	0.5956	0.6553
			(0.0005)	(0.0004)	(0.0001)	(0.0005)	(0.0008)	(0.0008)
Age 37-39			0.7142	0.7802		0.7169	0.6106	0.6717
			(0.0004)	(0.0003)		(0.0004)	(0.0008)	(0.0007)
Age 40-42			0.7101	0.8094		0.7193	0.6222	0.6851
			(0.0003)	(0.0002)		(0.0004)	(0.0007)	(0.0007)
Age 43-45		0.7859	0.7215	0.8176		0.7185	0.6316	0.6963
		(0.0008)	(0.0003)	(0.0001)		(0.0004)	(0.0007)	(0.0007)
Age 46-48		0.7449	0.7269			0.7128	0.6356	0.7011
		(0.0006)	(0.0003)			(0.0003)	(0.0007)	(0.0006)
Age 49-51		0.7182	0.7415			0.7030	0.6358	0.7041
		(0.0006)	(0.0002)			(0.0003)	(0.0006)	(0.0006)
Age 52-54	0.7366	0.7116	0.7377			0.6886	0.6304	0.7015
	(0.0010)	(0.0006)	(0.0001)			(0.0003)	(0.0006)	(0.0006)
Age 55-57	0.6802	0.6974				0.6690	0.6184	0.6927
	(0.0006)	(0.0006)				(0.0003)	(0.0006)	(0.0005)
Age 58-60	0.6192	0.6876				0.6448	0.6015	0.6831
	(0.0004)	(0.0005)				(0.0002)	(0.0005)	(0.0005)
Age 61-63	0.5880	0.6749				0.6153	0.5770	0.6701
	(0.0003)	(0.0005)				(0.0002)	(0.0004)	(0.0004)
Age 64-65	0.5505	0.6615				0.5887	0.5518	0.6557
	(0.0000)	(0.0000)				(0.0001)	(0.0001)	(0.0001)
Log income	0.0274	0.0226	0.0256	0.0407	0.0662			
	(0.0012)	(0.0006)	(0.0006)	(0.0006)	(0.0008)			
Person fixed effect?	Y	Y	Y	Y	Y	Y	Y	Y
% of RI Sample	3.1	10.9	11.5	10.3	5.0	39.5	7.9	10.1
R-squared	0.7948	0.7627	0.7537	0.7420	0.7343	0.7457	0.6769	0.6892

Notes: This table presents regression coefficients of annual individual portfolio equity shares on a set of demographic controls. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. Columns (1)-(5) show the results including age-group controls and a control for log income, broken out by birth cohort groups. Log income is measured as the log deviation of the individual's income from the average income of the RI sample. A cohort is defined as having been born in the ten year period beginning with the year indicated. Columns (6)-(8) show the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full RI sample from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XVII: Regressions of Equity Share on Automated Investment Allocation: Average Effect Two Years After Entering Sample, SEs Clusterd at the Employer Level

	Portfolio equity share					
	(1) All	(2) All	(3) Bottom Income Tercile	(4) Top Income Tercile	(5) No prior non-retirement wealth + no rollover assets	(6) No prior non-retirement wealth + no rollover assets
Treated	0.0552	0.0533	0.0599	0.0186	0.0578	0.0555
	(0.0025)	(0.0031)	(0.0044)	(0.0072)	(0.0025)	(0.0031)
Age 35-44	-0.0134	-0.0271	-0.0339	-0.0112	-0.0140	-0.0272
	(0.0006)	(0.0007)	(0.0013)	(0.0012)	(0.0006)	(0.0007)
Age 45-54	-0.0700	-0.0875	-0.1011	-0.0627	-0.0720	-0.0887
	(0.0007)	(0.0008)	(0.0015)	(0.0014)	(0.0007)	(0.0009)
Age 55-65	-0.1325	-0.1502	-0.1658	-0.1254	-0.1352	-0.1520
	(0.0012)	(0.0014)	(0.0026)	(0.0023)	(0.0013)	(0.0015)
Age 35-44 x Treatment	-0.0581	-0.0542	-0.0508	-0.0366	-0.0600	-0.0549
	(0.0051)	(0.0062)	(0.0113)	(0.0117)	(0.0052)	(0.0063)
Age 45-54 x Treatment	-0.1029	-0.0885	-0.0717	-0.0809	-0.1042	-0.0895
	(0.0071)	(0.0086)	(0.0129)	(0.0175)	(0.0074)	(0.0089)
Age 55-65 x Treatment	-0.1479	-0.1314	-0.1235	-0.1173	-0.1495	-0.1322
	(0.0091)	(0.0141)	(0.0172)	(0.0230)	(0.09023)	(0.0143)
Log income		0.1031				0.1072
		(0.0013)				(0.0014)
Constant	0.7352	0.7476	0.7180	0.7353	0.7335	0.7468
	(0.0003)	(0.0004)	(0.0006)	(0.0003)	(0.0003)	(0.0004)
Firm Fixed Effect?	Y	Y	Y	Y	Y	Y
% of Total Sample	1.3	0.9	0.3	0.3	1.2	0.9
% of Sample Enrolled 2005-2008	18.1	12.8	5.0	3.9	17.0	12.2
R-squared	0.1543	0.1502	0.2266	0.1044	0.1620	0.1565

