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Agency Problems in Target-Date Funds

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Agency Problems in Target-Date Funds *

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Abstract

Target-Date Funds (TDFs) are popular retirement investment vehicles that follow a predetermined schedule for rebalancing their mix of equity and fixed-income securities over time. We explore potential agency problems in TDFs by examining their return performance and their flow-performance relation. We find that TDFs under-perform balanced funds (BFs) which are also approved as a default option along with TDFs in 401(k) plans. We show that the under-performance is driven by TDFs that have a fund-of-fund structure which invests in funds with high expense ratios and low performance within the fund family. Additionally, we discover an absence of flow-performance relation in TDFs while BFs exhibit the convex flow-performance relation documented for mutual funds. Our evidence suggests the presence of agency problems in TDFs arising from investor inertia, weak incentives for fund managers to outperform peers, and opportunities for fund families to gain private benefits.
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Agency Problems in Target-Date Funds

Agency problems are likely to arise when principals fail to penalize agents for self-dealing or when agents face conflicts of interest while executing their duties to principals. This paper provides evidence that both of these conditions prevail in Target-Date Funds (TDFs). First, prior studies show that retirement plan participants exhibit inertia in changing the asset allocation of their 401(k) plans.[1] In addition, Gruber (1996) conjectures that pension plan participants that are restricted by their plans may not move money out of funds that perform poorly. These studies suggest that TDFs, whose assets are predominantly held in retirement accounts, are unlikely to face the consequences of poor performance from such passive principals. Pension Protection Act (PPA) of 2006 which approved TDFs as one of the Qualified Default Investment Alternatives (QDIAs) for automatic enrollment in 401(k) plans resulted in widespread adoption of TDFs as the default option while balanced funds (BFs), which are also an approved QDIA, are not widely used as the default choice.

Second, the structures of some TDFs offer avenue for conflicts of interest. TDFs structured as Single Funds (SFs) invest directly in stocks and bonds while TDFs with fund-of-fund (FOF) structure either invest in other mutual funds within the same fund family (*Internal* FOFs) or in funds outside the family (*External* FOFs). Of the three different structures, *Internal* FOFs have the greatest potential for self-dealing due to private benefits to fund families resulting from their discretion to select funds with high expense ratios or poor performance or low flows. Selection of funds with high expense ratios increase the family's revenues while funds with poor performance or low flows help to sustain funds that may be

[1] e.g. Agnew, Balduzzi, and Sunden (2003), Mitchell, Mottola, Utkus, and Yamaguchi (2006), Madrian and Shea (2000), Choi, Laibson, Madrian, and Metrick (2006).

less marketable. Why would plan sponsors allow this? A possible explanation as to why they may tolerate such actions arise from their own conflicts of interest due to a desire to secure votes in favor of management on shareholder proposals and the prospect to overweight securities of the firm in institutional portfolios.[2]

We investigate the flow-performance relation of TDFs and BFs over the period January 2003 to December 2008 and find that flows do not respond to past performance for TDFs implying that investors neither reward good performance nor punish poor performance. In contrast, BFs exhibit convex flow-performance relation indicating that investors chase performance. Thus, lack of flow-performance relation in TDFs increases the propensity for agency issues. Our results show that the return performance of TDFs trail BFs by 48 (86) basis points annually based on risk-adjusted net-of-fee (gross-of-fee) performance.

This under-performance of TDFs could instead be argued as the price paid by investors for the time-varying reallocation of assets (automatic rebalancing). To rule out this possibility, we compare the performance of the two predominant structures in TDFs (FOFs and SFs) with BFs. If the under-performance of TDFs is due to the automatic rebalancing feature, we expect both FOFs and SFs to under-perform BFs. However, we find that the risk-adjusted performance of TDFs with SF structure is comparable to that of BFs while TDFs with FOF structure under-perform BFs by 67 (117) basis points annually based on risk-adjusted net-of-fee (gross-of-fee) performance. Further, of the two categories, fund managers of TDFs with FOF structure are more likely to have conflicting loyalties while determining the funds that comprise the TDFs. Consistent with this hypothesis, we find that FOFs under-perform SFs

[2]e.g. Davis and Kim (2007), Cohen and Schmidt (2009).

by 79 (129) basis points annually based on risk-adjusted net-of-fee (gross-of-fee) performance.

A plausible explanation for the lower returns of TDFs with FOF structure could be the added diversification that the structure offers through investments in multiple funds. To rule out this possibility, we split the TDFs with FOF structure further into two categories, *Internal* FOFs and *External* FOFs. If the under-performance of TDFs with FOF structure is due to the diversification across funds, then both *Internal* as well as *External* FOF structures should under-perform TDFs with SF structure. However, our results show that *Internal* FOFs under-perform SFs by 58 (132) basis points based on risk-adjusted net-of-fee (gross-of-fee) performance while *External* FOFs perform at par with SFs. Furthermore, *Internal* FOFs under-perform *External* FOFs by 55 (63) basis points based on risk-adjusted net-of-fee (gross-of-fee) performance.

The above results lead us to directly examine the nature of private benefits that fund families earn while offering TDFs. In the case of TDFs with *Internal* FOF structure, "strategic" selection of constituent funds that have high expense ratios help to increase the family's revenues while redirecting flows to funds with poor performance or low flows helps to sustain funds that may be less marketable. Using hand-collected data of the holdings of TDFs with FOF structure from Securities and Exchange Commission's (SEC) quarterly filings, N-Q, N-CSR, and N-CSRS, we find that the probability of including constituent funds with high expense ratios and poor performance is greater for *Internal* FOFs than for *External* FOFs. Constituent funds of *Internal* FOFs are also likely to be funds with higher expense ratios or lower performance than other funds within the family. Our results are robust to alternate specifications including estimation of alphas over different horizons, alternate estimation

of expense ratios, variations in family characteristics, trends over time, variations in asset allocation as well as differences in organizational structure of fund families.

Overall, the findings in this paper have important policy implications as retirement monies are defaulted into TDFs subsequent to their approval as QDIA. We estimate that investors in the widely used *Internal* FOF structure among TDFs suffer losses to the tune of $\$489M$ to $\$733M$ annually compared to the investors of TDFs with *External* FOF structure. When compared to the investors of TDFs with SF structure, the losses extend from $\$652M$ to $\$1.5B$. These figures raise concerns about the suitability of TDFs as the default alternative in 401(k) plans which affects a large cross-section of the American population.

