Household Portfolios and Retirement Saving over the Life Cycle*

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Abstract

This paper shows that middle-class investors in the United States hold more than two thirds of their investable wealth in equities during their working lives, and that this share has a clear life-cycle pattern, rising modestly early in life and falling significantly as people approach retirement. Prior to 2000, investors held less investable wealth in equity and did not adjust the share over the working life. Further equity shares have become less dependent on income or wealth. While these changes in portfolio behavior changes are part of a broad, secular trend, they have been accelerated by the development and regulation of target date funds (TDFs). The Pension Protection Act (PPA) of 2006 allowed the use of TDFs as default options in retirement saving plans. We compare investors who enroll in the same savings plan shortly before and after the PPA, and find that those enrolling afterwards – who are defaulted into TDFs – have higher equity shares that decrease by more as they approach retirement. We also study retirement contribution rates over the life-cycle and find that in contrast to portfolio choices, these rates have been relatively stable, are increasing over the life-cycle, and are similar across cohorts and initial enrollment dates.

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Over the past four decades, there has been a dramatic shift in the financial landscape faced by the typical American investor. The broad-based shift from defined-benefit pension plans to defined-contribution (DC) plans has required individuals to take a more active role in making their own saving and investment decisions. This shift has been accompanied by changes both in financial regulation and in the financial products available to retail investors. As a result of these changes, more than half of American households now accumulate significant financial wealth by the time they retire, and must decide how to accumulate and allocate this wealth during their working lives.

Using anonymized account-level data from a large financial services firm, we document the lifecycle patterns of investment and retirement saving of American middle-class and upper-middle class investors, and how and why these patterns have changed since the end of the 20$^{\text{th}}$ century. We have three main sets of findings. First, these "typical" American investors hold roughly 70% of their financial wealth in equities, and the percent invested in equity has a concave lifecycle pattern, peaking around age 50 and then decreasing as retirement approaches. The average share invested in equity is significantly higher than measured in the Survey of Consumer Finances (SCF), a difference we largely attribute to respondents in the SCF understating the equity share in hybrid funds. Both this high level of equity investment and its lifecyle pattern are relatively recent developments. Investors in the 1990s held a lower fraction of their investable wealth in equity and did little re-balancing towards safe assets as they aged (see Ameriks and Zeldes, 2004).

Second, financial innovation and changes in regulation play an important role in accelarating the change to these new investment behaviors. In particular, we show that both the development of target dates funds (TDFs) and the passage of the Pension Protection Act of 2006 (PPA), which allowed the use of TDFs as default investment options in retirement plans, had a significant impact on the equity allocation of younger cohorts and on their re-balancing out of equity as they age. The impact of the PPA appears transitory however, as the adoption of TDFs becomes widespread within younger cohorts. Consistent with the rise of TDFs, we show that stock market participation is less dependent on income for younger cohorts, and even lower-income households are participating more in the stock market when young.

Our third and final set of results is that retirement saving rates among investors with retirement wealth increase steadily with age, almost doubling between age 25 and 65. In contrast to the evidence on portfolio allocations across cohorts, saving behavior has been stable, both across cohorts and around the PPA of 2006, suggesting at most minor effects of retirement saving products and regulation on the level of savings over the past two decades.

As nicely elucidated by Campbell (2016), the institutions and law surrounding household finance can be structured to facilitate optimal behavior. Our findings suggests that the security design and regulation leading to the rise of TDFs has facilitated portfolio choice by investors that is likely closer to optimal according to many proscriptive models. At the same time, the changes in retirement plan regulation and structure have been associated with minimal changes in retirement saving rates.

Our findings are based on 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. We focus on a sub-sample that is reasonably representative of the "typical" American retail investor with some retirement savings: investors with retirement savings accounts in the middle 80 percent of the age-adjusted distribution of retirement wealth, who we call *retirement investors* (RIs). Our analysis focuses on *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, and on *saving rates* defined primarily as (realized) retirement contribution rates (the vast majority of inflows into financial wealth among our retirement investors).

We first document that during the last two decades this sample of US middle-class and upper-middle class investors on average invest nearly 70% of their investable wealth in equities, a number that is higher than other sources report and higher than in prior decades. The 2016 SCF shows an average share of only 54% of investable wealth in a comparable sample. We present several pieces of evidence that this difference is significantly driven by under-reporting of equity shares in the SCF, and in particular by survey respondents (and SCF assumptions in data processing) underestimating the equity component of Target Date Funds (TDFs). This stylized fact also appears to be a change from previous behavior: using administrative data on retirement savings prior to 2000, Ameriks and Zeldes (2004) reports an average equity share of only 58%.

In addition, the cross-sectional pattern of equity shares has a declining pattern across ages. The average equity share varies from 74% for 25 years olds to 55% for 65 year olds, and is similar across different terciles in the income distribution. The SCF shows a decline of only about a third as large. This fact also appears to be a change from the period before 2000. Ameriks and Zeldes (2004) reports similar equity shares across ages.

We show that this cross-sectional pattern is driven by two separate factors: changes in allocation across time as each cohort ages, and differences in the portfolio allocations across birth cohorts.

First, controlling for cohorts by tracking individuals over time, we find that a cohort's average equity share increases by 7% as people ages from 25 to 50 (and moves through calendar time), and then falls by the same amount from age from 50 to 65, as people reallocate financial wealth into safer assets, such as fixed income or cash-like securities. . In contrast, Ameriks and Zeldes (2004) shows that in the 1990's investors held a roughly constant equity share of financial wealth as they aged. This age pattern we find explains about 6-7 percentage points (or a quarter of the variation) of the within-person portfolio reallocation as individuals age. This pattern is similar across terciles of (ex ante) income, and while log income levels explain about half of the (cross sectional) level differences in equity shares across people, it does not drive the way in which equity shares change as investors age.

Second, more recent (younger) birth cohorts have somewhat higher equity shares than prior cohorts 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 some evidence that younger cohorts rebalance more as they age than older cohorts. These patterns are even stronger when we control for income (potentially important since younger cohorts have broader stock market participation).

Why has investor behavior changed from the 1990s? We show that the increased allocation to equity early in life and rebalancing over time into safe assets was at least accelerated by, if not significantly driven by, the growth of Target Date funds (TDFs) facilitated by changes in pension law. TDFs are mutual funds that maintain 'age-appropriate' portfolio shares in different asset classes, mainly diversified equity and fixed income funds. Like the new pattern of investment that we uncover, a typical TDF allocates 80 to 90 percent of its assets to diversified equity and the remainder to bonds early in a persons life. Roughly 20 years before the investors' target retirement date, the TDF starts re-balancing the portfolio towards safe assets so as to reach a roughly even allocation between stocks and bonds by the target retirement date.[1] The Pension Protection Act (PPA) of 2006 sanctioned the use of TDFs as "Qualified Default Investment Alternatives" (QDIA) in 401(k) plans. Following this change in regulation, investment in TDFs increased dramatically, reaching $1.4 trillion

[1]These allocations are typical for TDFs across all investment managers. See for example Parker et al. (2020) for more information about general trends in TDF ownership.

in 2019 (Investment Company Institute, 2020). Prior to the PPA, most QDIAs were money market funds.

When the PPA was implemented in 2006, many firms introduced TDFs as the default investment fund in their 401(k) plans. In these cases, new enrollees in any plan (primarily new employees) are defaulted into a TDF absent actively making a different choice. Existing plan participants (employees) are unaffected by the change in default.[2] As a result, employees hired by these firms after 2006 – mostly younger people – who accept the default allocation are allocated to funds with roughly 90% invested in equity instead of 0%. And even those new hires who make active decisions may be influenced by the default.

We estimate the effect of the change in default in 2006 by comparing the equity shares of people who first enroll in a retirement plan in the two years before the Pension Protection Act and those who first enroll in the same plan with the same employer in the two years after. Because the regulation permitted but did not require employers to change the default allocation, we focus on firms that adopted TDFs as defaults in 2007.[3] This comparison measures the causal effect of the adoption of a TDF as default if employees do not endogenously time their start date at a company based on the change and if employers do not change their default in response to employee demand.

We find that the introduction of a TDF as the QDIA leads new enrollees to have significantly higher equity shares compared to enrollees starting prior to the switch. This difference occurs primarily for the young. The difference in the equity share of the youngest cohort (people 25-35 years at job start) is more than 5 percentage points higher for those enrolling after the TDF is adopted as the default. This difference is smaller for older enrollees, and even reverses for the oldest groups, consistent with the equity allocation prescribed by the glide path of target date funds. The effect of the QDIA on the young is persistent over at least several years. The effect is also much stronger for lower income investors. However, we also see that five years after enrolling the equity share of those who did not receive the TDF as QDIA starts to rise to that of the equity share of those that did. This increased equity share among 'untreated' investors suggests that investors started actively choosing to invest in TDFs, consistent with the large increase in funds in TDFs. Many investors in the control group were likely to be directed to TDFs going

[2]More recently, many plans have adopted automatic re-enrollment for existing employees. In automatic re-enrollment, retirement contributions of existing employees are (potentially) changed to being invested in the default fund unless these employees actively choose different allocations.

[3]We also repeat the analysis for all employers independent of their default option, though these estimates are much noisier since many employers took many years to change their default options.

forward, whether because their employer added a TDF option (independent of the default), or because they changed jobs. In other words, employers and other forces in the market actively encouraged retail investors to adopt a portfolio allocation over their life cycle that is more in line with textbook recommendations, even if they were not originally defaulted into the allocation.

In the third and last part of our paper, we show that retirement saving increases steadily over the life-cycle and that this behavior is relatively stable across cohorts and over time. We measure retirement saving by both elective (possibly default) contribution rates to retirement saving plans and ensure, in two different ways, that none of our conclusions are driven by people hitting the legal limit on contributions in a year. Across ages in the cross-section, contribution rates average 4.5% at 25 years of age and 8.5% at 65 year of age. While there is significant heterogeneity in the level of contribution rates across income terciles, the pattern across ages is similar. For example, across all ages, the bottom tercile of the income distribution has an almost two percentage point lower contribution rate than the top tercile: 3.9% compared to 5.7% at age 25, and 7.3% compared to 9.2% at age 65.

Unlike for portfolio allocations, we find that there has been little change in saving behavior across cohorts over time. That is, the level and age-pattern of saving in the cross-section is matched almost exactly by people's behavior as they age regardless of their cohort. Holding constant the person fixed effect, we find that between the age of 25 and 65 the average person increases their contribution rate by about 4.5 percentage points, only slightly larger than the increase in the cross-section. There is some slight evidence that the within person changes in contribution rates rise slightly more quickly for younger cohorts, though older cohorts started at higher contribution levels. And the oldest cohort, those born between 1943 and 1953, have contribution rates are about 0.5 percentage points higher in levels than the other cohorts. Similar to our analysis of portfolios, the life-cycle pattern of saving is similar after controlling for (log) annual income, and the cross-sectional pattern of saving by income group is matched by each cohort in that income group.

Finally, comparing people enrolling before and after the PPA, which had several provisions intended to increase savings (Choi et al. (2004)), we find that people enrolling after the act had not just similar contribution rates to those enrolling before the Act, but actually slightly lower contribution rates. Thus despite large changes over time in plan design and regulation, contribution rates to retirement saving plans among our sample of retirement investors have remained relatively stable.

Literature Review For portfolio choice, our paper is most closely related to the measurement of household portfolio allocations over the lifecycle and builds most directly on Ameriks and Zeldes (2004). Poterba and Samwick (2001) also find 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 et al., 2017). [4]

Our paper in part 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 et al. (2007), and Storesletten et al. (2007). Other examples that have been studied include non-standard utility functions, differences in risk aversion, and differences in beliefs.[5]

Our paper in part informs the study of institutions and the causes of changes in portfolio behavior. More closely related to our work, Mitchell and Utkus (2020), using Vanguard data, look at the effect of TDFs on existing employees and new entrants under both voluntary choice and automatic enrollment plans. They show 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 to our findings, TDF investors held substantially more in equity: 81% for TDF investors compared to 63% for those without TDFs.

For the lifecycle pattern of saving, as for portfolio choice, there is a large proscriptive literature concerned with what amount of saving households should be doing (e.g. Lusardi and Mitchell, 2007; Scholz et al., 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) suggest that more than 75% of US retirement savers display a significant shortfall in their contributions relative to an optimal

[4]There are substantial differences in portfolios across countries (Guiso et al., 2003b,a), for example Christelis et al. (2013) show that US household have higher levels of stock ownership and stock market participation than most European households (49.7% versus 26%).

[5]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. (2018) and Giglio et al. (2019).

consumption model. Poterba et al. (2011) similarly show that household have inadequate financial wealth to support retirement and for more than 70% of household social security is their major asset.

The invariance of retirement saving rates to large changes in regulation and defaults during our sample suggests that, in contrast to portfolio choice, the changes in regulation and retirement plan design have not meaningfully impacted retirement saving rates. This finding stands in contrast to the large effects of default enrollment for participation in DC plans (Madrian and Shea (2001), and Choi et al. (2004)). With automatic enrollment, 401(k) participation rates exceed 85% in all three companies the authors study, regardless of the tenure of the employee. Prior to automatic enrollment, participation rates ranged from 26–43% after 6 months of tenure. Under automatic enrollment, 65–87% of new plan participants save at the default contribution rate and invest exclusively in the default fund.