Notes: This table presents regression coefficients of annual household portfolio equity shares on a treatment dummy for being enrolled into a plan with a target date fund (TDF) as the default after the Pension Protection Act of 2006. We set this treatment dummy equal to one for those enrolled in their firm's retirement plan in 2007 or 2008 when that plan had a TDF as a default and zero for those enrolled in 2005 or 2006. Columns (1)-(2) show the results for the first two years of data after the individual enters our sample. Columns (3)-(4) repeat column (1) for those in the lowest and highest tercile of initial income, respectively. Columns (5)-(6) repeat columns (1)-(2) including only individuals who had no prior retirement wealth before enrollment and no rollover assets of any kind. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. Log income, when included, is the log deviation of the individual's current income from the average income of the RI sample. The sample is our set of retirement investors (RI) who enrolled in their plan from 2005-2008. Standard errors, in parentheses, are clustered at the employer level.

Table A.XVIII: Regressions of Equity Share on Automated Investment Allocation: Long-run Effect, Treated in 2007 Only

	Portfolio equity share						
	(1) Full Sample	(2) Bottom Income Tercile	(3) Top Income Tercile	(4) Age Enrolled 25-34	(5) Age Enrolled 35-44	(6) Age Enrolled 45-54	(7) Age Enrolled 55-65
Year of x Treatment	0.0406	0.0515	0.0467	0.0235	-0.0003	-0.0267	0.0003
	(0.0031)	(0.0052)	(0.0065)	(0.0029)	(0.0106)	(0.0120)	(0.0253)
1 Year After x Treatment	0.0245	0.0377	-0.0137	-0.0019	-0.0330	-0.0864	-0.1182
	(0.0014)	(0.0018)	(0.0041)	(0.0015)	(0.0059)	(0.0104)	(0.0152)
2 Years After x Treatment	0.0929	0.1067	0.0554	0.0478	0.0514	0.0115	-0.0207
	(0.0012)	(0.0017)	(0.0037)	(0.0014)	(0.0046)	(0.0077)	(0.0176)
3 Years After x Treatment	0.0614	0.0626	0.0427	0.0071	0.0106	0.0041	-0.0087
	(0.0012)	(0.0016)	(0.0033)	(0.0015)	(0.0037)	(0.0070)	(0.0134)
4 Years After x Treatment	-0.0210	-0.0154	-0.0212	-0.0068	-0.0121	-0.0123	-0.0205
	(0.0012)	(0.0020)	(0.0022)	(0.0017)	(0.0017)	(0.0025)	(0.0047)
5 Years After x Treatment	0.0107	0.0015	0.0064	0.0369	0.0146	-0.0168	-0.0175
	(0.0012)	(0.0019)	(0.0027)	(0.0017)	(0.0019)	(0.0026)	(0.0052)
1 Year After	0.0090	0.0210	0.0121	0.0135	0.0130	0.0092	0.0080
	(0.0009)	(0.0018)	(0.0013)	(0.0012)	(0.0014)	(0.0016)	(0.0026)
2 Years After	-0.0192	0.0024	-0.0207	0.0067	-0.0210	-0.0451	-0.0575
	(0.0010)	(0.0019)	(0.0014)	(0.0012)	(0.0015)	(0.0017)	(0.0029)
3 Years After	-0.0272	0.0048	-0.0388	0.0141	-0.0285	-0.0680	-0.0886
	(0.0010)	(0.0019)	(0.0015)	(0.0013)	(0.0016)	(0.0018)	(0.0030)
4 Years After	-0.0221	0.0077	-0.0340	0.0242	-0.0211	-0.0634	-0.0820
	(0.0010)	(0.0019)	(0.0015)	(0.0013)	(0.0016)	(0.0018)	(0.0031)
5 Years After	-0.0382	-0.0092	-0.0501	0.0132	-0.0375	-0.0855	-0.1016
	(0.0010)	(0.0019)	(0.0015)	(0.0013)	(0.0016)	(0.0018)	(0.0032)
Log income	0.0559						
	(0.0013)						
Constant	0.7279	0.6751	0.7473	0.7255	0.7432	0.7059	0.6374
	0.0010	0.0020	0.0014	0.0013	0.0015	0.0017	0.0028
% of RI Sample	1.5	0.5	0.5	0.8	0.6	0.4	0.1
% of Sample Enrolled 2005-2008	21.6	7.4	7.0	11.3	8.0	5.7	1.9
R-squared	0.0991	0.1753	0.0715	0.1583	0.1023	0.0925	0.1155

Notes: This table presents regression coefficients of annual household portfolio equity shares on being treated with the Pension Protection Act (PPA) of 2006. "Year of" means the year the individual enrolled in their retirement plan and "x years after" is x years after they enrolled in the plan. Each column includes year dummies for each year after enrollment, and interactions of these dummies with the treatment dummy. The treatment dummy is equal to one if the individual enrolled in 2007 to a plan that switched to having a target date fund as the default following the PPA and zero if they enrolled in 2005 or 2006. The full sample is those enrolled from 2005-2008 who otherwise meet the RI sample criteria. The bottom (top) income tercile includes those whose initial income is in the lowest (highest) tercile. Columns (4)-(7) break out the result for all individuals enrolled from 2005-2008 by age at enrollment. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity portion of hybrid funds, relative to total portfolios assets. Log income, when included, is the log deviation of the individual's current income from the average income of the RI sample. Standard errors, in parentheses, are clustered at the household level.