The remainder of the paper is organized as follows. We present the institutional details of TDFs in Section I followed by an exposition of related literature in Section II. We then develop our hypotheses in Section III followed by a description of data and variables in Section IV. In Section V, we provide evidence on lack of flow-performance sensitivity in TDFs followed by a discussion of our empirical analysis in Section VI, robustness checks in Section VII and concluding remarks in Section VIII.

I Target-Date Funds

Lack of diversification in many retirement plans led Barclays Global Investors and Wells Fargo Management to introduce Target-Date Funds in the early 1990s. Both families adopted the Single Fund structure while competitors like Fidelity, Vanguard, and T.Rowe Price that soon followed suit used the fund-of-fund structure for their TDFs. From the top panel of

Table I, we can see that the assets under management (AUM) of TDFs experienced a 11-fold increase from $\$11B$ to $\$127B$ while BFs experienced a modest increase during the period January 2001 to December 2008. At year-end 2007, more than two-thirds of 401(k) plans in the EBRI/ICI database included TDFs in their investment menu.[3] From the middle panel, we can see that TDFs with FOF structure grew phenomenally from $\$10B$ to $\$121B$ while TDFs with SF structure grew marginally during the same period. The bottom panel shows the growth of *Internal* FOFs from $\$10B$ in 2001 to $\$114B$ in 2008 and *External* FOFs from $\$8M$ in 2005 to $\$1.5B$ in 2008. Thus, it is clear that the growth of TDFs is attributable to TDFs with *Internal* FOF structure.

The target year in a TDF represents the year around which its investors retire. However, TDFs neither liquidate nor are they at their most conservative allocation in the target year considering the increasing life expectancy, inflation, and shortfall risks. Decade(s) after the target year is reached, TDF assets are merged with an income fund. While few TDFs are open to retail investors, most of them are offered as the default choice in 401(k) plans. Though all TDFs follow the life-cycle model of investing[4], there is a high diversity in the ratio of equities and bonds held by TDFs with the same target year as fund families use their own models to arrive at the composition (*glide path*). Figure 1 shows this diversity as a distribution of the percentage of assets invested in bonds/equities for different target years as of December 2008.[5] We control for the diversity in asset allocation in our empirical tests

[3]See Investment Company Institute web page http://ici.org/faqs/faqs_target_date, The US retirement market, 2007 http://www.ici.org/pdf/fm-v17n3.pdf - A report by Investment Company Institute, july 2008, Vol 17, No.3. and VanDerhei, Holden, and Alonso (2009).

[4]Refer to Bodie, Merton, and Samuelson (1992)

[5]For ease of exposition, we have combined cash equivalents with bond composition as both represent the conservative nature of the investment.

to ensure that our results are not driven by these differences.

During the financial crisis in 2008, investors close to retirement lost anywhere between 3.6 percent and 41 percent among the 31 TDFs with 2010 Target Date.[6] This prompted a joint public hearing by the Securities Exchange Commission (SEC) and the Department of Labor to consider whether regulatory changes, industry reforms or other revisions are needed with respect to TDFs. On June 16, 2010, the SEC voted 5-0 to a proposal to include a prominent table, chart or graph in the marketing material for TDFs showing the allocations among the various asset classes over the life of the funds and a statement that tells investors to consider their financial situation and tolerance for risk before investing. While these regulations help in alleviating the ignorance of investors, they fall short of addressing the potential agency problems highlighted in this paper.

II Related literature

While TDFs are gaining popularity among investors, academic research on these funds is still in its infancy. Though there are few studies discussing the theoretical aspects of life-cycle investing, ours is the first empirical study examining the cross-sectional variations in the return performance as well as the flow-performance relation of TDFs.[7] [8] Apart from contributing to this growing literature, we also add to three strands of extant literature. The

[6]Speech by Mary Schapiro, Chair of SEC, at the hearing on TDFs held on June 19, 2009. A transcript of the hearing is found at http://www.dol.gov/ebsa/pdf/TDFhearingtranscript.pdf

[7]We refer the interested reader to Viceira (2009), Bodie and Treussard (2007), and Poterba, Rauh, Venti, and Wise (2006).

[8]Flow performance relation among pension funds is analyzed by Guercio and Tkac (2002) who find that the relation is approximately linear as pension funds punish poorly performing managers and do not flock to recent winners.

first strand deals with agency issues in delegated portfolio management.[9] Our paper is closely related to Gaspar, Massa, and Matos (2006) which argues that from a family's perspective, expected assets are higher with a mix of funds delivering good and bad performance as opposed to funds reporting uniformly mediocre performance. To this end, fund families may favor funds that are adding most value to the family at the cost of other funds within the family. In this paper, we study another avenue for agency problems where fund families channelize TDF assets to under-performing or high-fee funds in the family.

Our paper also contributes to a second strand of literature which relates to the agency issues in retirement plans. Given that most TDF assets are held in retirement accounts, it is important that fund families attract retirement plan sponsors. In this context, Davis and Kim (2007) argue that fund families may not demand good corporate governance from firms whose 401(k) plans they manage. Cohen and Schmidt (2009) find that plan trustees systematically overweight their sponsor firms' stock held by the family. In light of the findings in our paper, it is conceivable that plan sponsors might benefit from favorable voting as well as overweighting of the firm's stock in return for letting plan trustees include under-performing or high-fee funds in TDFs offered by them.

Finally, our paper contributes to yet another strand of literature that pertains to investor behavior in retirement plans. Agnew, Balduzzi, and Sunden (2003) have shown that investors exhibit inertia in changing the asset allocation of their 401(k) plans. Madrian and Shea (2000) find that 401(k) participation is higher with automatic enrollment and participants

[9] e.g. Brown, Harlow, and Starks (1996), Chevalier and Ellison (1997), Hu, Kale, Pagani, and Subramanian (2011)), Lakonishok, Shleifer, Thaler, and Vishny (1991)), Allen and Gorton (1993), Dow and Gorton (1997)), Chevalier and Ellison (1999))

stick to default contribution rate and fund allocation. Our evidence that flows to TDFs are not sensitive to past performance is consistent with the documented inertia.

