Heterogeneity in Target Date Funds: Strategic Risk-taking or Risk Matching?

Internet Appendix

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A The Pension Protection Act of 2006

A.1 Overview

The PPA amends Title I of the Employee Retirement Income Security Act (ERISA) of 1974. Of particular interest to our study, it relieves sponsors of DC retirement plans of liability for investment losses when they default plan participants into "qualified default investment alternatives" (QDIAs). As specified by the Department of Labor's (DOL) Employee Benefits Security Administration (EBSA), QDIAs must be diversified to decrease the probability of large losses; be managed by an investment company registered under the Investment Company Act of 1940; not penalize or prevent a participant from transferring their assets from a QDIA to another investment alternative available under the plan; and not invest participant contributions directly in employer securities.[1] Potential QDIAs include TDFs, balanced funds (BFs), and professionally managed accounts. Note that plan sponsors and fiduciaries are not relieved of liability for the prudent selection and monitoring of a QDIA.

A.2 Timeline

In January 2005, a proposal was put forward to strengthen the pension system by putting into place new minimum funding requirements. Later that year, major pension reform bills were proposed in the House (The Pension Protection Act) and the Senate (The Pension Security and Transparency Act). The PPA of 2006 resulted from negotiations between the House and the Senate conducted in March 2006.[2] The final ruling was passed by the House on July 28, 2006, passed by the Senate on August 3, 2006, and signed into law on August 17, 2006. On September 27, 2006, the DOL published rules regarding "Default Investment Alternatives under Participant-Directed Individual Account Plans," which listed TDFs among the set of QDIAs. Although the rules technically went into effect on December 24, 2007, the likely effect on the demand for TDFs was well known to market participants in 2006.

A.3 Public Statements Summarizing Advantages and Disadvantages of TDFs

Source for all quotes: DOL and SEC Joint Public Hearing on TDFs and Other Similar Investment Options: June 18, 2009.

Advantages:

- "Target date funds were expected to make investing easier for the typical American and avoid the need for investors to constantly monitor market movements and realign their personal investment allocations." SEC Chairman Mary Shapiro
- "Target Date Funds are one of the most important recent innovations in retirement savings. They provide a convenient way for an investor to purchase a mix of asset classes within a single fund that will rebalance the asset allocation and become more conservative as the investor ages." Karrie McMillan, general counsel of the Investment Company Institute
- "Target Date Fund investors avoid extreme asset allocations that we often observe in retirement savings." Karrie McMillan, general counsel of the Investment Company Institute

[1] DOL: EBSA Federal Register: 29 CFR Part 2550, October 24, 2007.
[2] Congressional Research Service Report for Congress, October 23, 2006.

- "Target date funds were designed to be easy to use and require little maintenance." Richard Whitney, Director of Asset Allocation of T. Rowe Price

- "...the fundamental purpose of Target Date Funds is to provide investors a diversified, prudently-managed, appropriate exposure to investment risks." John Ameriks, economist and principal at the Vanguard Group

- "When evaluating the performance of Target date funds, it's important to acknowledge the extreme severity of the financial meltdown we have just experienced ...in our view they performed as designed. In particular, in the vast majority of cases, older investors were exposed to far less risks than younger investors and consequently suffered less dramatic losses." John Ameriks, economist and principal at the Vanguard Group

- "...it is important for investors to stay committed to a retirement savings plan. Target Date Funds are designed to help participants maintain this discipline." Derrick Young, Chief Investment Officer of the Fidelity Global Asset Allocation Group

Disadvantages:

- "While Target Date Mutual Funds currently do a good job of describing their objectives, risks and glide paths, we do see gaps in the public understanding of target date funds." Karrie McMillan, general counsel of the Investment Company Institute

- "Retirees do a lot of different things with the money in these plans at the point of retirement, and so there is some debate around exactly how the money is going to be used ...it's very difficult to come up with a sort of specific answer that solves the problem for everybody." John Ameriks, economist and a principal at the Vanguard Group

- "We have serious concerns that these funds are fundamentally misleading to investors because they're allowed to be managed in ways that are inconsistent with reasonable expectations that are created by the titles and the use of the names." Marilyn Capelli-Dimitroff, Chair of the Certified Financial Planner Board of Standards

- "Appropriate disclosures are required and must be provided, but in reality, disclosures are seldom read or understood fully despite our ongoing education of clients." Marilyn Capelli-Dimitroff, Chair of the Certified Financial Planner Board of Standards

- "When plan sponsors and participants started adopting TDFs in big meaningful numbers starting in 2002, the race was on for performance numbers, and this is where the train went off the track ...There is some theoretical rationale for employing a glide path through the accumulation phase. No credible rationale has ever been proffered for using a glide path in the distribution phase. This is what caused the unacceptably large losses in 2010 funds in 2008." Joe Nagengast, Target Date Analytics

- "...part of the concern here is when you have a fund of funds, it may become a lot easier to, for example, hide under-performing funds in Target Date Funds, [or] hide higher fee funds in a Target Date Fund that may not be completely appropriate." Dave Certner, Legislative Counselor and Legislative Policy Director at AARP

B Supplemental Analysis

B.1 Cross-sectional heterogeneity in TDF realized returns

Table B.1 documents substantial cross-sectional dispersion in realized annual returns of TDFs during our sample period. For example, for the 2015–2020 TDFs, the equally weighted cross-sectional standard deviation increases from 0.5% in 2000 to 1.8% in 2012.[3] The increase was especially marked between 2007 and 2008, jumping from 2.0% to 5.1%. Given the high market concentration documented in Table 1, we also compute value-weighted cross-sectional standard deviations. The value-weighted standard deviation increases from 0.4% in 2000 to 1.8% in 2012, and jumps from 1.2% in 2007 to 3.5% in 2008. The range increases from 1.1% to 8.5% between 2000 and 2012, and from 7.3% to 27.2% between 2007 and 2008. The patterns are similar for the other four pairs of target dates. In every case, we find that the standard deviation of annual returns is higher in the years after the PPA (2007–2012) than in the years before (2000–2006). Across all five target dates, the equally weighted standard deviations increase by between 0.9% and 1.8%, and the value-weighted standard deviations increase by between 0.4% and 1.3%.[4] That we find the greatest post-PPA return dispersion among TDFs with the earliest target dates suggests that those investors closest to retirement face the greatest uncertainty about TDF returns.

We also report descriptive statistics for the sample of BFs offered by families that offer TDFs during our sample period. That BFs exhibit more cross-sectional dispersion, on average, than TDFs is consistent with there being a wider range of investment strategies among BFs (which span four Lipper classifications) than within TDFs with similar target dates. However, for BFs, the equally weighted standard deviation increases by 0.2% following the PPA and the value-weighted standard deviation decreases by 0.4%. We formally test for differences between TDFs and BFs in Table 2.

B.2 Decomposing TDF variation

In this section, we benchmark dispersion in the realized returns and ex ante risk profiles of TDFs against both traditional (non-TDF) BFs and S&P 500 index funds. To obtain our sample of traditional BFs, we drop all of the funds that we identify as TDFs, and then restrict the sample to funds where the Lipper objective (as reported in CRSP) is "Balanced Fund." It includes four Lipper classifications: Flexible Portfolio Funds (FX), Mixed-Asset Target Allocation Conservative Funds (MTAC), Mixed-Asset Target Allocation Moderate Funds (MTAG), or Mixed-Asset Target Allocation Growth Funds (MTAM). To obtain our sample of S&P 500 index funds, we first require that the fund name include "S&P" or "500." Then, we manually drop funds that are not traditional S&P 500 index funds (e.g., the Direxion Funds S&P 500 Bear 2.5x Fund).

To quantify the contribution of the cross-sectional dispersion on the overall dispersion of returns, we compute three measures. We describe the measures for TDFs, but they can just as easily be calculated for BFs and index funds. First, we compute the "Total Dispersion," the total

[3] To increase the size of each cross-section, we combine TDFs with adjacent target dates (e.g., 2015 and 2020).

[4] That the changes in dispersion are qualitatively similar using the equally weighted and value-weighted measures indicates that the heterogeneity that we document is not being driven by a small number of funds with few assets under management. At the same time, that the value-weighted measures are consistently lower than the equally weighted measures is consistent with our hypothesis that families with low market share face a greater incentive to generate alphas than market leaders.

standard deviation of returns for TDFs with a given target date.[5] This is the variability of realized TDF returns around the overall average return for that target date, and measures the total risk faced by investors who invest in TDFs with target date j. In a balanced panel, this variability can be thought of as the risk faced by an investor who is assigned randomly to a TDF at the beginning of the sample, and who stays in that TDF for the remainder of the sample. Second, we compute the "Market Dispersion," the standard deviation over time of the return on an equally weighted portfolio of TDFs with a given target date.[6] Third, we compute the "Fund Dispersion," the standard deviation *within* a given target date.[7] In a balanced panel, this is the extra risk that an investor bears because of having chosen the i-th TDF with target date j, as opposed to an equally weighted portfolio of TDFs with target date j. This general approach can also be used to decompose the dispersion of alphas, idiosyncratic volatilities, five-factor R^2s, and U.S. equity betas from the five-factor model. In Table B.2 we present results for the full sample period, and separately for pre-PPA and post-PPA periods.

We first focus on the variability of realized TDF returns. Looking across the five samples of TDFs, we see that much of the risk associated with investing in TDFs comes from Market Dispersion: Total Dispersion ranges between 14.0% and 18.9%, and Market Dispersion ranges between 13.6% and 18.7%. However, there remains significant Fund Dispersion. Fund Dispersion ranges from 2.4% for 2035–2040 and 2045–2050 funds, to 3.2% for 2005–2010 funds, confirming that there is more Fund Dispersion in realized TDF returns when target dates are near than when they are far. Moreover, we find that Fund Dispersion approximately doubles between the pre-PPA and post-PPA periods.

Within the full sample of BFs, some of which have more discretion over asset allocation, market timing, and security selection, total dispersion is 13.9% and fund dispersion is 5.1%. In contrast, for S&P 500 index funds, total dispersion is 17.9% and fund dispersion is only 0.5%. Hence, all five target dates expose investors to greater total dispersion but less fund dispersion than traditional BFs. Perhaps more surprisingly, 2035–2045 TDFs expose investors to greater total dispersion than S&P 500 index funds, which invest close to 100% in U.S. equity. The patterns are similar when we switch our focus from total returns to alphas (measured using the annualized five-factor alphas from Table 2). On average, fund dispersion in *alphas* explains approximately 70% of the fund dispersion in total returns.