Table A.XIX: Cross-Sectional Regressions of Realized Contribution Rate, Full Sample and by Income Terciles

	Realized contribution rate				
	(1) All Observations	(2) All Observations	(3) First Tercile of Initial Income	(4) Second Tercile of Initial Income	(5) Third Tercile of Initial Income
Age 25-27	0.0456	0.0512	0.0393	0.0520	0.0569
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Age 28-30	0.0497	0.0540	0.0425	0.0545	0.0613
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Age 31-33	0.0526	0.0558	0.0445	0.0555	0.0629
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Age 34-36	0.0545	0.0568	0.0461	0.0558	0.0632
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Age 37-39	0.0560	0.0578	0.0474	0.0564	0.0634
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age 40-42	0.0576	0.0590	0.0490	0.0576	0.0639
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Age 43-45	0.0596	0.0608	0.0514	0.0596	0.0650
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)
Age 46-48	0.0617	0.0629	0.0538	0.0622	0.0664
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)
Age 49-51	0.0662	0.0674	0.0569	0.0662	0.0719
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)
Age 52-54	0.0713	0.0727	0.0604	0.0711	0.0782
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 55-57	0.0752	0.0768	0.0637	0.0756	0.0822
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 58-60	0.0792	0.0811	0.0671	0.0805	0.0863
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 61-63	0.0833	0.0855	0.0712	0.0857	0.0902
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 64-65	0.0848	0.0873	0.0734	0.0877	0.0915
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Log income		0.0185			
		(0.0000)			
Person fixed effect?	N	N	N	N	N
% of RI Sample	41.4	41.1	12.0	13.3	12.6
R-squared	0.0472	0.0578	0.0446	0.0390	0.0385

Notes: This table presents regression coefficients of realized contribution rate on a set of demographic controls. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. The baseline specification in column (1) shows the coefficients for the regression of realized contribution rate on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XX: Cross-Sectional Regressions of Realized Contribution Rate on Age Groups by Cohort and TDF Share

	Realized contribution rate							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1943 Cohort	1953 Cohort	1963 Cohort	1973 Cohort	1983 Cohort	Initial TDF Share 75-100 %	Initial TDF Share 25-75 %	Initial TDF Share 0-25 %
Age 25-27				0.0496	0.0565	0.0492	0.0474	0.0418
				(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0000)
Age 28-30				0.0517	0.0598	0.0533	0.0535	0.0480
				(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)
Age 31-33				0.0544	0.0625	0.0561	0.0566	0.0513
				(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 34-36			0.0569	0.0568	0.0651	0.0580	0.0583	0.0529
			(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0001)
Age 37-39			0.0568	0.0586		0.0595	0.0594	0.0539
			(0.0000)	(0.0000)		(0.0000)	(0.0001)	(0.0001)
Age 40-42			0.0578	0.0606		0.0611	0.0606	0.0549
			(0.0000)	(0.0000)		(0.0000)	(0.0001)	(0.0001)
Age 43-45		0.0646	0.0597	0.0632		0.0630	0.0622	0.0565
		(0.0001)	(0.0000)	(0.0001)		(0.0000)	(0.0001)	(0.0001)
Age 46-48		0.0645	0.0619			0.0650	0.0643	0.0582
		(0.0001)	(0.0000)			(0.0000)	(0.0001)	(0.0001)
Age 49-51		0.0673	0.0670			0.0697	0.0689	0.0621
		(0.0000)	(0.0000)			(0.0000)	(0.0001)	(0.0001)
Age 52-54	0.0772	0.0719	0.0738			0.0753	0.0747	0.0673
	(0.0002)	(0.0000)	(0.0001)			(0.0001)	(0.0001)	(0.0001)
Age 55-57	0.0790	0.0759				0.0793	0.0793	0.0716
	(0.0001)	(0.0000)				(0.0001)	(0.0001)	(0.0001)
Age 58-60	0.0810	0.0807				0.0834	0.0838	0.0762
	(0.0001)	(0.0001)				(0.0001)	(0.0001)	(0.0001)
Age 61-63	0.0844	0.0859				0.0876	0.0881	0.0809
	(0.0001)	(0.0001)				(0.0001)	(0.0002)	(0.0002)
Age 65-65	0.0859	0.0894				0.0894	0.0894	0.0826
	(0.0001)	(0.0002)				(0.0001)	(0.0002)	(0.0002)
Log income	0.0145	0.0156	0.0132	0.0241	0.0336			
	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)			
Person fixed effect?	N	N	N	N	N	N	N	N
% of RI Sample	3.2	11.0	11.5	10.4	5.0	15.4	3.5	5.2
R-squared	0.0058	0.0182	0.0363	0.0358	0.0572	0.0390	0.0474	0.0486

Notes: This table presents regression coefficients of annual individual realized contribution rates on a set of demographic controls. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. Columns (1)-(5) show the results including age-group controls and a control for log income, broken out by birth cohort groups. Log income is measured as the log deviation of the individual's income from the average income of the RI sample. A cohort is defined as having been born in the ten year period beginning with the year indicated. Columns (6)-(8) show the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). The sample is our full RI sample from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XXI: Within-Person Regressions of Realized Contribution Rate, Full Sample and by Income Terciles

