Default Options and Market Power: Evidence from Target-Date Funds*

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Abstract

This paper studies how default investment options generate market power in the U.S. retirement savings market. Focusing on Target-Date Funds (TDFs), the predominant default option in 401(k) plans, we show that the incremental fees TDFs charge over their underlying funds increased from about 4 basis points in 2010 to over 17 basis points in 2022. This increase is consistent with rising market power among TDF managers, who exploit fee-insensitive default investors. To quantify this market power and evaluate policy interventions, we develop and estimate a structural model of demand and fee setting in both TDF and non-TDF markets. Preventing price discrimination between TDFs and non-TDFs increases TDF investors' welfare by $1.4 billion, with only modest reductions in fund manager profits.

KEYWORDS: TDF, default options, 401(k) plans, fund fees.

JEL Classification: G11, G23, G28, G40, G51, J32, L51.

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1 Introduction

Default options in employer-sponsored 401(k) plans have transformed how American investors save for retirement. A large body of research shows that appropriate default funds, when combined with automatic enrollment, offset investors' inertia and inattention, leading to higher participation, savings, and equity exposure (Madrian and Shea, 2001; Choi et al., 2004; Beshears et al., 2009).

Since the 2006 Pension Protection Act (PPA), Target-Date Funds (TDFs) have become the dominant default option in 401(k) plans, with nearly four trillion dollars in assets as of 2024.[1] Structured around an expected retirement year, TDFs gradually rebalance allocations from equities toward bonds as investors approach retirement, aligning portfolio risk with individuals' changing risk tolerance, human capital, and consumption needs over the life cycle (Viceira, 2001; Campbell and Viceira, 2002). While the benefits of default options and TDFs are well established, much less is known about the frictions that shape competition and fee setting of these products. Precisely because default investment options cater to investor inertia and inattention, they may also create scope for fund managers to exercise market power.

This paper studies how default investment options can create market power that allows fund managers to extract rents from fee-insensitive investors. We show that TDF managers charge increasingly higher fees relative to the fees of the TDF underlying funds, which we refer to as *wrapper fees*. Owing to their fund-of-funds structure, TDFs enable managers to sell the same basket of funds both directly in the general mutual fund market and indirectly through TDFs. Because many investors hold TDFs as their default investment and rarely rebalance, they tend to be insensitive to fees, allowing fund managers to price discriminate by charging higher wrapper fees on TDFs while reducing fees on underlying funds to compete for more fee-sensitive investors.

We begin by documenting three empirical facts about TDFs. First, we show that TDF fees declined less than fees of their underlying funds. As a result, wrapper fees (incremental fees above fees of underlying funds) have increased from around 4 basis points (bps) in 2009 to over 17 bps in 2022. While fund managers may justify some positive wrapper fees to compensate for life-cycle rebalancing costs, it is unlikely these costs increase over time, especially as these funds achieve economies of scale.[2] A more plausible explanation is that investors in the underlying funds become increasingly fee-sensitive, whereas TDF managers can exploit default investors' inertia or inattention with higher wrapper fees.

Second, we show that flows into TDFs are substantially less sensitive to fees than flows into non-TDF mutual funds. The low fee-sensitivity is consistent with investors allocating assets to TDFs as the default options. As a result, TDF managers have lower

[1] According to the Investment Company Institute, 92% of TDF assets are held in retirement accounts.

[2] As a comparison, TDF and large cap equity fund charge roughly the same fees in the Thrift Saving Plan (TSP) for federal employees.

incentives to compete on fees.

Third, we show that the asset weighted distribution of TDF fees is more dispersed than the corresponding fee distribution for a broad set of equity and bond index funds. Although some low fee TDFs exist, they do not capture most TDF assets. By contrast, the index fund distribution is tightly concentrated at low fees, implying that most index fund assets are allocated to the cheapest available options. This pattern provides additional evidence that TDF investors are less fee sensitive than investors in non-TDF funds, consistent with TDFs serving primarily as default options in retirement plans.[3]

Taken together, these facts suggest default options create market power that allows fund managers to price-discriminate against fee insensitive investors.

In the second part of the paper, we develop a structural model to quantify TDF market power and fund managers' incentive to price-discriminate. In the model, fund managers sell mutual funds both directly in the broad mutual fund market and indirectly through their TDFs. Managers compete on fees in both the broad mutual fund market and in the TDF market to maximize total profits across their products.

To illustrate the main economics of the model, we first present a simplified version, where TDF and non-TDF markets are fully segmented. In this case, the equilibrium wrapper fee has a simple characterization: it equals the difference in the (inverse) fee elasticities of TDF and non-TDF investors. The intuition is straightforward: the more fee-sensitive non-TDF investors are, the larger the wrapper fee required to maintain markups on TDFs. Thus, as investors in the broader mutual fund market become increasingly fee-sensitive, the model predicts rising wrapper fees, consistent with the trend we observe in the data.

We then estimate our full structural model by combining mutual fund data from CRSP and Morningstar with comprehensive 401(k) plan-level data from BrightScope. Following Berry (1994) and Berry, Levinsohn and Pakes (1995), we estimate investment demand for five groups of agents. First, we recover plan sponsors' (i.e. employers') demand for TDFs from observed TDF offerings across 401(k) plans. Second, we estimate 401(k) participants' demand for TDFs chosen by their employers. Third, among 401(k) participants who do not have access to TDFs or opt out of TDFs, we estimate their demand for non-TDF funds. The final two groups are investors outside 401(k) plans who allocate among TDFs and non-TDFs. We estimate their demand using fund AUM net of allocations in 401(k) plans.

Our estimates suggest large and significant differences in fee sensitivities between TDF and non-TDF investors. TDF investors—both inside and outside 401(k) plans, including

[3]We focus on index funds as a benchmark, rather than the full universe of non TDF funds, because including active funds confounds fee dispersion with substantial heterogeneity in mandates and services that mechanically generates a wide fee range. Index funds are much closer substitutes within asset class, so differences in fees more directly reflect price competition and investor sorting into low fee share classes. Since many TDF portfolios are built from index like exposures in US equity, fixed income, and international equity, the index fund fee distribution provides a more relevant benchmark for fee discipline in the underlying building blocks of TDFs.

employers—are largely insensitive to fees with elasticities less than 1. By contrast, non-TDF investors exhibit high fee-sensitivity with elasticities above 2. To address potential endogeneity in fund fees, we follow Egan, MacKay and Yang (2021) and implement a Hausman-type instrumental variable strategy, instrumenting fund fees with the average fee of funds offered by the same manager in other investment categories. We also use custodian fees as a cost-shifter instrument (Janssen and Thiel, 2025) and obtain similar results.

Using these demand estimates, we invert fund managers' first-order conditions under Nash-Bertrand competition to recover marginal costs and markups. Consistent with the large difference in fee elasticities, we find that TDF markups are, on average, 20 bps higher than those of their underlying funds. In relative terms, TDF markups can be over 50% higher than those on non-TDF funds. In aggregate, TDF managers extract roughly $2.8 billion profits from wrapper fees in 2019.

Finally, we use the model to evaluate two counterfactual policies designed to curb market power in the TDF market. The first policy prevents fund managers from price discriminating between TDF and non-TDF investors, imposing zero wrapper fees. This policy generates substantial welfare gains for TDF investors, increasing their surplus by $1.4 billion through lower TDF fees, which decline by 12 bps. Although fund managers raise non-TDF fees to offset lost profit from TDFs, they are only able to raise fees by 2 bps, thanks to higher elasticities and larger share of non-TDF investors. Overall, total investor surplus and fund manager profits stay largely unchanged from the status quo. Total profit reduces by $0.6 billion, roughly 1%.

The second policy imposes a 20 basis point cap on TDF fees. The surplus of TDF investors increases by approximately $3.3 billion, driven by an average decline of about 20 basis points in TDF fees. The surplus of non-TDF investors remains unchanged. These gains, however, come at a substantial cost to fund managers, whose revenues and profits fall by over 5% relative to the status quo.

Overall, our counterfactual policies address the following "friction": TDFs have important welfare implications for retirement savings but are sold by profit-maximizing fund managers to fee-insensitive investors. We show that regulating market power in the TDF market could yield substantial welfare gains for retirement investors.

Related Literature. This paper contributes to three strands of the literature.

First, it contributes to a growing literature on Target-Date Funds (TDFs). One part of this literature studies how the adoption of TDFs affects 401(k) participants' investment behavior and retirement outcomes. TDF adoption has been shown to increase equity exposure and reduce idiosyncratic risk (Mitchell and Utkus, 2022; Parker et al., 2025; Choukhmane and de Silva, 2024; Keim and Mitchell, 2017), as well as to outperform broker-recommended portfolios (Chalmers and Reuter, 2020). Another part of this literature examines TDFs' investment performance and cost structure. Several studies

document systematic underperformance and attribute much of it to excessive fees (Sandhya, 2011; Brown and Davies, 2021; Massa et al., 2022), while Balduzzi and Reuter (2018) document substantial heterogeneity in TDFs' ex ante risk-taking, consistent with fund managers increasing risk exposure to attract flows following the 2006 PPA. This paper advances this literature by developing the first structural model of the TDF market, which allows us to quantify the extent of TDF managers' market power and to evaluate counterfactual policies designed to mitigate it.

Second, this paper contributes to the literature on default options in 401(k) plans.[4] This literature shows that the adoption of defaults, combined with automatic enrollment, substantially increases participation and savings among workers (Madrian and Shea, 2001; Choi et al., 2004; Beshears et al., 2009), and that these effects are strongest upon adoption and at short horizons but attenuate over time (Beshears et al., 2021; Choukhmane, 2024; Choukhmane and Palmer, 2024; Choi et al., 2024). This paper complements this literature by focusing on the supply side of default provision. We show that fund managers exploit the role of TDFs as default options to sustain higher markups, and that constraining their market power can yield large welfare gains for 401(k) investors—in addition to the benefits from the adoption of TDFs as default investments.

Lastly, this paper contributes to a growing literature that applies empirical industrial organization methods to study retirement markets from a supply-side perspective. Motivated by empirical evidence on agency frictions in the design of 401(k) plans (Pool et al., 2016, 2022; Doellman and Sardarli, 2016; Badoer et al., 2020; Gropper, 2023), several recent papers develop structural models to quantify these frictions and assess the impact of policies aimed at reducing plan costs. Bhattacharya and Illanes (2022) study how recordkeepers and employers jointly design 401(k) plans; Loseto (2023) examines whether workers would design better plan menus than employers; and Yang (2023) analyzes the role of switching costs and markups in explaining fee dispersion across plans. Related applications outside the U.S. include research on the Mexican pension system (Hastings et al., 2017) and the Chilean pension system (Illanes, 2017; Illanes and Padi, 2021; Boehm, 2024).

The remainder of the paper proceeds as follows. Section 2 describes the data sources. Section 3 presents motivating evidence on market power in the TDF market. Section 4 outlines the structural model. Section 5 presents the estimation results. Section 6 discusses the counterfactual policy analysis, and Section 7 concludes.

[4]The introduction of behavioral nudges such as default options in 401(k) plans is motivated by a large body of evidence documenting suboptimal investment behavior among plan participants. See, for example, Benartzi (2001), Benartzi and Thaler (2001, 2007), Agnew et al. (2003), Poterba (2003), Choi et al. (2009), Tang et al. (2010), and Sialm et al. (2015).

2 Data and Summary Statistics

2.1 Data Sources

We combine 401(k) plan-level data from BrightScope Beacon with data on mutual funds and ETFs from CRSP and Morningstar Direct.