III Hypotheses Development

Investor inertia coupled with tax advantage in retirement plans provide captive investors leading to agency problems in TDFs. Given the constraints, retirement plan participants are unlikely to punish poor fund performance by withdrawing capital or reward good performance with more capital infusion. Hence, our first hypothesis is that flows to TDFs should be unrelated to their past performance.

A benefit of the convex flow-performance relation is the implicit incentive for fund managers to outperform their peers. The dearth of such incentives in TDFs might adversely affect performance. A natural baseline to measure performance of TDFs is provided by BFs. This is an alternate choice available to plan sponsors as QDIA with a similar investment universe but is widely used by retail investors to diversify risk between equities and bonds. Thus, our second hypothesis is that TDFs should under-perform BFs on the basis of risk-adjusted performance.

BFs differ from TDFs in that their asset allocation is fixed during inception while managers of TDFs need to rebalance the allocation from time to time based on the glide path which accounts for risks faced by retirement investors.[10] Hence the under-performance of

[10]Chai, Horneff, Maurer, and Mitchell (2009) provide a realistically calibrated model that incorporates mortality and human capital risk and expands the investment universe to include annuities. In this paper, we assume that these risk factors are incorporated in the glide paths of TDFs and control for differences in asset allocation.

TDFs could be the price paid by investors for the automatic rebalancing feature. To disentangle the two explanations, we divide TDFs into two groups, funds that invest in other mutual funds (FOFs) and those that invest in stocks, bonds, and other asset classes (SFs).[11] However, only the FOF structure provides greater discretion to include funds that increase revenues to the fund family or redirect flows as desired. Hence, our third hypothesis is that TDFs with FOF structure should under-perform BFs while those with SF structure should perform at par with BFs.

The under-performance of TDFs with FOF structure could be construed as an agency problem. Alternately, diversification across funds might be the cause of under-performance. To disentangle the two explanations, we further analyze the subcategories of TDFs with FOF structure. While some FOFs invest in funds offered by their own family (*Internal FOFs*), others invest in funds from other families (*External FOFs*).[12] If FOFs under-perform SFs due to the added diversification, both *Internal* as well as *External* FOFs should under-perform SFs. However, if one of them under-performs SFs while the other does not, then the under-performance is not attributable to diversification across funds.[13]

A TDF with FOF structure may choose to invest internally as it facilitates movement of assets across funds with minimal transaction costs. Another explanation for internal investing is that it provides greater scope for "strategic" decision making. For instance, fund families may choose constituent funds with high expense ratio or redirect flows to

[11]Funds with SF structure might invest a small portion (less than 20%) of their assets in money market funds or index funds.

[12]Apart from *External* and *Internal* FOFs, there are a few funds that invest in funds within the family as well as funds outside the family (*Mixed FOFs*).

[13]Systematic differences in asset allocation cannot explain the under-performance as we compare risk-adjusted performance after explicitly controlling for differences in asset allocation.

funds within their stable that are experiencing poor performance or low flows. If the costs associated with strategic selection in the case of *Internal* FOFs exceed the benefits in the form of lower transaction costs, *Internal* FOFs should under-perform *External* FOFs which forms our fourth hypothesis.

To find direct evidence of agency problems, we examine the constituent funds of *Internal* FOFs and compare them with other funds within the family as well as the constituents of *External* FOFs. If agency problems distort the selection process of constituent funds in *Internal* FOFs, our fifth hypothesis would predict constituent funds of *Internal* FOFs to have higher expense ratios, lower performance, or lower flows compared to other funds in the family or those selected for *External* FOFs.

IV Data and variable construction

The main source of data for our paper is the survivor-bias-free mutual fund database from Center for Research in Security Prices (CRSP). To identify TDFs, we use the target year in the fund's name and ensure that they vary the equity/bond allocation along a predetermined "glide path". To analyze the constituent funds of TDFs with FOF structure, we collect data from Securities and Exchange Commission's (SEC) quarterly filings (N-Q, N-CSR, N-CSRS) where the funds are required to provide a complete list of their holdings. We merge our dataset with CRSP mutual fund database using fund name to obtain fund characteristics. Consistent with Wermers (2000), we combine the characteristics of the share classes to obtain the corresponding characteristic for the fund using the weighted averages where the weights

are based on the assets in each share class. Our sample period for this study ranges between January 2001 and December 2008 when there is a sufficient number of TDFs for statistical analysis. This yields over 3,100 fund-quarter observations consisting of 270 TDFs offered by 40 fund families.

To test our first hypothesis, we analyze the flow-performance relation of TDFs and BFs. We use the Lipper objective code provided by CRSP to identify BFs. Based on Sirri and Tufano (1998), we define $NetFlows_{it}$ for fund i in quarter t as follows:

$$NetFlows_{it} = \frac{AUM_{it} - AUM_{it-1} * (1 + R_{it})}{AUM_{it-1}} \tag{1}$$

where AUM_{it} is the assets under management of fund i in quarter t and R_{it} is the annualized quarterly return of fund i in quarter t. While net flows gives an overall direction of fund flows, it does not provide information about the actual inflows and outflows. Hence, we obtain this information from the N-SAR filings where mutual funds are required to report their monthly sales. This enables us to test the flow-performance relation for inflows and outflows separately.

Another important variable in our study is *fund performance*. While it is the dependent variable for a majority of tests, we use it as an explanatory variable in the flow-performance analysis. Consistent with extant literature, our first measure of *fund performance* is the risk-adjusted net-of-fee return (alpha) obtained using the Carhart (1997) four-factor model. While this model has been used to measure the performance of domestic equity funds, it may not be appropriate for TDFs as they have exposure to bonds (e.g. Comer (2006)) as well

as international equity. As shown in Figure 1, TDFs have over 20% of their assets invested in bonds. Hence, we expand the four-factor model to incorporate the risks due to bond and international equity. We use excess returns on *Barclay's Capital U.S. Aggregate index* and *MSCI EAFE* index as our bond and international equity factors as almost all TDFs use them as the benchmarks for bond and international equity components of their portfolios.[14] Thus, our second performance measure is the risk-adjusted net-of-fee performance estimated using our six-factor model. Since our study spans a period of eight years, computing a single alpha for the whole period might be too restrictive as it forces the funds to have constant betas over a long period. Hence, we divide our sample into four time periods of two years each, estimate alphas using 24 month intervals, and run a panel regression by pooling observations in the four periods.[15]

For our entire sample of balanced funds and TDFs, we estimate the betas for the six factors for each of the four time periods and compute the average difference in the loadings for successive time periods and present these statistics in Table II. We can see that the factor loadings are significantly different for the four periods which lends support to our use of two year periods to estimate alpha. For robustness, we repeat our analysis using risk-adjusted gross-of-fee performance measures. As CRSP mutual fund database reports the net-of-fee returns, we add the expense ratios to estimate the gross-of-fee returns.