	Realized contribution rate				
	(1) All Observations	(2) All Observations	(3) First Tercile of Initial Income	(4) Second Tercile of Initial Income	(5) Third Tercile of Initial Income
Age 25-27	0.0271	0.0142	0.0270	0.0282	0.0436
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 28-30	0.0344	0.0221	0.0331	0.0365	0.0534
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 31-33	0.0400	0.0283	0.0379	0.0427	0.0595
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 34-36	0.0439	0.0325	0.0416	0.0469	0.0626
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 37-39	0.0468	0.0357	0.0444	0.0504	0.0643
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Age 40-42	0.0493	0.0384	0.0470	0.0538	0.0653
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Age 43-45	0.0516	0.0409	0.0495	0.0570	0.0663
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Age 46-48	0.0541	0.0434	0.0520	0.0604	0.0675
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Age 49-51	0.0586	0.0480	0.0551	0.0650	0.0724
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Age 52-54	0.0640	0.0534	0.0588	0.0704	0.0782
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 55-57	0.0686	0.0581	0.0625	0.0757	0.0824
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 58-60	0.0736	0.0630	0.0664	0.0813	0.0870
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 61-63	0.0786	0.0681	0.0707	0.0870	0.0915
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 64-65	0.0817	0.0711	0.0731	0.0900	0.0944
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Log income		-0.0108			
		(0.0001)			
Person fixed effect?	Y	Y	Y	Y	Y
% of RI Sample	41.4	41.1	12.0	13.3	12.6
R-squared	0.7684	0.7709	0.7755	0.7635	0.7355

Notes: This table presents regression coefficients of realized contribution rate on a set of demographic controls. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. The baseline specification in column (1) shows the coefficients for the regression of realized contribution rate on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XXII: Within-Person Regressions of Realized Contribution Rate on Age Groups by Cohort and TDF Share

	Realized contribution rate							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1943 Cohort	1953 Cohort	1963 Cohort	1973 Cohort	1983 Cohort	Initial TDF Share 75-100 %	Initial TDF Share 25-75 %	Initial TDF Share 0-25 %
Age 25-27				0.0376	0.0570	0.0448	0.0926	0.0583
				(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0003)
Age 28-30				0.0428	0.0651	0.0510	0.1013	0.0682
				(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0003)
Age 31-33				0.0474	0.0725	0.0550	0.1067	0.0756
				(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0003)
Age 34-36			0.0468	0.0513	0.0777	0.0577	0.1101	0.0809
			(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0003)
Age 37-39			0.0474	0.0549		0.0598	0.1124	0.0851
			(0.0001)	(0.0001)		(0.0001)	(0.0003)	(0.0003)
Age 40-42			0.0488	0.0588		0.0616	0.1145	0.0886
			(0.0001)	(0.0000)		(0.0001)	(0.0003)	(0.0003)
Age 43-45		0.0688	0.0510	0.0607		0.0633	0.1164	0.0919
		(0.0002)	(0.0001)	(0.0000)		(0.0001)	(0.0003)	(0.0003)
Age 46-48		0.0689	0.0538			0.0653	0.1183	0.0950
		(0.0001)	(0.0001)			(0.0001)	(0.0003)	(0.0003)
Age 49-51		0.0716	0.0594			0.0698	0.1223	0.0996
		(0.0001)	(0.0000)			(0.0001)	(0.0002)	(0.0003)
Age 52-54	0.0946	0.0764	0.0690			0.0751	0.1272	0.1051
	(0.0002)	(0.0001)	(0.0001)			(0.0001)	(0.0002)	(0.0003)
Age 55-57	0.0964	0.0811				0.0795	0.1314	0.1098
	(0.0001)	(0.0001)				(0.0001)	(0.0002)	(0.0002)
Age 58-60	0.0974	0.0868				0.0841	0.1356	0.1150
	(0.0001)	(0.0001)				(0.0001)	(0.0002)	(0.0002)
Age 61-63	0.1006	0.0936				0.0884	0.1397	0.1205
	(0.0001)	(0.0001)				(0.0001)	(0.0002)	(0.0002)
Age 64-65	0.1039	0.0941				0.0906	0.1414	0.1238
	(0.0001)	(0.0000)				(0.0001)	(0.0001)	(0.0000)
Log income	-0.0131	-0.0159	-0.0155	-0.0079	0.0039			
	(0.0003)	(0.0002)	(0.0001)	(0.0001)	(0.0002)			
Person fixed effect?	Y	Y	Y	Y	Y	Y	Y	Y
% of RI Sample	3.2	11.0	11.5	10.4	5.0	15.4	3.5	5.2
R-squared	0.8156	0.7798	0.7505	0.7139	0.7412	0.7511	0.7482	0.7396

Notes: This table presents regression coefficients of annual individual realized contribution rates on a set of demographic controls. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. Columns (1)-(5) show the results including age-group controls and a control for log income, broken out by birth cohort groups. Log income is measured as the log deviation of the individual's income from the average income of the RI sample. A cohort is defined as having been born in the ten year period beginning with the year indicated. Columns (6)-(8) show the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full RI sample from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XXIII: Regressions of Realized Contribution Rate on Maxing Out on Contribution Limit