1 Data

This section describes the account-level dataset and then how we create a subsample that is representative of typical American retirement investors over their working lives.[6]

1.1 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 the 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; we aggregate all observed flows within each calendar year.

We focus on *investable wealth* defined as money market funds, non-money market funds, individual stocks and bonds, certificate of deposits, quasi-liquid retirement wealth, and

[6] In a method closely related to Meeuwis et al. (2018)

other managed accounts.[7] 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 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, martial status, and zip code. 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.

While these data provide a detailed view of portfolio allocations for a large number of US investors, there are two potential weaknesses 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 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 weakness is that we do not necessarily observe all the investable wealth of the people in our sample because we do not observe wealth at other institutions.[8]

1.2 Retirement investor subsample

Our firm's data mainly includes typical working Americans with retirement saving during their working lives, which makes it useful for characterising the investment behavior of this population. However, we want to both minimize and evaluate the importance of the two concerns just raised. Thus we define a sub-sample of people that are well-represented in our data and that we can confirm are broadly similar to the same sub-sample in the US population. Specifically, we define a sample of *retirement investor* (RIs) that we can compare to a similarly-defined sample in the Survey of Consumer Finances (SCF).

First, we restrict our retirement investor sample to investors that are between 25 and

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

[8]Note that we are only concerned about missing investable wealth. In our analysis of 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.

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 in 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 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 our data has few very wealthy. 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. Using individual investors aged 25-85 with some retirement wealth, we run quantile regressions of the log of individual's retirement wealth (comparable to the measures in the 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.[9] In the SCF, these individual retirement investors make up 28% of the population of US households and 38% of the population of households aged 25-65. They hold 33% (39%) of all household investable (retirement) wealth, and 52% (54%) of investable (retirement) wealth among households age 25-65. Approximately 33% of both retirement wealth and investable wealth is held by the top ten percent. Approximately 30% of retirement wealth and investable wealth is held by those aged 66-85.

Retirement investors – households between 25 and 65 and in the middle 80% of the distribution of retirement wealth at each age – make up 73 percent of our data, and hold 75 percent of all retirement wealth. Our sample of retirement investors contains millions of individual investors and well more than a trillion in investable wealth.

1.3 Descriptive statistics and comparison to SCF

The top panel of Table II shows summary statistics for our sample of retirement investors in 2016.[10] In our RI sample, the average age is 45 years old, and the average (median)

[9]These cut-offs increase with age. 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

[10]Appendix Table A.1 shows the same statistics for our entire sample period, 2006-2018.

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.[11] The average age is 47, the average (median) wage income is $66,459 ($50,000), about half are male, and 78% of investors are married.[12] In terms of their wealth, the average investor in the SCF RI sample has approximately $273,000 of investable household wealth and $98,000 in retirement wealth (bottom panel of Table II), and thus the retirement wealth is comparable to our sample. It is important to note that the statistics in Table II are representative of 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 are explicitly dropping the highest income group. As we see from the SCF, these investors hold a lot of wealth outside of retirement savings.

Figure A.2 shows that the retirement wealth distribution of our RI sample lines up well with individual respondents measured by the SCF. The SCF captures 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, presumably in part because we miss wealth held at other institutions and in part because our data measure *individual* wealth and so we miss some of the assets that are common to both spouses for partnered investors. Figure 2a 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.

The difference in wealth observed in the SCF and in our data is mainly due to the fact that the SCF measures household wealth rather than individual wealth. That is, little of

[11] Note that all measures in our data are at the individual level. In the SCF, we measure characteristics at the indiv.dual level, for the survey respondent and their partner, where possible. This includes wage labor income, retirement wealth, and age. When comparing levels of investable wealth, we are comparing individual RIs in our data to households in the SCF.

[12] 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.

the difference is due to our missing wealth held with other institutions. In our data, the sample of married households for which we observe both spouses has on average fifty percent more investable wealth. Figure 2b 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, our sample has a higher median wealth, while the SCF has a higher mean due to a few extremely wealthy investors. Appendix Tables A.2 to A.3 confirms this rough similarity both for married couples, and separately for single individuals. We conclude that the the difference in the distribution of wealth between our RI sample and that of the SCF is primarily driven by the unit of observation – individual investor as opposed to household.

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.

2 The equity shares of portfolios

2.1 The average equity share

Our first main result is that our retirement investor sample of middle-class American investors hold a large share of their portfolio in equity, more than measured in the SCF — as we discuss in this subsection — and more than reported in previous work — as we discuss in Section 2.4 and 2.5. 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 77.7%. Figure 3a 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.[13]

Table III shows that the equity shares calculated for RI's in the 2016 SCF are substantially lower, 54.5% of household investable wealth and 52% of individual retirement wealth.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

[13]Table A.4 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.

are higher for higher wealth households, equity shares calculated as aggregate equity over aggregate wealth are larger (e.g. see Bricker et al. (2016)).

We hypothesize that the difference between the equity shares arises largely because our data allows us to measure equity share exactly. Specifically, the SCF data are based on a survey in which people under-report the share of their wealth invested in equity because they are unaware that TDFs are allocated nearly entirely to equity for at least the first half of peoples' working lives. The main alternative hypotheses are that our sample under-represents investors with low equity shares and that the investments at other financial institutions that we do not observe have lower equity shares. Five pieces of evidence support our hypothesis over these alternatives.

First, consistent with people not being aware of the high equity content of TDFs, the respondents in the SCF who have some of their retirement assets in "mixed" funds report have lower than average equity shares, as shown in columns (2) and (4) of Table III.[14] 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. This is exactly the opposite of what we observe in our data, where the subset of investors with TDFs has a somewhat higher equity share (77% versus 71%) consistent with under-reporting of equity share by SCF respondents.

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

[14]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 a assets in a mutual fund or ETF. Thus, the same way survey responses may misreport equity share, they may also misreport (or we may mischaracterize) investments as hybrid funds.

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.

Fourth, it is notable that outside of retirement wealth our investors hold significantly lower shares of their wealth in equity both than they do in retirement accounts and than the SCF households report in non-retirement accounts, but this further supports our main hypothesis. Specifically, consider the argument that our sample overstates equity share because we omit non-retirement wealth that the SCF measures. This is possible because, as noted, the distribution of wealth in our sample does not perfectly match that in the SCF, mostly due to the SCF reporting a somewhat larger amount of wealth held in non-retirement accounts, 13% versus 4% (Figures A.2 and 2 and Table II). But non-retirement assets in the SCF (Panel C of Table III), have a higher equity share than in our sample and than in retirement accounts, 73%.[15] Because this wealth has a high equity share, if we were able to observe and add such wealth to our data, it would 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. This is consistent with the rise of TDFs, both in our sample and in the United States in general (see Figure 6 and Parker et al. (2020)). Appendix Figures A.3 and A.4 show the time series of the equity share of retirement wealth and investable wealth, respectively in 2007, 2010, 2013, and 2016 (the years of the SCF that overlap with our data). While there is already a large difference between the average equity share reported in the SCF and our sample in 2007, the gap grows over time, which supports the nation that TDFs contribute to the difference. Moreover, the difference between those with and without TDFs in their portfolios grows over time in the SCF, further suggesting that the mismeasurement is worsened by the presence of TDFs in the portfolio.

Despite these five arguments, there remains the possibility that the difference in measured equity shares comes either from idiosyncrasies of our sample or the wealth held at the institution we observe. For example, we could in part be measuring a firm fixed effect that raises equity share. Another possibility is that our average equity share is affected by the gender composition of our sample or by the fact that our unit of analysis is individuals and the SCF measures households.

[15] 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.

However, neither the unit of observation nor household composition appear to be responsible for our finding of high average equity shares. Appendix Table A.5 shows that the above pieces of evidence that TDF equity shares are misreported in the SCF all appears in the subsamples of only married investors (married investors in the SCF and investors in our data for which we observe both spouses). For these sub-samples, we are comparing groups of individuals with very similar gender composition. Appendix Table A.6 also shows similar patterns in the sample of all single investors in the SCF and in our sample, although with the one exception. Single investors who hold TDFs in their retirement accounts have higher non-retirement equity shares than all single investors.[16] This fact suggests that the non-retirement wealth of younger, single investors, that we do not observe in our data likely has a higher equity share than the wealth we do observe. Lastly, Table A.7 shows the residuals from a regression of portfolio equity share on gender, wealth, and birth-year fixed effects. The four arguments outlined above also hold in the residuals, further indicating that the results are not driven by differences in sample composition.

We conclude that, while the two samples do not match perfectly, the SCF likely significantly understates the average equity shares of our retirement investor sample. We now turn to analysis of the lifecycle dynamics of equity shares and how this has changed relative to similar administrative data from the 1990's.

2.2 The cross-section of equity shares by age

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 3b, the average equity share is roughly constant across ages prior to age 50 and then declines rapidly with age after age 50. We first regress equity share on indicator variables for three-year age groups using the following specification:

$$y_{it} = \beta_1 \times Age_{it} + \beta_2 \times Inc_{it} + \epsilon_{it} \tag{1}$$

where y_{it} is portfolio equity share, Age_{it} represents three-year age groups and Inc_{it} is the investor's labor income, which is only included in some specifications. The first column of Table IV shows that equity shares actually decline monotonically with age, beginning at approximately 74% for 25-27 year-olds and decreasing to approximately 55% for 64-65

[16] See columns (2) and (4) of Panel C of Table A.6.

year-olds. But this decline is uneven. From age 26 to 48 the average equity share decreases by only four percent over 22 years, while after age 50 the equity share decreases by 2-3% per year.[17]

This pattern of declining equity share with age not only survives controlling for income but becomes more steady and more significant. Column (2) of Table IV shows the results of a cross sectional regression of investor equity share on the log deviation of the individual's income in each year from the sample mean as well as age groups. Differences in income explain roughly as much variation in portfolios as age groups explain. People with higher income tend to have higher equity shares, with a doubling of the deviation of income from the mean associated with a nearly 8% higher equity share. This effect is identified from the primary source of variation which is differences in income across individuals not age groups. Column (2) shows that comparing people with the same income across ages, the portfolio share of equity still declines monotonically with age and still declines more quickly after age 50, but now also equity shares declines significantly before age 50.

This cross-sectional age pattern holds widely across sub-groups of retirement investors. Columns (3)-(5) of Table IV show how these average age patterns differ across terciles of initial investor income.[18] The lifecycle patterns found in columns (1) and (2) is not driven by just high-income or just low-income investor: equity share decreases by approximately 25% over the lifecycle, regardless of one's initial income tercile. Comparing columns (3)-(5), we see that the equity share is higher, by about 5%, in the highest income group, but the decrease with age is similar in magnitude.

2.3 The portfolio share of equity over the lifecycle

The cross-sectional age-pattern of equity shares can be driven by differences in investors across cohorts or by differences in behavior as people age. In this subsection, we present our second main result: tracking the same individuals over time, equity shares are hump-shaped across the working life.

Table V shows analogous regressions to the specification in equation (1) but including

[17] Appendix Table A.8 shows that the results are similar using price-constant equity shares. The price-constant equity share measures inflows and outflows to each asset, ignoring any change in price. In other words, it is insensitive to appreciation.

[18] 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 initial income greater than roughly $75,000 per year.

person fixed effects. Accounting for the person fixed effect, column (1) shows that when people are young, they choose 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.

This pattern is close to the average income profile over the working life, but changes in income do not drive this result. The same pattern holds in column (2) when controlling for income and with a slightly higher magnitude (9% instead of 7%). While the level of income explains a lot of the cross-sectional differences in equity share (as before, about as much as age), changes in income over the dozen years that we observe people explains very little of the lifecycle pattern of equity share.[19]

The last three columns of Table V show regression results with a person fixed effect for different levels of initial income. Similar to the purely cross-sectional analysis, the lifecycle hump-shaped pattern holds across income groups. Each group increases its equity share by 5-6% from age 25-50, and then decreases it going forward. We observe more aggressive rebalancing away from equity in the higher income groups, with the richest decreasing their share by about 6% relative to their position at age 25-27. Those in the lowest income group decrease theirs 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.

2.4 Changes across cohorts

This subsection presents our third main result: that equity shares are increasing across cohorts and the hump-shaped pattern of equity over the life is a relatively new phenomenon. We show how lifecycle behavior has changed for different cohorts over time, which sets the stage for our analysis of the role of financial product development and regulation in Section 2.7. Further, this section and the next explain why previous work measured lower equity shares than we find in our data.

We focus on cohorts of people born in 10-year periods. Our data allows us to construct five such cohorts, ranging from customers both between 1943 and 1952, to customers born between 1983 and 1992. Within the oldest of the three cohorts (those born in decades starting in 1943, 1953 and 1963) we find that equity shares decline as people get older.

[19] The coefficient on income measuring the effect of changes in income is also smaller than the coefficient on the level of income in Table IV measured in the cross section, a effect examined in detail in the companion paper Meeuwis (2019).

However, the reverse is true in the two youngest cohorts. For people born in the decades starting in 1973 and 1983, equity shares increase with age.... Figure 4a shows that the three cohorts born more recently (those born in the decades starting in 1965, 1975, and 1985) have slightly higher equity shares to those born 1955 to 1964 early in the sample but ten percent more in equity by the end.[20] The oldest cohort, those born between 1945 and 1955, start with roughly 5% less of their portfolio allocated to equity and end the sample with 15 to 25 percent less than the youngest three cohorts. These differences are of course due to both the age profile and differences across cohorts.