Our control variables based on extant literature are expense ratio, age, turnover ratio, and assets under management. Since age and assets under management are known to have

[14]Blake, Elton, and Gruber (2007) use a similar framework except for the momentum factor to measure the performance of stock mutual funds that have exposure to bonds and international equity.

[15]In specifications involving *External* and *Mixed* FOFs, we are restricted to using only the last four years as these funds came into existence only in 2005.

skewed distributions, we use their logged values. In the case of TDFs with FOF structure, the expense ratio as reported in CRSP does not include the fees paid to constituent funds. Similarly, the turnover ratio as reported in CRSP understates the actual turnover as it does not include the turnover of the underlying funds. Hence, we augment the values of expense ratio and turnover ratio with the corresponding average values of the constituent funds. As we do not classify BFs as FOF and SF structures, we do not add fees paid to constituent funds. This might underestimate the gross-of-fee performance of BFs and bias against finding under-performance for TDFs. To control for family effects, we include the total assets under management of the family as an independent variable. We also include the proportion of assets invested in bonds as an additional variable to control for differences due to asset allocation that may not be captured by our bond factor. Finally, as our data has panel structure, we allow for clustering of standard errors by fund families and quarters for all our tests unless specified otherwise. Next, we provide a discussion of flow-performance relation for BFs, TDFs, and the subcategories of TDFs.

V Potential for agency problems in TDFs

In this section, we establish the potential for agency problems in TDFs by analyzing the flow-performance relation of TDFs and BFs. Sirri and Tufano (1998) find that in a sample of domestic equity funds, investors tend to chase funds with good performance while they do not punish funds with poor performance resulting in a convex flow-performance relation. However, if investors are busy or captive, they are unlikely to reward good performance

or punish poor performance. This implies that in the case of TDFs, flows may be unrelated to performance. BFs on the other hand are not primarily targeted at retirement plan participants. Moreover, despite being approved as QDIA, they are not prevalently used as the default instrument. Given that they are chosen by active investors, we expect their flow-performance relation to be similar to that of equity funds.

A Univariate Analysis of Flow-Performance Relation

While Sirri and Tufano (1998) focus on equity funds, we extend the analysis to TDFs and BFs. To evaluate fund performance for each quarter, we use the prior 24 monthly returns of a fund and estimate its alpha using the six-factor model as explained in Section IV. We then divide the funds into deciles based on their performance for that quarter. For each performance decile, we calculate the average net flows for the subsequent period using the definition provided in Section IV and present our results in Figure 2. For robustness, we repeat our analysis using the four-factor model and find qualitatively similar results. Consistent with extant literature, we find the flow-performance relation to be convex for BFs. However, in the case of TDFs, there is no clear pattern in the flow-performance relation. Based on these results, it appears that managers of TDFs do not have implicit incentives to outperform their peers or face the threat of withdrawal of funds as investors neither reward good performance nor punish poor performance.

B Multivariate Analysis of Flow-Performance Relation

For the multivariate analysis, we separate our sample into BFs and TDFs and repeat the analysis for both sub-groups using a simple linear regression given by the following model:

$$\begin{aligned} NetFlows_{i,t} =& \beta_0 + \beta_1 Perf_{i,t-1} + \beta_2 LogAUM_{i,t-1} + \beta_3 ExpenseRatio_{i,t-1} \\ &+ \beta_4 ObjFlows_{i,t-1} + \beta_2 RetVolat_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{2}$$

where $NetFlows_{i,t}$ is the net percentage growth of fund i in quarter t, $Perf_{i,t-1}$ is the net-of-fee six-factor alpha, $LogAUM_{i,t}$ is the log of assets under management of fund i in quarter t, $ExpenseRatio_{i,t}$ is the expense ratio of fund i in quarter t, $ObjFlow_{i,t}$ is the growth of funds in quarter t with fund i's investment objective, and $RetVolat_{i,t}$ is the standard deviation of returns over the previous 24 months.

While the above model assumes a linear relation, we follow Sirri and Tufano (1998) and use the following piece-wise linear model to capture the convexity of the flow-performance relation.

$$\begin{aligned} NetFlows_{i,t} = & \beta_0 + \beta_1 LowPerf_{i,t-1} + \beta_2 MidPerf_{i,t-1} + \beta_3 HighPerf_{i,t-1} \\ &+ \beta_4 LogAUM_{i,t-1} + \beta_5 ExpenseRatio_{i,t-1} + \beta_6 ObjFlows_{i,t-1} \\ &+ \beta_7 RetVolat_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{3}$$

We define $LowPerf_{i,t}$ as $Min(0.2, RANK_{i,t})$ where $RANK_{it}$ is defined as the percentile performance (measured as the net-of-fee six-factor alpha) of fund i in quarter t relative to other funds with the same investment objective. Similarly, we define $MidPerf_{i,t}$ as

$Min(0.6, RANK_{i,t} - LowPerf_{i,t})$ and the highest quintile of performance as $HighPerf_{i,t} = RANK_{i,t} - (LowPerf_{i,t} + MidPerf_{i,t})$. Finally, all other variables are as defined in Equation 2.

As alternate specifications, we repeat the above analysis for TDFs using both inflows as well as outflows instead of net flows. For robustness, we repeat the analysis with four-factor alphas as performance measures, family fixed effects as well as investment objective fixed effects and find qualitatively similar results. Results from the linear model are reported in Table III. We can see that the flow-performance relation is linear for BFs while flows are unrelated to performance for TDFs for net flows as well as for inflows and for outflows. The results from the piece-wise linear model provides evidence of a convex flow-performance relation for BFs. We find the slopes of the performance-growth relation over the three ranges to be significantly different from zero and based on the pairwise t-tests, we can reject the hypothesis that performance sensitivity of the lowest quintile is the same as that of the highest quintile as well as the middle three quintiles combined as in Sirri and Tufano (1998). However, in the case of TDFs, we fail to reject the hypothesis that performance sensitivity of the lowest quintile is the same as that of the highest quintile as well as the middle three quintiles. Thus, the flow-performance relation of BFs is linear and convex during our sample period while there is no relation between flows and performance for TDFs. Another interesting point is that while fund flows to mutual funds are negatively related to expense ratios in the case of BFs, they are not sensitive to expense ratios in the case of TDFs. Thus, unlike BFs, flows to TDFs are not related to performance or expenses and hence fail to provide managers with incentives to outperform their peers. Instead, it incentivizes fund

families to sell poorly performing or high-fee funds which establishes the potential for agency problems in TDFs.