	Realized contribution rate			
	(1) All Observations	(2) All Observations	(3) All Observations	(4) All Observations
Max Out	0.0584 (0.0001)	0.0590 (0.0001)		
Max Out Ever			0.0403 (0.0001)	0.0475 (0.0001)
Age 25-34	0.0477 (0.0000)	0.0475 (0.0000)	0.0458 (0.0000)	0.0430 (0.0000)
Age 35-44	0.0528 (0.0000)	0.0528 (0.0000)	0.0495 (0.0000)	0.0479 (0.0000)
Age 45-54	0.0613 (0.0000)	0.0613 (0.0000)	0.0574 (0.0000)	0.0561 (0.0000)
Age 55-65	0.0735 (0.0000)	0.0735 (0.0000)	0.0696 (0.0000)	0.0681 (0.0000)
Log income		-0.0014 (0.0001)		-0.01235 (0.0001)
Age 35-44 x Max Out	-0.0173 (0.0001)	-0.0174 (0.0001)		
Age 45-54 x Max Out	-0.0184 (0.0001)	-0.0185 (0.0001)		
Age 55-65 x Max Out	-0.0056 (0.0001)	-0.0057 (0.0002)		
Age 35-44 x Max Out Ever			-0.0031 (0.0001)	-0.0027 (0.0001)
Age 45-54 x Max Out Ever			-0.0005 (0.0001)	0.0003 (0.0001)
Age 55-65 x Max Out Ever			0.0104 (0.0001)	0.0111 (0.0001)
Person fixed effect?	N	N	N	N
Percentage of Total Sample	44.9	41.3	44.9	41.3
R-squared	0.1118	0.1123	0.1473	0.1518

Notes: This table presents regression coefficients of annual realized contribution rates on measures of maxing out on retirement contributions. The realized contribution rate is the percentage of an individual's annual income that has been invested into a retirement account over the previous year, calculated at the end of each calendar year. Maxing out is defined as when an individual exceeds the dollar amount that is allowed for 401(k) contributions in a year, set by the IRS. Columns (1)-(2) contain a dummy for maxing out that it set to one if the individual maxes out their contribution in the current year. Columns (3)-(4) contain a dummy for maxing out that is set to one if the individual has *ever* maxed out their contribution while we observe them in our sample. Each specification also contains interactions of the corresponding max out measure with age group dummies. Log income is measured in the first (or second, if first is not available) year that we observe the individual. We then take the log deviation of the first year's income from the RI sample's average. The sample is our full RI sample from 2006-2017. Standard errors, in parentheses, are clustered at the household level.

Table A.XXIV: Regressions of Reported Contribution Rate on the Pension Protection Act: Long-run Effect, Treated in 2007 Only

	Reported contribution rate						
	(1) Full Sample	(2) Bottom Income Tercile	(3) Top Income Tercile	(4) Age Enrolled 25-34	(5) Age Enrolled 35-44	(6) Age Enrolled 45-54	(7) Age Enrolled 55-65
Year of x Treatment	-0.0049	-0.0059	-0.0047	-0.0034	-0.0059	-0.0067	-0.0095
	(0.0003)	(0.0004)	(0.0005)	(0.0003)	(0.0005)	(0.0006)	(0.0010)
1 Year After x Treatment	-0.0104	-0.0084	-0.0120	-0.0078	-0.0105	-0.0121	-0.0140
	(0.0001)	(0.0002)	(0.0003)	(0.0001)	(0.0002)	(0.0003)	(0.0007)
2 Years After x Treatment	-0.0074	-0.0070	-0.0086	-0.0055	-0.0069	-0.0098	-0.0117
	(0.0001)	(0.0002)	(0.0003)	(0.0001)	(0.0002)	(0.0003)	(0.0006)
3 Years After x Treatment	-0.0026	-0.0030	-0.0032	-0.0015	-0.0025	-0.0046	-0.0058
	(0.0001)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)	(0.0006)
4 Years After x Treatment	-0.0016	-0.0016	-0.0027	-0.0010	-0.0027	-0.0055	-0.0070
	(0.0001)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0003)	(0.0007)
5 Years After x Treatment	-0.0008	0.0001	-0.0032	-0.0012	-0.0025	-0.0041	-0.0045
	(0.0001)	(0.0002)	(0.0004)	(0.0002)	(0.0002)	(0.0004)	(0.0008)
1 Year After	-0.0039	-0.0064	-0.0036	-0.0062	-0.0034	0.0029	0.0017
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0006)
2 Years After	-0.0091	-0.0093	-0.0093	-0.0094	-0.0115	-0.0051	-0.0075
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0007)
3 Years After	-0.0126	-0.0125	-0.0123	-0.0117	-0.0157	-0.0105	-0.0142
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0007)
4 Years After	-0.0129	-0.0135	-0.0117	-0.0113	-0.0163	-0.0114	-0.0148
	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0004)	(0.0007)
5 Years After	-0.0131	-0.0144	-0.0110	-0.0114	-0.0170	-0.0127	-0.0170
	(0.0002)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0004)	(0.0008)
Log income	0.0429						
	(0.0002)						
Constant	0.0806	0.0698	0.0982	0.0706	0.0826	0.0891	0.1047
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0004)	(0.0003)
Firm Fixed Effect?	Y	Y	Y	Y	Y	Y	Y
% of RI Sample	1.9	0.7	0.6	1.0	0.7	0.5	0.2
% of Sample Enrolled 2005-2008	27.7	9.7	8.9	14.4	10.0	7.0	2.3
R-squared	0.1512	0.1213	0.0840	0.1355	0.1232	0.1120	0.1476