When we turn to idiosyncratic volatility, we find that fund dispersion always exceeds market dispersion. Again, the level of fund dispersion approximately doubles between the pre-PPA

[5] For target date j the Total Dispersion is defined as

$$\hat{\sigma}_{Tj} = \sqrt{\frac{1}{\sum_{t=1}^{T_j} N_{jt}} \sum_{t=1}^{T_j} \sum_{i=1}^{N_{jt}} (r_{ijt} - \bar{\bar{r}}_j)^2},$$

where r_{ijt} is a TDF's yearly return and $\bar{\bar{r}}_j$ is the average return across all TDFs with target date j and all years.

[6] Market Dispersion is defined as

$$\hat{\sigma}_{Mj} = \sqrt{\frac{1}{\sum_{t=1}^{T_j} N_{jt}} \sum_{t=1}^{T_j} N_{jt} (\bar{r}_{jt} - \bar{\bar{r}}_j)^2},$$

where $\bar{r}_{jt}$ is the year-t return on an equally weighted portfolio of TDFs with target date j.

[7] Fund Dispersion is defined as

$$\sqrt{\hat{\sigma}_{Tj}^2 - \hat{\sigma}_{Mj}^2} = \sqrt{\frac{1}{\sum_{t=1}^{T_j} N_{jt}} \sum_{t=1}^{T_j} \sum_{i=1}^{N_{jt}} (r_{ijt} - \bar{r}_{jt})^2}.$$

and post-PPA periods. The differences between fund dispersion and market dispersion are more pronounced for five-factor model R^2s and U.S. equity betas. For R^2s, total dispersion ranges between 3.5% and 4.4%, and market dispersion ranges between 0.5% and 1.0%. Overall, Table B.2 confirms that TDFs with the same target date expose investors to significantly different levels of idiosyncratic and systematic risk. With respect to economic significance, the dispersion within each sample of TDFs is about half as large as within the samples of BFs.

B.3 Robustness Tests and Additional Analysis

- Table B.3 lists the number of family-year and TDF-month observations separately by market share categories for pre-PPA and post-PPA families.
- Table B.4 reestimates Table 2 comparing TDFs to the full sample of BFs rather than the subsample of BFs offered by families that ever offer TDFs.
- Table B.5 compares the return dispersion of BFs and TDFs from pre-PPA and post-PPA families that were introduced before and after December 31, 2006.
- Table B.6 extends several of the specifications in Table 4 to consider alternative measures of cross-sectional dispersion (i.e., squared deviations and absolute deviations) and alternative sample periods (i.e., 2000–2012, 2007–2012, and 2007–2012 excluding 2008 and 2009).
- Table B.7 reestimates several of the specifications in Tables 4–6 when dispersion is measured at the level of the mutual fund family.
- Tables B.8–B.10 reestimate all of the specifications from Tables 4–6 using data from 2007–2012.
- Tables B.11–B.13 reestimate all of the specifications from Tables 4–6 using data from 2007–2012 excluding 2008 and 2009.
- Table B.14 extends several of the specifications in Table 4 to consider both market share within the market for TDFs and market share within the broader market for mutual funds.
- Table B.15 extends several of the specifications in Table 4 to consider the year that a family enters the market for TDFs.
- Table B.16 complements Table 8 by providing additional plan-level evidence on TDF risk versus industry risk.
- Table B.17 reestimates Table 8 using the absolute value of average plan-level (target-date adjusted) TDF risk as new dependent variables and the absolute value of (demeaned) firm risk as new independent variables. This allows us to explore whether the safest and riskiest firms are more likely to match with safest and riskiest TDFs.
- Table B.18 uses data from IRS Form 5500 to calculate the fraction of retirement plan participants in each broad industry category in 2005 and 2012. The fractions are quite similar except that the fraction of participants in manufacturing has fallen while the fraction of participants in health care has risen.

Table B.1: Annual returns

This table summarizes the annual net returns earned by TDFs with different target dates in different calendar years. Each calendar year, the sample includes all TDFs for which we observe 12 monthly returns. Within each target date-year cell, we report the number of TDFs, the average annual net return, standard deviation of annual net returns (both equally weighted and value-weighted based on the family's market share in the TDF market), and the minimum and maximum annual net returns. We also report summary statistics for BFs offered by families that ever offer TDFs.

	2005 & 2010						2015 & 2020						2025 & 2030					
	#		SD				#		SD				#		SD			
	Funds	Mean	EW	VW	Min	Max	Funds	Mean	EW	VW	Min	Max	Funds	Mean	EW	VW	Min	Max
2000	4	0.5%	0.2%	0.2%	0.2%	0.7%	4	-3.7%	0.5%	0.4%	-4.1%	-3.0%	4	-5.7%	0.5%	0.4%	-6.1%	-5.1%
2001	4	-1.9%	1.7%	1.2%	-4.3%	-0.7%	4	-7.2%	1.2%	0.9%	-9.1%	-6.4%	4	-10.6%	0.8%	0.6%	-11.7%	-9.9%
2002	5	-7.4%	1.8%	0.7%	-9.3%	-4.6%	5	-12.0%	2.8%	0.9%	-14.0%	-7.2%	5	-15.2%	2.9%	1.0%	-17.3%	-10.3%
2003	6	17.5%	3.4%	1.1%	14.4%	23.8%	6	22.2%	3.2%	1.5%	19.3%	27.4%	6	25.4%	3.0%	1.7%	22.8%	30.0%
2004	10	7.8%	2.0%	1.1%	5.6%	11.6%	10	9.7%	1.6%	1.0%	8.2%	12.8%	10	11.1%	1.5%	0.9%	9.9%	14.1%
2005	13	4.7%	1.0%	0.7%	3.0%	6.2%	16	5.8%	1.2%	0.8%	4.1%	7.8%	16	6.8%	1.3%	0.9%	4.8%	8.8%
2006	20	9.7%	2.2%	1.4%	6.6%	13.9%	26	11.7%	2.0%	1.5%	7.9%	16.2%	26	13.4%	2.1%	1.5%	9.5%	17.6%
2007	28	6.2%	1.6%	1.0%	2.7%	9.2%	41	6.5%	2.0%	1.2%	2.2%	9.5%	38	6.8%	2.3%	1.4%	1.9%	10.2%
2008	35	-24.0%	5.9%	3.9%	-41.5%	-10.9%	53	-29.5%	5.1%	3.5%	-43.7%	-16.5%	50	-34.4%	3.8%	2.7%	-44.6%	-25.0%
2009	34	22.5%	4.2%	3.8%	12.6%	31.4%	67	25.1%	4.4%	4.3%	11.9%	35.4%	64	28.4%	4.1%	4.2%	18.6%	37.9%
2010	34	10.7%	1.3%	1.1%	7.6%	13.7%	71	12.0%	1.5%	1.2%	7.4%	14.9%	68	13.6%	1.4%	0.9%	9.5%	17.1%
2011	33	1.5%	2.0%	1.8%	-2.6%	6.7%	74	0.0%	2.3%	1.3%	-5.4%	9.6%	72	-1.8%	2.3%	1.2%	-6.7%	10.0%
2012	29	9.9%	1.9%	1.8%	4.9%	12.8%	72	11.4%	1.8%	1.8%	6.4%	14.9%	73	13.4%	1.6%	1.6%	9.1%	17.1%
Pre-PPA			1.9%	1.3%					1.8%	1.5%					1.8%	1.6%		
Post-PPA			3.3%	2.3%					3.1%	2.3%					2.7%	2.1%		

	2035 & 2040						2045 & 2050						Balanced funds					
	#		SD				#		SD				#		SD			
	Funds	Mean	EW	VW	Min	Max	Funds	Mean	EW	VW	Min	Max	Funds	Mean	EW	VW	Min	Max
2000	3	-10.0%	0.2%	0.2%	-10.1%	-9.7%							53	1.6%	6.5%	6.8%	-12.0%	18.7%
2001	4	-13.7%	0.3%	0.1%	-13.9%	-13.4%							56	-4.5%	5.4%	5.4%	-17.0%	11.0%
2002	5	-18.0%	3.0%	0.9%	-20.1%	-12.8%	1	-15.8%	0.0%	0.0%	-15.8%	-15.8%	67	-10.0%	7.2%	8.7%	-35.0%	6.1%
2003	6	28.2%	2.5%	1.6%	24.2%	31.2%	1	26.3%	0.0%	0.0%	26.3%	26.3%	60	20.6%	5.7%	9.8%	9.8%	48.6%
2004	10	11.9%	1.0%	0.7%	10.9%	14.1%	2	13.0%	0.2%	0.1%	12.9%	13.1%	73	8.7%	2.4%	2.7%	3.2%	15.0%
2005	16	7.4%	1.3%	0.8%	5.2%	9.1%	4	8.1%	0.9%	1.0%	6.9%	9.2%	78	5.2%	1.8%	2.4%	0.7%	13.2%
2006	25	14.7%	1.7%	1.3%	11.2%	17.8%	8	15.9%	0.9%	0.3%	14.6%	17.5%	140	11.0%	3.4%	3.1%	2.6%	21.9%
2007	35	6.9%	2.6%	1.5%	1.6%	10.9%	14	6.5%	2.9%	0.8%	1.4%	11.2%	193	6.0%	3.1%	2.5%	-8.9%	23.3%
2008	48	-36.9%	2.4%	1.8%	-41.4%	-30.6%	33	-37.8%	2.2%	2.3%	-41.6%	-33.6%	236	-25.7%	7.8%	6.1%	-42.7%	1.2%
2009	63	30.5%	4.0%	3.9%	20.6%	39.5%	51	31.5%	4.0%	3.8%	20.5%	42.5%	351	22.9%	7.3%	5.8%	-2.1%	47.5%
2010	67	14.6%	1.7%	0.9%	9.9%	20.9%	56	14.9%	1.5%	0.9%	12.4%	20.1%	318	11.8%	2.5%	2.3%	3.5%	21.7%
2011	71	-3.3%	2.4%	1.1%	-7.7%	10.0%	62	-3.8%	2.5%	1.2%	-8.1%	10.0%	312	0.5%	3.0%	3.3%	-7.7%	10.9%
2012	73	14.8%	1.7%	1.5%	9.5%	18.1%	67	15.3%	1.6%	1.4%	9.7%	18.2%	327	11.6%	2.9%	2.6%	-7.6%	24.1%
Pre-PPA			1.6%	1.5%					0.7%	0.6%					4.7%	4.8%		
Post-PPA			2.5%	1.9%					2.5%	1.9%					4.9%	4.4%		

Table B.2: Decomposition: Total dispersion, market dispersion, and fund dispersion

In this table, we measure dispersion in annual net returns, annualized five-factor alphas, annualized idiosyncratic volatilities, R^2 from the five-factor model, and U.S. equity betas estimated in a five-factor model. The sample period is 2002–2012. Let x_{ijt} be the value for TDF i with target date j in year t, $\overline{x}_{jt}$ be the equally weighted average of all funds with target date j in year t, and $\overline{\overline{x}}_j$ be the equally weighted average of all (TDF i, year t) pairs within target date j. "Total dispersion" measures the variation of x_{ijt} around $\overline{\overline{x}}_j$. "Market dispersion" measures the time-series variation of $\overline{x}_{jt}$ around $\overline{\overline{x}}_j$. For example, when x_{ijt} is the annual net return of TDF i with target date j in year t, "Market dispersion" measures time-series variation in the annual net returns of an equally weighted portfolio of TDFs with target date j. This is the variability that investors are exposed to when they invest in the average TDF. "Fund dispersion" measures that additional variability that investors are exposed to when they are randomly assigned to a single TDF rather than to the average TDF. When "Total dispersion," "Market dispersion," and "Fund dispersion" are measured as variances, "Fund dispersion" equals "Total dispersion" minus "Market dispersion." However, in the table, we report the corresponding standard deviations. For comparison, we perform a similar decomposition for the universe of traditional BFs, the subset of BFs offered by families that ever offer TDFs, and the universe of S&P 500 index funds.