BrightScope Beacon provides detailed plan level information for ERISA defined contribution plans, covering approximately 85% of plan assets. BrightScope collects the data from Form 5500, which employer sponsors file with the Department of Labor (DOL) every year. Our BrightScope sample is from 2009 to 2019. For each plan $\times$ year, BrightScope provides the menu of investment options and total amount allocated in each option across all participants. Specifically, the data allows us to observe whether employer sponsors offer any TDF to their participants, and which TDFs they offer. We merge our investment menu data from BrightScope with additional plan characteristics directly from Form 5500.

We obtain mutual fund (including ETF) assets under management, expense ratios, classifications, and fund managers from Morningstar Direct. We classify TDFs based on Morningstar *global category*. We use *fund ID* to identify shareclasses of the same fund, and *strategy ID* to identify funds with different target retirement years of the same TDF series. Finally, we also obtain TDF holdings from CRSP.

When analyzing fees, we use mutual fund data from Morningstar and CRSP up to 2022. Because BrightScope Beacon data is up to 2019, we stop at 2019 for our structural estimation.

2.2 TDF Fees and Wrapper Fees

We measure TDF wrapper fees using the difference between the TDF's expense ratio and portfolio-weighted average expense ratio of the TDF's underlying funds. We specify the details of the wrapper fee calculation in Appendix C.

We make two remarks regarding wrapper fees. First, different share classes of the same TDF charge different expense ratios but invest in the same share class of their underlying funds. Because the underlying investments generally (though not always) use the lowest-cost institutional share class, the difference in expense ratio between TDFs and their underlying funds also captures fee variation across share classes, which is common among mutual funds. To address this concern, we only focus on the wrapper fee of the TDF's institutional share class (or, when unavailable, its lowest-cost share class).

Second, certain underlying funds are not available for individual purchase. For example, the Fidelity All-Sector Equity Fund (FSAEX) charges a zero expense ratio and "is provided to clients as an underlying investment in Fidelity Freedom Funds (Fidelity TDF) or certain asset management programs."[5] In this case, the underlying fund repre-

[5]See Fidelity fund website: https://fundresearch.fidelity.com/mutual-funds/summary/

Table 1: Summary Statistics

	Num Obs	Mean	St. Dev.	Pct10	Pct50	Pct90
Employer Level						
Offer TDF	35,253	0.82	0.38	0.00	1.00	1.00
Have Default Option	31,173	0.89	0.31	0.00	1.00	1.00
Have Auto-Enrollment	31,173	0.35	0.48	0.00	0.00	1.00
Allocation to TDF	31,043	0.41	0.26	0.09	0.38	0.79
Fund Level Equal-weighted						
TDF						
Expense Ratio (pp)	58	0.57	0.28	0.14	0.60	0.90
Wrapper Fee (pp)	58	0.22	0.22	0.01	0.11	0.54
AUM (billion)	58	23.79	75.78	0.07	2.47	39.87
Non-TDF						
Expense Ratio (pp)	9,215	0.75	0.41	0.19	0.75	1.35
AUM (billion)	9,215	2.53	12.99	0.01	0.26	4.25
Fund Level Asset-weighted						
TDF						
Expense Ratio (pp)	58	0.37	0.25	0.12	0.44	0.65
Wrapper Fee (pp)	58	0.14	0.21	0.00	0.03	0.55
Share in 401(k)	58	0.41	0.12	0.22	0.43	0.49
Manager is Recordkeeper	58	0.87	0.34	0.00	1.00	1.00
Non-TDF						
Expense Ratio (pp)	9,215	0.41	0.34	0.05	0.31	0.92
Share in 401(k)	9,215	0.07	0.11	0.00	0.01	0.22
Manager is Recodkeeper	9,215	0.44	0.50	0.00	0.00	1.00

Summary statistics at employer (plan) level and fund level as of 2019. We restrict to employers whose 401(k) plans have over 75% of assets invested in mutual funds. Allocation to TDF is only based on mutual fund TDFs. At fund level, we report both equal-weighted statistics in the middle panel and asset-weighted statistics in the bottom panel. Statistics for TDFs are reported at the TDF Series level. Expense ratios are winsorized at the 1% level.

sents an "extreme" share class that is only accessible to specific clients through Fidelity's fund-of-funds. One potential concern is that the zero expense ratio is not economically meaningful. We argue this is not the case, because around the time Fidelity reduced expense ratios of such funds to zero, Fidelity also introduced its ZERO series of funds with zero expense ratios that are accessible to all investors with a Fidelity brokerage account.

2.3 Summary Statistics

We report summary statistics as of 2019 in Table 1. The top panel is at the employer (plan) level. 80% of employers offer TDF in their 401(k) plans as of 2019. 89% has default investment options and 35% have automatic enrollment. In 401(k) plans with mutual fund TDFs (excluding CITs or separate accounts), participants allocate 40% of their assets to TDFs on average, consistent with TDFs being popular default investment

316128636. Brown and Davies (2021) also discusses this restriction.

options.

In the middle and bottom panels, we report fund level summary statistics, both equal-weighted and asset-weighted. Statistics for TDFs are reported at the TDF Series level.[6] The average TDF expense ratio is 58 bps on an equal-weighted basis and 37 bps on an asset-weighted basis. For non-TDFs, the equal- and asset-weighted expense ratios are 75 bps and 41 bps, respectively. In comparison, investors in non-TDFs allocate a larger fraction of their assets to lower-fee funds, consistent with greater fee sensitivity. The asset-weighted TDF wrapper fee is 14 bps (where we restrict to institutional share class as discussed in Section 2.2). Although some TDFs charge zero wrapper fees, TDFs at the 90th percentile charge over 50 bps above the fees of their underlying funds.

The average TDF in our sample has nearly $24 billion in assets, much larger than the average non-TDF. On average, 40% of TDF assets come from 401(k) plans (with the rest mostly from other retirement accounts such as IRAs), whereas only 7% of non-TDF assets come from 401(k) plans. TDF managers are also much more likely to provide recordkeeping services.

3 Motivating Evidence

We present three sets of motivating facts that highlight the potential market power of TDF managers. First, we compare the fees charged by TDFs with the fees of their underlying funds. Second, we test whether flows into TDFs are less sensitive to fees than flows into non TDF funds. Third, we compare the asset weighted distribution of fees for TDFs with the distribution of fees for a broad set of equity and bond index funds.

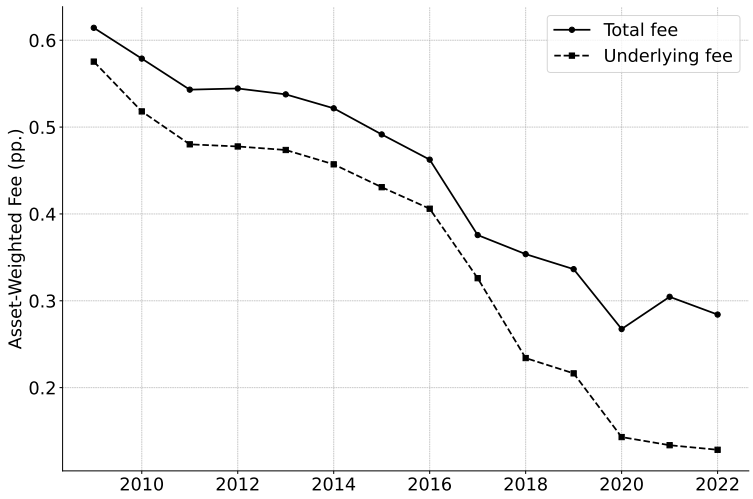
3.1 Comparing TDF Fees Over Fees of Underlying Funds

The fund-of-funds structure of TDFs allows us to compare their expense ratios with the average expense ratios of their underlying funds, effectively benchmarking each TDF against a replicating portfolio of the same holdings. Figure 1 shows that TDFs consistently charge higher fees than their underlying funds, and that this gap has widened over time—from around 4 bps in 2009 to over 17 bps in 2022.[7] As more investors default into TDFs, they are effectively paying increasingly higher markups relative to the same basket of funds. While fund managers may justify some wrapper fees to cover life-cycle rebalancing costs, it is unlikely that these costs have grown over time. A more plausible explanation is that TDF managers may be exploiting default investors' inertia or inattention to increase their markups.

[6] A TDF Series is a set of TDFs, offered by the same fund manager, with different target year of retirement. For example, Fidelity offers the Fidelity Freedom TDF Series, which contains several TDFs: the Fidelity Freedom 2020 for individuals who are expected to retire around 2020, the Fidelity Freedom 2030 for those expected to retire around 2030, etc.

[7] Figure 1 restricts the sample to the institutional (or, when unavailable, the lowest-cost) TDF share class. Figure B.1 shows similar patterns for the full sample of TDFs.

Figure 1: TDF Fees vs. Underlying Fees



Asset-weighted average expense ratios of Target-Date Funds (TDFs) and underlying funds held by TDFs. The TDF sample is restricted to institutional share classes or the cheapest share class available.

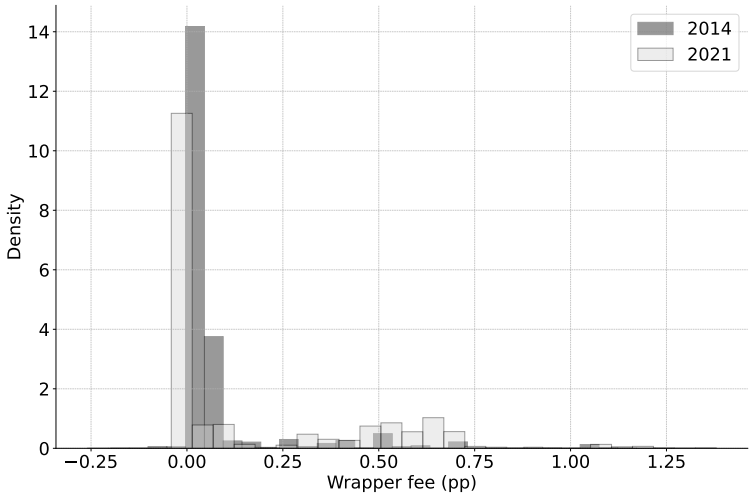
Figure 2 highlights that wrapper fees—the difference between TDF total fees and fees of their underlying funds—vary substantially across TDFs. Comparing 2014 and 2021, the distribution shifts to the right, but not uniformly: only some TDFs have increased their wrapper fees, suggesting heterogeneous fee-setting behavior among TDF managers.

Wrapper fees across managers. A potential explanation for these differences is whether the TDF manager also serves as a 401(k) recordkeeper, who designs and provides menus of investment options for plan participants. For vertically integrated TDF managers who also act as recordkeepers, it may be easier to designate their own funds as default options and thereby attract the assets of inattentive investors. Consistent with this explanation, Figure 3a shows how wrapper fees for recordkeepers and non-recordkeepers changed in different ways.

Wrapper fees for TDFs offered by recordkeepers were relatively low around 2010, but rose sharply between 2017 and 2018. This increase is difficult to reconcile with higher costs for two reasons. First, recordkeepers are typically large asset managers, such as Fidelity and Vanguard (with the notable exception of BlackRock) and therefore are more likely to benefit from economies of scale than smaller providers. Second, it is unlikely that recordkeepers experienced a cost increase large enough to justify the sharp rise in wrapper fees, particularly because non recordkeepers do not seem to experience a comparable increase over the same period. A more plausible explanation is that vertically integrated TDF providers exploit their role as recordkeepers to access the assets of default investors in 401(k) plans. Consistent with this explanation, Table B.1 shows that TDF provider market share in the market for 401(k) recordkeeping services predicts significantly higher TDF wrapper fees.[8].