Notes: This table presents regression coefficients of reported contribution rate on being treated with the Pension Protection Act (PPA) of 2006. "Year of" means the year the individual enrolled in their retirement plan and "x years after" is x years after they enrolled in the plan. Each column includes year dummies for each year after enrollment, and interactions of these dummies with the treatment dummy. The treatment dummy is equal to one if the individual enrolled in 2007 immediately after the PPA, and zero if they enrolled in 2005 or 2006. The full sample is those enrolled from 2005-2007 who otherwise meet the RI sample criteria. The bottom (top) income tercile includes those whose initial income is in the lowest (highest) tercile. Columns (4)-(7) break out the result for all individuals enrolled from 2005-2007 by age at enrollment. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. Log income, when included, is the log deviation of the individual's current income from the average income of the RI sample. Standard errors, in parentheses, are clustered at the household level.

Table A.XXV: Cross-Sectional Regressions of Reported Contribution Rate, Full Sample and by Income Terciles

	Reported contribution rate				
	(1) All Observations	(2) All Observations	(3) First Tercile of Initial Income	(4) Second Tercile of Initial Income	(5) Third Tercile of Initial Income
Age 25-27	0.0573	0.0715	0.0497	0.0632	0.0752
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Age 28-30	0.0611	0.0720	0.0519	0.0654	0.0797
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Age 31-33	0.0643	0.0725	0.0535	0.0664	0.0815
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Age 34-36	0.0668	0.0729	0.0549	0.0666	0.0825
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Age 37-39	0.0691	0.0736	0.0562	0.0670	0.0834
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 40-42	0.0716	0.0751	0.0580	0.0681	0.0847
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 43-45	0.0742	0.0773	0.0606	0.0702	0.0863
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 46-48	0.0770	0.0798	0.0634	0.0730	0.0882
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 49-51	0.0822	0.0853	0.0667	0.0775	0.0950
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 52-54	0.0876	0.0912	0.0703	0.0826	0.1019
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 55-57	0.0920	0.0960	0.0738	0.0875	0.1067
	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Age 58-60	0.0962	0.1010	0.0774	0.0928	0.1113
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 61-63	0.1000	0.1055	0.0815	0.0975	0.1152
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 64-65	0.0997	0.0927	0.0880	0.1052	0.1276
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Log income		0.0492			
		(0.0001)			
Person fixed effect?	N	N	N	N	N
% of RI Sample	45.6	33.7	10.5	12.0	11.6
R-squared	0.0507	0.1040	0.0447	0.0376	0.0372

Notes: This table presents regression coefficients of reported contribution rate on a set of demographic controls. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The baseline specification in column (1) shows the coefficients for the regression of reported contribution rate on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XXVI: Within-Person Regressions of Reported Contribution Rate, Full Sample and by Income Terciles

	Reported contribution rate				
	(1) All Observations	(2) All Observations	(3) First Tercile of Initial Income	(4) Second Tercile of Initial Income	(5) Third Tercile of Initial Income
Age 25-27	0.0345	0.0306	0.0373	0.0380	0.0547
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0003)
Age 28-30	0.0407	0.0359	0.0422	0.0453	0.0645
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 31-33	0.0463	0.0406	0.0467	0.0515	0.0714
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 34-36	0.0507	0.0444	0.0505	0.0562	0.0763
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 37-39	0.0545	0.0476	0.0538	0.0602	0.0799
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 40-42	0.0582	0.0507	0.0568	0.0640	0.0832
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 43-45	0.0616	0.0538	0.0597	0.0677	0.0862
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 46-48	0.0653	0.0571	0.0628	0.0716	0.0893
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 49-51	0.0714	0.0631	0.0664	0.0768	0.0970
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Age 52-54	0.0778	0.0696	0.0707	0.0825	0.1048
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Age 55-57	0.0837	0.0756	0.0750	0.0885	0.1111
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 58-60	0.0899	0.0819	0.0797	0.0949	0.1174
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 61-63	0.0959	0.0884	0.0848	0.1013	0.1236
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 64-65	0.0997	0.0927	0.0880	0.1052	0.1276
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Log income		0.0212			
		(0.0001)			
Person fixed effect?	Y	Y	Y	Y	Y
% of RI Sample	45.6	33.7	10.5	12.0	11.6
R-squared	0.7764	0.7870	0.7809	0.7649	0.7438

Notes: This table presents regression coefficients of reported contribution rate on a set of demographic controls. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The baseline specification in column (1) shows the coefficients for the regression of reported contribution rate on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XXVII: Cross-Sectional Regressions of Reported Contribution Rate on Age Groups by Cohort and TDF Share