VI Evidence of agency problems in TDFs

In this section, we present evidence of agency problems in TDFs and a mechanism through which it manifests. We begin with the univariate analysis of BFs, TDFs and their subcategories followed by our tests for under-performance. First, we show that TDFs under-perform BFs and within the two categories of TDFs, FOFs under-perform SFs. Then, we show that among the categories of FOFs, *Internal* FOFs (TDFs that invest in funds within the family) under-perform *External* FOFs (TDFs that invest in funds of other families). Finally, we study the determinants of the constituents of FOFs that invest internally and show that *Internal* FOFs tend to include funds with high expense ratios and poor performance.

A Univariate Analysis of BFs and TDFs

In Table IV, we present the average fund characteristics of TDFs and BFs in the first two columns and the differences in mean in the third column. From the table, we can see that based on the four-factor (six-factor) model, TDFs under-perform BFs by 1.28% (1.35%) annually on a net-of-fee risk-adjusted basis and by about 1.97% (2.06%) annually on a gross-of-fee risk-adjusted basis. Based on average fund characteristics, BFs are of comparable size, older, have lower net flows, lower equity allocation, higher bond allocation, and lower volatility of monthly returns compared to TDFs.

In Table V, we provide the characteristics of TDFs having the FOF and SF structures in the first two columns and the differences in the means in the third column. We find that based on the four-factor (six-factor) model, FOFs under-perform SFs by 1.73% (1.76%) annually on a net-of-fee basis and by about 2.68% (2.73%) annually on a gross-of-fee basis. On average, FOFs are larger, younger, and have higher net flows, higher equity component, lower bond component, and higher volatility in monthly returns compared to SFs.

In the first three columns of Table VI, we present the fund characteristics of the three sub-groups of FOFs namely *Internal*, *External*, and *Mixed* FOFs.[16] In the remaining three columns, we present the differences in means. From the fourth column, we can see that based on the four-factor (six-factor) model, *Internal* FOFs under-perform *External* FOFs by 30 (29) basis points on a net-of-fee risk-adjusted basis and by 29 (28) basis points on a gross-of-fee risk-adjusted basis. *Internal* FOFs are larger, older, and have higher turnover ratio, lower flows, lower expense ratio, lower equity allocation, higher bond allocation, and lower volatility in monthly returns. Additionally, we report the weighted average turnover ratio and expense ratio of the constituent funds. We can see that *Internal* FOFs have constituents with greater expense ratios and higher turnover ratios. While the revenue generated from fees paid to constituent funds is redirected into the fund family's coffers in the case of *Internal* FOFs, it is paid to other fund families in the case of *External* FOFs. From the fifth and sixth columns, we can see that *Mixed* FOFs are comparable in performance to *Internal* FOFs but under-perform *External* FOFs. For our subsequent analysis, we combine *Mixed* FOFs with *External* FOFs as managers of both categories have the option of including funds

[16] *Mixed* FOFs are TDFs with FOF structure that invest partly within the family and partly outside.

from families outside. To the extent that managers of *Mixed* FOFs have opportunities for "strategic" selection, it will bias our tests against finding under-performance. Additionally, our results are qualitatively similar when we repeat our analysis after excluding *Mixed* FOFs from the sample.

Impact of Pension Protection Act

Pension Protection Act (PPA) of 2006 acted as a catalyst in spurring the growth of TDFs in the later part of our sample. Subsequent increase in the adoption of TDFs as the default option ensured steady flows to these funds thereby increasing potential gains from "strategic" selection of constituents. Descriptive statistics for balanced funds, TDFs, and their subcategories for the periods before and after PPA are available upon request. Not only do we find that TDFs under-perform BFs based on net-of-fee and gross-of-fee risk-adjusted returns for the entire time-period, but also that the under-performance based on net-of-fee four-factor (six-factor) alpha increases from 29 (47) basis points in the pre-PPA period to 112 (108) basis points in the post-PPA period. A similar analysis of gross-of-fee four-factor (six-factor) alpha shows an increase from 14 (19) to 165 (164) basis points. In the case of under-performance of FOFs relative to SFs, once again we find that our net-of-fee results persist in both time periods and the under-performance increases with the passage of PPA. In particular, during the pre-PPA period, the under-performance of FOFs based on net-of-fee four-factor (six-factor) alpha is 84 (101) basis points while it increases to 146 (140) basis points in the post-PPA period. However, in terms of gross-of-fee four-factor (six-factor) alpha, the under-performance decreases from 220 (237) basis points to 211 (204) basis points

which is attributable to a narrowing fee differential between FOFs and SFs.

B Under-performance of TDFs over BFs

We start by comparing the performance of TDFs with that of BFs. Our sample for this test consists of all fund-quarter observations during the period Jan 2001 to Dec 2008 where the fund is either a TDF or a BF. We use the following model to conduct our analysis:

$$\begin{aligned} Perf_{i,t} = \kappa_0 + \kappa_1 TDF_i + \kappa_2 ExpenseRatio_{i,t} + \kappa_3 LogAge_{i,t} \\ + \kappa_4 LogAUM_{i,t} + \kappa_5 Turnover_{i,t} + \kappa_6 NetFlow_{i,t} \\ + \kappa_7 FamilyAUM_{i,t} + \kappa_8 Bond_{i,t} + \epsilon_{i,t} \end{aligned} \tag{4}$$

where the dependent variable $Perf_{i,t}$ is the performance measure of the i^{th} fund in the t^{th} quarter and TDF_i is a dummy variable that takes the value 1 if the i^{th} fund is a TDF and 0 otherwise. $ExpenseRatio_{i,t}$ is the expense ratio of the i^{th} fund in the t^{th} quarter. In the case of TDFs with FOF structure, $ExpenseRatio_{i,t}$ includes the average expense ratio of the constituent funds. $Turnover_{i,t}$ is the minimum of purchases and sales made by the i^{th} fund in the t^{th} quarter divided by the total assets under management for the t^{th} quarter. In the case of TDFs with FOF structure, $Turnover_{i,t}$ includes the average turnover ratio of the constituent funds. $LogAge_{i,t}$ is the log of age of the i^{th} fund in the t^{th} quarter and $LogAUM_{i,t}$ is the log of assets under management of the i^{th} fund in the t^{th} quarter. $NetFlow_{i,t}$ is the growth rate for the i^{th} fund in the t^{th} quarter and is calculated as shown in Section IV. Although we use risk-adjusted performance measures, we control for any residual impact of

asset allocation by including $Bond_{i,t}$, the percentage of assets invested by fund i in fixed income securities in the t^{th} quarter. To control for family effects, we include $FamilyAUM_{i,t}$, the log of assets under management of the fund family.