	Net return			5-factor alpha			Idiosyncratic volatility			5-factor R^2			U.S. equity beta		
	Total	Market	Fund	Total	Market	Fund	Total	Market	Fund	Total	Market	Fund	Total	Market	Fund
Full sample period															
TDFs: 2005 & 2010	14.0%	13.6%	3.2%	3.1%	2.1%	2.2%	1.1%	0.7%	0.8%	4.4%	0.9%	4.3%	0.11	0.04	0.10
TDFs: 2015 & 2020	15.6%	15.3%	2.9%	2.8%	1.8%	2.1%	1.0%	0.6%	0.8%	4.2%	1.0%	4.0%	0.13	0.07	0.11
TDFs: 2025 & 2030	17.9%	17.7%	2.6%	2.6%	1.8%	2.0%	1.0%	0.6%	0.8%	3.5%	0.5%	3.5%	0.12	0.06	0.11
TDFs: 2035 & 2040	18.9%	18.7%	2.4%	2.8%	1.9%	2.0%	1.0%	0.6%	0.9%	3.5%	0.5%	3.5%	0.11	0.04	0.10
TDFs: 2045 & 2050	17.1%	16.9%	2.4%	2.9%	2.1%	2.0%	1.1%	0.5%	0.9%	4.0%	0.5%	4.0%	0.12	0.03	0.11
Balanced funds (All)	13.9%	13.0%	5.1%	4.4%	2.0%	3.9%	2.2%	0.9%	2.0%	12.8%	1.3%	12.7%	0.20	0.03	0.20
Balanced funds (TDFs)	14.0%	13.3%	4.4%	3.8%	2.3%	3.0%	1.5%	0.8%	1.3%	6.5%	0.7%	6.4%	0.18	0.03	0.18
S&P 500 index funds	17.9%	17.9%	0.5%	1.5%	1.5%	0.5%	0.5%	0.4%	0.3%	1.3%	0.4%	1.2%	0.03	0.03	0.01
Pre-PPA (2000–2006)															
TDFs: 2005 & 2010	6.7%	6.5%	1.6%	1.6%	0.7%	1.5%	0.5%	0.3%	0.4%	2.3%	0.9%	2.1%	0.07	0.01	0.07
TDFs: 2015 & 2020	9.1%	8.9%	1.6%	1.7%	0.8%	1.5%	0.4%	0.2%	0.4%	1.3%	0.7%	1.2%	0.07	0.01	0.06
TDFs: 2025 & 2030	10.8%	10.7%	1.5%	1.8%	1.0%	1.5%	0.4%	0.2%	0.4%	1.0%	0.6%	0.8%	0.07	0.03	0.06
TDFs: 2035 & 2040	12.3%	12.2%	1.5%	1.7%	1.0%	1.4%	0.4%	0.1%	0.4%	1.0%	0.6%	0.8%	0.07	0.03	0.06
TDFs: 2045 & 2050	6.2%	6.2%	0.7%	1.3%	1.0%	0.8%	0.4%	0.2%	0.3%	0.8%	0.0%	0.8%	0.06	0.06	0.03
Balanced funds (All)	11.5%	10.4%	4.9%	3.7%	1.1%	3.6%	1.9%	0.6%	1.8%	13.8%	0.7%	13.8%	0.19	0.00	0.19
Balanced funds (TDFs)	10.3%	9.4%	4.2%	2.4%	0.7%	2.2%	1.1%	0.5%	0.9%	7.8%	0.8%	7.7%	0.17	0.00	0.17
S&P 500 index funds	17.5%	17.5%	0.4%	1.4%	1.3%	0.4%	0.4%	0.3%	0.1%	0.5%	0.4%	0.2%	0.04	0.04	0.01
Post-PPA (2007–2012)															
TDFs: 2005 & 2010	15.1%	14.7%	3.4%	3.3%	2.3%	2.4%	1.1%	0.7%	0.9%	4.7%	0.9%	4.6%	0.11	0.04	0.10
TDFs: 2015 & 2020	16.2%	15.9%	3.0%	2.9%	1.9%	2.2%	1.1%	0.6%	0.9%	4.4%	1.0%	4.2%	0.13	0.07	0.11
TDFs: 2025 & 2030	18.6%	18.4%	2.7%	2.7%	1.9%	2.0%	1.0%	0.6%	0.8%	3.7%	0.5%	3.7%	0.13	0.06	0.11
TDFs: 2035 & 2040	19.5%	19.3%	2.5%	2.9%	2.0%	2.1%	1.0%	0.5%	0.9%	3.7%	0.5%	3.7%	0.11	0.04	0.11
TDFs: 2045 & 2050	17.3%	17.1%	2.4%	2.9%	2.1%	2.0%	1.0%	0.5%	0.9%	4.0%	0.5%	4.0%	0.12	0.03	0.11
Balanced funds (All)	14.8%	13.9%	5.2%	4.6%	2.2%	4.1%	2.3%	1.0%	2.1%	12.3%	0.9%	12.3%	0.20	0.01	0.20
Balanced funds (TDFs)	14.7%	14.0%	4.5%	4.1%	2.6%	3.2%	1.6%	0.8%	1.4%	6.1%	0.6%	6.1%	0.18	0.01	0.18
S&P 500 index funds	18.3%	18.3%	0.5%	1.5%	1.4%	0.5%	0.5%	0.3%	0.4%	1.7%	0.3%	1.6%	0.03	0.03	0.01

Table B.3: Number of mutual fund families and TDFs based on market share and whether they entered post PPA

Panel A reports the number of mutual fund families that offer TDFs each year, based on their share in the TDF market (*Low*, *Medium*, or *High*), and on whether they entered the TDF market before or after December 31, 2006 (*Pre-PPA family* vs. *Post-PPA family*). Panel B reports the corresponding number of TDF-month observations. Note that the total number of TDF-month observations exceeds those included in the regressions in Tables 4–6 because we are not imposing the filter that we possess sufficient historical return data to estimate five-factor alphas.

A

	Number of families						
	Pre-PPA family			*Post-PPA family*			All
	Low	*Medium*	*High*	*Low*	*Medium*	*High*	
2000	1	0	3	0	0	0	4
2001	2	0	3	0	0	0	5
2002	2	2	2	0	0	0	6
2003	4	4	1	0	0	0	9
2004	5	5	3	0	0	0	13
2005	12	4	4	0	0	0	20
2006	16	5	4	0	0	0	25
2007	16	5	4	8	0	0	33
2008	17	5	4	17	1	0	44
2009	15	5	4	15	1	0	40
2010	14	6	4	14	1	0	39
2011	13	8	3	15	1	0	40
2012	11	8	3	14	1	0	37

B

	Number of TDF-months						
	Pre-PPA family			*Post-PPA family*			All
	Low	*Medium*	*High*	*Low*	*Medium*	*High*	
2000	60	0	185	0	0	0	245
2001	115	0	192	0	0	0	307
2002	133	64	152	0	0	0	349
2003	165	207	99	0	0	0	471
2004	190	384	192	0	0	0	766
2005	575	394	315	0	0	0	1284
2006	1114	251	421	0	0	0	1786
2007	1335	418	468	436	0	0	2657
2008	1560	488	547	969	99	0	3663
2009	1471	704	588	1433	108	0	4304
2010	1411	926	701	1154	119	0	4311
2011	1229	1376	612	1154	120	0	4491
2012	1247	1555	611	1304	120	0	4837