	Reported contribution rate							
	(1) 1943 Cohort	(2) 1953 Cohort	(3) 1963 Cohort	(4) 1973 Cohort	(5) 1983 Cohort	(6) Initial TDF Share 75-100 %	(7) Initial TDF Share 25-75 %	(8) Initial TDF Share 0-25 %
Age 25-27				0.0699	0.0728	0.0637	0.0604	0.0536
				(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 28-30				0.0684	0.0749	0.0657	0.0644	0.0585
				(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)
Age 31-33				0.0700	0.0776	0.0687	0.0676	0.0622
				(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 34-36			0.0752	0.0719	0.0808	0.0714	0.0699	0.0645
			(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age 37-39			0.0728	0.0740		0.0741	0.0718	0.0665
			(0.0001)	(0.0000)		(0.0001)	(0.0001)	(0.0001)
Age 40-42			0.0737	0.0768		0.0767	0.0739	0.0684
			(0.0000)	(0.0001)		(0.0001)	(0.0001)	(0.0001)
Age 43-45		0.0846	0.0757	0.0807		0.0795	0.0763	0.0705
		(0.0001)	(0.0000)	(0.0001)		(0.0001)	(0.0001)	(0.0001)
Age 46-48		0.0821	0.0788			0.0823	0.0788	0.0726
		(0.0001)	(0.0000)			(0.0000)	(0.0001)	(0.0001)
Age 49-51		0.0854	0.0850			0.0882	0.0843	0.0771
		(0.0001)	(0.0001)			(0.0001)	(0.0001)	(0.0001)
Age 52-54	0.0994	0.0904	0.0928			0.0941	0.0903	0.0823
	(0.0002)	(0.0001)	(0.0001)			(0.0001)	(0.0001)	(0.0001)
Age 55-57	0.1005	0.0952				0.0988	0.0954	0.0871
	(0.0001)	(0.0001)				(0.0001)	(0.0001)	(0.0001)
Age 58-60	0.1016	0.1009				0.1032	0.1000	0.0918
	(0.0001)	(0.0001)				(0.0001)	(0.0001)	(0.0002)
Age 61-63	0.1049	0.1064				0.1072	0.1037	0.0961
	(0.0001)	(0.0001)				(0.0001)	(0.0002)	(0.0002)
Age 65-65	0.1065	0.1100				0.1088	0.1050	0.0976
	(0.0001)	(0.0002)				(0.0001)	(0.0002)	(0.0003)
Log income	0.0496	0.0510	0.0450	0.0507	0.0520			
	(0.0003)	(0.0001)	(0.0001)	(0.0001)	(0.0001)			
Person fixed effect?	N	N	N	N	N	N	N	N
% of RI Sample	2.4	9.0	9.6	8.6	4.2	16.9	4.0	5.9
R-squared	0.0410	0.0597	0.0358	0.0834	0.0873	0.0440	0.0482	0.0515

Notes: This table presents regression coefficients of annual individual reported contribution rates on a set of demographic controls. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. Columns (1)-(5) show the results including age-group controls and a control for log income, broken out by birth cohort groups. Log income is measured as the log deviation of the individual's income from the average income of the RI sample. A cohort is defined as having been born in the ten-year period beginning with the year indicated. Columns (6)-(8) show the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). The sample is our full RI sample from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.

Table A.XXVIII: Cross-Sectional Regressions of Reported Contribution Rate, Full Sample and by Cohort, SEs Clustered at the Employer Level

	Reported contribution rate						
	(1) All Observations	(2) All Observations	(3) 1943 Cohort	(4) 1953 Cohort	(5) 1963 Cohort	(6) 1973 Cohort	(7) 1983 Cohort
Age 25-27	0.0573 (0.0120)	0.0715 (0.0018)				0.0699 (0.0003)	0.0728 (0.0002)
Age 28-30	0.0611 (0.0087)	0.0720 (0.0014)				0.0684 (0.0003)	0.0749 (0.0001)
Age 31-33	0.0643 (0.0077)	0.0725 (0.0012)				0.0700 (0.0002)	0.0776 (0.0001)
Age 34-36	0.0668 (0.0061)	0.0729 (0.001)			0.0752 (0.0025)	0.0719 (0.0002)	0.0808 (0.0002)
Age 37-39	0.0691 (0.0100)	0.0736 (0.0010)			0.0728 (0.0016)	0.0740 (0.0005)	
Age 40-42	0.0716 (0.0092)	0.0751 (0.0015)			0.0737 (0.0007)	0.0768 (0.0005)	
Age 43-45	0.0742 (0.0110)	0.0773 (0.0015)		0.0846 (0.0121)	0.0757 (0.0009)	0.0807 (0.0010)	
Age 46-48	0.0770 (0.0102)	0.0798 (0.0011)		0.0821 (0.0033)	0.0788 (0.0006)		
Age 49-51	0.0822 (0.0087)	0.0853 (0.0014)		0.0854 (0.0016)	0.0850 (0.0011)		
Age 52-54	0.0876 (0.0106)	0.0912 (0.0011)	0.0994 (0.0011)	0.0904 (0.0008)	0.0928 (0.0004)		
Age 55-57	0.0920 (0.0090)	0.0960 (0.0017)	0.1005 (0.0019)	0.0952 (0.0009)			
Age 58-60	0.0962 (0.0153)	0.1010 (0.0021)	0.1016 (0.0005)	0.1009 (0.0013)			
Age 61-63	0.1000 (0.0220)	0.1055 (0.0038)	0.1049 (0.0011)	0.1064 (0.0021)			
Age 64-65	0.0997 (0.0662)	0.0927 (0.0076)	0.1065 (0.0015)	0.1100 (0.0192)			
Log income		0.0492 (0.0016)	0.0496 (0.0010)	0.0510 (0.0010)	0.0450 (0.0006)	0.0507 (0.0005)	0.0520 (0.0005)
Person fixed effect?	N	N	N	N	N	N	N
% of RI Sample	45.6	33.7	2.4	9.0	9.6	8.6	4.2
R-squared	0.0507	0.1040	0.0410	0.0597	0.0358	0.0834	0.0873