We present the results of the above regression in Table VIII. Since our baseline is balanced funds, the negative sign on the TDF dummy that we find indicates that TDFs under-perform BFs. This under-performance is large, ranging from 47 (48) basis points annually based on net-of-fee four-factor (six-factor) alphas to 86 (86) basis points annually based on gross-of-fee four-factor (six-factor) alphas. It is important to note that a reduction of 47 basis points in performance is almost half the annual expense ratio of these funds. Since a TDF controls about $\$618M$ on average, if the under-performance is a result of agency problems, it translates to a loss of roughly $\$2.9M$ of investor wealth per TDF on post-fees basis and about $\$5.3M$ of investor wealth per TDF on pre-fees basis. Given that there are around 280 TDFs, the loss amounts to $\$810M$ to $\$1.5B$ dollars. If agency issues do not play a role, then the 47 to 86 basis points difference in performance of TDFs relative to BFs can be construed as the premium that investors are willing to pay for the automatic rebalancing feature. To disentangle the two explanations, we compare the performance of the two structures of TDFs, namely FOFs and SFs, with that of BFs in the next section.

C Automatic-rebalancing or strategic selection

To tease out the cause of under-performance, we investigate the performance of the subcategories of TDFs. To this end, we estimate the following regression for all TDFs and

BFs in our sample .

$$\begin{aligned} Perf_{i,t} =& \kappa_0 + \kappa_1 FOF_i + \kappa_2 SF_i + \kappa_3 ExpenseRatio_{i,t} + \kappa_4 LogAge_{i,t} + \\ & \kappa_5 LogAUM_{i,t} + \kappa_6 Turnover_{i,t} + \kappa_7 NetFlow_{i,t} + \\ & \kappa_8 FamilyAUM_{i,t} + \kappa_9 Bond_{i,t} + \epsilon_{i,t} \end{aligned} \tag{5}$$

where the dependent variable $Perf_{i,t}$ is the performance measure of the i^{th} TDF in the t^{th} quarter, FOF_i is a dummy that takes the value 1 if the i^{th} TDF has FOF structure and 0 otherwise and SF_i is a dummy that takes the value 1 if the i^{th} TDF has SF structure and 0 otherwise. All other control variables are the same as defined in Equation 4.

We present our results in Table VIII. BFs continue to be our baseline. This implies that a negative coefficient on the FOF dummy variable indicates that BFs outperform TDFs with FOF structure while a positive coefficient on the SF dummy variable indicates that TDFs with SF structure outperform BFs. We find the under-performance by TDFs with FOF structure relative to BFs based on four-factor (six-factor) alphas to be 68 (67) basis points annually on a net-of-fee risk-adjusted basis and 119 (117) basis points annually on a gross-of-fee risk-adjusted basis. In the case of TDFs with SF structure, performance is not significantly different from that of BFs for the six-factor models while the four-factor models show that these funds out-perform BFs by around 140 basis points. Thus, we can rule out time-varying re-allocation as the main driver of the under-performance of TDFs. We also find that TDFs with FOF structure under-perform TDFs with SF structure by around 82 (79) basis points annually using net-of-fee four-factor (six-factor) alphas and by around 133 (129) basis points based on gross-of-fee four-factor (six-factor) alphas. Given that the

average assets under management of a TDF with FOF structure is around $\$657M$ dollars, the under-performance implies a loss of $\$5.2M$ to $\$8.7M$ dollars of investor wealth per TDF with FOF structure relative to those with SF structure which ranges from $\$1.38B$ to $\$2.32B$ dollars for the 266 FOFs. This indicates that the losses suffered by TDFs as shown in the earlier analysis is almost entirely driven by TDFs with FOF structure.

If the under-performance is attributed to the reduction in risk due to diversification across funds, the shortfall of 79 to 133 basis points can be seen as the price paid by investors for this diversification. To disentangle the two explanations, we compare the performance of the two subgroups of FOFs namely, *External* FOFs and *Internal* FOFs, with that of SFs in the next section.

D Costs and benefits of FOF structure

As *External* FOFs came into existence only in 2005, our sample period for subsequent analyses consists of all TDFs over the period Jan 2005 to Dec 2008. To compare the performance of *Internal* FOFs with that of *External* FOFs, we replace the FOF dummy by two dummy variables called *Internal* and *External*. *Internal* takes the value 1 if the funds' assets are invested entirely within the family and zero otherwise. Similarly, *External* takes the value 1 if the funds' assets are invested at least partially outside the family and zero otherwise. We continue to use the same set of control variables as before and estimate the

following regression:

$$\begin{aligned} Perf_{it} =& \kappa_0 + \kappa_1 Internal_i + \kappa_2 External_i + \kappa_3 ExpenseRatio_{i,t} + \\ & \kappa_4 LogAge_{i,t} + \kappa_5 LogAUM_{i,t} + \kappa_6 Turnover_{i,t} + \\ & \kappa_7 NetFlow_{i,t} + \kappa_8 Bond_{i,t} + \kappa_9 FamilyAUM_{i,t} + \epsilon_{i,t} \end{aligned} \tag{6}$$

where $Internal_i$ and $External_i$ are dummy variables as defined above and the performance measures as well as control variables are the same as in Equation 4.