[8]Although a strong positive correlation between recordkeeping market shares and TDF wrapper fees

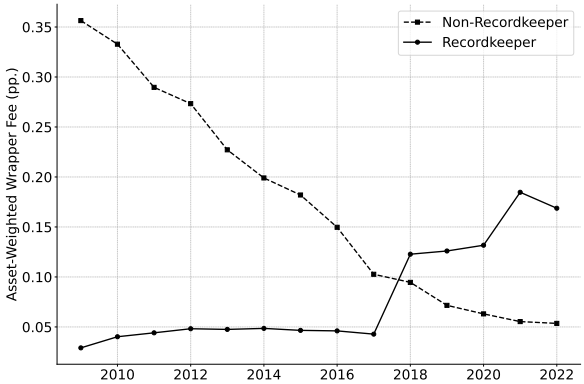
Figure 2: Wrapper Fees Distribution



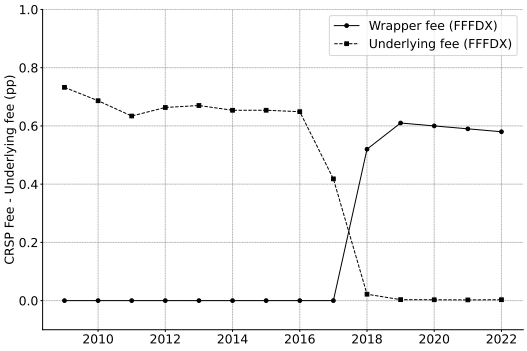
Asset-weighted distribution of wrapper fees in 2014 and 2021. The TDF sample is restricted to institutional share classes or the cheapest share class available.

Figure 3: Wrapper Fees and Underlying Fees

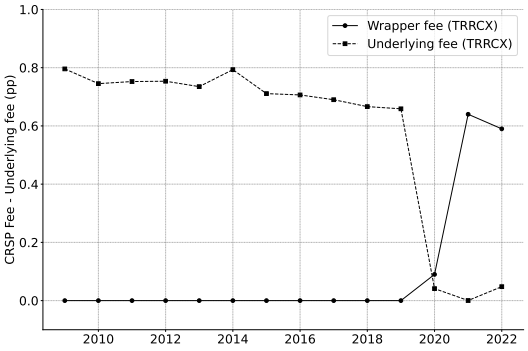
(a) Wrapper fee by manager type



(b) Fidelity Freedom 2020



(c) T Rowe Price Retirement 2030



Panel (a) plots average wrapper fees for TDFs operated by fund managers who also serve as 401(k) recordkeepers and fund managers who do not have recordkeeping functions. Panels (b) and (c) compare wrapper fees and underlying fees for two TDFs operated by recordkeepers.

Among fund managers that also serve as recordkeepers, the increase in wrapper fees is driven primarily by several large managers, such as Fidelity and T. Rowe Price. These managers reduced the expense ratios of some of their underlying funds to zero or near zero. Although these funds are held within their TDFs, the overall TDF fees remained largely unchanged, which mechanically raised wrapper fees (see Figures 3b and 3c). This pattern is consistent with a fee strategy in which managers lower fees on underlying funds to attract fee sensitive investors while maintaining TDF fees, thereby increasing markups on inattentive default investors.[9]

Decomposition of changes in wrapper fees. To further shed light on the drivers of the wrapper fee increase, we decompose changes in wrapper fees into four components: advisor fees, distribution fees, custodian fees, and transfer agent fees. Custodian and transfer agent fees are more likely to reflect underlying costs, as they are paid to external parties for asset safeguarding and administrative services. Distribution fees can represent marketing or distribution payments to brokers, or markups applied primarily to retail share classes. Advisor fees are the component most likely to capture markups, as they reflect the compensation to investment advisors or fund managers for portfolio management services.

Figure B.4a shows that some TDFs increased their advisor fees by 20 to 80 basis points between 2009 and 2022, mirroring the pattern observed in Figure 2. By contrast, Figures B.4b to B.4d show no meaningful increase in the other components of wrapper fees. Thus, the observed rise in wrapper fees is more consistent with higher markups than with higher costs.

We also compare changes in each fee component to those of balanced funds and broad U.S. equity and bond funds. Balanced funds invest in both equities and bonds while maintaining a target asset allocation (such as 60 percent equities and 40 percent bonds). Although their objectives differ from those of TDFs, both fund types regularly rebalance across asset classes. However, we find no increase in any of the four fee components among balanced funds. Indeed, balanced funds and broad equity and bond funds display similar distributions of fee changes. This suggests that the cost of rebalancing has not risen over time and is therefore unlikely to explain the increase in TDF wrapper fees.

could suggest that wrapper fees partly finance the costs of bundling recordkeeping and investment services, this is unlikely to be the primary explanation, since wrapper fees have remained stable for several large TDF providers that also serve as 401(k) recordkeepers (Figure B.2).

[9]Fund managers make lumpy fee changes rather than revising fees in a smooth and continuous manner. This pattern is likely driven by menu costs or organizational frictions. Appendix Figure B.3 shows that around the time Fidelity and T. Rowe Price reduced fees of TDF underlying funds, from 2016 to 2018 for Fidelity and from 2020 to 2021 for T. Rowe Price, these fund managers also reduced fees broadly across other funds. One possibility is that these managers faced increasing pressure from fee sensitive investors and ultimately chose to incur fixed adjustment costs to reduce fees across a wide range of funds.

Table 2: Flow-Fee Sensitivity

	Fund Flow (pp)	
	(1)	(2)
%Δ Expense Ratio	-0.852***	-0.880***
	(0.038)	(0.038)
%Δ Expense Ratio × TDF	0.767***	0.810***
	(0.277)	(0.284)
Global Category × Index × Year Fixed Effects		X
N	79120	79022
Adjusted R^2	0.12	0.18

Fund flows sensitivity to fees. Estimates are based on Equation (1). We winsorize flow and percentage fee changes at 5%. We restrict to equity, fixed income, and allocation funds (including Target Date Funds) from 2009 to 2019.

3.2 Fee Elasticity

Next, we document substantial differences in fee sensitivity between TDF and non TDF investors, which may help explain why fund managers have incentives to raise TDF wrapper fees. We provide two pieces of evidence. First, we test whether flows into TDFs respond differently to fees than flows into other funds. Second, we compare the asset weighted distribution of TDF fees with the corresponding distribution for a broad set of equity and bond index funds.

Flow-fee sensitivity. To compare flows into TDF and non-TDF funds, we focus on equity, fixed income, and allocation funds, which are comparable to underlying funds held by TDFs. We then estimate the fee elasticity of fund flows by regressing fund flows on percentage changes in expense ratios:

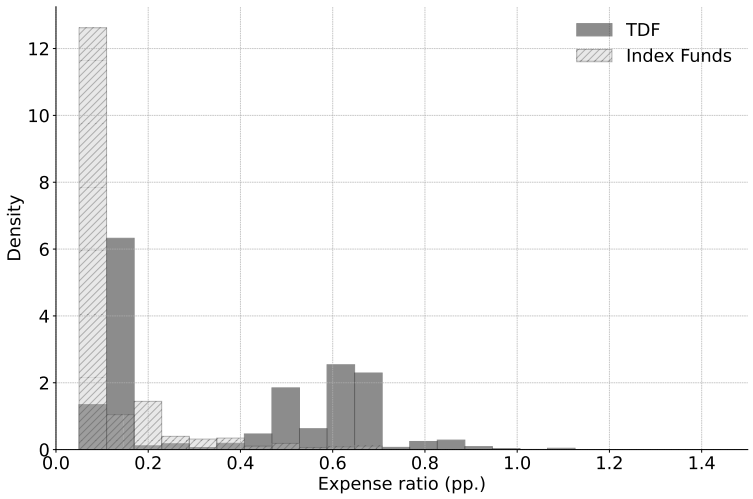
$$Flow_{it} = \eta \times \%\Delta fee_{it} + \eta^{tdf} \times \%\Delta fee_{it} \times 1\{TDF_i\} + X_{it}\beta + \gamma_{it} + \epsilon_{it}. \quad (1)$$

We compute fund flows as the percentage change in total net assets (TNA) net of returns, $Flow_t = TNA_t/TNA_{t-1} - Ret_t$. Here, η captures the elasticity of flows with respect to fees, and η^{tdf} captures the difference in elasticities between TDFs and non-TDFs. For simplicity, we report OLS estimates (rather than 2SLS estimates with fee instruments). X_{it} includes controls for fund age and lagged returns, and γ_{it} are asset category × index × year fixed effects that control for fund heterogeneity.

Table 2 shows that non-TDF funds have an estimated elasticity of about 0.9. The coefficient η^{tdf} is positive and statistically significant, implying that elasticity of TDFs is much lower. This finding is consistent with TDF investors being largely insensitive to fees, reflecting the prominent role of TDF as default options in 401(k) plans.

Distribution of TDF fees. Figure 4 provides complementary evidence that TDF investors are substantially less fee sensitive than non-TDF investors in the broad mutual

Figure 4: Asset-weighted distribution of fees: TDF vs. Index Funds



Notes: The figure plots the asset-weighted distribution of net expense ratios for TDF and for a broad set of passive index mutual funds. The index fund sample includes US equity, fixed income, and international equity index mutual funds, chosen to match the main asset categories that typically appear as underlying holdings in TDF.

fund market. It compares the asset-weighted distribution of fees for TDF with the fee distribution for a broad range of equity and bond index funds. The typical dollar invested in a TDF pays a much higher fee than the typical dollar invested in an index fund. The mean fee is 0.37 percentage points for TDFs versus 0.11 percentage points for index funds, and the median is 0.44 versus 0.06. At the upper tail, the difference remains large, with the 90th percentile at 0.65 for TDFs and 0.21 for index funds. Together, these moments suggest that a sizeable share of TDF assets remains invested in relatively high fee products, consistent with investors that do not aggressively reallocate toward cheaper alternatives.

The dispersion of fees is also markedly larger for TDFs. The standard deviation of the asset weighted fee distribution is 0.25 for TDFs, more than twice the 0.11 observed for index funds. This pattern is informative because it indicates that, although some low fee TDFs exist, they do not capture the bulk of TDF assets. By contrast, the index fund distribution is tightly concentrated at low fees, implying that most assets are allocated to the cheapest available index options. This contrast is consistent with a market in which index investors search more actively and respond more strongly to fee differences, while TDF investors remain less responsive to differences in fees.

4 Model

We present a model of fee competition between differentiated mutual fund managers who sell their products in two markets. Managers sell their funds directly in the general mutual fund market and package their funds into TDFs. Managers can also price-discriminate,

selling funds at their own expense ratios and in the TDF market with additional wrapper fees. We begin with a stylized model to highlight the main economic intuition behind managers' fee-setting behavior and then develop the full structural model that we take to the data.

4.1 A Stylized Model of TDF pricing

We start with a simple case of full segmentation, where investors do not substitute between TDFs and non-TDFs. Consider a fund manager who can sell its fund directly at a fee p^a, and indirectly through a TDF at a fee $p^d = p^a + \tilde{p}$, where $\tilde{p}$ denotes the wrapper fee. [10] The fund manager chooses p^a and $\tilde{p}$ to maximize his joint profit

$$\max_{p^a, \tilde{p}} \quad s^a(p^a)(p^a - c) + s^d(p^d)(p^d - c),$$

where $s^a(\cdot)$ and $s^d(\cdot)$ denote the respective demand in the non-TDF market where investors make active decisions and the TDF market with default investors. We also assume that the marginal cost c is the same in both markets, which is reasonable when the rebalancing costs of TDFs are negligible, and we relax this assumption when we estimate our full model subsequently.