Table B.4: Benchmarking TDFs against full sample of BFs

The dependent variable in each OLS regression is a measure of cross-sectional dispersion. The unit of observation is fund i offered by family k in month or year t. Unlike Table 2, in which the comparison group is the subsample of BFs offered by families that offer TDFs, the comparison group is the full sample of BFs. We compute cross-sectional dispersion in monthly net returns in month t as $(r_{ijt} - \overline{r}_{jt})^2$, where j is either the TDF's target date or the BF's Lipper classification (Flexible Portfolio Funds (FX), Mixed-Asset Target Allocation Conservative Funds (MTAC), Mixed-Asset Target Allocation Moderate Funds (MTAG), or Mixed-Asset Target Allocation Growth Funds (MTAM)). The cross-sectional dispersion in monthly five-factor alphas in month t is computed similarly. Each month, we estimate the five-factor model for fund i using daily excess returns between month $t-11$ and month t. The five factors are the daily excess returns of the CRSP U.S. value-weighted market index, MSCI World Index excluding the United States, Barclays U.S. Aggregate Bond Index, Barclays Global Aggregate excluding the United States, and GSCI Commodity Index. The five-factor alpha of fund i in month t is defined as the difference between realized excess return in month t and the predicted component of the excess returns from the five-factor model in month t (i.e., the "systematic" component of the return) where factor loadings are estimated using daily returns between month $t-12$ and month $t-1$. The cross-sectional dispersion in U.S. equity beta is computed as $(\beta_{ijt} - \overline{\beta}_{jt})^2$, where we focus on betas estimated using daily returns for calendar year t. Idiosyncratic volatility is the nonannualized standard deviation of monthly five-factor alphas earned by fund i in calendar year t. R^2 from five-factor model is the R^2 estimated using daily returns for calendar year t. We report the average value of each measure separately for BFs and TDFs, for three time periods. Pre-PPA includes 2000–2006 for cross-sectional dispersion in monthly net returns, 2002–2006 for idiosyncratic volatility, and 2001–2006 for the other three measures. Post-PPA includes 2007–2012. Post-PPA (excl. crisis) includes 2007 and 2010–2012. We also report the coefficients from regressions that test for changes in each measure for TDFs or BFs ("difference") and for TDFs relative to each sample of BFs ("diff.-in-diff."). Standard errors are simultaneously clustered by family and time (month or year). *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent variable:	Cross-sectional dispersion in monthly net return		Cross-sectional dispersion in monthly 5-factor alpha		Cross-sectional dispersion in U.S. equity beta		Idiosyncratic volatility		R^2 from 5-factor model	
Fund Type:	BFs	TDFs	BFs	TDFs	BFs	TDFs	BFs	TDFs	BFs	TDFs
Frequency:	Monthly	Monthly	Monthly	Monthly	Annual	Annual	Annual	Annual	Annual	Annual
Pre-PPA	2.156***	0.212***	0.903***	0.066***	0.035***	0.005***	2.340***	0.991***	0.899***	0.966***
Post-PPA	1.721***	0.748***	0.942***	0.232***	0.026***	0.011***	2.576***	1.944***	0.923***	0.971***
Post-PPA (excl. crisis)	1.074***	0.464***	0.611***	0.145***	0.025***	0.012***	2.009***	1.615***	0.923***	0.968***
Difference	−0.435	0.536**	0.039	0.166***	−0.01 ***	0.005**	0.235	0.953***	0.024***	0.005
Difference (excl. crisis)	−1.082***	0.252*	−0.292*	0.079**	−0.01 ***	0.006**	−0.331	0.624***	0.024**	0.003
Diff.-in-diff.		0.971**		0.128		0.015***		0.718**		−0.019**
Diff.-in-diff. (excl. crisis)		1.334***		0.371***		0.017***		0.956***		−0.021**

Table B.5: Return characteristics of pre-PPA and post-PPA funds from pre-PPA and post-PPA families

This table compares three return characteristics for four samples of BF and TDFs. The return characteristic in panel A is the squared deviation of monthly returns (i.e., the first dependent variable in Table 4), the return characteristic in panel B is the squared deviation of monthly alphas (i.e., the second dependent variable in Table 4), and the return characteristic in panel C is idiosyncratic volatility (i.e., the third dependent variable in Table 4). In panels A and B, the unit of observation is fund i in month t; in panel C, the unit of observation is fund i in December of year t. The four samples are defined based on whether funds were introduced before or after December 31, 2006 (pre-PPA vs. post-PPA) and whether the family offering fund i entered the TDF market before or after December 31, 2006 (pre-PPA family vs. post-PPA family). The pre-PPA period begins in 2000 in panel A, 2001 in panel B, and 2002 in panel C. In Column 5, we report the coefficient from regressions that test for differences between post-PPA and pre-PPA BFs from pre-PPA families (Column 2 minus Column 1). In Column 6, we test for differences between post-PPA BFs from post-PPA and pre-PPA families (Column 4 minus Column 2). In Column 7, we test for differences between post-PPA and pre-PPA BFs from post-PPA families (Columns 4 minus Column 3). In Column 12, we test for differences between post-PPA and pre-PPA TDFs from pre-PPA families (Columns 9 minus Column 8). In Column 13, we test for differences between post-PPA TDFs from post-PPA and pre-PPA families (Column 11 minus Column 9). The standard errors in these regressions are simultaneously clustered by family and time (month or year), and are reported below the estimated coefficients. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Fund Type:	BFs							TDFs					
Family Type:	*Pre-PPA*	*Pre-PPA*	*Post-PPA*	*Post-PPA*				*Pre-PPA*	*Pre-PPA*	*Post-PPA*	*Post-PPA*		
Fund Age:	*Pre-PPA*	*Post-PPA*	*Pre-PPA*	*Post-PPA*	(2) - (1)	(4) - (2)	(4) - (3)	*Pre-PPA*	*Post-PPA*	*Pre-PPA*	*Post-PPA*	(9) - (8)	(11) - (9)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A. Cross-sectional dispersion in monthly net return													
Pre-PPA	1.281	—	1.238	—				0.212	—	—	—		
Post-PPA	1.292	1.129	1.229	1.128	−0.163	−0.001	−0.102	0.413	0.460	—	1.606	0.047	1.146*
					(0.554)	(0.514)	(0.26)					(0.188)	(0.640)
Post-PPA (excl. crisis)	0.471	0.701	0.639	0.627	0.230	−0.074	−0.012	0.256	0.444	—	0.881	0.188	0.437
					(0.227)	(0.261)	(0.167)					(0.258)	(0.432)
B. Cross-sectional dispersion in monthly 5-factor alpha													
Pre-PPA	0.346	—	0.462	—				0.066	—	—	—		
Post-PPA	0.415	0.337	0.665	0.511	−0.078	0.175	−0.154	0.196	0.119	—	0.406	−0.077	0.287***
					(0.092)	(0.264)	(0.245)					(0.043)	(0.110)
Post-PPA (excl. crisis)	0.222	0.296	0.325	0.340	0.074	0.044	0.016	0.097	0.083	—	0.300	−0.014	0.217**
					(0.092)	(0.172)	(0.128)					(0.018)	(0.101)
C. Idiosyncratic volatility													
Pre-PPA	1.635	—	2.198	—				1.035	—	—	—		
Post-PPA	2.064	1.964	2.509	2.210	−0.100	0.246	−0.299	1.936	1.680	—	2.421	−0.256	0.742**
					(0.154)	(0.692)	(0.571)					(0.165)	(0.297)
Post-PPA (excl. crisis)	1.658	1.841	1.929	1.808	0.183	−0.033	−0.121	1.557	1.537	—	2.229	−0.020	0.692***
					(0.147)	(0.485)	(0.168)					(0.107)	(0.259)

Table B.6: Robustness: Two measures of cross-sectional dispersion and three sample periods

Extension of Table 4 that considers two measures of cross-sectional dispersion and three sample periods. The unit of observation is TDF i offered by family k in month t. We measure cross-sectional dispersion in monthly net returns and monthly five-factor alphas as both squared deviations from the cross-sectional mean for funds with the same target date (like in Table 4) and as absolute deviations from this cross-sectional mean. The three sample periods are "full" (2001–2012), "post-PPA" (2007–2012), and "excl. crisis" (2007–2012 excluding 2008 and 2009). Columns 1 and 7 report the specifications from Table 4, which focus on squared deviations and are estimated using data for our full sample period. Columns 4 and 10 report comparable specifications where the dependent variable is now absolute deviations. The other columns differ only in the sample periods being considered. For each specification, we report the annualized difference in dispersion between low market share families that enter post-PPA to low market share families that enter pre-PPA. For measures of squared deviation, we compare the square root of the average predicted value for low market share families that enter post-PPA to the square root of the average predicted value for low market share families that enter pre-PPA. For measures of absolute deviation, we compare the average predicted value for low market share families that enter post-PPA to the average predicted value for low market share families that enter pre-PPA. The standard errors in these regressions are simultaneously clustered by family and month, and are reported below the estimated coefficients. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent Variable:	Cross-sectional dispersion in monthly net returns						Cross-sectional dispersion in monthly 5-factor alphas					
	Squared deviation			Absolute deviation			Squared deviation			Absolute deviation		
Time Period:	Full	Post-PPA	Excl. Crisis	Full	Post-PPA	Excl. Crisis	Full	Post-PPA	Excl. Crisis	Full	Post-PPA	Excl. Crisis
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Low market share ×	0.849**	0.863**	0.827*	0.269**	0.274***	0.266**	0.347***	0.351***	0.276**	0.190***	0.190***	0.177***
textitPost-PPA family	(0.368)	(0.365)	(0.485)	(0.107)	(0.106)	(0.126)	(0.131)	(0.130)	(0.124)	(0.056)	(0.056)	(0.054)
Low market share ×	0.154*	0.170**	0.048	0.073	0.078	0.042	0.096**	0.102**	0.050***	0.059***	0.060***	0.054**
textitPre-PPA family	(0.079)	(0.084)	(0.070)	(0.051)	(0.052)	(0.051)	(0.041)	(0.045)	(0.017)	(0.022)	(0.023)	(0.021)
Medium market share	0.091	0.115	0.060	0.031	0.044	0.034	0.044**	0.049**	0.029***	0.034***	0.033**	0.031**
	(0.085)	(0.098)	(0.060)	(0.047)	(0.052)	(0.041)	(0.018)	(0.021)	(0.009)	(0.011)	(0.014)	(0.015)
Index-fund-based TDF	−0.078	−0.089	−0.135*	−0.075*	−0.088*	−0.118**	−0.001	0.001	−0.019*	−0.026**	−0.025*	−0.036***
	(0.068)	(0.074)	(0.069)	(0.043)	(0.045)	(0.048)	(0.023)	(0.026)	(0.011)	(0.013)	(0.014)	(0.011)
H_0: *Low* × *Post-PPA*												
= *Low* × *Pre-PPA* = 0	0.016**	0.012***	0.185	0.031**	0.024**	0.098*	0.004***	0.005***	0.002***	0.000***	0.000***	0.000***
H_0: *Low* × *Post-PPA*												
= *Low* × *Pre-PPA*	0.059*	0.058*	0.112	0.064*	0.062*	0.075*	0.056*	0.056*	0.070*	0.026**	0.026**	0.034**
Annualized difference:												
Low × *Post-PPA*												
minus *Low* × *Pre-PPA*	4.36%	4.26%	6.37%	2.02%	1.95%	2.76%	2.20%	2.13%	3.09%	1.25%	1.20%	1.59%
Target date-by-time fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	21,788	19,501	13,397	21,788	19,501	13,397	21,788	19,501	13,397	21,788	19,501	13,397
R^2	11.23%	10.90%	7.61%	24.65%	23.67%	21.10%	10.29%	9.99%	4.80%	22.64%	21.10%	13.32%

Table B.7: Robustness: Family-level measures of cross-sectional dispersion in realized returns and ex ante risk-taking