Second, and more importantly, younger cohorts have higher equity shares than older cohorts at the same age. This fact can be seen at the ages for which cohorts overlap in Figure 4b which shows equity share by age for different cohorts.[21] More precisely (based on Appendix Table A.9), at any age there is a monotone increase in average equity share as one looks at younger cohorts (excluding 'endpoints' for each cohort where age composition potentially plays a big role) at the same age.

Tracking the same investor over time shows that the lifecycle profile of equity shares has risen and become more hump-shaped. Columns (1)-(5) of Table VI show the same specification in Table V but broken out by birth year cohort.

First, the older cohorts allocate away from equity sooner and more quickly than younger cohorts. Comparing the results in column (1) to column (2), we see that from ages 55-65, the 1943 cohort decreases its equity share (relative to their own shares at age 52-54) by 16%. Meanwhile, those in the 1953 cohort decreased their equity share (again, relative to their own shares at age 52-54) by only about 7%.[22] Similarly large difference appears when comparing the 1953 cohorts (column (2)) to the 1963 cohorts (column (3)). Those born 1953-1962 decrease their equity shares, by about 7% from age 43-52, while those born 1963-1972 actually increase their equity share by nearly 2% over the same age range.

Second, among the youngest cohorts, shown in Columns (4) and (5), we see that 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 born 10 years earlier.

[20]Figure A.6a shows a similar pattern for portfolios betas. Moreover, portfolios betas within cohort are relativley stable over time.

[21]Figure A.6b shows that this pattern is also true for portfolio betas. In other words, more recent cohorts have higher-beta portfolios than older cohorts when comparing them at the same age.

[22]Put differently, comparing the trend in column (2) from ages 43-57 we see that those born from 1953-1962 decrease equity shares at about 2-4% per year, on average. On the other hand, column (3) shows that those born from 1963-1972, at the same age, hold their equity share almost constant until they reach age 52, when the start to decrease it by only 1-2% per year.

Again, these patterns demonstrate the effect of increased equity market participation among younger individuals, as well as the impact of TDFs on investment allocations. As shown in Figure 6, younger cohorts are much more heavily invested in TDFs, which in part drives higher participation in equity markets.

These trends highlight both the importance of increased participation in equity markets among younger cohorts and the impact of automated investment allocation. Columns (6)-(8) of Table VI splits the sample by initial allocation to TDFs. Those who begin with a high allocation of their portfolio to a TDF (75-100%), maintain approximately 70% equity share in early life and gradually reduce to about 60% at age 65. In contrast, those with a low allocation to TDFs (0-25%) start with approximately 62% equity and increase it to 70% by mid-life and lower it only modestly to 66% at age 65. That is, these individuals follow more of a hump-shaped pattern in their equity shares. In summary, those who are heavily invested in TDFs start life with much higher equity shares and exhibit much stronger rebalancing behavior than those who are not. This in of itself does not imply that TDFs change behavior, as investing in a TDF is a choice by the investor. Thus, it may just be that those who do so are more likely to engage in such rebalancing behavior. We'll address this further in section 2.7 using the Pension Protection Act of 2006.

2.5 Relation to Ameriks and Zeldes (2004)

In this subsection, we compare our results to Ameriks and Zeldes (2004) which employed data prior to 2000. Using data from both the SCF and a not-for-profit organization that was at the time the largest pension provider in the United States, they found no evidence that individuals gradually reduce their equity shares with age. Figure 5 replicates Figure 12 from Ameriks and Zeldes (2004) and visually summarizes and allows comparison of our results with that paper's results.

First, the top panel shows the cross sectional average equity share by age for four of the years in our sample. Immediately, we see that equity share decreases dramatically over the lifecycle, from about 75-85% at age 25 to approximately 60-65% at age 85. The speed of reducing equity also increases around age 50-55, as we saw in the regression results. We also observe that investors have higher equity shares at every age in the more recent years of our sample. In contrast, in earlier data Ameriks and Zeldes (2004) find that these series decrease somewhat early in life, but are nearly flat in age starting around age 35 indicating that individuals did not previously decrease their equity share as they age.

The middle panel of Figure 5 shows the cross sectional average of equity share by age, this time for each birth year cohort in our sample. Similarly to the figure above, we see that each cohort decreases its equity share with age; the youngest cohorts (those born from 1975-1993) show a flat profile over our sample, as they have not yet reached the age when equity share typically begins to decline. Ameriks and Zeldes (2004) found that it used to be that each cohort's line was *upward sloping* in age.

To summarize, we find the pattern that equity shares consistently decrease with age particularly in the second half of working life both within person and in the cross section, while Ameriks and Zeldes (2004) showed no evidence of this behavior prior to 2000. These results are verified in the final panel of Figure 5, in which we show the coefficients from a regression of equity share on age and cohort dummies and then on age and time dummies. When we consider the predicted equity share without age and time effects, the line is downward sloping, emphasizing that younger cohorts have higher equity shares. Ameriks and Zeldes (2004) find this to be a flat line. When we consider the predicted equity share without age and cohort effects, the line is hump-shaped, emphasizing that investors reduce their equity shares as they age. Ameriks and Zeldes (2004) find this line to be strongly upward sloping.

We also find that trends in equity share have changed substantially from the 1990s to now using the SCF data. We repeat this exercise for the SCF from 2007-2016 and compare the results to Figure 9 in Ameriks and Zeldes (2004), which shows the same figure for the SCF from 1989-1999. In the top panel of Figure A.5, the equity share is slightly decreasing in age amongst SCF RI investors. On the other hand, Ameriks and Zeldes (2004) find a roughly flat profile, indicating that there are minimal age effects. In the middle panel, the equity share is flat in age for the younger cohorts, and decreasing in age for the older cohorts, as we found in our sample. Ameriks and Zeldes (2004) find that the equity share is increasing in age within cohorts.

Lastly, the bottom panel of Figure A.5 shows that when we consider the predicted equity share without age and time effects, the line is nearly flat. thus, the age effects are much weaker in this sample than in our own data.[23] When we consider the predicted equity share without age and cohort effects, the line is strongly downward sloping, indicating that equity exposure decreases with age within cohorts. In contrast, Ameriks and Zeldes (2004) found this line to be strongly upward sloping. In summary, even in the SCF, more

[23] This is consitent with what we observe in Table III, where the equity share decreases much more with age in our data than in the SCF.

recent data shows stronger age effects and a pattern of rebalancing away from equity as investors age. This trend was not present in earlier waves of the SCF.

The next subsection addresses the question of why the investment behavior of the typical American has changed.

2.6 The role of TDFs in the portfolio allocation over the lifecycle

The development of Target Date Funds and then their rapid rise following the Pension Protection Act (PPA) of 2006 have contributed to both of the main new facts we document: equity shares that are high earlier in life and decline linearly 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 401(k) plans. The act provided a "safe harbor provision" that gave legal cover for employers to use TDFs as default investment vehicles in retirement plans. Prior to this provision, both employers and pension administrators faced potential legal liability for using TDFs as default options. As a result, investment defaults typically contained much less equity, and a large share were money market funds. Following the PPA, plans increasingly defaulted new enrollees into TDFs, thus moving employees who passively accepted or chose the default investment out of primarily very safe, low-return funds and into largely equity funds. Figure 6 shows that indeed the prevalence of TDFs rose steadily following the PPA.

To identify the role of TDFs in investors' portfolio allocation, 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 (or employers) did not endogenously change the jobs they take due to the introduction of the Pension Protection Act or their (potential) employers response to it. This is a reasonable assumption 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. In contrast people who joined their employers after 2006 may have joined workplaces in which TDFs were default investments in the 401(k) plans. We focus specifically on individuals who enrolled in plans in 2007 or 2008 that switched to having a TDF as a default following the PPA.

The PPA significantly accelerated the availability and adoption of TDFs as default allocations across a wide set of employers and asset management firms in the US, see for example Parker, Schoar and Sun (2020) for an industry level analysis. The paper also documents a large rise in the assets under management by TDFs following the PPA.

First, in Table VII we analyze the short term effect of being defaulted into a TDF. We take the sample of employees who start a new job between 2005 and 2008 at a firm that switched to having a TDF as the default option after 2006. The specification is:

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

where y_{it} is the portfolio equity share. $D_{treated}$ is a dummy variable equal to one if an investor is enrolled in a retirement plan that switched to having a TDF default immediately after the PPA, in 2007 or 2008. λ_f is an employer fixed effect, so we compare 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 dummies for every 10-year age cohort at enrollment and interactions of those age groups at enrollment with the treatment. This specification uses a shorter (2 year) time horizon after enrollment. Below, we will use a longer (5 year) period after enrollment to measure the persistent impact on portfolios. These regressions include only firm-level fixed effects and not individual-level fixed effects since we estimate the effect of the PPA by comparing across investors who enrolled just before and after 2006. We are relying on our identifying assumption that the type of employees joining a firm by age and income profiles of people joining a firm were not significantly affected by the PPA or the switch in defaults. As discussed above we believe this is a very sensible assumption, since employees are typically not aware of these default allocation options.

Column (1) of Table VII shows the baseline specification in which we regress equity share on the treatment dummy, age group dummies, and the interaction of the treatment with each age group. In this first regression, we use only the first two years of data for which we observe each investor. Focusing on this short time window allows us to abstract from any longer term trends in the investment environment. The coefficient on the *treated* dummy 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) has a 5.5% higher equity share during the first two years of their employment. The effect is statistically significant and economically large; since as we showed, on average, people increase and decrease their equity share by approximately 7% over the course of their life, 5.5% is a substantial increase. When looking at the interaction of treatment with different age groups, conditional on treatment, we see that older individuals who are defaulted into TDFs by the PPA decrease their equity shares more rapidly relative to those who enrolled before the Act. For example, prior to the PPA, those aged 55-65 at enrollment have 13% lower equity shares than those aged 25-34 (row 4). Those treated by the PPA however, have equity shares that are lower by nearly 15 percentage points more (row 7). This age pattern is exactly the impact that we would expect automatic enrollment in a TDF fund to have due to the automated re-balancing by TDFs. Column (2) shows that the effect on young households goes down only slightly when controlling for income. The magnitude of the effect decreases to 5.3%. The age patterns are also quite similar when controlling for income.

The effect of a TDF default is generally larger for households with low income and lower for households with high income. In Columns (3)-(4) of Table VII, we repeat the analysis from Column (1) for the subsamples of people with the highest and lowest initial income. Column (3) shows that the initial impact on equity share at young ages is almost 6% and that TDFs have cause a strong reblancing towards safer assets for older age groups. In Column (4) we show a parallel analysis for the highest income tercile. For this group the treatment effects are much more muted. For the youngest group (people 25-35 in age) the magnitude of treatment effect on equity shares is less than 2%. This small effect is likely because even without being defaulted into TDFs this groups has relatively high equity shares. Similarly, we also see that the rebalancing effect of TDFs for the highest income tericle is much less pronounced.

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 households. As a result, the results are virtually unchanged from those in the first two columns. Somewhat surprisingly, this is true even for older new employees.

In order to analyze the impact of the PPA on the investment dynamics and persistence of portfolio allocation over time, we now repeat the analysis above but tracking individuals for five years after enrollment. The specification is:

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

where the notation is the same as in equation (2) and we have added year fixed effects λ_t and interactions of these year fixed effects with the treatment. These coefficients trace out the investment trend for both control and treatment group over time, respectively. In this specification, we also split out the regressions by age groups, rather than including the full set of age dummies and interactions, for ease of exposition.

The results are shown in Table VIII. As before, Column (1) shows the results for the full sample enrolled in 2005-2008. Columns (2)-(3) break out the results by income terciles and columns (4)-(7) break out the results by age at enrollment.[24]

The results in column (1) confirm 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, but the magnitude of the effect decays over time. Moreover, the year dummies 1 to 5 after enrollment show the general trend of decreasing equity allocation with age. As we saw before, there is significant heterogeneity by income, illustrated in columns (2) and (3). The positive effect of the PPA is much larger for the low income group, however it is not persistent, shrinking to nearly zero five years after treatment.

The results in columns 1 to 3, however, mask significant heterogeneity by age. TDFs tend to raise equity shares for the young and lower equity shares for those near retirement. Column (4) shows the results for those aged 25-34 at enrollment. We see that in the year of enrollment, their equity share is on average 1.5% higher than the control group and goes up to almost 4% difference for 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. 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

[24] Appendix Table A.10 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.

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 7 shows the average equity shares but now broken out by age and income tercile.[25] Looking first at the youngest age group (25-34) in Figure 7a, the PPA significantly increased equity shares for the low income group. 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 7b 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 PPA.

2.7 Summary: Equity Shares Over the lifecycle

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 rather than following a flat or hump-shaped pattern. This is relatively new behavior, not visible prior to 2000. This large change appears to be due to the combination of industry development of and regulatory approval of target date funds as defaults in retirement saving plans. These TDFs provide age-appropriate allocations across broad assets classes based on financial theory given historical risk and returns. Thus, TDFs invest the assets of younger working investors almost entirely into equity and automate re-balancing linearly, at a steady rate out of equity as investors approach retirement age.