Because the manager can freely adjust the wrapper fee $\tilde{p}$, he can optimize directly over the TDF price p^d. Under full segmentation between TDFs and non-TDFs, the first-order conditions reduce to the standard Bertrand pricing equations:

$$p^d = c - \frac{s^d}{\partial s^d / \partial p^d},$$
$$p^a = c - \frac{s^a}{\partial s^a / \partial p^a}.$$

Substituting $p^d = p^a + \tilde{p}$ and combining the two equations gives the optimal wrapper fee as the difference of (inverse) semi-elasticities between TDF and non-TDF markets:

$$\tilde{p} = \underbrace{\left(-\frac{s^d}{\partial s^d / \partial p^d}\right)}_{\text{inverse semi-elasticities of TDF}} - \underbrace{\left(-\frac{s^a}{\partial s^a / \partial p^a}\right)}_{\text{inverse semi-elasticities of non-TDF}} \tag{2}$$

Equation (2) captures the economics of managers' fee-setting behavior. The more fee-sensitive investors are outside the TDF market, the higher the TDF wrapper fees. Thus, if mutual fund investors outside 401(k) plans become more fee-sensitive over time, the model predicts rising wrapper fees.

[10] In our model (both the stylized one here and the full version in the following section), we assume all underlying funds of TDFs come from the same fund managers. In our data, around 95% of TDF assets belong to the same fund managers, which is similar to statistics reported in Brown and Davies (2021). Hence, we consider our assumption to be relatively innocuous.

4.2 Structural Model of TDFs and Mutual Funds

Our full structural model shares the same economic intuition and has a richer structure that allows us to rationalize observed data. There are three agents: employer sponsors, investors, and fund managers. Let $\mathcal{J}$ and $\mathcal{D}$ collect the set of non-TDFs and TDFs. Let $\mathcal{J}_f$ and $\mathcal{D}_f$ denote the set of non-TDFs and TDFs offered by fund manager f. The model captures the following sequence of choices:

1. Each fund manager f sets the fees of their non-TDFs $j \in \mathcal{J}_f$ and fees of their TDFs $k \in \mathcal{D}_f$, which together determine the wrapper fees.

2. Each employer sponsor m chooses whether to offer a TDF $k \in \mathcal{D}$ in their 401(k) plan, or none.

3. Each investor i in plan m makes a retirement allocation decision in two steps:

   3a. The investor decides whether to invest in the TDF k offered in plan m.

   3b. The investor who opts out of the TDF (or if none is offered by the employer) makes an active allocation decision among non-TDFs in $\mathcal{J}$ that are offered in 401(k) menus.

4. Each investor i outside 401(k) plans makes an allocation decision in two steps:

   4a. The investor decides whether to invest in some TDF $k \in \mathcal{D}$ or not.

   4b. The investor who does not invest in any TDFs makes an active allocation decisions among non-TDFs in $\mathcal{J}$.

Step 3a corresponds to how 401(k) participants invest in TDFs as their default options. Step 4a captures inattentive TDF investors outside 401(k) plans, for example, those investing through IRAs. Although TDFs are not formally structured as default options, investors who allocate to TDFs may not actively consider other investment options due to the life-cycle rebalancing features of TDFs. Hence, we model investors as first making a conscious decision to opt out of TDFs in step 4a and then actively allocating among non-TDFs in step 4b.

4.2.1 Employer TDF Choice (Step 2)

Employer m chooses a TDF $k \in \mathcal{D}$ or no TDF.[11] We consider TDF k as the "default option" of plan m. In practice, this default can take several forms: it may serve as the automatic enrollment default, as the default for workers who voluntarily enroll but do not make an active allocation decision, or as an "informal default" in which the TDF is

[11] We consider TDF at the *strategy* level. We consider TDFs with different retirement years of the same strategy as one fund. Employers rarely offer more than one TDF strategies. In the rare situation with multiple TDF strategies, we designate the TDF strategy with larger total AUM as the chosen TDF.

recommended to participants. For tractability, we abstract from modeling the detailed design of these default features and instead represent them through the employer's decision to offer a TDF. We assume employer m derives the following utility from offering TDF k:

$$u_{mkt} + \epsilon_{mkt} = -\alpha^{emp} p_k + X'_{mkt}\beta + \epsilon_{mkt},$$

where p_k is the expense ratio of TDF k. X_{kt} includes fund-level controls for fund age, index funds, and an indicator for whether the manager of k is also a recordkeeper. ϵ_{mkt} captures idiosyncratic preferences that follows Type I extreme value distribution.

We normalize the utility of the outside option of no TDF to zero. The outside option includes both the case where the employer offers no default and the case where the employer offers other types of default such as money market funds. Since we focus on TDFs, we do not distinguish among alternative defaults.

The probability that employer m selects k is the following.

$$q^{emp}_{mkt} = \frac{\exp(u_{mkt})}{1 + \sum_{k' \in \mathcal{D}} \exp(u_{mk't})}, \tag{3}$$

4.2.2 Investors in 401(k) Plans (Step 3)

We distinguish between investors in 401(k) plans and those outside 401(k) plans. 401(k) investor i first makes a binary decision of whether to invest in the TDF k chosen by her employer m (Step 3a). We assume at this step, investor i is unaware of the rest of the plan menu, capturing the role of TDFs as default options. The utility from investing in TDF k is

$$u_{mkt} + \epsilon_{imkt} = -\alpha^{in,tdf} p_k + X'_{mkt}\beta + \epsilon_{imkt}.$$

X_{mkt} includes fund-level controls as well as plan-level characteristics, such as whether the employer offers a default option or automatic enrollment.

Aggregating across investors, the fraction of assets in plan m allocated to TDF k is

$$q^{in,tdf}_{mkt} = \frac{\exp(u_{mkt})}{1 + \exp(u_{mkt})}. \tag{4}$$

Next (Step 3b), 401(k) investors who opt out of TDFs or whose employers do not offer TDFs choose among the remaining funds $\mathcal{J}$. We do not model the specific menu design of each plan and instead allow investors to choose among all funds offered in 401(k) plans. For active allocations, utility is

$$u_{jt} + \epsilon_{ijt} = -\alpha^{in,active} p_j + X'_{jt}\beta + \xi_{jt} + \epsilon_{ijt},$$

where X_{jt} includes a rich set of controls with fixed effects at the fund investment category $\times$ index $\times$ year level.

Aggregating across investors, the fraction of assets allocated to fund $j \in \mathcal{J}$ is the following. We consider allocation to money market funds as the outside option and normalize its utility to zero.

$$q_{jt}^{in,active} = \frac{\exp(u_{jt})}{1 + \sum_{l \in \mathcal{J}} \exp(u_{lt})}. \tag{5}$$

4.2.3 Investors Outside 401(k) Plans (Step 4)

Investors outside 401(k) plans face a similar two-step decision. They first decide whether to invest in a TDF (Step 4a). If not, they make an active allocation among non-TDFs in $\mathcal{J}$ (Step 4b).

The first step captures TDF investments through retirement accounts other than 401(k) plans (e.g., IRAs). The second step captures the demand of investors who actively construct their portfolios among non-TDFs. This two-step structure is motivated by TDFs' life-cycle rebalancing features. Once investors choose TDFs, they may no longer actively consider other investment options.

The share of outside 401(k) assets allocated to TDF k is denoted by $q_{k,t}^{out,tdf}$, following Equation (4). Similar to 401(k) active investors, outside investors who opt out of TDFs can choose among all funds in $\mathcal{J}$, including products not commonly available in 401(k) plans, such as ETFs. The share of outside 401(k) assets allocated to fund j is denoted by $q_{j,t}^{out,active}$ and is characterized as in Equation (5).

While the allocation problem is analogous for the two groups, we estimate their preferences separately. Identification relies on different sources of variation in observed fund market shares: variation within 401(k) plans identifies the preferences of 401(k) investors, while variation in the broader mutual fund market identifies the preferences of outside investors.

4.2.4 Fund Manager Fee-Setting Problem (Step 1)

Fund managers compete in a standard Nash-Bertrand fee-setting game. Again, $\mathcal{J}_f \subseteq \mathcal{J}$ and $\mathcal{D}_f \subseteq \mathcal{D}$ denote, respectively, the sets of non-TDFs and TDFs offered by manager f. Manager f chooses fees to maximize total profit:

$$\max_{(p_j, p_k)_{j \in \mathcal{J}_f, k \in \mathcal{D}_f}} \quad \sum_{j \in \mathcal{J}_f} (p_j - c_j) D_j^a(p) + \sum_{k \in \mathcal{D}_f} (p_k - c_k) D_k^d(p),$$

where $D_j^a(p)$ is the demand for non-TDF j and $D_k^d(p)$ is the demand for TDF k. Since investors both inside and outside 401(k) plans can allocate across TDFs and non-TDFs, these demand functions depend on the entire vector of fees in $\mathcal{J} \cup \mathcal{D}$. For simplicity, we dropped the time subscript.

The demand for TDF $k \in \mathcal{D}$ is

$$D_k^d = \underbrace{\sum_m M_m q_{km}^{emp} q_{km}^{in,tdf}}_{\text{401(k) demand}} + \underbrace{M_{out} q_k^{out,tdf}}_{\text{outside 401(k) demand (e.g., IRAs)}}.$$

where M_m denotes assets in plan m, and M_{out} denotes total asset outside 401(k) plans. We abstract away from modeling the effect of fees and fund choices on assets M_m, M_{out}.

Similarly, the expression of the demand for non-TDF $j \in \mathcal{J}$ is

$$D_j^a = \underbrace{\sum_m M_m \Big(1 - \sum_{k \in \mathcal{D}} q_{km}^{emp} q_{km}^{in,tdf}\Big) q_j^{in,active}}_{\text{401(k) demand}} + \underbrace{M_{out}\Big(1 - \sum_{k \in \mathcal{D}} q_k^{out,tdf}\Big) q_j^{out,active}}_{\text{outside 401(k) demand}}$$

In a Nash-Bertrand equilibrium, all fund providers set fees simultaneously to maximize profits taking competitors' fees as given. The resulting equilibrium markups are characterized by the following system of $|\mathcal{J}| + |\mathcal{D}|$ equations:

$$\begin{bmatrix} p^a - c^a \\ p^d - c^d \end{bmatrix} = - \begin{bmatrix} \Delta_{a,a} & \Delta_{a,d} \\ \Delta_{d,a} & \Delta_{d,d} \end{bmatrix}^{-1} \begin{bmatrix} D^a \\ D^d \end{bmatrix} \tag{6}$$

where p^a is the $|\mathcal{J}|$-vector of non-TDF fees, p^d is the $|\mathcal{D}|$-vector of TDF fees, and Δ is a $|\mathcal{J}| + |\mathcal{D}|$ by $|\mathcal{J}| + |\mathcal{D}|$ matrix defined as

$$\Delta = \begin{bmatrix} \Delta_{a,a} & \Delta_{a,d} \\ \Delta_{d,a} & \Delta_{d,d} \end{bmatrix} \equiv \nabla D \odot \Omega = \begin{bmatrix} \nabla_a D^a \odot \Omega^a & \nabla_a D^d \odot \Omega^d \\ \nabla_d D^a \odot \Omega^a & \nabla_d D^d \odot \Omega^d \end{bmatrix}$$

where ∇D is the demand Jacobian and Ω is the product ownership matrix.

As in our stylized model, we can decompose TDF fees into wrapper fees plus underlying fees. Unlike our stylized model, we allow for multiple underlying funds and define the underlying fee as a holding-weighted average of the fees of the underlying funds. Formally, we decompose the fees on TDF k as

$$p_k = \underbrace{\tilde{p}_k}_{\text{wrapper fee}} + \underbrace{\sum_{j \in \mathcal{J}} w_{k,j} p_j}_{\text{underlying fee}}$$

where $\omega_{k,j}$ is the share of fund k assets allocated to underlying fund j.