Extension of Tables 4–6 in which the unit of observation switches from the TDF to the mutual fund family. The dependent variable is the equally weighted average of the TDF-level measures for family k in month t or year t. The first two dependent variables are cross-sectional dispersion in monthly net returns and monthly five-factor alphas, both measured as squared deviations from the cross-sectional mean for funds with the same target date and month, and then averaged across all of the TDFs offered by family k in month t. The third dependent is idiosyncratic volatility, which is demeaned within target date and year and then averaged across all of the TDFs offered by family k in year t. The fourth dependent is the R^2 from the five-factor model, which is demeaned within target date and year and then averaged across all of the TDFs offered by family k in year t. The fifth dependent variable is cross-sectional dispersion in domestic equity betas estimated in the five-factor model, which is measured as the squared deviation from the cross-sectional mean for funds with the same target date and year, and then averaged across all of the TDFs offered by family k in year t. The sample period is 2002–2012 for idiosyncratic volatility and 2001–2012 for the other four measures. The standard errors in these regressions are simultaneously clustered by family and month, and are reported below the estimated coefficients. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent Variable:	Cross-sectional dispersion in monthly net return		Cross-sectional dispersion in monthly 5-factor alpha		Idiosyncratic volatility		R^2 from 5-factor model		Cross-sectional dispersion in 5-factor U.S. equity beta	
Frequency:	Monthly	Monthly	Monthly	Monthly	Annual	Annual	Annual	Annual	Annual	Annual
Low market share ×	0.925**	0.811**	0.407***	0.316**	0.821***	0.723***	−0.038**	−0.038**	2.049*	2.304**
textitPost-PPA family	(0.405)	(0.368)	(0.148)	(0.141)	(0.270)	(0.275)	(0.016)	(0.016)	(1.061)	(1.125)
Low market share ×	0.081	0.041	0.079**	0.066*	0.242**	0.233	−0.015	−0.013	0.537***	0.650**
textitPre-PPA family	(0.100)	(0.092)	(0.036)	(0.036)	(0.103)	(0.144)	(0.009)	(0.009)	(0.192)	(0.263)
Medium market share	0.156	0.125	0.042**	0.016	0.073	0.033	−0.006***	−0.004*	0.045	0.179
	(0.138)	(0.143)	(0.021)	(0.037)	(0.104)	(0.144)	(0.002)	(0.002)	(0.142)	(0.167)
Index-fund-based TDF	−0.183	−0.254	−0.003	0.001	−0.467***	−0.312**	0.004	0.003***	−0.279	−0.239
	(0.171)	(0.196)	(0.030)	(0.029)	(0.134)	(0.139)	(0.002)	(0.001)	(0.226)	(0.243)
Average demeaned characteristic		0.177**		0.239***		0.325***		0.163		0.176
of family's BFs		(0.080)		(0.057)		(0.074)		(0.170)		(0.112)
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA*	0.036**	0.040**	0.024**	0.070*	0.042**	0.066*	0.146	0.160	0.178	0.155
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA* = 0	0.067*	0.083*	0.006***	0.030**	0.001***	0.025**	0.046*	0.044*	0.001***	0.006***
Date fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,707	2,707	2,707	2,707	207	207	246	246	264	246
R^2	13.04%	20.61%	11.12%	24.93%	17.21%	30.41%	9.62%	10.99%	8.06%	10.17%

Table B.8: Cross-sectional dispersion in TDF returns and alphas and the level of idiosyncratic risk, 2007–2012

Extension of Table 4 that limits the sample period to 2007–2012. The unit of observation is TDF i offered by family k in month t. Estimation performed via OLS. We include a separate fixed effect for each target retirement date (e.g., 2020), each time period (month or year). Standard errors are simultaneously clustered by family and time (month or year). *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent Variable:	Cross-sectional dispersion in monthly net return		Cross-sectional dispersion in monthly 5-factor alpha		Idiosyncratic volatility		Average monthly 5-factor alpha		Alpha scaled by idiosyncratic volatility	
Frequency:	Monthly	Monthly	Monthly	Monthly	Annual	Annual	Annual	Annual	Annual	Annual
Low market share ×	0.863**	0.779**	0.351***	0.266**	0.743***	0.662***	−0.062**	−0.033*	−0.038*	−0.025
Post-PPA family	(0.365)	(0.342)	(0.130)	(0.119)	(0.253)	(0.232)	(0.032)	(0.019)	(0.022)	(0.015)
Low market share ×	0.170**	0.117*	0.102**	0.071*	0.304**	0.275*	−0.009	0.004	−0.016	0.001
Pre-PPA family	(0.084)	(0.070)	(0.045)	(0.037)	(0.129)	(0.148)	(0.020)	(0.015)	(0.012)	(0.010)
Medium market share	0.115	0.085	0.049**	0.013	0.057	−0.006	−0.015	−0.011	−0.029	−0.027*
	(0.098)	(0.088)	(0.021)	(0.029)	(0.121)	(0.143)	(0.029)	(0.019)	(0.019)	(0.015)
Index-fund-based TDF	−0.089	−0.111*	0.001	−0.004	−0.482***	−0.350***	0.000	0.024	−0.022	−0.007
	(0.074)	(0.059)	(0.026)	(0.023)	(0.181)	(0.134)	(0.042)	(0.034)	(0.025)	(0.022)
Average demeaned characteristic		0.158**		0.258***		0.377***		0.555***		0.537***
of family's BFs		(0.071)		(0.044)		(0.070)		(0.043)		(0.081)
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA* = 0	0.012**	0.020**	0.005***	0.021**	0.004***	0.012**	0.046**	0.042**	0.161	0.110
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA*	0.058*	0.057*	0.056*	0.101	0.090*	0.094*	0.233	0.012**	0.316	0.036**
Target date-by-time fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	19,501	19,501	19,501	19,501	1,454	1,454	1,454	1,454	1,454	1,454
R^2	10.90%	17.08%	9.99%	21.71%	14.12%	27.78%	50.86%	64.20%	57.16%	66.11%

Table B.9: Differences in the level of factor model R^2s, 2007–2012

Extension of Table 5 that limits the sample period to 2007–2012. The unit of observation is TDF i offered by family k in December of year t. The dependent variable is fund i's R^2 in a one-factor or five-factor model estimated during calendar year t using daily returns. The one-factor (CAPM) model is based on the excess daily returns on the CRSP U.S. value-weighted index. The five-factor model adds the excess daily return on the Barclay U.S. Aggregate Bond Index; the excess daily return on the MSCI World Index excluding the United States, Barclays Global Aggregate excluding the United States, and GSCI Commodity Index. The set of independent variables matches Table 4 except that we now control for the average R^2 of the family's BFs. Estimation performed via OLS. Standard errors are simultaneously clustered by family and year. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent variable:	R^2 from CAPM		R^2 from 5-factor model	
Frequency:	Annual	Annual	Annual	Annual
Low market share	−0.064**	−0.059**	−0.033**	−0.033**
× *Post-PPA family*	(0.027)	(0.024)	(0.013)	(0.013)
Low market share	−0.008	−0.007	−0.006**	−0.006**
× *Pre-PPA family*	(0.008)	(0.005)	(0.003)	(0.002)
Medium market share	−0.015	−0.012	−0.003	−0.002
	(0.014)	(0.014)	(0.003)	(0.004)
Index-fund-based TDF	0.007	0.010	0.005**	0.005**
	(0.009)	(0.009)	(0.002)	(0.002)
Average demeaned R^2		0.298**		0.134
of family's BFs		(0.144)		(0.155)
H_0: *Low* × *Post-PPA*				
= *Low* × *Pre-PPA* = 0	0.044**	0.022**	0.002***	0.000***
H_0: *Low* × *Post-PPA*				
= *Low* × *Pre-PPA*	0.043**	0.039**	0.051*	0.058*
Target date-by-year fixed effects?	Yes	Yes	Yes	Yes
N	1,748	1,748	1,748	1,748
R^2	26.03%	29.17%	20.86%	21.74%

Table B.10: Levels and dispersion in five-factor model betas, 2007–2012

Extension of Table 6 that limits the sample period to 2007–2012. The unit of observation is TDF i offered by family k in December of year t. In panel A, the dependent variable is the beta estimated for TDF i in a five-factor model. In panel B, the dependent variable is the squared deviation of each beta for TDF i in year t. The set of independent variables matches Tables 4 and 5, except that we control for the average beta tilt of the family's BFs in panel A and we control for average squared deviation of the family's BFs in panel B. Coefficients in panel B are multiplied by 100. Estimation performed via OLS. Standard errors are simultaneously clustered by family and year. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

A

Beta:	U.S. equity		U.S. debt		Global equity		Global debt		Commodities	
Low market share ×	−0.036	−0.032	0.079*	0.061**	−0.004	−0.007	0.021***	0.020***	0.008	0.012*
Post-PPA family	(0.042)	(0.039)	(0.037)	(0.027)	(0.009)	(0.009)	(0.006)	(0.006)	(0.009)	(0.007)
Low market share ×	0.000	0.011	0.024	0.012	0.003	0.003	0.007**	0.007**	−0.008	−0.002
Pre-PPA family	(0.031)	(0.029)	(0.022)	(0.011)	(0.005)	(0.004)	(0.003)	(0.003)	(0.008)	(0.003)
Medium market share	0.008	0.008	0.058**	0.049***	−0.009**	−0.006	0.015***	0.016***	−0.016*	−0.010*
	(0.032)	(0.031)	(0.025)	(0.017)	(0.005)	(0.005)	(0.006)	(0.006)	(0.009)	(0.005)
Index-fund-based TDF	−0.003	−0.002	0.056	0.008	−0.013**	−0.011***	0.011***	0.011***	−0.005	−0.002
	(0.018)	(0.018)	(0.036)	(0.013)	(0.005)	(0.003)	(0.003)	(0.004)	(0.005)	(0.004)
Average demeaned beta tilt		0.231		0.425***		0.515***		0.428***		0.762***
of family's BFs		(0.203)		(0.079)		(0.109)		(0.100)		(0.123)
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA* = 0	0.391	0.433	0.195	0.061*	0.767	0.580	0.000***	0.001***	0.011*	0.020**
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA*	0.172	0.197	0.122	0.066*	0.506	0.317	0.030**	0.022**	0.004**	0.009***
Target date-by-year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748
R^2	75.67%	76.26%	57.54%	63.87%	43.26%	57.35%	25.55%	33.75%	21.44%	38.44%