In Table IX, we present our results for the above model. In this analysis, we compare the performance of *Internal* and *External* FOFs using TDFs with SF structure as the baseline. We can see that over our sample period, TDFs with *Internal* FOF structure under-perform those with SF structure for all specifications while TDFs with *External* FOF structure under-perform those with SF structure only when we use gross-of-fee alphas. This implies that the under-performance of FOFs cannot be entirely due to diversification of across funds. From these results, *Internal* FOFs under-perform SFs by about 56 (58) basis points based on net-of-fee four-factor (six-factor) alphas and by about 130 (132) basis points based on gross-of-fee four-factor (six-factor) alphas.

More importantly, *Internal* FOFs under-perform *External* FOFs by about 42 (55) basis points based on net-of-fee four-factor (six-factor) alphas and 50 (63) basis points based on gross-of-fee four-factor (six-factor) alphas. Since both *External* and *Internal* FOFs have the FOF structure and carry out portfolio rebalancing at regular intervals, the under-performance cannot be attributed to reduced risk, dual layer of fees or the timely reallo-

cation of assets. Thus, the under-performance is clearly attributable to "strategic" decisions made by the fund family that benefits the family over the investor. Since the average size of *Internal* FOFs is around $\$557M$, the extent of loss suffered by investors in an internally managed TDF with FOF structure is in the range of $\$2.3M$ to $\$3.5M$. Given the prevalence of this category of TDFs (209 funds in 2008), the cumulative loss is approximately $\$489M$ to $\$733M$. Based on a similar calculation, the loss from investing in *Internal* FOFs relative to SFs ranges from $\$652M$ to $\$1.5B$.

In our analysis thus far, we have not differentiated between fund families that are mutually owned as opposed to those owned by external shareholders. Given the nature of our study, it is important to distinguish between these two forms of organization as their incentives are different. In particular, fund families that are mutually owned return the profits to investors of their funds while profits to fund families owned by external shareholders belong to those owners. Our sample consists of a few fund families that are mutually owned and all of them offer TDFs with *Internal* FOF structure. If the under-performance that we document is due to agency problems, it is unlikely to affect TDFs belonging to those mutually owned fund families. To test this, we divide TDFs with *Internal* FOF structure into two groups, *Mutual Internal* FOFs and *Non-Mutual Internal* FOFs. We repeat the above analysis after replacing the dummy variable *Internal* by two additional dummy variables MIFOF and NMIFOF. We define MIFOF (NMIFOF) to take the value 1 if the TDF has *Internal* FOF structure and belongs (does not belong) to a mutual organization and 0 otherwise. In unreported results, we find that TDFs with *Non-Mutual Internal* FOF structure under-perform TDFs with SF structure by 53 (56) basis points on net-of-fee four-factor (six-factor) alphas and 127 (130)

basis points based on gross-of-fee four-factor (six-factor) alphas while they under-perform TDFs with *External* FOF structure by 46 (58) basis points on net-of-fee four-factor (six-factor) alphas and 54 (66) basis points based on gross-of-fee four-factor (six-factor) alphas. Additionally, we find that performance of TDFs with *Mutual Internal* FOF structure is comparable to that of TDFs with *External* FOF structure for all specifications and to that of TDFs with SF structure on net-of-fee four-factor (six-factor) alphas while they under-perform TDFs with SF structure by 82 (103) basis points based on gross-of-fee four-factor (six-factor) alphas. The under-performance in the gross-of-fee specification is due to the higher expense ratio of TDFs with SF structure relative to those with *Mutual Internal* FOF structure. Finally, we find that TDFs with *Non-Mutual Internal* FOF structure under-perform those with *Mutual Internal* FOF structure by 45 (27) basis points based on net-of-fee four-factor (six-factor) alphas and 44 (27) basis points based on gross-of-fee four-factor (six-factor) alphas. These results indicate that the under-performance of TDFs is not caused by the fund-of-fund structure *per se*, but the incentives induced by the structure. In the next section, we turn our attention to the selection decision of TDFs with FOF structure.

E Selection of constituent funds by *Internal* FOFs

To study the drivers of under-performance of *Internal* FOFs, we analyze the selection process by which constituent funds are determined for *Internal* FOFs and test whether fund families make these decisions to extract private benefits. To this end, we compare the constituents of *Internal* FOFs to other funds in the family that are not part of any TDF at the point when those constituents are added. We estimate the probability that a fund from

a family is included in an *Internal* FOF using the following logistic regression model:

$$\begin{aligned} UF_{i,t} =& \kappa_0 + \kappa_1 Perf_{i,t-1} + \kappa_2 ExpenseRatio_{i,t-1} + \kappa_3 NetFlow_{i,t-1} + \\ & \kappa_4 LogAge_{i,t-1} + \kappa_5 LogAUM_{i,t-1} + \kappa_6 Turnover_{i,t-1} + \\ & \kappa_7 Bond_{i,t-1} + \kappa_8 LogFamAUM_{i,t-1} \end{aligned} \tag{7}$$

where the dependent variable $UF_{i,t} = \ln\left(\frac{prob(Fund_{it} \text{ is a constituent of an Internal FOF})}{prob(Fund_{it} \text{ is not a constituent of an Internal FOF})}\right)$, is the log odds of the i^{th} fund being selected as a constituent of an *Internal* FOF in quarter t. Our explanatory variables for this specification are fund performance ($Perf_{i,t}$), expense ratio ($ExpenseRatio_{i,t}$), and net flows ($NetFlow_{i,t}$). The control variables are log of age of funds ($LogAge_{i,t}$), log of assets under management ($LogAUM_{i,t}$), turnover ($Turnover_{i,t}$), percentage of assets invested in bonds ($Bond_{i,t}$) and log of assets under management of the family ($LogFamAUM_{i,t}$). To avoid forward-looking bias while using performance as an independent variable, for each fund we re-estimate the alphas for every quarter using the four-factor (six-factor) model for the 24 months prior to that quarter. We use one period lagged value for all the explanatory and control variables as these are likely to impact the selection decision of the constituent funds. We allow for standard errors to cluster by family and quarters. We provide the results of this analysis in Panel A of Table X. These results indicate that for any fund in the family, ceteris paribus, the probability of inclusion in the TDF is positively related to the expense ratio and negatively related to performance and net flows. In other words, funds selected by *Internal* FOFs tend to have lower performance, higher expense ratios and lower net flows relative to other funds in the family. Additionally, these funds are likely to be smaller, older and have greater allocation to

bonds. Moreover, the significant negative value for coefficient of performance in the gross-of-fee specification questions the ability of the managers of these constituent funds. If selection of poor performing, high expense funds as constituents by *Internal* FOFs is done to increase private benefits, we expect TDFs with FOF structure and investing in families outside to select funds with relatively better performance and lower expense. We test this conjecture in the next section by comparing the characteristics of the constituent funds of *Internal* FOFs with those of *External* FOFs.