Letting $c^d = W c^a$ and W be a $|\mathcal{D}| \times |\mathcal{J}|$ matrix collecting the holding shares of each TDF, the equilibrium $|\mathcal{D}|$-vector of wrapper fees is given by

$$\begin{aligned} \tilde{p} = &- (S_d)^{-1} D^d - W\left(-\Delta_{a,a}^{-1} D^a\right) + (S_d)^{-1} \Delta_{d,a} \Delta_{a,a}^{-1} D^a \\ &- W\left(-\Delta_{a,a}^{-1} \Delta_{a,d} (S_d)^{-1} \Delta_{d,a} \Delta_{a,a}^{-1} D^a - \Delta_{a,a}^{-1} \Delta_{a,d} (S_d)^{-1} D^d\right) \end{aligned} \tag{7}$$

where S_d is a $|\mathcal{D}| \times |\mathcal{D}|$ matrix defined as $S_d \equiv \Delta_{d,d} - \Delta_{d,a}(\Delta_{a,a})^{-1}\Delta_{a,d}$.[12] Equation (7) generalizes the expression for the optimal wrapper fee derived in Equation (2). Differently from our stylized model, TDFs and non-TDFs are sold in both 401(k) plans and outside 401(k) plans. If we assume again that markets are fully segmented (i.e., $\Delta_{a,d} = O$ and $\Delta_{d,a} = O$), Equation (7) simplifies to $\tilde{p} = -(\Delta_{dd})^{-1}D^d - W(-\Delta_{a,a}^{-1}D^a)$ which corresponds to Equation (2) of our stylized model.

5 Estimation Results

This section presents the estimation results. We estimate five demand systems: (i) employers' demand for TDFs, (ii) 401(k) investors' demand for TDFs chosen by their employers, (iii) demand for TDFs among investors outside 401(k) plans, (iv) demand for non-TDFs among 401(k) investors, and (v) demand for non-TDFs among investors outside 401(k) plans.

To address the endogeneity of fees, we follow Egan, MacKay and Yang (2021) and construct Hausman instruments, defined as the average fees of mutual funds managed by the same fund manager but offered in other Morningstar global categories, excluding TDFs. The exclusion restriction requires the average fees of other funds from the same manager to be uncorrelated with a fund's unobserved demand. This restriction is plausible if the average fees of other funds primarily proxy for the manager's operating costs. When part of these costs is common across funds from the same manager—for example, due to economies of scale or scope—the Hausman instrument also satisfies the relevance condition.

In Appendix B we repeat part of our analysis using a cost-shifter instrument based on fund-level custodian fees. One advantage of using custodian fees is that it allows us to control for fund manager fixed effects, which capture preferences for fund brands. The exclusion restriction requires custodian fees to be uncorrelated with investors' unobserved demand. This assumption is plausible if, after controlling for observed fund characteristics such as fund age and asset class, variation in custodian fees primarily reflects operational costs associated with safekeeping fund assets. The relevance condition holds whenever custodian costs are passed through to investors via fund fees. Overall, the results are qualitatively similar to the ones with the Hausman instrument.

5.1 Employer TDF Choice

We estimate employers' TDF choice at plan-level using maximum likelihood (MLE). To address fee endogeneity, we introduce a control function with a Hausman instrument below and with a cost shifter in Appendix. First, we regress TDF expense ratios on the

[12] We provide detailed derivations in Appendix A

Table 3: Employer Demand Estimates

	Employer Default Choice	
	MLE	MLE (Hausman Control Fn)
Expense Ratio (pp)	-1.10***	-1.27***
	(0.04)	(0.04)
Expense Ratio (pp) x Year	-0.05***	-0.14***
	(0.01)	(0.01)
TDF	-6.27***	-5.04***
	(0.05)	(0.05)
TDF x Year	-0.06***	0.03***
	(0.01)	(0.01)
Recordkeepers	1.94***	1.94***
	(0.02)	(0.02)
log(Fund Age)	1.74***	1.30***
	(0.02)	(0.02)
N	876,407	876,407
Elasticity	-0.51	-0.75

MLE estimates of Equation (3). We restrict to a balanced panel of plans with over 75% of assets invested in mutual funds. We also drop plans whose TDF is not a mutual fund. In the second column, we construct control function by regressing fees on Hausman or cost shifter instruments, along with the same set of controls.

instruments and controls. Second, we include a polynomial of the first-stage residuals in the MLE estimation.

Table 3 presents the estimates. We estimate a more negative fee coefficient α^{emp} with control function using a Hausman instrument.[13] However, the implied elasticity to TDF fees remains below -1 on average, suggesting that employers are insensitive to fees. We also estimate that employers' fee sensitivities increase over time. In terms of other characteristics, employers prefer TDFs with longer track records and TDFs whose managers are also recordkeepers.

Because we only observe fees and other characteristics for mutual funds, we restrict the estimation sample to 401(k) plans with more than 75% of assets invested in mutual funds. Our sample therefore excludes plans where TDFs are offered through Collective Investment Trusts (CITs) or Separately Managed Accounts (CMAs). CITs and CMAs are offered by large employers who have the bargaining power to negotiate lower fees with major fund managers. Hence, the demand for these alternative structures of TDFs will not affect fees of TDFs structured as mutual funds.

[13]Table B.2 reports the estimates using custodian fees as IV.

5.2 401(k) Investor TDF Choice

We estimate 401(k) investors' decision to invest in the employer-selected TDF using Equation (4), following Berry (1994). Table 4 reports our estimates at the plan–year level. We estimate a small $\alpha^{in,tdf}$, suggesting again low fee-sensitivities. Interestingly, we estimate that fee sensitivities decrease over time with positive coefficient on the interaction between expense ratio and time trend. This offsets the increase in fee sensitivities among employers reported in Table 3. As TDFs become more popular, investors could be more likely to make inactive choices in later part of the sample.[14] Even with instruments, our estimates imply elasticities close to zero.[15]

We also find that investors allocate more to their TDFs in plans with default options or automatic enrollment. Investors also value TDFs offered by recordkeepers and TDFs with longer track records.

5.3 401(k) Investors' Active Allocation

Investors in 401(k) plans can also choose to invest directly in non-TDF funds. We estimate the demand for these investors using Equation 5, again following Berry (1994).

We report the estimates on fund characteristics and the fee-sensitivity parameter $\alpha^{in,active}$ in the left hand side section (columns 1 and 2) of Table 5.[16] When making active allocation decisions, 401(k) investors are estimated to be much more sensitive to fees than investors who default into TDFs. Moreover, the fee sensitivity of active investors increases over time. Investors appear to value funds with longer track records and funds whose manager is also a recordkeeper. Since the largest recordkeepers are among the most well-known fund managers, the preference for recordkeepers is likely a proxy for brand value.

5.4 Allocation of Investors Outside 401(k) Plans

Next, we estimate demand for investors outside 401(k) plans. Like 401(k) investors, they first choose whether to invest in a TDF. If not, they allocate across non-TDF funds.

We measure TDF assets held outside 401(k) plans by subtracting TDF holdings in 401(k) plans from the total TDF assets under management. We assume the remainder is held largely in retirement accounts outside 401(k), such as IRAs or Roth IRAs. According to ICI statistics, over 92% of TDF assets are held in retirement accounts, so we may be misattributing around 8% of TDF assets to retirement investors.

[14] Alternatively, since the dependent variable is based on investor's allocated assets to TDFs, this positive fee × year interaction could also mechanically reflect the incremental contribution defaulted into TDFs over time.

[15] Table B.3 reports the estimates using custodian fees as IV, together with the OLS and Hausman IV specifications.

[16] Corresponding estimates using custodian fees as a cost shifter instruments are included in Table B.4

Table 4: Demand Estimates for 401(k) TDF Investors

	Worker Allocation to Default	
	OLS	Hausman IV
Expense Ratio (pp)	-0.30***	-0.41***
	(0.03)	(0.03)
Expense Ratio (pp) x Year	0.11***	0.13***
	(0.00)	(0.00)
log(Fund Age)	0.62***	0.55***
	(0.02)	(0.03)
Default Option	0.38***	0.38***
	(0.02)	(0.02)
Auto-Enroll	0.19***	0.19***
	(0.01)	(0.01)
Recordkeepers	0.24***	0.26***
	(0.03)	(0.03)
N	25,048	25,048
Elasticity	0.09	0.10

Estimates of Equation 4 as the plan x year level. We restrict the sample to plans that offer a mutual fund TDF series.

Table 5 reports the estimates. The right hand side section (columns 5 and 6) shows that investors outside 401(k) plans are only slightly more sensitive to TDF fees compared to employers when choosing TDFs as default options for their 401(k) investors. But our estimates are not precise. The OLS estimate is not significant and the 2SLS estimate using the Hausman instrument is significant only at the 5% level. Unlike demand for non-TDFs, we do not have consistent evidence that TDF investors become more fee sensitive over time. However, since we are restricted to around 600 TDF $\times$ year observations, we may not have a sufficient statistical power.

The middle section (columns 3 and 4) focuses on non-TDF funds held outside 401(k) plans. Investors are again much more fee-sensitive than TDF investors, and their fee-sensitivity also increases over time. Through the lens of our model, this widening gap in fee-sensitivity between TDF and non-TDF investors could explain why fund managers charge higher TDF wrapper fees.

Figure 5 plots the estimated fee semi-elasticities over time for different investor groups. Figure 5a presents the aggregate semi-elasticities for TDF and non-TDF investors, showing a widening gap in the fee sensitivity between the two groups. Consistent with the intuition from our stylized model in Equation (2), this widening gap should give fund managers stronger incentives to raise TDF wrapper fees and price discriminate across investor types.

Figure 5b further decomposes these aggregate semi-elasticities into investors inside and outside 401(k) plans. TDF investors inside 401(k) plans exhibit similar and relatively stable fee sensitivity to those outside, consistent with TDFs being perceived as informal default options even outside 401(k) plans. In contrast, the fee sensitivity of non-

Table 5: Demand Estimates for Non-TDF Investors and TDF Investors Outside 401(k)

	Non-TDF in 401(k)		Non-TDF outside 401k		TDF outside 401k	
	OLS	Hausman IV	OLS	Hausman IV	OLS	Hausman IV
Expense Ratio (pp)	-2.01***	-3.55***	-1.58***	-2.91***	-0.74	-2.26**
	(0.10)	(0.19)	(0.04)	(0.08)	(0.49)	(1.13)
Expense Ratio (pp) x year	-0.13***	-0.14***	-0.03***	-0.05***	-0.16**	-0.00
	(0.02)	(0.03)	(0.01)	(0.01)	(0.08)	(0.19)
log(Fund Age)	1.50***	1.54***	1.20***	1.21***	2.21***	2.26***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.14)	(0.16)
Recordkeepers	1.60***	1.26***	0.91***	0.58***	1.07***	0.84***
	(0.04)	(0.04)	(0.02)	(0.02)	(0.21)	(0.25)
N	35,228	35,228	60,760	60,760	579	579
Elasticity	-1.37	-2.21	-0.93	-1.71	-0.84	-1.19
Category x index x year FE	X	X	X	X		
Year FE					X	X

Estimates at the fund–year level. In columns (1) and (3), we estimate demand across funds in 401(k) plans, controlling for year × Morningstar category × index fixed effects. In columns (3) and (4), we estimate demand across funds outside 401(k) plans, controlling for year × Morningstar category × index fixed effects. In columns (5)–(6), we estimate demand across TDFs outside 401(k) plans, controlling for year fixed effects.

TDF investors declines over time for both groups, with a notably sharper decline among investors inside 401(k) plans. Since TDFs in 401(k) plans are typically used as default options, the subset of participants who opt out of the default can be, on average, more fee-sensitive than non-TDF investors outside 401(k) plans. An alternative explanation is that our estimates partly capture employers' sensitivity to fees, as they can influence worker allocation choice when setting plan menus.