B

Dispersion in beta:	U.S. equity		U.S. debt		Global equity		Global debt		Commodities	
Low market share ×	1.843*	1.789*	2.190*	1.671	0.098***	0.059*	0.059***	0.058***	0.101	0.103*
Post-PPA family	(0.973)	(0.957)	(1.282)	(1.153)	(0.033)	(0.031)	(0.018)	(0.019)	(0.062)	(0.060)
Low market share ×	0.230	0.209	0.089	0.035	0.069**	0.043**	0.013	0.013	−0.017	−0.013
Pre-PPA family	(0.192)	(0.159)	(0.235)	(0.223)	(0.034)	(0.021)	(0.009)	(0.009)	(0.017)	(0.017)
Medium market share	−0.019	−0.082	0.010	−0.102	0.010	0.007	0.051*	0.052*	−0.020	−0.016
	(0.167)	(0.102)	(0.295)	(0.292)	(0.014)	(0.010)	(0.031)	(0.031)	(0.020)	(0.020)
Index-fund-based TDF	−0.299**	−0.357**	−0.430**	−0.589***	−0.010	−0.022	−0.029	−0.029	0.016	0.017
	(0.124)	(0.144)	(0.204)	(0.176)	(0.025)	(0.017)	(0.019)	(0.019)	(0.016)	(0.013)
Average dispersion in demeaned		0.188*		0.202***		0.314***		0.028		0.047
beta of family's BFs		(0.109)		(0.022)		(0.030)		(0.043)		(0.138)
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA* = 0	0.044**	0.048**	0.221	0.350	0.006***	0.053*	0.001***	0.001***	0.123	0.215
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA*	0.120	0.114	0.108	0.151	0.485	0.612	0.033**	0.040**	0.057*	0.080*
Target date-by-year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748
R^2	6.15%	7.44%	6.51%	15.64%	11.19%	45.33%	6.05%	6.17%	7.01%	7.05%

Table B.11: Cross-sectional dispersion in TDF returns and alphas and the level of idiosyncratic risk, 2007 & 2010–2012

Extension of Table 4 that limits the sample period to 2007 and 2010–2012. The unit of observation is TDF i offered by family k in month t. Estimation performed via OLS. We include a separate fixed effect for each target retirement date (e.g., 2020), each time period (month or year). Standard errors are simultaneously clustered by family and time (month or year). *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent Variable:	Cross-sectional dispersion in monthly net return		Cross-sectional dispersion in monthly 5-factor alpha		Idiosyncratic volatility		Average monthly 5-factor alpha		Alpha scaled by idiosyncratic volatility	
Frequency:	Monthly	Monthly	Monthly	Monthly	Annual	Annual	Annual	Annual	Annual	Annual
Low market share ×	0.827*	0.782*	0.276**	0.262**	0.719***	0.689***	−0.046	−0.038	−0.034	−0.024
Post-PPA family	(0.485)	(0.464)	(0.124)	(0.122)	(0.238)	(0.217)	(0.032)	(0.033)	(0.025)	(0.024)
Low market share ×	0.048	0.086	0.050***	0.050***	0.273**	0.251*	−0.045**	−0.021	−0.028**	0.000
Pre-PPA family	(0.070)	(0.070)	(0.017)	(0.015)	(0.134)	(0.138)	(0.022)	(0.025)	(0.014)	(0.021)
Medium market share	0.060	0.100*	0.029***	0.026***	0.058	−0.020	−0.033	−0.032	−0.039	−0.040*
	(0.060)	(0.054)	(0.009)	(0.007)	(0.133)	(0.146)	(0.027)	(0.021)	(0.024)	(0.022)
Index-fund-based TDF	−0.135*	−0.101*	−0.019*	−0.015	−0.312***	−0.256***	−0.003	0.017	−0.031	−0.014
	(0.069)	(0.059)	(0.011)	(0.012)	(0.096)	(0.096)	(0.039)	(0.042)	(0.020)	(0.022)
Average demeaned characteristic		0.366**		0.089**		0.346***		0.473***		0.558***
of family's BFs		(0.177)		(0.039)		(0.121)		(0.101)		(0.133)
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA* = 0	0.185	0.116	0.002***	0.001***	0.006***	0.006***	0.089**	0.517	0.136	0.457
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA*	0.112	0.138	0.070*	0.085*	0.064*	0.047**	0.975	0.536	0.773	0.244
Target date-by-time fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13,397	13,397	13,397	13,397	1,031	1,031	1,031	1,031	1,031	1,031
R^2	7.61%	9.65%	4.80%	5.13%	15.36%	20.45%	45.18%	55.10%	50.47%	61.27%

Table B.12: Differences in the level of factor model R^2s, 2007 & 2010–2012

Extension of Table 5 that limits the sample period to 2007 and 2010–2012. The unit of observation is TDF i offered by family k in December of year t. The dependent variable is fund i's R^2 in a one-factor or five-factor model estimated during calendar year t using daily returns. The one-factor (CAPM) model is based on the excess daily returns on the CRSP U.S. value-weighted index. The five-factor model adds the excess daily return on the Barclay U.S. Aggregate Bond Index; the excess daily return on the MSCI World Index excluding the United States, Barclays Global Aggregate excluding the United States, and GSCI Commodity Index. The set of independent variables matches Table 4 except that we now control for the average R^2 of the family's BFs. Estimation performed via OLS. Standard errors are simultaneously clustered by family and year. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent variable:	R^2 from CAPM		R^2 from 5-factor model	
Frequency:	Annual	Annual	Annual	Annual
Low market share	−0.076**	−0.070**	−0.039**	−0.040**
× *Post-PPA family*	(0.035)	(0.032)	(0.016)	(0.017)
Low market share	−0.004	−0.009**	−0.006**	−0.005**
× *Pre-PPA family*	(0.010)	(0.004)	(0.003)	(0.003)
Medium market share	−0.014	−0.013	−0.003	0.000
	(0.014)	(0.012)	(0.003)	(0.004)
Index-fund-based TDF	0.007	0.007	0.004*	0.003
	(0.009)	(0.008)	(0.002)	(0.002)
Average demeaned R^2		0.433***		0.287
of family's BFs		(0.104)		(0.239)
H_0: *Low* × *Post-PPA*				
= *Low* × *Pre-PPA* = 0	0.095*	0.005***	0.005***	0.000***
H_0: *Low* × *Post-PPA*				
= *Low* × *Pre-PPA*	0.043**	0.055*	0.050**	0.060*
Target date-by-year fixed effects?	Yes	Yes	Yes	Yes
N	1,205	1,205	1,205	1,205
R^2	24.17%	29.30%	19.74%	22.07%

Table B.13: Levels and dispersion in five-factor model betas, 2007 & 2010–2012

Extension of Table 6 that limits the sample period to 2007 and 2010–2012. The unit of observation is TDF i offered by family k in December of year t. In panel A, the dependent variable is the beta estimated for TDF i in a five-factor model. In panel B, the dependent variable is the squared deviation of each beta for TDF i in year t. The set of independent variables matches Tables 4 and 5, except that we control for the average beta tilt of the family's BFs in panel A and we control for average squared deviation of the family's BFs in panel B. Coefficients in panel B are multiplied by 100. Estimation performed via OLS. Standard errors are simultaneously clustered by family and year. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

A

Beta:	U.S. equity		U.S. debt		Global equity		Global debt		Commodities	
Low market share ×	−0.044	−0.037	0.079	0.071**	−0.012	−0.014	0.024***	0.024***	0.006	0.010
Post-PPA family	(0.049)	(0.044)	(0.037)	(0.034)	(0.010)	(0.010)	(0.007)	(0.006)	(0.012)	(0.010)
Low market share ×	0.000	0.017	0.024	0.021*	0.004	0.003	0.005	0.005*	−0.009	−0.002
Pre-PPA family	(0.035)	(0.032)	(0.022)	(0.011)	(0.007)	(0.006)	(0.003)	(0.003)	(0.010)	(0.005)
Medium market share	0.018	0.018	0.058**	0.045***	−0.010**	−0.008	0.012**	0.015***	−0.021**	−0.014***
	(0.035)	(0.032)	(0.025)	(0.013)	(0.005)	(0.005)	(0.006)	(0.005)	(0.010)	(0.005)
Index-fund-based TDF	−0.005	−0.006	0.056	0.003	−0.013**	−0.013***	0.013***	0.013***	−0.004	−0.001
	(0.021)	(0.020)	(0.036)	(0.010)	(0.005)	(0.003)	(0.004)	(0.004)	(0.006)	(0.003)
Average demeaned beta tilt		0.378**		0.492***		0.494***		0.404***		0.761***
of family's BFs		(0.176)		(0.080)		(0.136)		(0.118)		(0.160)
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA* = 0	0.224	0.336	0.269*	0.047**	0.421	0.308	0.006***	0.001***	0.110	0.182
H_0: *Low* × *Post-PPA*										
= *Low* × *Pre-PPA*	0.092*	0.148	0.160	0.138**	0.193	0.133	0.005***	0.001***	0.053*	0.101
Target date-by-year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,205	1,205	1,205	1,205	1,205	1,205	1,205	1,205	1,205	1,205
R^2	74.02%	75.45%	53.14%	59.93%	42.81%	55.70%	25.01%	31.69%	22.20%	37.09%

B

Dispersion in beta:	U.S. equity		U.S. debt		Global equity		Global debt		Commodities	
Low market share ×	2.348*	2.286*	2.823*	2.370	0.121***	0.075*	0.059**	0.059**	0.117	0.115
Post-PPA family	(1.288)	(1.280)	(1.615)	(1.503)	(0.041)	(0.042)	(0.024)	(0.024)	(0.093)	(0.088)
Low market share ×	0.093	0.180	0.084	0.205	0.087**	0.055*	0.010	0.011	−0.028	−0.032
Pre-PPA family	(0.242)	(0.219)	(0.270)	(0.248)	(0.042)	(0.032)	(0.013)	(0.017)	(0.024)	(0.027)
Medium market share	−0.074	−0.002	0.043	0.038	0.008	0.005	0.058*	0.059*	−0.030	−0.033
	(0.164)	(0.129)	(0.308)	(0.336)	(0.010)	(0.013)	(0.033)	(0.033)	(0.025)	(0.026)
Index-fund-based TDF	−0.266*	−0.188	−0.364**	−0.385***	−0.010	−0.020	−0.037*	−0.037*	0.020	0.019
	(0.146)	(0.140)	(0.168)	(0.138)	(0.024)	(0.016)	(0.020)	(0.020)	(0.018)	(0.015)
Average dispersion in demeaned		0.291***		0.298***		0.311***		0.018		−0.028
beta of family's BFs		(0.096)		(0.050)		(0.046)		(0.081)		(0.152)
H_0: *Low* × *Post-PPA*										
= *Low* × Pre-PPA = 0	0.171	0.107	0.203	0.199	0.004***	0.102	0.032**	0.030**	0.150	0.274
H_0: *Low* × *Post-PPA*										
= *Low* × Pre-PPA	0.092	0.117	0.100*	0.158	0.527	0.655	0.088*	0.136	0.112	0.132
Target date-by-year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,205	1,205	1,205	1,205	1,205	1,205	1,205	1,205	1,205	1,205
R^2	6.89%	8.80%	6.88%	14.21%	12.04%	44.15%	5.76%	5.79%	6.73%	6.74%