3 Contribution Rates

This section presents an analysis of contribution rates to retirement plans over investors' working lives that mirrors the analysis of portfolio composition in the previous section. We show three main results. First, contribution rates consistently increase with age, by 4-5%. This behavior is consistent across cohorts and income groups. Second, younger cohorts' savings are more dependent on income than in previous cohorts. This is largely driven by

[25]These are estimated in unreported regressions that repeat columns (4) and (7) from Table VIII on the income subsamples.

contribution limits set by the IRS that affect higher income (and therefore older) individuals more. Third, average contribution rates responded only minimally to the Pension Protection Act of 2006, and actually decreased slightly following the Act. Contribution rates seem to be less sensitive than equity shares to the changing regulatory environment or investment trends over time.

3.1 Realized Contribution Rates

First, we show that contribution rates increase monotonically with age, from about 4.5% at age 25 to 8.5% at age 65. Table IX shows our main cross sectional results, specified by equation (1), with realized contribution rates as the dependent variable. 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. In column (1), we regress reported contribution rate on age group dummies. The coefficients demonstrate the increasing profile of the savings rate in age. Column (2) adds a control for log income. The coefficient implies that each 1% increase in income is associated with a nearly 2% increase in reported contribution rate. However, even with the income control, the age pattern still holds, with contribution rate increasing by about 4% from age 25-65.

In addition, while savings rates vary by income, the increasing lifecycle patters holds regardless of income. Columns (3)-(5) show the same specification as in column (1), broken out by terciles of initial income. Those in the highest income group (column (5)) save nearly 2% more, on average, than those in the lowest income group (column (3)) 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.

Next, we show that each cohort follows a similar pattern of increasing contribution rates with age, but that income has a stronger effect on younger cohorts.. Table A.11, columns (1)-(5) show the same specification as in column (2) of the previous table, broken out by birth year cohorts. Each cohort follows a similar pattern of increasing savings with age. Investors also increase their contributions with age at similar rates. However, the magnitude of the income coefficient increases with younger cohorts, explaining over 3% of the variation for the youngest cohort versus only 1.5% for the oldest cohort. In unreported results, we observe that the specifications in columns (1)-(5), excluding the income control, reveal a similar average contribution rate for each age group, regardless of cohort.[26] However, conditional on income, we see that average realized contribution rates diverge. For example, conditional on income, the 1983 cohort has rates approximately 0.5-1% higher than their 1973 cohort counterparts at the same age. This increasing trend, however, is not monotonic with cohort. Those in the 1963 cohort have slightly lower contribution rates than those in the 1953 cohort at the same age when controlling for income. Thus, there appear to be distinct interactions of income and cohort effects, which likely also depend on contribution limits set by the IRS, as discussed in the next section.

Columns (6)-(8) of Appendix Table A.11 show that individuals follow a similar profile for savings with age, regardless of the share of their portfolios that is in TDFs. Each group increases their contribution rate by approximately 4% from age 25-65. Those with lower allocations to TDFs (column (8)) also have a slightly lower contribution rate, by about .5-1% compared to their counterparts who have the majority of their portfolios allocated to TDFs (column (6)).

Now we move on to the within person results for contribution rates and find that the same increasing in age pattern holds within-person as well. Moreover, we show that higher contribution rates are not driven by people earning higher incomes as they age. Table X shows the regression of realized contribution rate on age group dummies, including a person fixed effect. In the baseline results in column (1), we see the same pattern holds within person as in the cross section: contribution rates increase by approximately 5% over the lifecycle. This explains nearly all of the aggregate variation observed in the cross section. In column (2), we also control for log income. This 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 not due to increasing incomes.

Once again, all income groups also show a similar lifecycle pattern, though those with higher incomes have higher contribution rates overall. Columns (3)-(5) show the regression for groups based on their initial income. The coefficients show a parallel dynamic for contribution rate, regardless of income. Each group increases its contribution rate over the lifecycle by 4.5-5%. However, those with higher initial incomes increase it by 1-2% more than those in the lowest income group over their lifetimes and start off with higher rates.

The within-person results broken out by cohort again show that each cohort increases its savings rate with age. Columns (1)-(5) of XI show the results from the specification in

[26] This is also verified in Figure 8. To see this, compare the level of each cohort with its adjacent cohort's line approximately ten years prior.

column (2) of the previous table, broken out by birth year cohorts. Those in the younger cohorts actually increase their rate of contribution at a slightly faster pace. For example, comparing column (4) to column (5), we see that 28-30 year-olds born from 1983-1992 increase their contribution rate by .81%, relative to at age 25-27, while 28-30 year-olds born from 1973-1982 increase it by only .52%. A similar pattern holds when differencing across rows for the other age groups that are common to multiple cohorts. In summary, although older cohorts start at higher savings rate, the younger cohorts increase their rate faster as they age. This holds even when controlling for income.

Finally, columns (6)-(8) then break out the within-person results by initial TDF share. As in the cross-section, those heavily invested in TDFs (column (6)) have higher contribution rates to start. However, they also increase their contribution rate by slightly less than those with a low allocation to TDFs (column (8)). This persists with age, resulting in those with a high initial TDF share increasing their savings by about 1.5% less than those with a low initial TDF share over the lifecycle.

3.2 Realized versus Reported Contribution Rates

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. [27] 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.

In this subsection, we address this discrepancy in two ways, both of which confirm the results above. First, we regress realized contribution rate on a dummy equal to one if the individual hit their contribution limit in the given year. This is calculated by taking their *reported* contribution rate and multiplying it by their income; if this is larger than

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

the allowed amount by the IRS in that year, then the dummy is set equal to one.[28,29] The specification is:

$$y_{it} = \beta_1 \times D_{maxout} + \beta_2 \times D_{maxout} \times Age_{it} + \beta_3 \times Age_{it} + \epsilon_{it} \tag{4}$$

where D_{maxout} is a dummy equal to one if the investors maxes out on their retirement contribution, as described above, in a given year. Age_{it} are dummies for ten-year age groups. In some specifications, we also include a control for the investor's current income.

Table XII shows the results. We find that the cap mostly hits people in middle age, as realized contribution rates decrease by about 1% for those in the older age groups (relative to those aged 25-34), as shown in column (1). The decrease is larger for those aged 35-54 and 45-54, reflecting the fact that it is less likely for the oldest age group to max out due to the "catch-up" contributions that are permitted. Regardless, contribution rates still increase by nearly 3% from the youngest to the oldest in our sample. The same pattern holds when controlling for income, in column (2). In line with expectations, a higher income is associated with a lower realized contribution rate, when controlling for hitting the contribution limit. We also see that those who reach the limit have a higher contribution rate than those who do not, on average, by nearly 6%. This makes sense given that very few individuals should max out due to very high incomes. Our sample selection process is exactly designed to capture middle class US individuals who would not be likely to hit the limit due to high income. In fact, only 6-9% of our sample with available income data max out on their contribution in a given year.

Columns (3)-(4) show analogous regressions, using a slightly different measure for maxing out on contribution limits. In columns (1)-(2), the measure was based only on the current year's reported contribution and income. Now, we set the *max out ever* dummy 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). That is, if the dummy described above is *ever* equal to one, then this dummy is also automatically set equal to one for all the years we observe someone in our sample. Again, we see that the contribution rate still increases with age, even when controlling for the cap. Moreover, those who

[28] Contribution limits increased over our sample period, from \$15,000 in 2006 to \$18,000 in 2017. We use the limit is the corresponding year when calculating if an individual has hit the limit.

[29] Note that individuals aged greater than 50 are also allowed "catch-up" contributions. These have risen from \$5,000 in 2006 to \$6,000 in 2017. Thus, the threshold for maxing out is higher for those aged greater than 50.

have ever reached the limit also have higher contribution rates overall, by about 4%. The interaction terms show a different pattern than those in columns (1) and (2). We see that individuals are most likely to hit he cap and thus have slightly lower rates at ages 35-44 and ages 45-54, but the effect is economically small. However, the age 55-65 group shows a higher contribution rate, conditional on ever having hit the cap. This demonstrates that most people are maxing out while aged 35-54, and thus perhaps catching up later in life prior to retirement, especially since they are then permitted to contribute a higher amount. This is verified in Appendix Figure A.7, which show 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.

Our second method of addressing the discrepancy between realized and reported contribution rates is by repeating the analysis on the *reported* contribution rate. The reported contribution rate is the percentage of income that the individual designates to their retirement account at the beginning of each year. The results largely confirm the trends that we observed for realized rates. In the cross-section, designated savings increases monotonically with age from about 6% to 10% over the lifecycle (Table XIII). Hence, reported contribution rates are about 1% higher than the realized rates observed in Table IX, confirming that some individuals set a rate that is too high and hence save at a rate lower than anticipated. Column (2) of Table XIII adds a control for log income. The coefficient implies that each 1% increase in income is associated with a nearly 5% increase in reported contribution rate. Adding income also doubles the R-squared. This contrasts with the results on *realized* contribution rates, where the impact of income was much smaller. The limit on contribution rates mechanically prevents high income people from saving as much as they may want to. Even with the income control, the age pattern still holds.

We observe similar patterns with reported rates as we did with realized rates when looking at different cohorts and different TDF allocation groups (Appendix Table A.12). Each cohort and TDF group follows a similar pattern of increasing savings with age. One difference from the results on realized rates is that income does not drive a wedge between cohorts. This again verifies the effect of the contribution limit; because most people who reach their limit are older, the cap does not affect the youngest cohorts in our sample as much.

The baseline results including a person fixed effect, shown in Table XIV confirm that individuals increase their contribution with age at a magnitude that explains nearly all of the aggregate variation. Moreover, higher 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 (Table XV, columns (1)-(5)) . Additionally, those with a high allocation to TDFs (column (6)) increase their contribution rate by slightly less than those with a low allocation to TDFs (column (8)) at every age.

3.3 The Effect of the Pension Protection Act of 2006

In this subsection, we present evidence that the Pension Protection Act of 2006, which had several provisions included to encourage savings in retirement funds (Beshears et al. (2010)), actually had a negative impact on average contribution rates.

Tables XVI- XVII show our difference-in-difference results, from equations (2) and (3) this time with reported contribution rate as the dependent variable. We now designate anyone enrolled from 2007-2008 as a treated investor, regardless of whether or not their plan's default investment allocation changed.[30] First, in column (1) of Table XVI, we observe that contribution rates decrease in the treated group by -0.43% in the two years following entrance to the sample. Hence, the effect is negative but small. The magnitude is similar when controlling for income in column (2). Columns (3)-(4) shows that the treatment effect is similar across income groups.

These results also confirm that the age effects on contribution rates are large, with the average contribution rate increasing by 4% from age 25-34 to age 55-65, consistent with the result in Table XIII. However, the coefficients on the interaction of the age groups with the treatment are negative and economically meaningful. For example, those in the treatment group aged 55-65 when enrolled have about 1.2% lower contribution rates than those in the control group. This effect monotonically increases in magnitude with age.

The effect is similar for those with no other retirement assets prior to enrollment, shown in columns (5)-(6). This result mplies 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 by year in the five years following enrollment, we see that the

[30]This differs from the analysis on portfolios equity shares, where 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 several provisions intended to influence 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 investors, regardless of which plan features changed following the PPA.

PPA had a small but negative effect on average contribution rates; the effect is largest for the oldest investors. Table XVII shows the results that trace out the effect by year after enrollment. This includes individual dummies for each year after treatment and interactions of these dummies with an indicator for being treated by the PPA (enrolled in 2007 or 2008, versus 2005 or 2006). The year dummies estimate the trend over the five year period following enrollment for those enrolled in 2005-2006, who were not affected by the PPA. The year by treatment dummies estimate the average effect of the treatment on the treated in each year. Column (1) shows the results for the full sample enrolled in 2005-2008. Columns (2)-(3) break down the results by income terciles and Columns (4)-(7) break out the results by age at enrollment.

In the full sample (column (1)), we see that the PPA indeed has a negative effect on contribution rates, but the magnitude decreases over time and is essentially zero five years after treatment. Splitting the result by age group, columns (4)-(7) shows that the effect is negative for each age group, but larger in magnitude for the older age groups. The initial effect is largest for those aged 55-65 when enrolled: their contribution rates are 1.3% lower than the control group in the year of enrollment (versus only -0.6% for those aged 25-34). However, by five years after treatment, this difference is only one half of a percentage point.[31]

Figure 10 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.[32] Looking first at those aged 25-34 in Figure 10a, the PPA significantly decreased contribution rates for both income groups, intially by about 0.7-0.9%. 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 10b. The treated group with high incomes decreases their contribution rate by about 0.7% following treatment. For the lower income group, the immediate effect is larger: 1.3%. For both income groups, the difference between treated and control after five years is nearly zero.

It is worth noting that both the treatment and control group decrease their contribution rate over the five year time period following enrollment, despite the fact that we have seen that contribution rates increase with age, both the in cross-section (Table XIII) and

[31] Appendix Table A.13 shows that the results are similar if we include only those enrolled in 2007, rather than 2007-2008. This eliminates any possible spurious effects on savings rates due to the financial crisis.

[32] These are estimated in unreported regressions that repeat columns (4) and (7) from Table XVII on the income subsamples.

within-person (Table XIV). This is likely due to the fact that the five-year period that we are observing post-PPA happens to take place during the financial crisis. In Figure 9, it is evident that contribution rate decreased uniformly across birth cohorts from 2007-2009.