Notes: This table presents regression coefficients of reported contribution rate on a set of demographic controls. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. The baseline specification in column (1) shows the coefficients for the regression of reported contribution rate on age group dummies. In the second column, we add a control for the log of income in the current year, measured as the individual's log deviation from the average income in the RI sample. Columns (3)-(5) show the results of the baseline specification for the first (lowest) through the third tercile of initial income, respectively. Initial income is based upon the income observed in the first (or second, if first is not available) year that we observe the individual. The sample is our full set of retirement investors (RI) from 2006-2018. Standard errors, in parentheses, are clustered at the employer level.

Table A.XXIX: Within-Person Regressions of Reported Contribution Rate on Age Groups by Cohort and TDF Share

	Reported contribution rate							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1943 Cohort	1953 Cohort	1963 Cohort	1973 Cohort	1983 Cohort	Initial TDF Share 75-100 %	Initial TDF Share 25-75 %	Initial TDF Share 0-25 %
Age 25-27				0.0577	0.0791	0.0598	0.1062	0.0632
				(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0003)
Age 28-30				0.0586	0.0856	0.0633	0.1121	0.0707
				(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0003)
Age 31-33				0.0617	0.0927	0.0670	0.1172	0.0774
				(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0003)
Age 34-36			0.0641	0.0650	0.0986	0.0703	0.1214	0.0827
			(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0003)	(0.0003)
Age 37-39			0.0618	0.0693		0.0733	0.1248	0.0873
			(0.0001)	(0.0001)		(0.0001)	(0.0003)	(0.0003)
Age 40-42			0.0631	0.0743		0.0762	0.1283	0.0916
			(0.0001)	(0.0001)		(0.0001)	(0.0003)	(0.0003)
Age 43-45		0.0877	0.0656	0.0817		0.0790	0.1315	0.0956
		(0.0002)	(0.0001)	(0.0000)		(0.0001)	(0.0003)	(0.0003)
Age 46-48		0.0855	0.0695			0.0820	0.1347	0.0995
		(0.0002)	(0.0001)			(0.0001)	(0.0003)	(0.0003)
Age 49-51		0.0888	0.0768			0.0881	0.1407	0.1053
		(0.0001)	(0.0001)			(0.0001)	(0.0002)	(0.0003)
Age 52-54	0.1206	0.0944	0.0802			0.0943	0.1471	0.1116
	(0.0002)	(0.0001)	(0.0001)			(0.0001)	(0.0002)	(0.0003)
Age 55-57	0.1209	0.1005				0.0997	0.1531	0.1176
	(0.0001)	(0.0001)				(0.0001)	(0.0002)	(0.0002)
Age 58-60	0.1215	0.1081				0.1053	0.1591	0.1240
	(0.0001)	(0.0001)				(0.0001)	(0.0002)	(0.0002)
Age 61-63	0.1260	0.1166				0.1104	0.1643	0.1303
	(0.0001)	(0.0001)				(0.0001)	(0.0001)	(0.0002)
Age 64-65	0.1316	0.1194				0.1133	0.1674	0.1342
	(0.0000)	(0.0000)				(0.0000)	(0.0000)	(0.0000)
Log income	0.0231	0.0237	0.0180	0.0182	0.0241			
	(0.0004)	(0.0002)	(0.0002)	(0.0002)	(0.0002)			
Person fixed effect?	Y	Y	Y	Y	Y	Y	Y	Y
% of RI Sample	2.4	9.0	9.6	8.6	4.2	16.9	4.0	5.9
R-squared	0.8488	0.7977	0.7666	0.7325	0.7472	0.7599	0.7601	0.7497

Notes: This table presents regression coefficients of annual individual reported contribution rates on a set of demographic controls. The reported contribution rate is the percentage of their income that an individual designates to be allocated into their retirement accounts at the beginning of each calendar year. Columns (1)-(5) show the results including age-group controls and a control for log income, broken out by birth cohort groups. Log income is measured as the log deviation of the individual's income from the average income of the RI sample. A cohort is defined as having been born in the ten year period beginning with the year indicated. Columns (6)-(8) show the results for different groups based on the initial share of their portfolio that is invested in target date funds (TDFs). All regressions include a person fixed effect. The age group coefficients are normalized by adding the average fixed effect back to the estimated coefficients. The excluded age group is those aged 64-65. The sample is our full RI sample from 2006-2018. Standard errors, in parentheses, are clustered at the individual level.