Finally, Figure 5c decomposes the semi-elasticity of TDF investors in 401(k) plans into worker and employer components. The results suggest that workers have become less fee-sensitive over time, consistent with the increasing use of TDFs as default options and the broader adoption of automatic enrollment features. In contrast, employers appear to have become more fee-sensitive, potentially reflecting heightened awareness of fiduciary liability risks following the numerous lawsuits filed over the past decade.

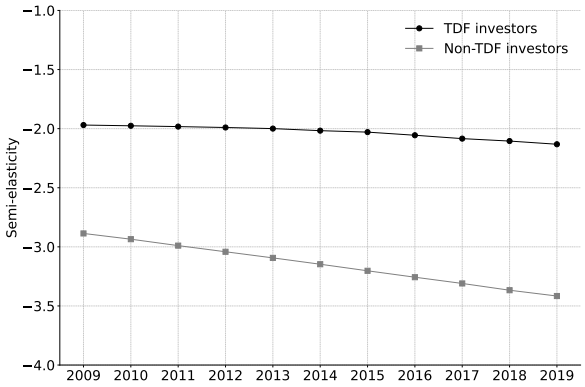
5.5 Supply Side: Marginal Costs and Markups

We use our demand estimates to recover fund managers' marginal costs and markups by inverting the Nash–Bertrand equilibrium conditions in Equation (6).

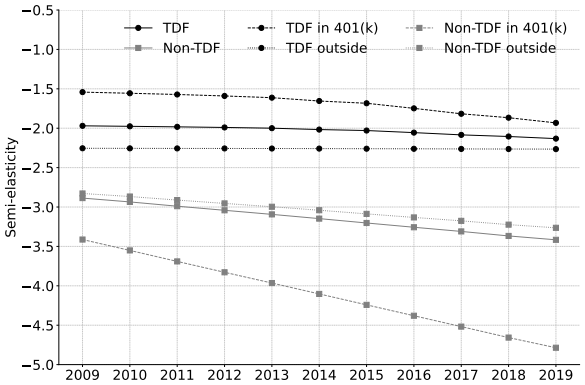
For simplicity, we assume that each fund manager offers up to three composite funds: a TDF, an underlying fund held by the TDF, and a non-underlying fund. We also adopt a broader definition of underlying funds. Specifically, we include all funds within the same manager × Morningstar global category cohort whose fees are either weakly lower than any funds held by TDFs or below the 40th percentile, which is roughly the average percentile of TDF underlying funds within their respective cohorts.

Figure 5: Demand Semi-elasticity Over Time

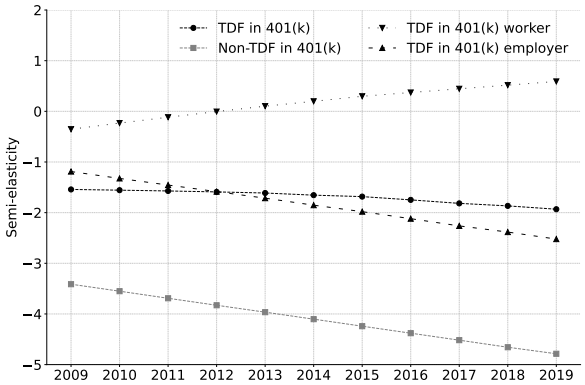
(a) TDF v. non-TDF



(b) Inside 401(k) v. Outside 401(k)



(c) Employers v. Workers in 401(k)



Estimated time trend of investor semi-elasticity to fees. Panel (a) shows the semi-elasticity for TDF and non-TDF investors. Panel (b) decomposes the semi-elasticity for investors inside and outside 401(k) plans. Panel (c) further decomposes the semi-elasticity of TDF investors within 401(k) plans into employer and worker components.

Table 6: Equilibrium Outcomes Under the Status Quo

	TDF	Underlying	Non-underlying	Total
Hausman IV				
Market share	0.06	0.38	0.38	0.82
Fee	0.38	0.20	0.53	0.36
Fee (unweighted)	0.53	0.38	0.66	0.52
Marginal cost	-0.15	-0.14	0.20	0.02
Markups	0.52	0.34	0.32	0.35
Semi-elasticity	-1.92	-3.16	-3.33	-3.15

Market shares, average fees, average marginal costs, average markups and average (own) semi-elasticities for TDFs, underlying and non-underlying funds. Marginal costs are calibrated after inverting price-setting equilibrium conditions in Equation (6). Estimates are for the year 2019. Fees, marginal costs, and markups are measured in percentage points. Column "total" reports total share and weighted average results across three categories.

Conceptually, this broader definition of wrapper fees compares TDF fees with the fees of funds comparable to their underlying funds, rather than only with the underlying funds themselves. We find this broader definition to be more economically meaningful. A TDF may not invest in the lowest-fee (or cheapest share-class) alternatives among comparable funds, which our previous definition of wrapper fees does not capture. In addition, because the identity of underlying funds is endogenous, this broader definition accounts for the set of funds that could potentially serve as underlying funds.

Table 6 reports cost and markup estimates using the Hausman instrument for year 2019. TDF markups are roughly 20 bps higher than markups on their underlying funds. The difference in markups is larger than wrapper fees discussed in Section 3 due to the broader definition of wrapper fees. As assets in TDF mutual funds (excluding TDFs structured as CITs) reached 1.4 trillion dollars in 2019, our estimates imply that TDF managers generate about $2.8 billion profits from wrapper fees. Table B.5 reports results based on the cost shifter instrument. Since we estimate higher fee elasticities, we recover higher marginal costs and lower markups.

6 Counterfactuals

We use our model to evaluate two counterfactual policies aimed at limiting the market power of TDFs. The first policy requires fund managers to set identical fees for their TDFs and underlying funds. This rule eliminates TDF wrapper fees, effectively preventing price discrimination between TDF and non-TDF investors. The second policy imposes a 20 bps cap on TDF fees. We select the cap to be around the average fees of underlying funds under the status quo.

For each policy, we report counterfactual market shares, fees, and markups in Table 7. We also compute changes in revenues, profits, and consumer surplus relative to the status

Table 7: Counterfactual Equilibrium Outcomes

	TDF	Underlying	Non-underlying	Total
Status quo				
Market share	0.06	0.38	0.38	0.82
Fee	0.38	0.20	0.53	0.36
Fee (unweighted)	0.53	0.38	0.66	0.52
Markups	0.52	0.34	0.32	0.35
No wrapper fee				
Market share	0.07	0.37	0.38	0.82
Fee	0.26	0.22	0.53	0.37
Fee (unweighted)	0.41	0.41	0.66	0.52
Markups	0.40	0.36	0.32	0.34
TDF fee cap				
Market share	0.08	0.38	0.37	0.83
Fee	0.17	0.20	0.53	0.34
Fee (unweighted)	0.18	0.38	0.66	0.49
Markups	0.25	0.34	0.32	0.32

Counterfactual market shares, average fee and average markups. In addition to market shares, all remaining figures are measured in basis points. Outcomes are based on Hausman IV estimates for the year 2019. Column "total" reports total share and weighted average results across the three fund categories.

quo in Table 8. We separately report consumer surplus for four groups of investors: 401(k) TDF investors, 401(k) non-TDF investors, TDF investors outside 401(k), and non-TDF investors outside 401(k). For 401(k) TDF investors, we use the logit inclusive value from the employer's TDF choice problem in Equation (3). For the other three groups, we use the inclusive value from their respective decisions. For each group, we compute their consumer surplus as their respective inclusive value multiplied by their total assets. Aggregate consumer surplus is the sum of these four groups.

6.1 No Wrapper Fee

The middle panel in Table 7 presents equilibrium outcomes under the no-wrapper-fee policy. The results are based on the Hausman IV estimates, with analogous results based on cost IV estimates reported in Table B.6.

Relative to the status quo (reported again in the top panel of Table 7), eliminating wrapper fees lowers TDF fees while raising fees on the underlying funds. TDF fees fall by around 12 bps on an equal-weighted basis and also weighted by assets. TDF market share increases by 0.6 percentage point, or 10% relative to the status quo given a 30% reduction in TDF asset-weighted fees. The smaller increase in market share is consistent with TDF investors' limited fee sensitivity. On the other hand, equal-weighted and asset-weighted fees of underlying funds (according to our broader definition) of TDFs increase by 2 bps.

In the aggregate, since non-TDF funds account for a larger share of assets, overall mutual fund fees and markups remain nearly unchanged relative to the status quo.

The first column of Table 8 reports the implied changes in consumer surplus, revenues, and profits. Preventing fund managers from price discriminating increases surplus for TDF investors (both in and outside 401(k) plans) by approximately $1.4 billion. In response, managers recoup some of these losses by raising fees on underlying funds. However, their ability to do so is limited by the high fee sensitivity of non-TDF investors. As a result, total investor surplus stay roughly unchanged from the status quo. Fund manager profits decline by approximately 1%, as the non-TDF market remains the dominant segment.

Overall, this policy substantially increases the surplus of TDF investors while leaving aggregate market outcomes largely unchanged. While we do not model other supply-side responses, such as product repositions or exits, we consider such responses to be unlikely given the modest reduction in fund managers' profits.

6.2 Fee Cap

We implement the 20 bps cap on TDF fees in three steps. First, we assume that fund managers with marginal costs exceeding 20 bps exit the market. Second, we solve for the equilibrium among the remaining fund managers. Finally, we impose the cap on managers whose optimal fees are above 20 bps and re-solve for the equilibrium among those for whom the cap does not bind.

The bottom panel of Table 7 reports the resulting equilibrium outcomes. As expected, average TDF fees fall sharply under this policy, by roughly 20 bps relative to the status quo. Weighted average TDF markups decline by 28 bps, a 50% reduction from the status quo. Outcomes for non-TDFs remain essentially unchanged, again reflecting the strong fee sensitivity of non-TDF investors that limits managers' market power.

The second column of Table 8 shows that, unlike the no-wrapper-fee policy, the fee cap has much larger effects on aggregate market outcomes. The surplus for TDF investors increases by over $3 billion. However, this gain comes at expense of fund managers. Fund managers experience a 5% reduction in revenues and a 6% reduction in profits.

For completeness, we also report results based on estimates using the cost shifter instrument in Table B.7. Results are qualitatively similar. Because status quo profits are lower given higher elasticities, the percentage reduction in profit is larger.

6.3 Discussions

Overall, our counterfactual policies increase the welfare of TDF investors, at the expense of non-TDF investors under the no-wrapper-fee policy and of fund managers under the fee-cap policy. Because these changes do not constitute a Pareto improvement, whether these outcomes are desirable depends on the weights a social planner assigns to the

Table 8: Counterfactual Welfare Changes

	No wrapper fee	TDF fee cap
Δ *Consumer surplus*		
TDF in 401(k)	0.71	1.29
Non-TDF in 401(k)	-0.15	0.01
TDF outside 401(k)	0.70	1.97
Non-TDF outside 401(k)	-0.79	0.07
Total	0.47	3.35
Fee revenues		
Δ Revenue	0.19	-2.58
% Δ Revenue	0.39	-5.19
Profits		
Δ Profits	-0.56	-3.00
% Δ Profits	-1.18	-6.31

Counterfactual changes in consumer surplus, revenues and profits relative to the status quo. Outcomes are measured in billion dollars, except for percentage changes in revenue and profit. Outcomes are based on Hausman IV estimates for the year 2019.

surplus of TDF investors, non-TDF investors, and fund managers. We argue that the planner may place greater weight on the welfare of TDF investors, because they can be less financially sophisticated and inadequate retirement savings can generate broader societal costs. From this perspective, the "friction" we address is that a highly welfare relevant investment decision, the choice of TDF, is made by relatively fee-insensitive investors. Our counterfactuals mitigate this friction either by leveraging the decisions of fee-sensitive investors through a ban on price discrimination or by directly regulating TDF fees.