In summary, we find that contribution rates increase significantly over the lifecycle, by about 4-5% from age 25 to age 65. This finding is consistent across birth-year cohorts, income groups, and TDF allocation groups. We observe that higher income individuals have higher savings rates overall, but that the lifcycle profile is similar to those with lower incomes. Moreover, those with a lower allocation to TDFs tend to increase savings a bit more over the lifecycle than those with a majority of their assets in TDFs. We also observe that there are some small differences between cohorts in their savings levels, but the lifcycle profiles are similar. Lastly, we find only a small but negative effect of the Pension Protection Act of 2006 on savings rates.This finding is consistent with Choi et al. (2004) and Madrian and Shea (2001), which find that savings rates decreased, on average, following the PPA, due to higher income individuals who would have otherwise saved more simply choosing the (lower) default savings rate.

4 Conclusion

The results in this paper suggest that individual investor portfolios have undergone a number of significant changes over last two decades. New regulations as well as innovations in retirement savings products have helped to increase access to a more diverse set of retirement assets and allowed younger and less affluent investor to access equity markets. These innovations also seem to have made it easier for investors to adjust their portfolios over the life cycle, since we see a distinct life cycle pattern where old investors in the more recent cohorts rebalance their funds into safer assets compared to earlier cohorts.

But our results also highlight the importance of having large scale data as used in this paper. We highlight that the SCF understates equity holdings for retail investors by more than 15%. This discrepancy seems to largely arise since survey respondents understate or do not recall allocations in hybrid funds such as target date funds or target risk funds.

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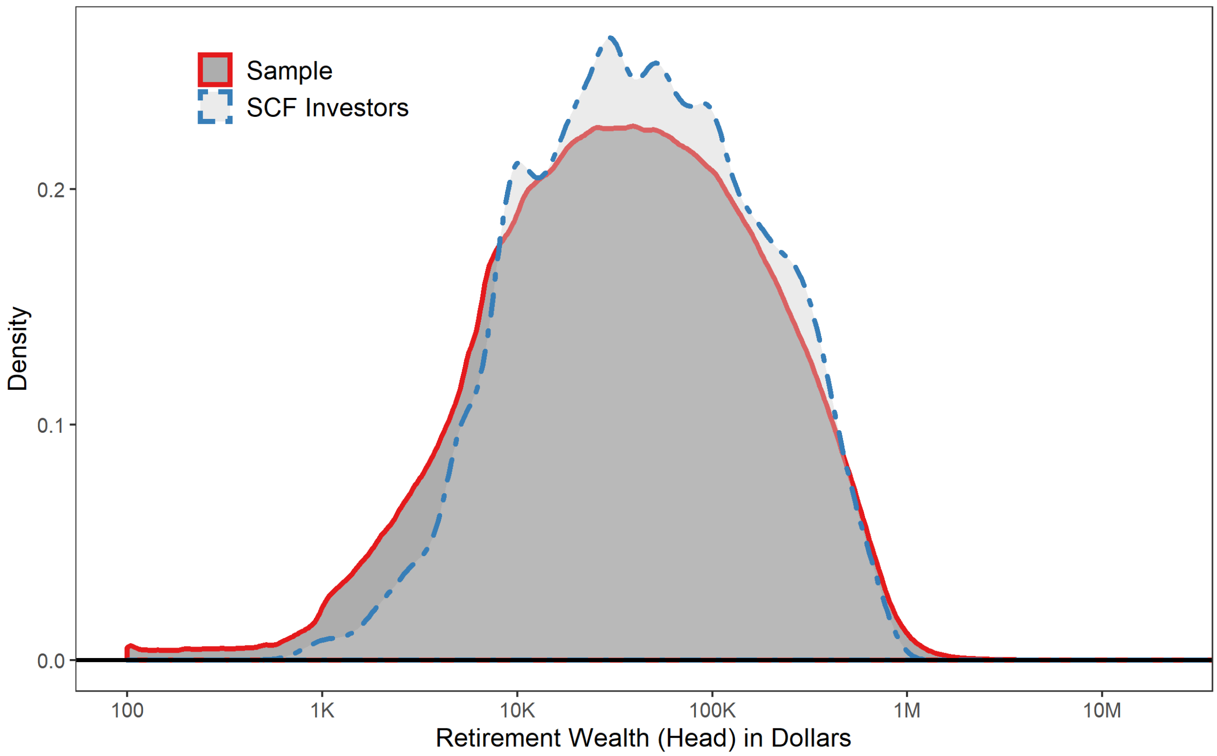
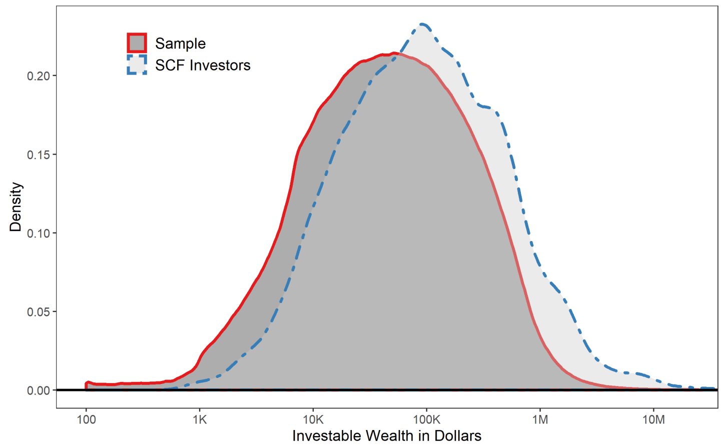
Figure 1: Individual Retirement Wealth Distribution in Firm Data and the SCF in 2016



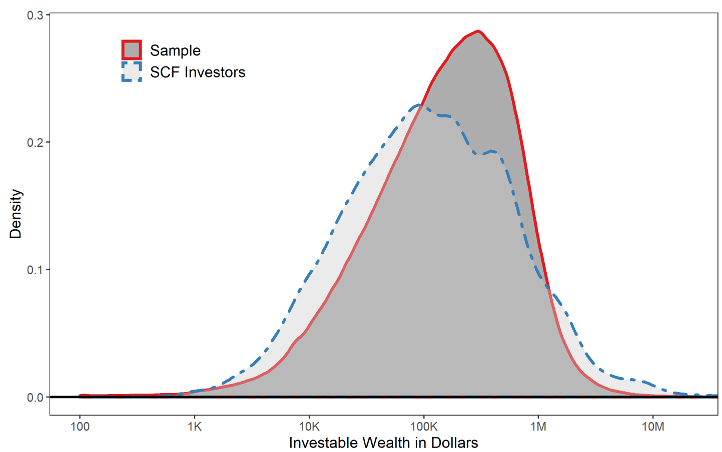
Notes: This figure plots the distribution of retirement wealth in the sample of retirement investors (RIs) versus the distribution of retirement wealth for RIs in the SCF in 2016. Retirement wealth is defined as any wealth in retirement saving accounts of all types (excluding defined benefit plans and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

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

(a) Investable wealth, individual versus household



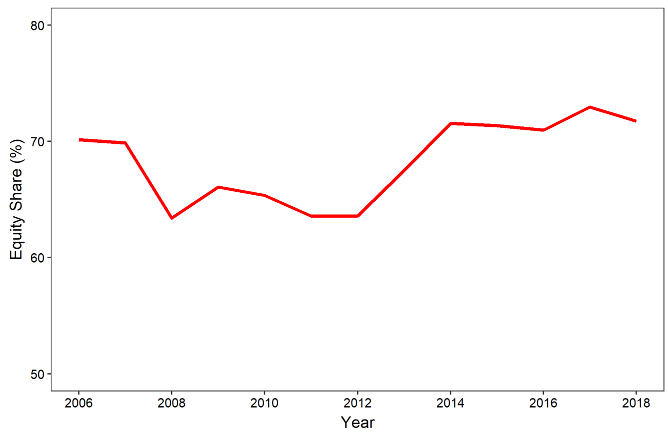
(b) Investable wealth, household versus household



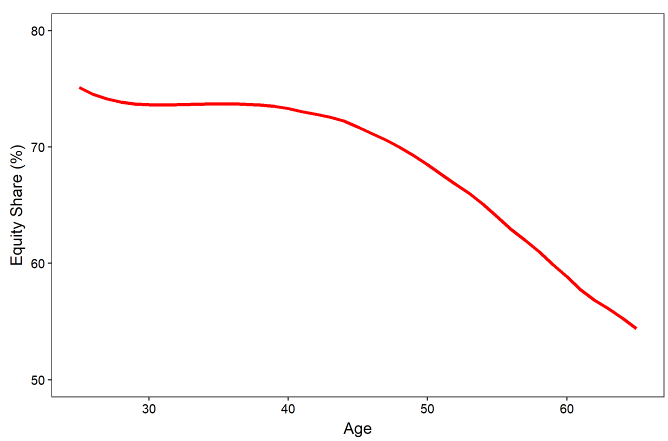
Notes: This figure plots the distribution of investable wealth of retirement investors (RIs) versus the distribution of investable wealth for RIs in the SCF in 2016. The top panel shows individual investable wealth in our sample versus household investable wealth in the SCF. The bottom panel shows household 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, certificate of deposits, quasi-liquid retirement wealth, and other managed accounts.

Figure 3: Portfolio Equity Share by Year and Age

(a) Equity Share by Year



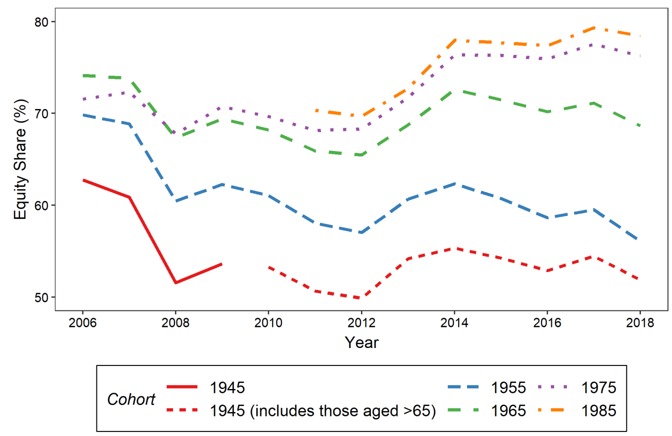
(b) Equity Share by Age



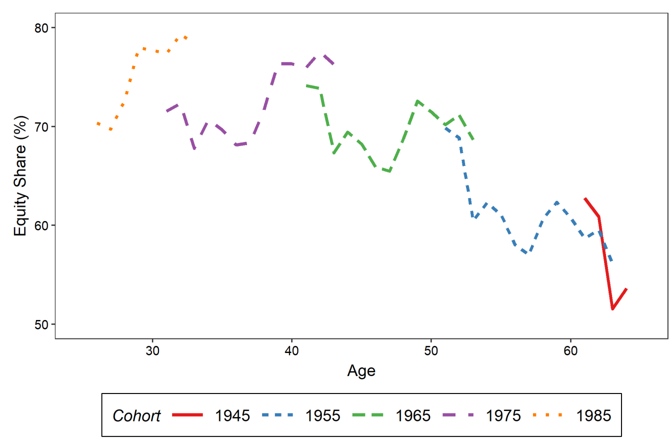
Notes: This figure shows the portfolio equity share in our sample. The top panel shows the equity share for the entire sample, averaged by year. The bottom panel shows the equity share averaged by age. The portfolio equity share is defined as the sum of equity securities, pure equity funds, and the equity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

Figure 4: Portfolio Equity Share by Birth Cohort

(a) Equity Share by Birth Cohort and Year

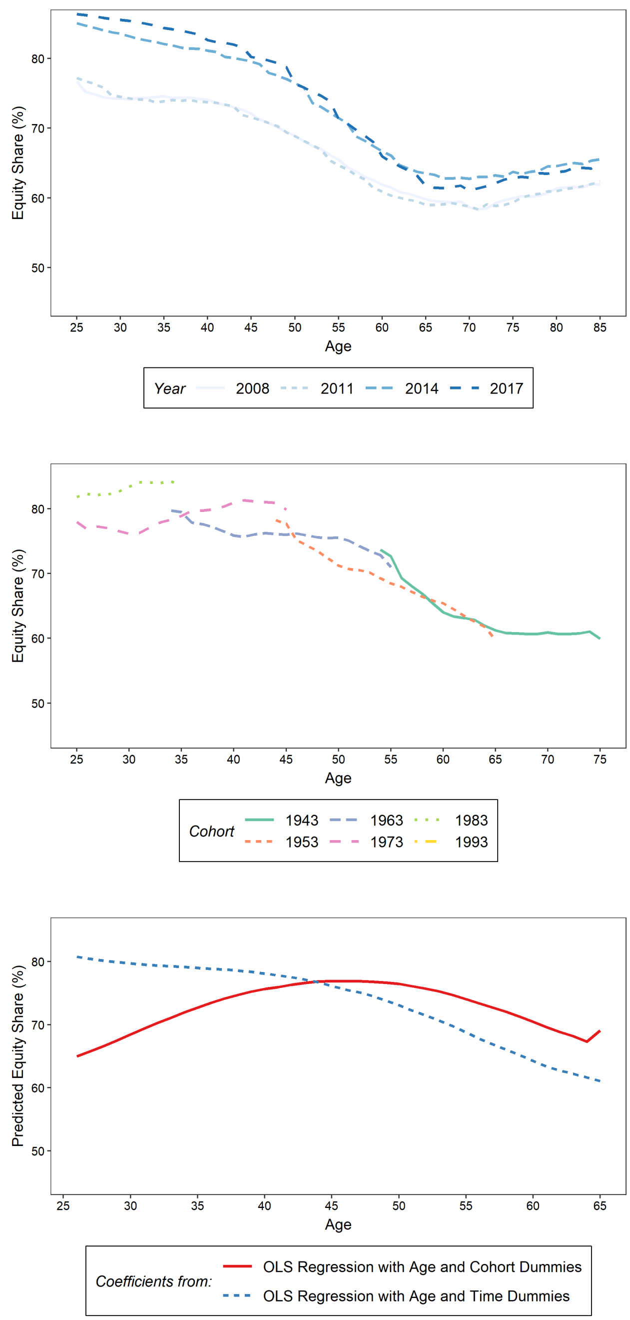


(b) Equity Share by Birth Cohort and Age



Notes: These figures show the portfolio equity share averaged by birth year cohorts. The 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 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).