Table B.14: Explaining dispersion in monthly net returns and alphas (alternative version)

Extension of Table 4 that asks how TDF-level dispersion varies with a family's market share in the TDF market and in the overall mutual fund market (based on total AUM in CRSP). For each interaction between TDF market share dummy and Total market share dummy, we report the total number of fund-month observations (All), as well as the number of fund-month observations associated with families entering the TDF market before (Pre) or after (Post) the PPA. The sample period is 2002–2012 for idiosyncratic volatility and 2001–2012 for the other two measures. Estimation performed via OLS. Standard errors are simultaneously clustered by family and year. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent variable:	All	Pre	Post	Cross-sectional dispersion in monthly net return		Cross-sectional dispersion in monthly 5-factor alpha		Idiosyncratic volatility	
Frequency				Monthly	Monthly	Monthly	Monthly	Annual	Annual
TOTAL LOW	11494	8764	2730	0.170		0.094*		0.402**	
				(0.144)		(0.055)		(0.163)	
TOTAL MEDIUM	6980	5440	1540	0.504**		0.206**		0.637***	
				(0.241)		(0.093)		(0.224)	
TDF LOW × TOTAL LOW	7872	5142	2730		−0.002		0.052		0.388***
					(0.134)		(0.032)		(0.148)
TDF LOW × TOTAL MED	3548	2008	1540		0.593**		0.262***		0.869***
					(0.289)		(0.095)		(0.224)
TDF LOW × TOTAL HIGH	0	0	0						
TDF MED × TOTAL LOW	3112	3112	0		0.126		0.056**		0.217**
					(0.101)		(0.026)		(0.095)
TDF MED × TOTAL MED	2215	2215	0		0.147***		0.066**		0.417***
					(0.055)		(0.031)		(0.154)
TDF MED × TOTAL HIGH	684	110	574		−0.460		−0.163		−0.232
					(0.283)		(0.100)		(0.385)
TDF HIGH × TOTAL LOW	510	510	0		0.044		0.079**		0.780***
					(0.082)		(0.031)		(0.160)
TDF HIGH × TOTAL MED	1217	1217	0		0.119***		0.056***		0.173**
					(0.043)		(0.007)		(0.075)
TDF HIGH × TOTAL HIGH	2630	2630	0						
Post-PPA family				0.608**	0.586**	0.190*	0.170*	0.422**	0.330*
				(0.292)	(0.284)	(0.102)	(0.099)	(0.198)	(0.196)
Index-fund-based TDF				0.052	−0.059	0.051	0.019	−0.155	−0.182*
				(0.106)	(0.071)	(0.043)	(0.015)	(0.097)	(0.100)
Average demeaned return dispersion of family's BFs				0.157**	0.156**	0.255***	0.254***	0.368***	0.367***
				(0.070)	(0.070)	(0.047)	(0.047)	(0.063)	(0.064)
Target date-by-time period fixed effects?				Yes	Yes	Yes	Yes	Yes	Yes
N				21,788	21,788	21,788	21,788	1,609	1,609
R^2				17.64%	18.14%	21.94%	22.29%	27.73%	31.94%

Table B.15: Explaining dispersion in monthly net returns and alphas (alternative version)

Extension of Table 4 that asks how TDF-level dispersion varies with the time-period during which the family first enters the TDF market. We report the number of fund-month observations (All) for families entering during three distinct time periods: [1994, 2002], [2003, 2006], and [2007, 2012]. The sample period is 2002–2012 for idiosyncratic volatility and 2001–2012 for the other two measures. We report the p-value from the hypothesis test that families entering between 2003 and 2006 have the same average cross-sectional dispersion as families entering after 2006. We also report the p-value from the hypothesis test that families entering between 2003 and 2006 and the families entering after 2006 have the same average cross-sectional dispersion as families entering before 2003 (the omitted category). Because there are so few entrants after 2008, it is not possible to subdivide the post-PPA sample. Estimation performed via OLS. Standard errors are simultaneously clustered by family and year. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

Dependent variable:	All	Cross-sectional dispersion in monthly net return		Cross-sectional dispersion in monthly 5-factor alpha		Idiosyncratic volatility	
Frequency:		Monthly	Monthly	Monthly	Monthly	Annual	Annual
Family entered market before 2003	6188						
Family entered market [2003, 2006]	10826	0.089	0.070	0.057*	0.036	0.160*	0.130
		(0.076)	(0.058)	(0.030)	(0.030)	(0.082)	(0.095)
Family entered market [2007, 2012]	4844	0.687**	0.638**	0.281**	0.206*	0.579**	0.482*
		(0.341)	(0.319)	(0.118)	(0.110)	(0.254)	(0.249)
Index-fund-based TDF		−0.170***	−0.162***	−0.055	−0.044*	−0.644***	−0.509***
		(0.065)	(0.056)	(0.034)	(0.025)	(0.186)	(0.099)
Average demeaned return dispersion of family's BFs			0.158**		0.256***		0.352***
			(0.071)		(0.046)		(0.069)
H_0 : *[2003, 2006] = [2007, 2012]*		0.079*	0.076*	0.062*	0.126	0.101	0.143
H_0 : *[2003, 2006] = [2007, 2012]* = 0		0.083*	0.078*	0.014**	0.102	0.023**	0.112
Target date-by-time period fixed effects?		Yes	Yes	Yes	Yes	Yes	Yes
N		21,788	21,788	21,788	21,788	1,609	1,609
R^2		10.82%	17.01%	10.02%	21.56%	10.97%	23.17%

Table B.16: Additional plan-level evidence on TDF risk versus industry risk

In this table, we relate risk measures for the TDF held by each retirement plan to risk measures for the industry to which the firm sponsoring the plan belongs. The risk measures mirror those used in Table 8. Panels A and B focus on differences in CAPM beta, and panels C and D focus on differences in idiosyncratic risk. Panels A and C report results for the full sample of retirement plans, and panels C and D report results for the subsample of plans that feature autoenrollment. We use family-level measures of TDF risk to place TDFs into three risk terciles, and we use the median risk levels of the publicly traded firms within each industry to place firms into three risk terciles. Then, we plot the number of retirement plans that fall into each of the nine cells. Finally, we calculate the fraction of retirement plans within each industry risk tercile that offer TDFs from the bottom, middle, and top tercile of TDF risk. That there are more observations in the lowest tercile of industry beta implies that retirement plans in the BrightScope sample come disproportionately from firms in the bottom tercile of industry betas. That there are more observations in the middle tercile of TDF beta implies that retirement plans in the BrightScope sample match disproportionately with TDFs with betas that fall in the middle tercile of TDF risk. In panels A and D, we can reject the hypothesis that industry risk is independent of TDF risk (p-values in χ^2 tests are .000 and .018). In panels B and C, we cannot (p-values are .273 and .412).

		A. Industry beta – Full sample						
		Tercile 1		Tercile 2		Tercile 3		Total
TDF	Tercile 1	1,294	29.9%	531	26.8%	479	28.6%	2,304
Beta	Tercile 2	2,146	49.6%	966	48.8%	749	44.7%	3,861
	Tercile 3	887	20.5%	482	24.4%	449	26.8%	1,818
	Total	4,327		1,979		1,677		7,983
		B. Industry beta – Autoenrollment sample						
		Tercile 1		Tercile 2		Tercile 3		Total
TDF	Tercile 1	355	33.6%	181	29.1%	134	31.2%	670
Beta	Tercile 2	426	40.3%	267	43.0%	184	42.9%	877
	Tercile 3	275	26.0%	173	27.9%	111	25.9%	559
	Total	1056		621		429		2,106
		C. Industry idiosyncratic risk – Full sample						
		Tercile 1		Tercile 2		Tercile 3		Total
TDF	Tercile 1	619	26.8%	962	28.7%	629	27.1%	2,210
Idio.	Tercile 2	1,553	67.3%	2,210	65.9%	1,546	66.5%	5,309
Risk	Tercile 3	135	5.9%	180	5.4%	149	6.4%	464
	Total	2,307		3,352		2,324		7,983
		D. Industry idiosyncratic risk – Autoenrollment sample						
		Tercile 1		Tercile 2		Tercile 3		Total
TDF	Tercile 1	214	31.0%	202	24.3%	164	28.1%	580
Idio.	Tercile 2	432	62.6%	566	68.0%	366	62.7%	1,364
Risk	Tercile 3	44	6.4%	64	7.7%	54	9.2%	162
	Total	690		832		584		2,106

Table B.17: Testing for risk matching in plan-level data (alternative version)

Extension of Table 8. The unit of observation is the single-employer DC retirement plan i offered by firm j in industry k in 2010. The dependent variable measures the risk of the TDFs offered by plan i. In panel A, our measure of risk is the *absolute value* of the average target-date adjusted tilt in CAPM beta. In panel B, it is the *absolute value* of the average target-date adjusted standard deviation of idiosyncratic monthly returns. The sample is limited to the 95.8% of plans that offer TDFs from a single family. Before calculating the absolute values of our measures of firm risk, we subtract the average measure of firm risk within the sample of plans. The other plan-level and family-level control variables are the same as those used in Table 8, except that we also take the absolute value of the average category-adjusted measure of risk for the other investment options offered by plan i. Coefficients in panel B are multiplied by 100. Estimation performed via OLS. Standard errors are simultaneously clustered by family and year. *, **, and *** denote statistical significance at the 10% level, 5% level, and 1% level, respectively.