7 Conclusion

This paper examines how default investment options generate market power in the U.S. retirement market. Using a structural model of the Target-Date Fund (TDF) market, we show that the interaction between investors' low fee sensitivities and fund managers' pricing incentives can sustain large markups on default investment products.

Empirically, we find that TDF investors—both inside and outside 401(k) plans—are substantially less fee-sensitive than other mutual fund investors, and that TDF markups exceed those of comparable funds by about 20 basis points. The resulting aggregate profit from wrapper fees amounts to roughly $2.8 billion as of 2019.

Our counterfactual analysis shows that constraining fund managers' ability to price discriminate between TDF and non-TDF investors could substantially improve TDF investor welfare. Imposing zero wrapper fees raises TDF investors' surplus by $1.4 billion, with negligible effects on fund managers' profits but a welfare loss of similar magnitude

for non-TDF investors. A 20 basis points fee cap delivers even larger welfare gains of $3 billion for TDF investors but entails a sharper reduction in managers' revenues and profits. Transferring surplus from non-TDF investors or fund managers to TDF investors can be potentially desirable if the social planner places a greater weight on the welfare of retirement savers who can be less financially sophisticated.

These findings highlight an important policy tension: while default options such as TDFs have been highly effective in improving retirement savings, investors' inertia and inattention can give rise to market power that erode some of these gains. Designing regulation that preserves the behavioral benefits of defaults while limiting fund managers' ability to extract rents is therefore essential for improving the efficiency and fairness of defined-contribution retirement systems.

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A Appendix: Derivations

Equilibrium wrapper fee. We start from the expression for the equilibrium price-cost margins,

$$\begin{bmatrix} p^a - c^a \\ p^d - c^d \end{bmatrix} = - \begin{bmatrix} \Delta_{a,a} & \Delta_{a,d} \\ \Delta_{d,a} & \Delta_{d,d} \end{bmatrix}^{-1} \begin{bmatrix} D^a \\ D^d \end{bmatrix}$$

and rewrite it as

$$\begin{bmatrix} p^a - c^a \\ p^d - c^d \end{bmatrix} = - \begin{bmatrix} \Delta_{a,a}^{-1} + \Delta_{a,a}^{-1}\Delta_{a,d}(S_d)^{-1}\Delta_{d,a}\Delta_{a,a}^{-1} & -\Delta_{a,a}^{-1}\Delta_{a,d}S_d^{-1} \\ -S_d^{-1}\Delta_{d,a}\Delta_{a,a}^{-1} & S_d^{-1} \end{bmatrix} \begin{bmatrix} D^a \\ D^d \end{bmatrix},$$

where $S_d \equiv \Delta_{d,d} - \Delta_{d,a}(\Delta_{a,a})^{-1}\Delta_{a,d}$.

Letting $p^d = \tilde{p} + W(p^a - c^a)$, then the wrapper fee equal

$$\tilde{p} = -(S_d)^{-1}D^d + S_d^{-1}\Delta_{d,a}\Delta_{a,a}^{-1}D^a - W(p^a - c^a).$$

Substituting for $(p^a - c^a)$ we obtain the expression in the main text.

Derivation of demand Jacobian. We derive the expression for the derivatives of the demand function for a default and non-default fund respectively.

Recall the demand for TDF $k \in \mathcal{D}$:

$$D_k^d = \sum_m M_m q_{km}^{emp} q_{km}^{in,tdf} + M_{out} q_k^{out,tdf}$$

The derivative of D_k^d with respect to fees of TDF $l \in \mathcal{D}$ is given by

$$\frac{\partial D_k^a}{\partial p_l} = \sum_m M_m \left(\frac{\partial q_{km}^{emp}}{\partial p_l} q_{km}^{in,tdf} + q_{km}^{emp} \frac{\partial q_{km}^{in,tdf}}{\partial p_l} 1\{l = k\} \right) + M_{out} \frac{\partial q_k^{out,tdf}}{\partial p_l}.$$

The demand for non-TDF fund $j \in \mathcal{J}$ is

$$D_j^a = \underbrace{\sum_m M_m \left(1 - \sum_{k \in \mathcal{D}} q_{km}^{emp} q_{km}^{in,tdf}\right) q_j^{in,active}}_{\text{401(k) demand}} + \underbrace{M_{out}\left(1 - \sum_{k \in \mathcal{D}} q_k^{out,tdf}\right) q_j^{out,active}}_{\text{outside 401(k) demand}}$$

The derivative of non-TDF fund j with respect to fees of TDF $l \in \mathcal{D}$ reads

$$\frac{\partial D_j^a}{\partial p_l} = \sum_m M_m \left[\left(1 - \sum_k q_{km}^{emp} q_{km}^{in,tdf}\right) \frac{\partial q_j^{in,active}}{\partial p_l} - \left(\sum_k \frac{\partial q_{km}^{emp}}{\partial p_l} q_k^{in,tdf} + q_{km}^{emp} \frac{\partial q_k^{in,tdf}}{\partial p_l} 1\{k = l\} \right) q_j^{in,active} \right]$$

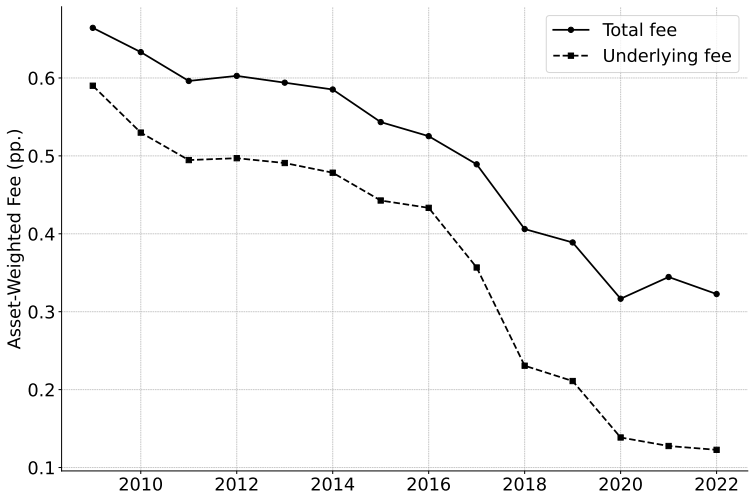
$$+ M_{out}\left[\left(1-\sum_k q_k^{out,tdf}\right)\frac{\partial q^{out,active}}{\partial p_l} - \sum_k \frac{\partial q_k^{out,tdf}}{\partial p_l} q_j^{out,active}\right]$$

Fees of non-TDF funds will not affect demand for TDF funds. As such the derivative of D_k^d with respect to non-TDF $l \in \mathcal{J}$ is zero. The derivative of D_j^a demand with respect to non-TDF l is instead given by:

$$\frac{\partial D_j^a}{\partial p_l} = \sum_m M_m \left(1-\sum_{k\in\mathcal{D}} q_{km}^{emp} q_{km}^{in,tdf}\right)\frac{\partial q_j^{in,active}}{\partial p_l} + M_{out}\left(1-\sum_k q_k^{out,tdf}\right)\frac{\partial q_j^{out,active}}{\partial p_l}.$$

B Appendix: Additional Figures and Tables

Figure B.1: TDF Fees v. Underlying Fees



Asset-weighted average expense ratios of Target-Date Funds (TDFs) and underlying funds held by TDFs. The sample includes all TDFs.

Figure B.2: Wrapper Fees and Underlying Fees

(a) Fidelity (b) T. Rowe Price

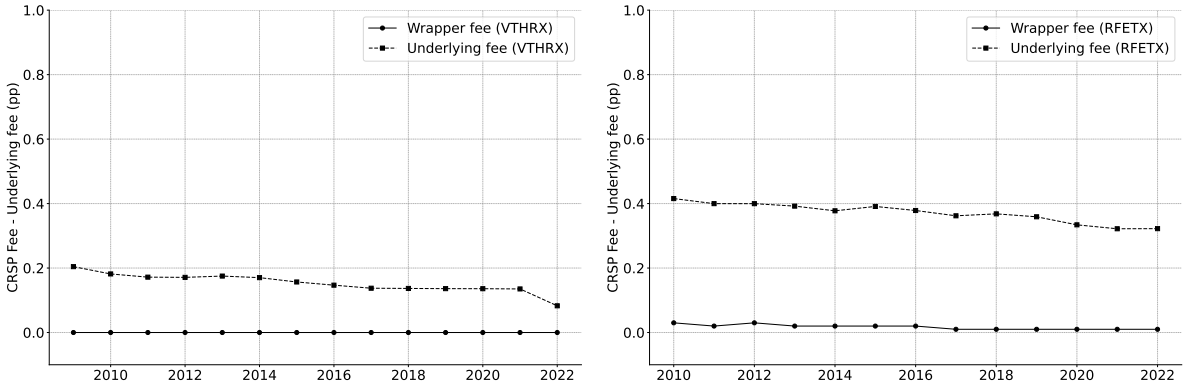
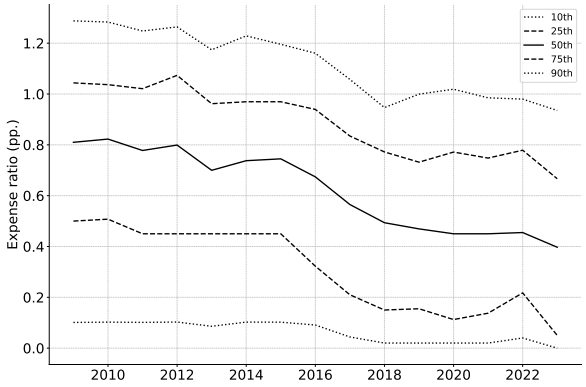


Figure shows wrapper fees and underlying fees for two TDFs whose providers are also 401(k) recordkeepers.

Figure B.3: Distributions of Fees of Non-TDFs and Non-underlying Funds Over Time

(a) Fidelity



(b) T. Rowe Price

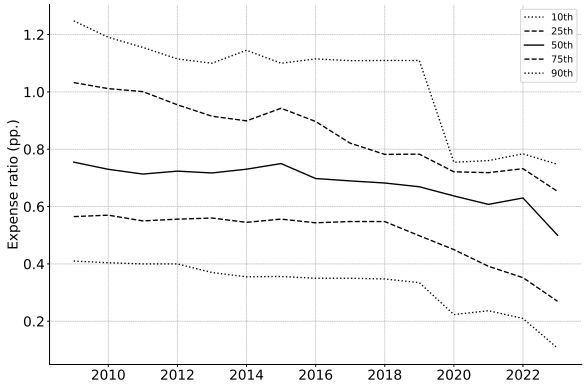
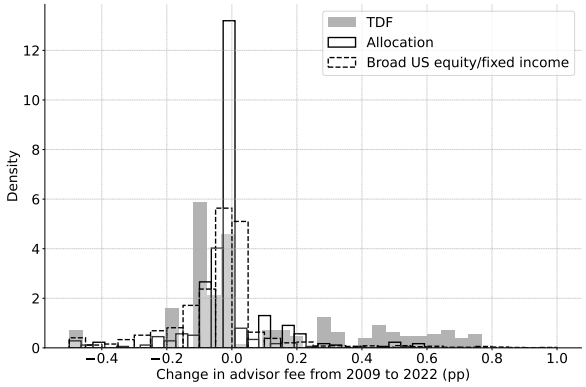


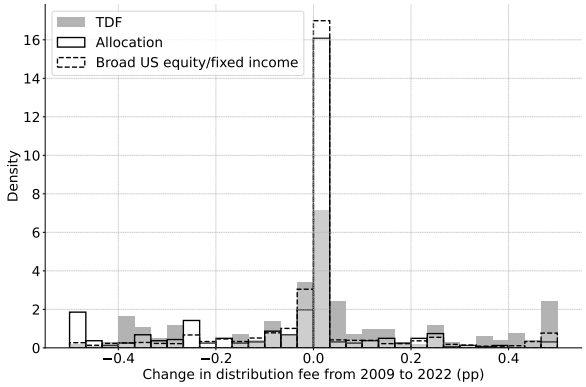
Figure shows percentiles of fund expense ratios for Fidelity and T. Rowe Price. We exclude funds held by other TDFs as underlying funds. We also restrict to allocation funds, and board equity and bond funds.