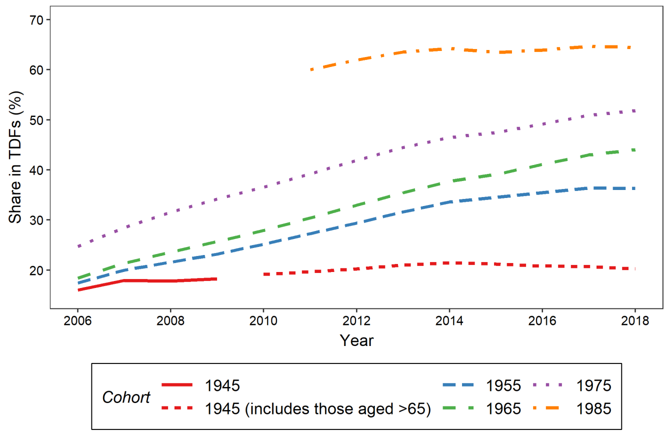
Figure 5: Equity Share Among Equity Owners



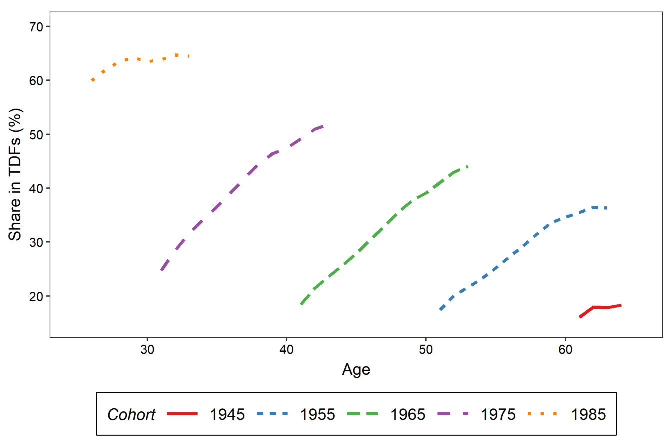
Notes: This figure replicates the results shown in Figure 12 of Ameriks and Zeldes (2004). The top figure shows the observed equity share by age in four different years of our sample. The middle figure shows the observed equity share by age in each cohort in our sample. A cohort is defined as having 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 age and cohort dummies and then on age and time dummies. We obtain the predicted values by adding the median cohort and 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 6: Target Date Fund Share by Birth Cohort

(a) TDF Share by Birth Cohort and Year



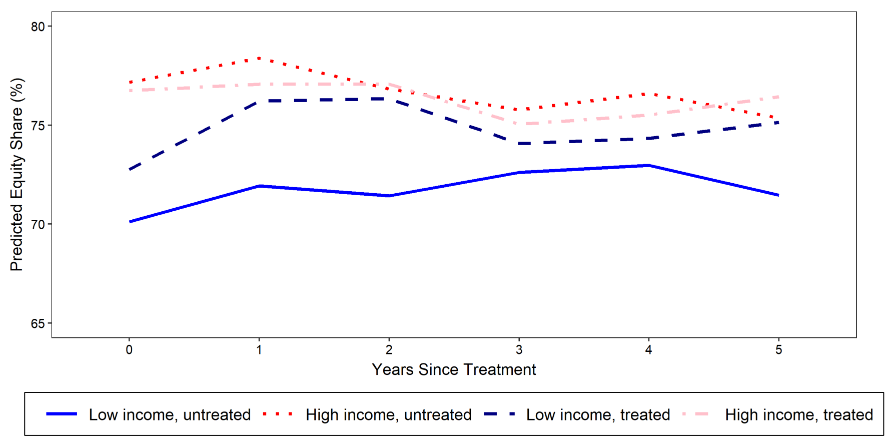
(b) TDF Share by Birth Cohort and Age



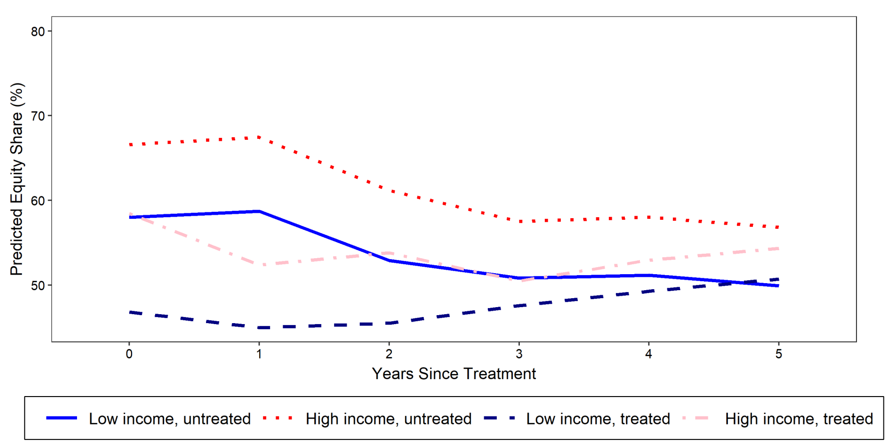
Notes: These figures show the share of the portfolios that is invested in Target Date Funds (TDF) averaged by birth year cohorts. The top panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The bottom panel shows the averages by age, where age is the median age of the cohort. 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 7: Predicted Equity Share: Pension Protection Act

(a) Age Enrolled 25-34



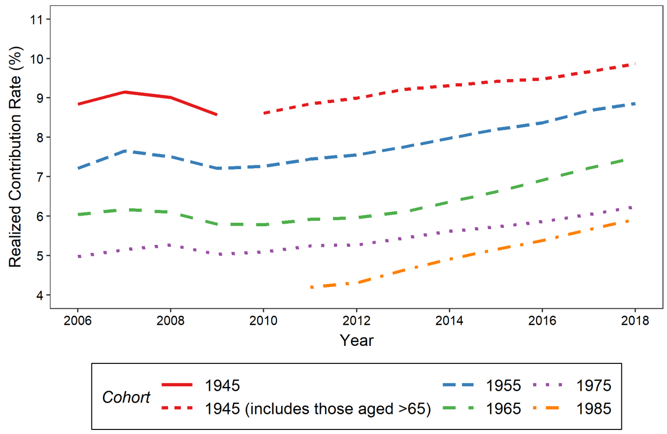
(b) Age Enrolled 55-65



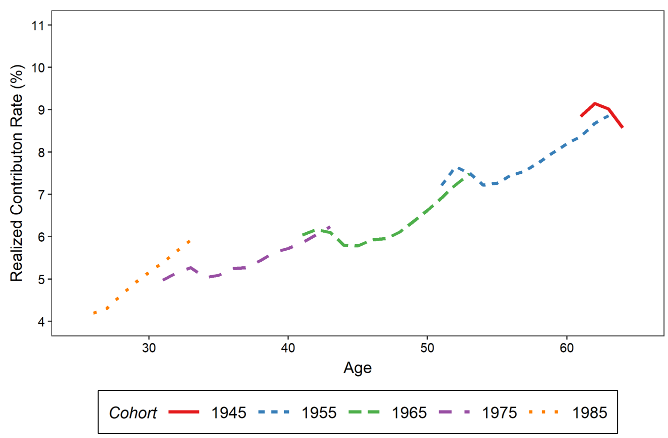
Notes: This figure shows the predicted equity share for those treated by the Pension Protection Act of 2006 and those not treated by the act, split out by age and income groups. The top panel shows the results for those aged 25-34 when enrolled. The bottom panel shows the results for those aged 55-65 when enrolled. The 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 8: Realized Contribution Rate by Birth Cohort

(a) Realized Contribution Rate by Birth Cohort and Year



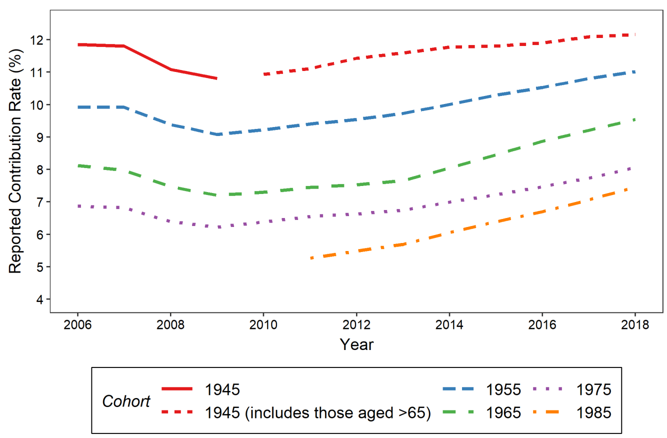
(b) Realized Contribution Rate by Birth Cohort and Age



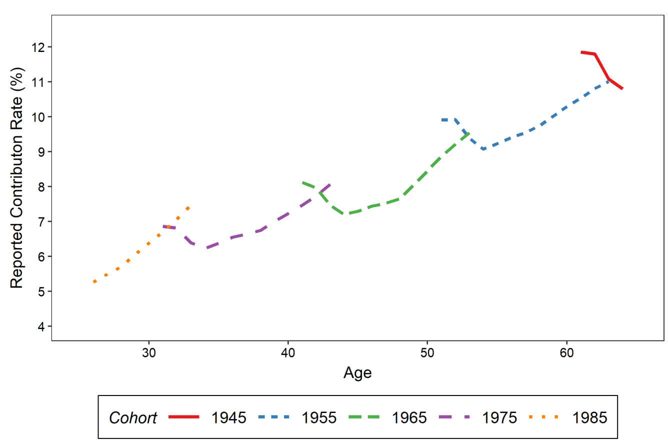
Notes: These figures show the realized contribution rate averaged by birth year cohorts. The top panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The bottom panel shows the averages by age, 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 9: Reported Contribution Rate by Birth Cohort

(a) Reported Contribution Rate by Birth Cohort and Year



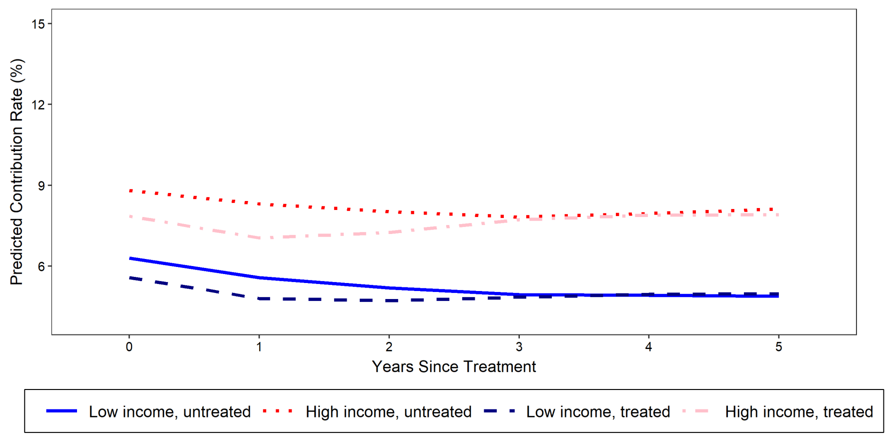
(b) Reported Contribution Rate by Birth Cohort and Age



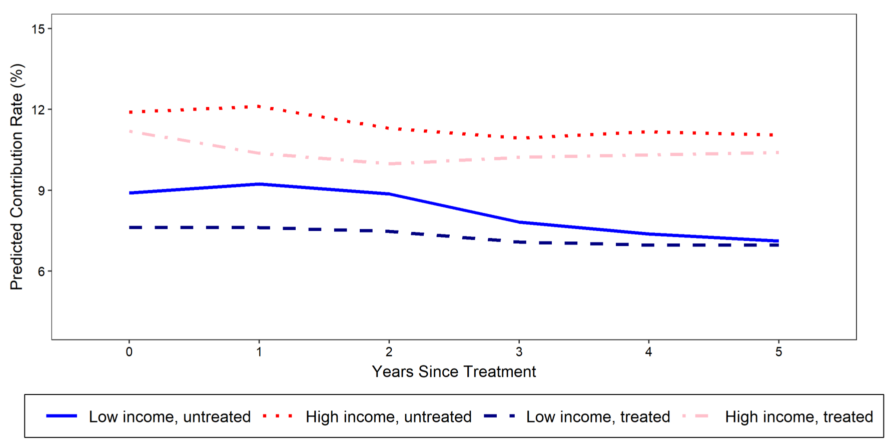
Notes: These figures show the reported contribution rate averaged by birth year cohorts. The top panel shows the averages by year over our sample period. We include only years during which each member of the cohort is aged 25-65, unless otherwise indicated. The bottom panel shows the averages by age, where age is the median age of the cohort. The reported contribution rate is the percentage of their income than 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 10: 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 than 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	This is the dollar value of the following assets, measured at the end of each calendar year: money market mutual funds, non-money market funds (including mutual funds and ETFs), individual stocks and bonds, certificate of deposits, and trusts. It includes these assets whether they are held in retirement funds, individual brokerage accounts, or accounts managed by a financial advisor. The measure excludes bank accounts (checking and saving), savings bonds, cash value of life insurance, durable goods, and housing.
Retirement wealth	This is 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	This is 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 deposits and trusts that are not held in retirement accounts.
Labor income	This is the dollar value of gross labor/wage income (pre-tax) earned for the head of household. In our data, it is available for a subset of investors. We annualize all income observations by scaling up part-year incomes to a full-year equivalent. In the SCF, we calculate labor income by adding wages from the head of household's first and second job as well as any income from self-employment. It excludes any income from rental properties, dividends, royalites or any other sources that are not payments for labor. When included in regressions, we normalize income by taking the log deviation of labor income from the RI sample's average in the same year.
Retirement Share of Wealth	This is the 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. A typical TDF allocates 80 to 90 percent of assets to diversified equity funds and the remainder to bond funds until 25 years before retirement, when the equity share declines roughly linearly until reaching 30 to 40 percent 10 years after retirement. Also sometimes referred to as "hybrid", "combination", "auto-rebalancing", or "mixed" funds.