A

Dependent variable:	abs(Average CAPM beta tilt of TDFs in plan i)						
abs(CAPM beta tilt of firm j)	0.002**	0.002	0.001				
	(0.001)	(0.001)	(0.001)				
abs(Median CAPM beta tilt				−0.003	−0.007*	−0.007*	−0.008*
within industry of firm j)				(0.003)	(0.004)	(0.004)	(0.004)
abs(Median CAPM beta)						0.003	0.003
× Autoenrollment						(0.003)	(0.003)
Single record keeper (SRK)	−0.012***	−0.012***		−0.008***			
	(0.002)	(0.002)		(0.001)			
Market share of SRK			−0.133***		−0.119***	−0.119***	−0.120***
within BrightScope			(0.009)		(0.010)	(0.009)	(0.009)
TDF from *Pre-PPA family*	−0.019***	−0.018***	−0.032***	−0.013***	−0.029***	−0.029***	−0.029***
with *Low market share*	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
TDF from *Post-PPA family*	0.060***	0.061***	0.032***	0.065***	0.059***	0.059***	0.059***
with *Low market share*	(0.013)	(0.013)	(0.012)	(0.005)	(0.005)	(0.005)	(0.006)
ln(plan assets)	0.000	0.000	0.003***	0.000	0.003***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln(number of participants)	0.000	0.001	−0.002	0.000	−0.001	−0.001	−0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Autoenrollment	0.004***	0.003**	0.004***	0.004***	0.004***	0.003**	0.003**
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Offer company stock	0.004***	0.002	0.000	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
abs(Average beta tilt of							−0.050***
non-TDFs offered by plan j)							(0.015)
H_0: *Low* × *Pre-PPA*							
= *Low* × *Post-PPA*	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Industry fixed effects?	—	Yes	Yes	—	—	—	—
N	968	968	758	7,983	5,504	5,504	5,504
Adj. R^2 (excl. supply-side)	1.43%	2.23%	2.23%	0.53%	0.53%	0.71%	0.69%
Adj. R^2	17.81%	18.34%	36.41%	18.50%	35.74%	35.75%	35.94%

B

Dependent variable:	abs(Standard deviation of idiosyncratic returns tilt of TDFs in plan i)						
abs(Idiosyncratic risk of firm j)	−0.049	−0.052	−0.070				
	(0.051)	(0.056)	(0.059)				
abs(Median idiosyncratic risk within industry of firm j)				0.083	0.084	0.118	0.114
				(0.067)	(0.064)	(0.074)	(0.069)
abs(Median idiosyncratic risk) × Autoenrollment						−0.140	−0.124
						(0.117)	(0.111)
Single record keeper (SRK)	0.005	0.005		−0.009			
	(0.010)	(0.010)		(0.006)			
Market share of SRK within BrightScope			0.156**		0.130**	0.130**	0.127**
			(0.068)		(0.055)	(0.055)	(0.054)
TDF from *Pre-PPA family* with *Low market share*	0.002	0.006	0.027	−0.025***	−0.001	−0.001	0.001
	(0.024)	(0.023)	(0.028)	(0.007)	(0.012)	(0.012)	(0.012)
TDF from *Post-PPA family* with *Low market share*	0.048	0.070	0.052***	0.035**	0.057***	0.057***	0.058***
	(0.045)	(0.051)	(0.012)	(0.015)	(0.021)	(0.021)	(0.022)
ln(plan assets)	0.024***	0.026***	0.036***	0.028***	0.033***	0.033***	0.032***
	(0.005)	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)	(0.003)
ln(number of participants)	−0.017***	−0.019**	−0.029***	−0.018***	−0.020***	−0.021***	−0.020***
	(0.006)	(0.008)	(0.007)	(0.002)	(0.003)	(0.003)	(0.003)
Autoenrollment	0.012*	0.011	0.014*	−0.002	−0.001	0.002	0.002
	(0.007)	(0.008)	(0.008)	(0.004)	(0.005)	(0.006)	(0.006)
Offer company stock	0.006	−0.005	0.002	0.005	0.003	0.003	0.004
	(0.007)	(0.009)	(0.009)	(0.006)	(0.007)	(0.007)	(0.007)
abs(Average risk of non-TDFs offered by plan j)							−0.529***
							(0.084)
H_0: *Low* × *Pre-PPA* = *Low* × *Post-PPA*	0.386	0.260	0.378	0.001***	0.002***	0.002***	0.004***
Industry fixed effects?	—	Yes	Yes	—	—	—	—
N	968	968	758	7,983	5,504	5,504	5,504
Adj. R^2 (excl. supply-side)	2.99%	7.56%	7.56%	3.87%	3.87%	3.86%	4.63%
Adj. R^2	3.06%	7.96%	13.44%	4.34%	8.58%	8.58%	9.77%

Table B.18: Distribution of Retirement Plan Participants Across Industries, 2005 & 2012

In this table, we use data from Form 5500 to calculate the fraction of retirement plan participants that work in broad industry categories in 2005 and 2012. The sample is limited to filings that report both an NAICS industry classification and a positive number of plan participants. We use the first 2 digits of the 6-digit NAICS to assign firms to broad industry groups.

		Fraction of retirement plan participants within each broad industry	
Code	Industry	2005	2012
11	Agriculture	0.65%	0.53%
21	Mining	0.70%	0.86%
22	Utilities	1.75%	1.50%
23	Construction	4.67%	5.00%
31-33	Manufacturing	29.01%	24.59%
42	Wholesale trade	3.08%	2.84%
44-45	Retail trade	9.15%	10.93%
48	Transportation	4.62%	4.90%
49	Warehousing	0.62%	0.16%
51	IT	5.49%	4.59%
52	Finance & insurance	10.60%	9.50%
53	Real estate	1.18%	0.88%
54	Professional & scientific	7.33%	6.69%
55	Management	3.49%	3.19%
56	Waste management	2.17%	2.22%
61	Education	0.57%	2.53%
62	Health care	9.29%	13.02%
71	Arts & entertainment	0.81%	0.88%
72	Hotel & food services	2.85%	2.80%
81	Other services	1.96%	2.34%
92	Public administration	0.02%	0.04%

C Inconsistencies in CRSP equity holdings data

In earlier versions of this paper, we used CRSP data on allocations to equity, bonds, and cash, to document dispersion in TDF glide paths. However, after downloading a version of the CRSP mutual fund database that extended our sample through 2012, we lost faith in the quality of these CRSP variables. This is why, in the current version, we test for dispersion in glide paths by testing for dispersion in factor loadings estimated using daily returns.

This section of the Online Appendix documents significant differences in the fraction of a TDF's portfolio invested in common stock (*PER_COM*) between the old and new versions of the CRSP data. CRSP changed data vendors, resulting in "new" historical data for *PER_COM* from 1998 to the present. Table C.1 compares the availability of equity holdings data for 5,870 share class-level observations between 1994 and 2009 (when our earlier version of the CRSP data ends). We observe either *PER_COM_OLD* or *PER_COM_NEW* for 93.3% of the observations. However, we possess both *PER_COM_OLD* and *PER_COM_NEW* for only 77.0% of the observations. Moreover, the correlation between *PER_COM_NEW* and *PER_COM_OLD* is only 0.561. Because TDFs are structured as funds of funds they disclose their holdings of the underlying funds rather than their indirect holdings of equity and debt. This likely explains the large number of observations for which *PER_COM_NEW* or *PER_COM_OLD* is missing or coded as zero.

Table C.2 calculates the average difference between *PER_COM_NEW* and *PER_COM_OLD* for different samples of TDFs. The unit of observations is TDF portfolio i in calendar year t. We drop any TDF-year observation for which *PER_COM_NEW* or *PER_COM_OLD* equals zero. The average difference is close to zero, but there are significant differences across calendar years (-11.8% in 2004 to 16.9% in 2006), target date differences (6.4% for 2010 TDFs and -4.2% for 2050 TDFs), and target date-year cells (-24.9% to 32.0%).

Table C.1: Comparing equity holdings in NEW and OLD versions of CRSP Mutual Fund Data

This table compares equity holdings data from two different versions of the CRSP mutual fund database. The OLD version was downloaded from WRDS in 2010 and the NEW version was downloaded in 2013. The sample is limited to TDFs. The unit of observation is share class i in year t. We observe equity holdings (*PER_COM*) from both versions for 77.0% of the observations. The correlation between *PER_COM_NEW* and *PER_COM_OLD* is 0.5608.

	ALL	NEW or OLD		NEW and OLD			NEW only		OLD only		Neither	
	#	#	%	#	%	Corr.	#	%	#	%	#	%
1994	10	10	100.0%	10	100.0%	1.0000	0	0.0%	0	0.0%	0	0.0%
1995	10	10	100.0%	10	100.0%	1.0000	0	0.0%	0	0.0%	0	0.0%
1996	15	15	100.0%	15	100.0%	1.0000	0	0.0%	0	0.0%	0	0.0%
1997	18	18	100.0%	18	100.0%	1.0000	0	0.0%	0	0.0%	0	0.0%
1998	24	19	79.2%	0	0.0%		0	0.0%	19	79.2%	5	20.8%
1999	35	30	85.7%	0	0.0%		0	0.0%	30	85.7%	5	14.3%
2000	36	22	61.1%	0	0.0%		0	0.0%	22	61.1%	14	38.9%
2001	69	31	44.9%	0	0.0%		0	0.0%	31	44.9%	38	55.1%
2002	87	37	42.5%	6	6.9%	0.9969	0	0.0%	31	35.6%	50	57.5%
2003	146	57	39.0%	30	20.5%	0.9097	15	10.3%	12	8.2%	89	61.0%
2004	261	134	51.3%	35	13.4%	0.5523	30	11.5%	69	26.4%	127	48.7%
2005	460	426	92.6%	208	45.2%	0.4194	104	22.6%	114	24.8%	34	7.4%
2006	690	670	97.1%	505	73.2%	0.3880	45	6.5%	120	17.4%	20	2.9%
2007	1,069	1,063	99.4%	846	79.1%	0.3137	34	3.2%	183	17.1%	6	0.6%
2008	1,476	1,472	99.7%	1,394	94.4%	0.7862	30	2.0%	48	3.3%	4	0.3%
2009	1,464	1,461	99.8%	1,445	98.7%	0.7010	9	0.6%	7	0.5%	3	0.2%
ALL	5,870	5,475	93.3%	4,522	77.0%	0.5608	267	4.5%	686	11.7%	395	6.7%

Table C.2: Changes in equity holdings from OLD to NEW versions of CRSP Mutual Fund Data

This table reports the average difference between *PER_COM_NEW* and *PER_COM_OLD*. The unit of observation is portfolio i in year t. The sample is limited to TDFs for which we observe both *PER_COM_NEW* and *PER_COM_OLD*, and for which neither variable equals zero.

	2010	2020	2030	2040	2050	ALL
2002	-0.19%		-2.24%	-1.92%		-1.45%
2003	-5.05%	-7.18%	-6.79%	-0.83%		-4.96%
2004	-0.80%	0.40%	-24.94%	-21.91%		-11.81%
2005	7.80%	23.65%	5.50%	8.35%	1.86%	10.68%
2006	32.00%	27.26%	12.95%	3.12%	4.72%	16.91%
2007	22.69%	23.59%	11.61%	4.82%	5.77%	13.76%
2008	-4.14%	-4.40%	-5.68%	-5.59%	-6.99%	-5.39%
2009	-5.89%	-6.36%	-6.30%	-6.48%	-7.25%	-6.48%
ALL	6.39%	4.75%	-0.07%	-2.52%	-4.22%	0.80%