Figure B.4: Wrapper Fees Break Down

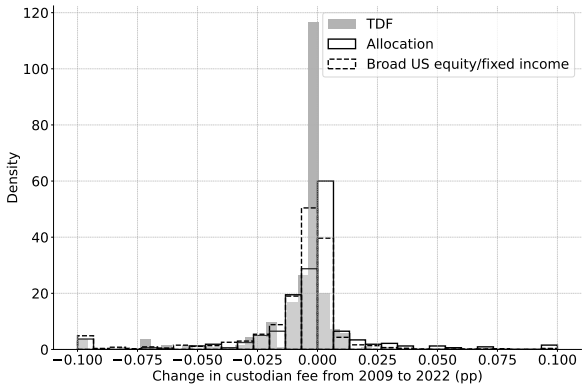
(a) Advisor Fees



(b) Distribution Fees



(c) Custodian Fees



(d) Transfer Agency Fees

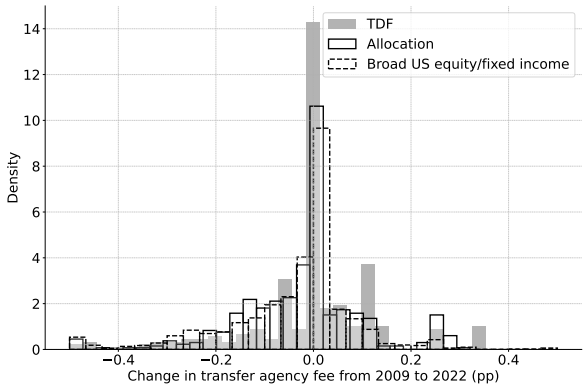


Figure shows the change in different components of TDF wrapper fees from 2009 to 2012. Panels (a) to (d) show the change in advisor fees, distribution fees, custodian fees, and lastly transfer agent fees.

Table B.1: TDF Wrapper Fees vs. Recordkeeping Services

	TDF Wrapper Fee				
	2019			2022	
Intercept	0.017	0.005	0.145***	0.055***	0.142***
	(0.017)	(0.016)	(0.016)	(0.010)	(0.017)
Recordkeeping market share (AUM)	0.011***				
	(0.001)				
Recordkeeping market share (plans)		0.026***			
		(0.003)			
Recordkeeper				0.112***	
				(0.033)	
American Funds			0.057		-0.002
			(0.053)		(0.043)
BlackRock			-0.168***		-0.154***
			(0.017)		(0.018)
Fidelity			0.348***		0.312***
			(0.038)		(0.036)
JP Morgan			-0.029		-0.059***
			(0.024)		(0.022)
TIAA			0.144***		0.054**
			(0.040)		(0.027)
T. Rowe Price			-0.111***		0.398***
			(0.021)		(0.027)
Vanguard			-0.145***		-0.142***
			(0.016)		(0.017)
N	1,684	1,684	1,684	1,497	1,497
R2	0.24	0.29	0.51	0.02	0.60

Fund-level OLS regressions of TDF wrapper fees on the provider's market share in the 401(k) recordkeeping market and provider fixed effects. The first three specifications are for the year 2019 where we observe 401(k) recordkeepers market shares in BrightScope. The last two specification are for the year 2022. Observations are weighted by the fund AUM. Wrapper fees are measured for TDF institutional share classes.

Table B.2: Employer Demand Estimates

	Employer Default Choice		
	MLE	MLE (Hausman Control Fn)	MLE (Cost Control Fn)
Expense Ratio (pp)	-1.10***	-1.27***	-0.44***
	(0.04)	(0.04)	(0.06)
Expense Ratio (pp) x Year	-0.05***	-0.14***	-0.04***
	(0.01)	(0.01)	(0.01)
TDF	-6.27***	-5.04***	-6.77***
	(0.05)	(0.05)	(0.06)
TDF x Year	-0.06***	0.03***	-0.04***
	(0.01)	(0.01)	(0.01)
Recordkeepers	1.94***	1.94***	2.07***
	(0.02)	(0.02)	(0.02)
log(Fund Age)	1.74***	1.30***	1.70***
	(0.02)	(0.02)	(0.02)
N	876,407	876,407	876,407
Elasticity	-0.51	-0.75	-0.24

MLE estimates of Equation (3). We restrict to plans with over 75% of assets invested in mutual funds. We also drop plans whose TDF is not a mutual fund. In the second and third columns, we construct control functions by regressing fees on Hausman or cost shifter instruments, along with the same set of controls.

Table B.3: Demand Estimates for 401(k) TDF Investors

	Worker Allocation to Default		
	OLS	Hausman IV	Cost IV
Expense Ratio (pp)	-0.30***	-0.41***	-0.58***
	(0.03)	(0.03)	(0.05)
Expense Ratio (pp) x Year	0.11***	0.13***	0.16***
	(0.00)	(0.00)	(0.01)
log(Fund Age)	0.62***	0.55***	0.48***
	(0.02)	(0.03)	(0.03)
Default Option	0.38***	0.38***	0.37***
	(0.02)	(0.02)	(0.02)
Auto-Enroll	0.19***	0.19***	0.18***
	(0.01)	(0.01)	(0.01)
Recordkeepers	0.24***	0.26***	0.26***
	(0.03)	(0.03)	(0.03)
N	25,048	25,048	25,048
Elasticity	0.09	0.10	0.09

Estimates of Equation 4 as the plan x year level. We restrict the sample to plans that offer a mutual fund TDF series.

Table B.4: Demand Estimates for Non-TDF Investors and TDF Investors Outside 401(k)

	Non-TDF in 401(k)			Non-TDF outside 401k			TDF outside 401k		
	OLS	Hausman IV	Cost IV	OLS	Hausman IV	Cost IV	OLS	Hausman IV	Cost IV
Expense Ratio (pp)	-2.01***	-3.55***	-6.08***	-1.58***	-2.91***	-12.97***	-0.74	-2.26**	-4.96***
	(0.10)	(0.19)	(1.12)	(0.04)	(0.08)	(1.20)	(0.49)	(1.13)	(1.92)
Expense Ratio (pp) x year	-0.13***	-0.14***	-1.44***	-0.03***	-0.05***	-1.45***	-0.16**	-0.00	-0.16
	(0.02)	(0.03)	(0.30)	(0.01)	(0.01)	(0.32)	(0.08)	(0.19)	(0.34)
log(Fund Age)	1.50***	1.54***	1.94***	1.20***	1.21***	1.89***	2.21***	2.26***	3.16***
	(0.02)	(0.02)	(0.06)	(0.01)	(0.01)	(0.07)	(0.14)	(0.16)	(0.22)
Recordkeepers	1.60***	1.26***		0.91***	0.58***		1.07***	0.84***	
	(0.04)	(0.04)		(0.02)	(0.02)		(0.21)	(0.25)	
N	35,228	35,228	35,180	60,760	60,760	60,688	579	579	579
Elasticity	-1.37	-2.21	-6.63	-0.93	-1.71	-10.80	-0.84	-1.19	-3.03
Category x index x year FE	X	X	X	X	X	X			
Year FE							X	X	X
Fund manager FE			X			X			X

Estimates at the fund–year level. In columns (1)–(3), we estimate demand across funds in 401(k) plans, controlling for year × Morningstar category × index fixed effects. In columns (4)–(6), we estimate demand across funds outside 401(k) plans, controlling for year × Morningstar category × index fixed effects. In columns (7)–(9), we estimate demand across TDFs outside 401(k) plans, controlling for year fixed effects.

Table B.5: Equilibrium Outcomes Under the Status Quo

	TDF	Underlying	Non-underlying	Total
Cost IV				
Market share	0.06	0.38	0.38	0.82
Fee	0.40	0.20	0.53	0.37
Fee (unweighted)	0.53	0.38	0.66	0.52
Marginal cost	0.02	0.16	0.48	0.30
Markups	0.38	0.05	0.04	0.07
Semi-elasticity	-3.12	-23.77	-25.76	-23.12

Market shares, average fees, average marginal costs, average markups and average (own) semi-elasticities for TDFs, underlying and non-underlying funds. Marginal costs are calibrated after inverting price-setting equilibrium conditions in Equation (6). Estimates are for the year 2019. In addition to market shares and elasticities, all remaining figures are measured in percentage points. Column "total" reports total share and weighted average results across three categories.

Table B.6: Counterfactual Equilibrium Outcomes

	TDF	Underlying	Non-underlying	Total
Status quo				
Market share	0.06	0.38	0.38	0.82
Fee	0.40	0.20	0.53	0.37
Fee (unweighted)	0.53	0.38	0.66	0.52
Markups	0.38	0.05	0.04	0.07
No wrapper fee				
Market share	0.09	0.34	0.39	0.82
Fee	0.31	0.22	0.53	0.37
Fee (unweighted)	0.41	0.41	0.66	0.53
Markups	0.26	0.05	0.04	0.07
TDF fee cap				
Market share	0.11	0.36	0.36	0.83
Fee	0.19	0.20	0.53	0.34
Fee (unweighted)	0.19	0.38	0.66	0.47
Markups	0.18	0.05	0.04	0.06

Counterfactual market shares, average fee and average markups. In addition to market shares, all remaining figures are measured in basis points. Outcomes are based on estimates for the year 2019 with Cost IV. Column "total" reports total share and weighted average results across the three fund categories.

Table B.7: Counterfactual Welfare Changes

	No wrapper fee	TDF fee cap
Δ *Consumer surplus*		
TDF in 401(k)	0.44	0.03
Non-TDF in 401(k)	-0.07	-0.00
TDF outside 401(k)	0.91	2.46
Non-TDF outside 401(k)	-0.30	-0.02
Total	0.98	2.47
Fee revenues		
Δ Revenue	0.92	-3.00
% Δ Revenue	1.84	-6.00
Profits		
Δ Profits	-0.33	-0.78
% Δ Profits	-3.53	-8.29

Counterfactual changes in consumer surplus, revenues and profits relative to the status quo. Outcomes are measured in billion dollars, except or percentage changes in revenue and profit. Outcomes are based on cost-shifter IV for the year 2019.

C Appendix: Data Construction

C.1 Measuring TDF Wrapper Fees

Morningstar Direct provides two expense ratio variables. The first is a time-invariant snapshot variable called *prospectus net expense ratio*, which measures fund fees at the time we extract the data from Morningstar Direct. The second is a time-varying variable called *net expense ratio*, which is consistent with net expense ratio from CRSP. For the vast majority of funds, these two variables are identical as of the same date. For TDFs, however, these two variables can differ due to their fund-of-funds structure. After cross-checking with annual reports and fund prospectuses from fund websites, we confirm that the prospectus net expense ratio from Morningstar Direct measures the total fees paid by TDF investors. Furthermore, the sum of the time-varying expense ratio and the weighted average expense ratios of underlying funds equals the prospectus net expense ratio for the same as-of date. Hence, we use the time-varying net expense ratio from Morningstar Direct as our measure of wrapper fees.

For a small set of fund series, the Morningstar Direct prospectus expense ratios are the same as the time-varying net expense ratios. We suspect this is driven by differences in prospectus reporting formats across fund series and have adjusted accordingly.