Definitions of key variables, continued

Variable	Definition
TDF Share of Investable Wealth	This is the total dollar value of TDFs in the portfolio divided by total investable wealth at the end of each calendar year.
Employment Tenure	This is the number of years that an employee has been working for his current employer. It is available for a subset of our sample: the same subset for which labor income is available.
Equity share of retirement wealth	This is the percentage share of the retirement portfolio 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). We divide the value of these holdings by the total retirement wealth at the end of each calendar year to obtain equity share.
Equity share of investable wealth	This is the percentage share of investable 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). We divide the value of these holdings by total investable wealth at the end of each calendar year to obtain equity share.
Equity share of non-retirement wealth	This is the percentage share of non-retirement wealth 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). We divide the value of these holdings by the total non-retirement wealth at the end of each calendar year to obtain equity share.
Long-term bonds (fixed income)	This is a type of asset that is included in total investable wealth, but not equity. It includes 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)	This is a type of asset that is included in total investable wealth, but not equity. It includes money market mutual funds, short-term treasury bonds, and CDs.

Definitions of key variables, continued

Variable	Definition
Market betas	To calculate CAPM market betas, we use all available return data from 2006 to 2018. We estimate betas from monthly regressions of excess asset returns on excess market returns. We assign a market beta to funds and securities that have at least 24 monthly return observations. We set the market beta of short-term bonds to zero. To deal with missing returns for certain asset types, 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). In particular, we estimate the market beta of a mixed-asset fund with a time-varying equity share 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 investor portfolio.
Reported contribution rate	This is 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.
Realized contribution rate	This is the total realized annual retirement contributions, taken as a 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.

Table II: Characteristics of Sample of Retirement Investors in 2016 (SCF)

Retirement Investors				
	Summary Statistics			
	Mean	Median	SD	Percentage of RI Sample with Observed Data
Age (Years)	45.38	46	11.28	100%
Share Female (%)	45.5	0	49.8	94.0%
Share Married (%)	71.8	100	45.0	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	47.00	10.63	3130
Female (%)	49.69	0.00	49.99	3130
Married (%)	77.80	100.00	38.71	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	3130
Retirement Wealth (Individual, $)	97,658	41,500	155,503	1889
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 than 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: 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 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 V: 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	0.162
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 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 VI: 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 VII: 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) shows 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 VIII: 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 who's 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 IX: 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 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 X: 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 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 XI: Within-Person Regressions of Realized Contribution Rate on Age Groups by Cohort and TDF Share

	Realized 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				0.0376	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 XII: 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 XIII: 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 than 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 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 XIV: 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 than 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 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 XV: Within-Person 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				0.0577	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 than 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.

Table XVI: 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)
% 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) shows 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 than 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 XVII: 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)
% 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 who's 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 than 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.

Unpublished Appendix for

Household Portfolios and Retirement Saving over the Life Cycle

by

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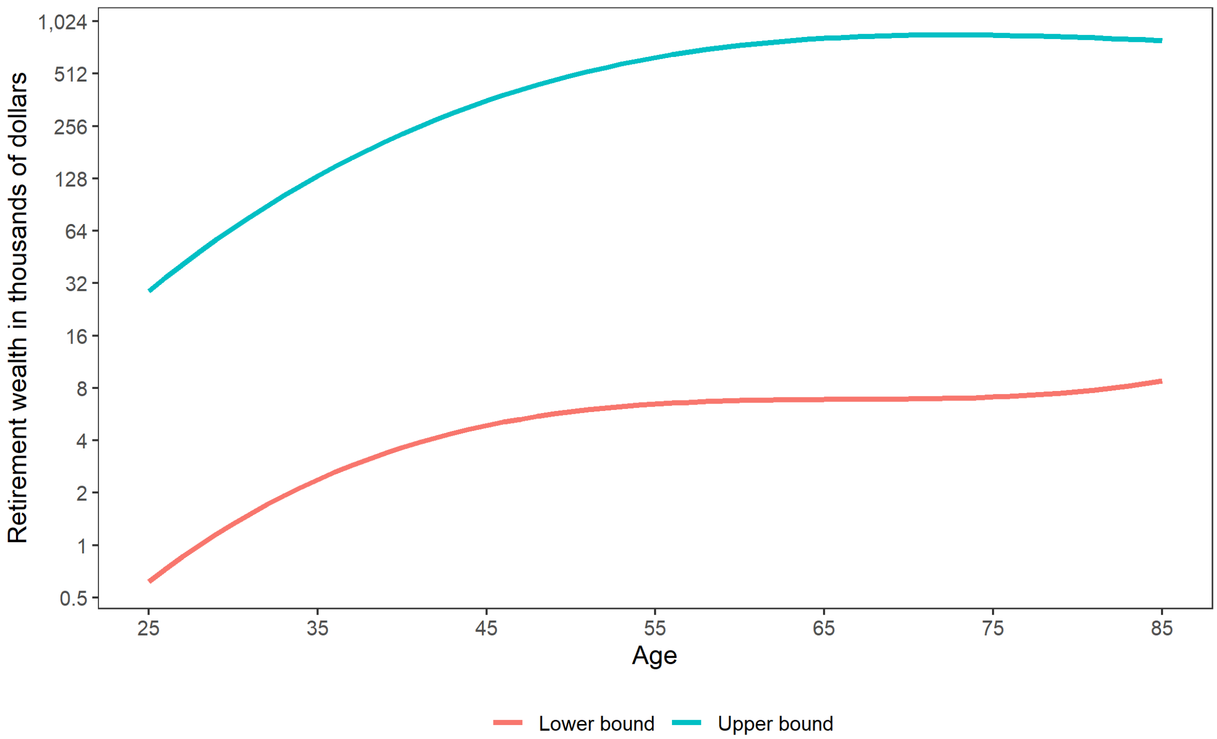
Allison Cole

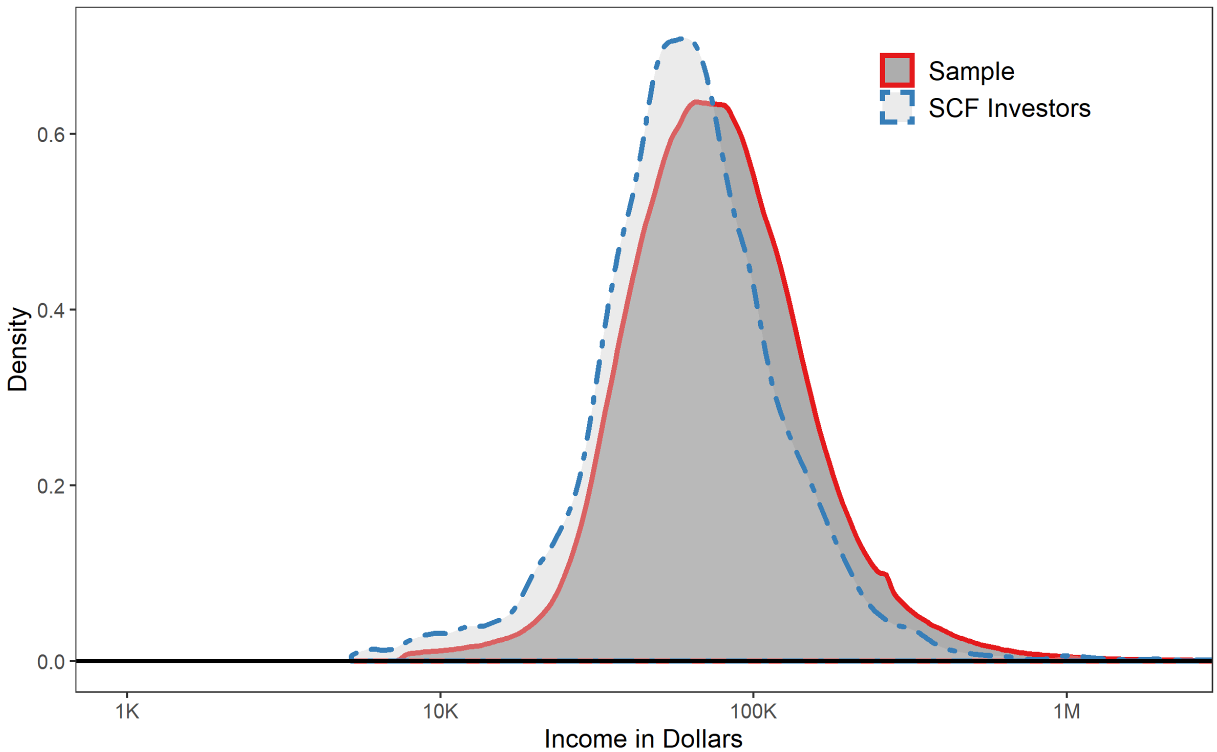
February 2, 2021

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 1.2. 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.

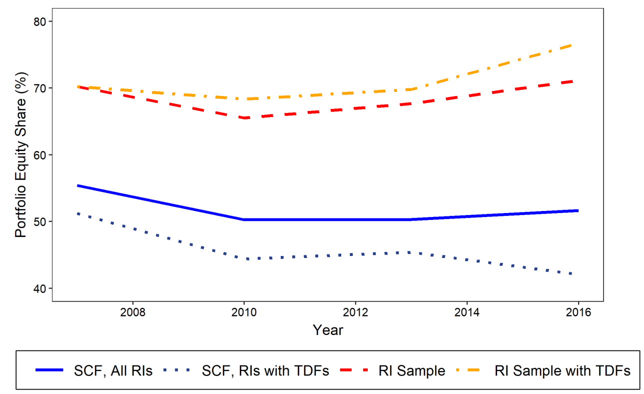
Figure A.2: Individual Labor Income Distribution in Firm Data and the SCF in 2016



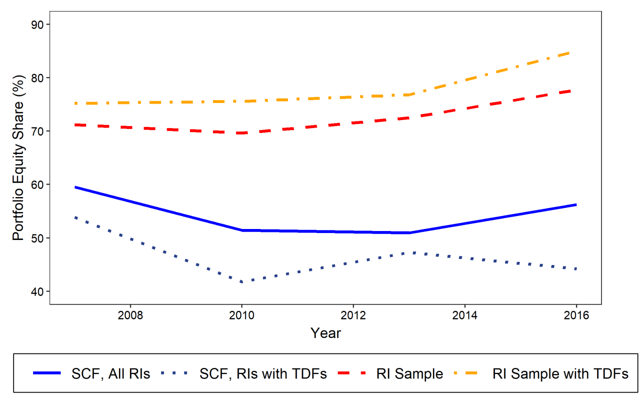
Notes: This figure plots the distribution of labor income in the sample of retirement investors (RIs) versus the distribution of labor income for RIs in the SCF in 2016.

Figure A.3: Equity share of retirement wealth

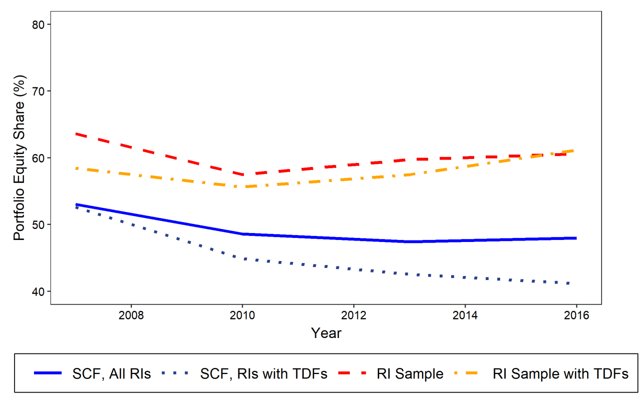
(a) All ages



(b) Age 25-34



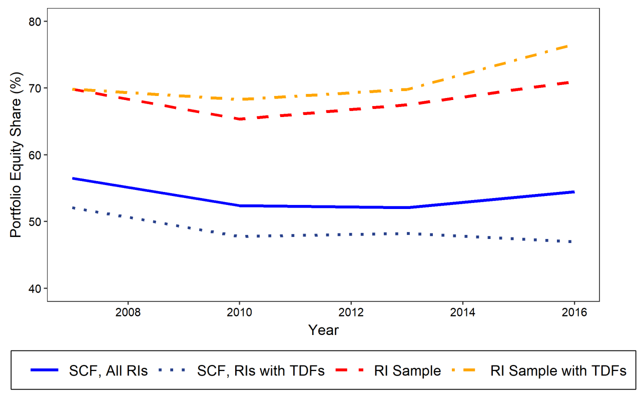
(c) Age 55-65



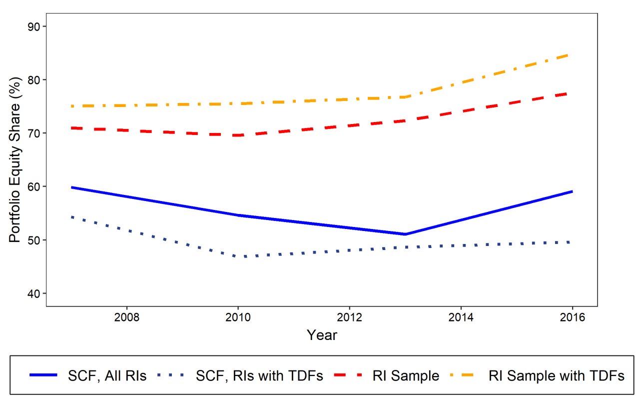
Notes: These figures show the portfolio equity share of retirement wealth over time. The SCF data is every three years, in 2007, 2010, 2013, and 2016. We show the same years in our sample. We also show the equity share for all RIs and for RIs who hold some assets in a TDF separately. Panel a shows all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

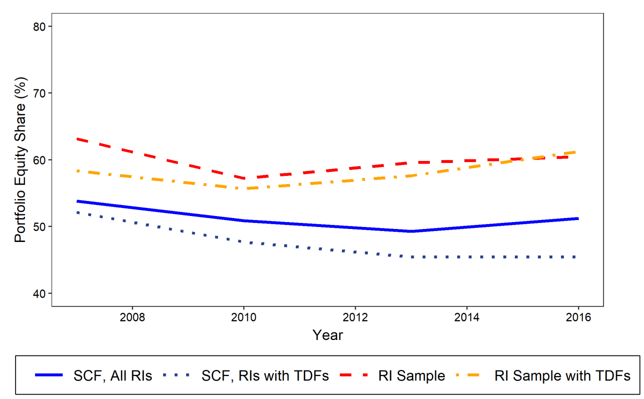
(a) All ages



(b) Age 25-34

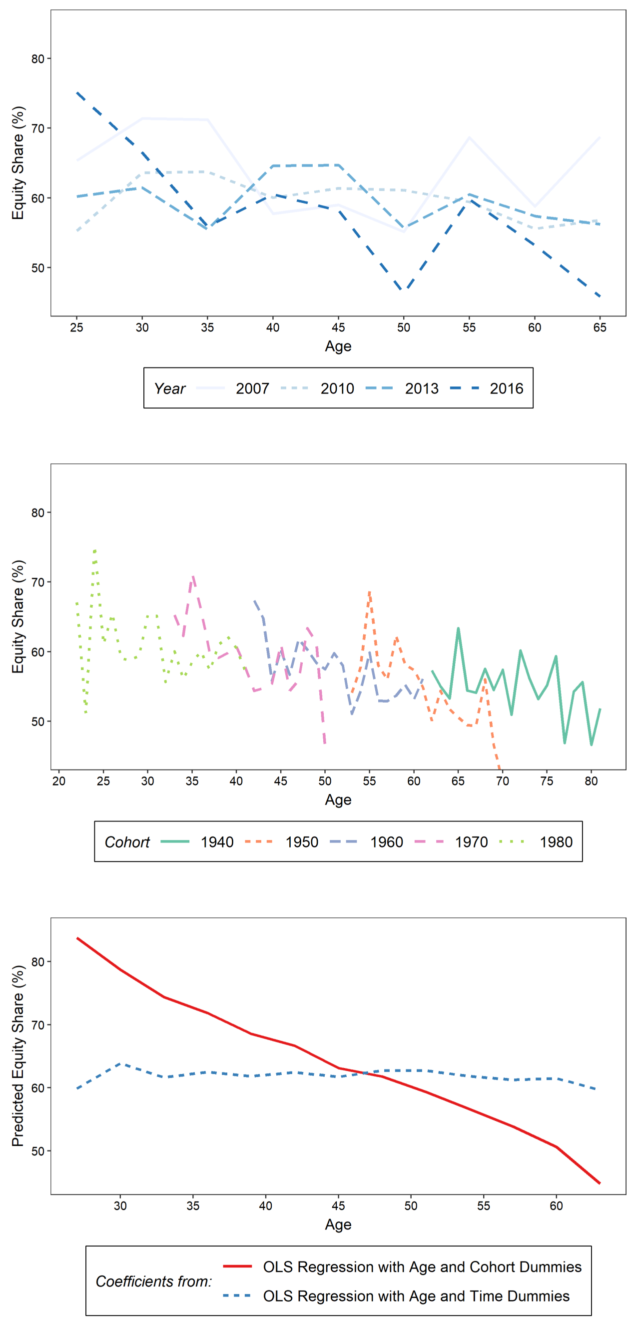


(c) Age 55-65



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.

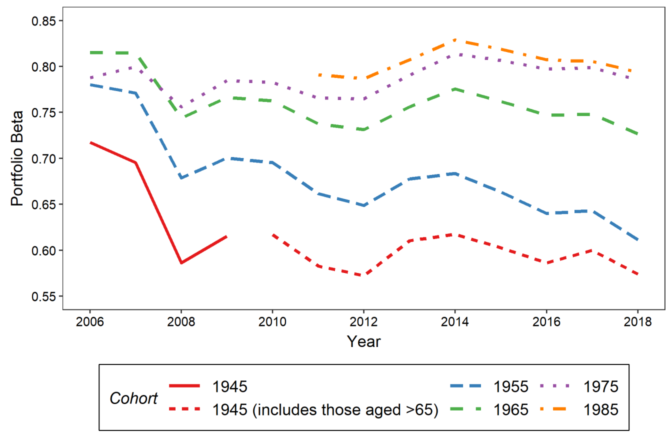
Figure A.5: Equity Share Among Equity Owners (SCF)



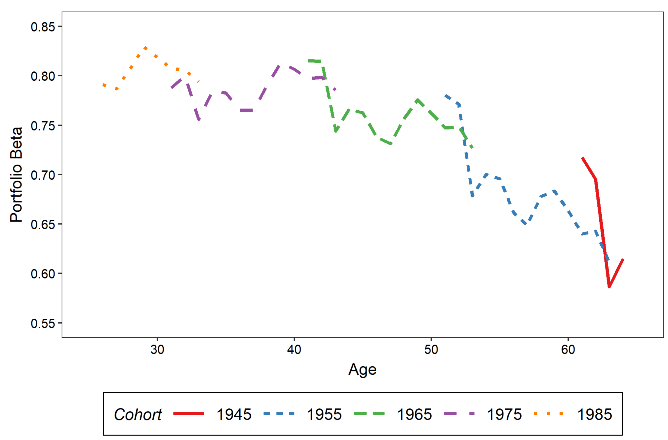
Notes: This figure replicates the results shown in Figure 9 of Ameriks and Zeldes (2004) using the SCF from 2007, 2010, 2013, and 2016. The top figure shows the observed equity share by age in each year. The middle figure shows the observed equity share by age in each cohort in our sample. A cohort is 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 age and cohort dummies and then on age and time dummies. We obtain the predicted values by adding the median cohort and 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 SCF retirement investors (RI) who own at least some equity.

Figure A.6: Portfolio Beta by Birth Cohort

(a) Portfolio Beta by Birth Cohort and Year

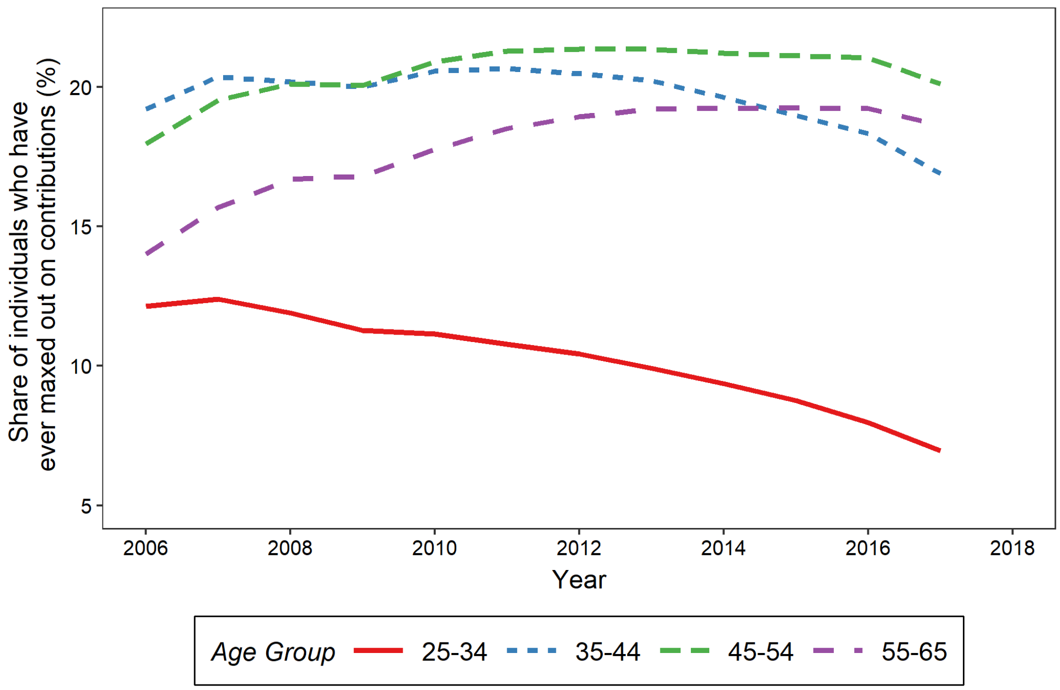


(b) Portfolio Beta by Birth Cohort and Age



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 avaiable 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.7: Incidence of Maxing Out on Contribution Limits, by Age Group



Notes: This figure shows the percentage of households 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.

Table A.1: 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 than 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.2: 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, $)	101,349	77,000	1,445,913	2556
Investable Wealth (Household, $)	273,282	72,000	17,019,097	2556
Retirement Wealth (Household, $)	225,166	94,000	718,051	2556
Retirement Wealth (Individual, $)	97,658	41,500	155,503	2556
Retirement Share of Investable Wealth (Individual, %)	58.35	56.60	37.23	2556
Retirement Share of Investable Wealth (Household, %)	87.81	100.00	31.33	2556

Notes: This table presents summary statistics on demographics, wealth, and portfolio allocations for a subsample or our Retirement Investors (RI) sample whom 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 than 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.3: 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 whom 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 than 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.4: 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). 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.5: 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.6: 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.7: 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.8: 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	0.8061	0.7433	0.7941	0.8012
	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0006)
Age 28-30	0.7317	0.7984	0.7296	0.7811	0.7894
	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0004)
Age 31-33	0.7313	0.7894	0.7244	0.7722	0.7794
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Age 34-36	0.7327	0.7813	0.7229	0.7666	0.7716
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Age 37-39	0.7327	0.7725	0.7193	0.7607	0.7660
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Age 40-42	0.7281	0.7606	0.7108	0.7509	0.7584
	(0.0001)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Age 43-45	0.7203	0.7473	0.6992	0.7384	0.7489
	(0.0001)	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 46-48	0.7054	0.7278	0.6795	0.7179	0.7331
	(0.0001)	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 49-51	0.6844	0.7016	0.6549	0.6906	0.7091
	(0.0001)	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 52-54	0.6595	0.6726	0.6264	0.6596	0.6802
	(0.0001)	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 55-57	0.6297	0.6383	0.5919	0.6228	0.6458
	(0.0001)	(0.0002)	(0.0004)	(0.0003)	(0.0003)
Age 58-60	0.5988	0.6038	0.5585	0.5845	0.6087
	(0.0001)	(0.0002)	(0.0004)	(0.0004)	(0.0003)
Age 61-63	0.5690	0.5705	0.5240	0.5459	0.5731
	(0.0002)	(0.0003)	(0.0004)	(0.0004)	(0.0004)
Age 64-65	0.5477	0.5454	0.4956	0.5144	0.5444
	(0.0002)	(0.0003)	(0.0006)	(0.0005)	(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 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.9: Cross-Sectional 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				0.7376	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.10: 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 who's 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.11: 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.12: 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 than 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.13: 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)
% 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 who’s 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 than 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.