F Constituents of *Internal* FOFs and *External* FOFs

To discern the determinants of including a fund in an *Internal* FOF versus an *External* FOF, we compare their constituent funds when they are initially included in the TDF. Our sample period for this analysis is from January 2005 to December 2008 as TDFs with *External* FOF structure came into existence only in 2005. Given that a fund is a constituent fund for some TDF, we estimate the probability that it becomes a constituent fund of a TDF with *Internal* FOF structure using the following logistic regression model:

$$\begin{aligned} UF_{i,t} = \kappa_0 &+ \kappa_1 Perf_{i,t-1} + \kappa_2 ExpenseRatio_{i,t-1} + \kappa_3 NetFlow_{i,t-1} \\ &+ \kappa_4 LogAge_{i,t-1} + \kappa_5 LogAUM_{i,t-1} + \kappa_6 Turnover_{i,t-1} \\ &+ \kappa_7 Bond_{i,t-1} + \kappa_8 LogFamAUM_{i,t-1} \end{aligned} \tag{8}$$

where the dependent variable $UF_{i,t} = \ln\left(\frac{prob(Fund_{it} \text{ is a constituent of an Internal FOF})}{prob(Fund_{it} \text{ is a constituent of an External FOF})}\right)$, is the log odds of the i^{th} fund being selected as a constituent of an *Internal* FOF in quarter t.

Our explanatory variables for this specification are performance ($Perf_{i,t-1}$), expense ratio ($ExpenseRatio_{i,t}$), and net flows ($NetFlow_{i,t}$), while the control variables are log of age of funds ($LogAge_{i,t}$), log of assets under management ($LogAUM_{i,t}$), turnover ($Turnover_{i,t}$), percentage of assets invested in bonds ($Bond_{i,t}$), and log of assets under management of the family ($LogFamAUM_{i,t}$). We use the one-period lagged value for all the explanatory and control variables as these are likely to influence the selection decision of the constituent funds. We measure risk-adjusted performance as net-of-fee (gross-of-fee) alpha where we estimate the four-factor (six-factor) alphas for each fund i over quarter t using the monthly returns of the prior 24 months.

We provide the results of this analysis in Panel B of Table X. Consistent with our expectations, we find that the coefficient of performance is negative indicating that fund families are more likely to choose funds with poor performance in the case of TDFs with *Internal* FOF structure relative to TDFs with *External* FOF structure. The results are striking given the fact that we have much fewer observations (169 vs 26812) compared to those in Panel A where we compare constituent funds of *Internal* FOFs against other funds in the family. Furthermore, in the case of expense ratio, we find that funds with higher expense ratios are more likely to be included in TDFs with *Internal* FOF structure than in TDFs with *External* FOF structure. However, we find the probability of inclusion of a constituent fund in a TDF with *Internal* FOF structure is not additionally influenced by the net flows to the constituent fund relative to constituents of TDFs with *External* FOF structure. Once again we find significant negative value for coefficient of performance in the gross-of-fee specification raising questions regarding the ability of managers of the constituent funds of *Internal*

FOFs. Overall, our results suggest that the under-performance of *Internal* FOFs could be due to the inclusion of constituent funds that have lower performance and higher expense ratios. These funds also have lower flows relative to other funds in the family suggesting that some fund families may be using TDFs as a vehicle to promote poorly performing funds, increase revenues to the family, and redirect flows to funds that are not favored by investors. Inclusion of funds with poor performance in TDFs raises the question regarding the cause of poor performance. On one hand, funds may perform poorly due to poor managerial skills while on the other hand the under-performance might be a consequence of "strategic" decision by the management to use these funds to cross-subsidize certain other funds in the family. We follow the methodology of Gaspar, Massa, and Matos (2006) to test whether fund families with *Internal* FOFs practice cross-subsidization. In untabulated results, we find that funds in the bottom quartile of year-to-date returns within a family that offers TDFs with *Internal* FOF structure are likely to under-perform similar funds from other families by 12 basis points per month which is suggestive of cross-subsidization.

VII Robustness checks

In this section, we discuss several alternate specifications to show that our main result, under-performance by TDFs with fund-of-fund structure and investing internally, is robust and present the results in Table XI. For ease of comparison, we begin with the results for our base model followed by different alternate specifications. For brevity, we report only the extent of under-performance for each case.

1. Base model: We compare the average performance of all TDFs in our sample with the average performance of all BFs over the period January 2001 to December 2008. We use net-of-fee and gross-of-fee risk adjusted performance measures where risk adjusting is done using four-factor and six-factor models. Thus, we have four measures of performance of which the net-of-fee alphas are more pertinent to the investor.

2. An alternate way to control for family effects is to restrict the BFs to the families that offer TDFs. While this will effectively control for family effects, it reduces our sample size considerably. We present the results of this analysis as the first alternate specification in Table XI. From these results, we can see that the under-performance persists despite using a sample that is almost a third of the original sample size.

3. A shortcoming of our data is that in the case TDFs with FOF structure, we do not know the share class of the constituent funds. Consistent with Wermers (2000), we combine net returns, expense ratio and other fund characteristics of all classes using the weighted average, where weights are based on assets in each share class. Thus, our analysis is at the fund level. If TDFs consistently invest in the share class with lowest fees, our estimates for expense ratio and gross-of-fee returns may be overstated. To provide a lower bound, we repeat our analysis by choosing the lowest fees among shareclasses as the fees for the fund and present the results in the second alternate specification. We find the results to be qualitatively similar and a bit weaker for all cases except under-performance of *Internal* FOFs where the results are stronger relative to the base-case.

4. In our analysis thus far, we have pooled funds with longer maturity along with shorter-maturity funds. However, longer-maturity funds might be systematically different from those with shorter-maturity. While our linear multi-factor model captures the differences in investment styles, there might be other fundamental differences in the two categories. Hence, we introduce an additional control variable that measures the years remaining to the target year. Another aspect that might affect our results is that the approval as QDIA in 2006 resulted in a surge in the number of TDFs. Particularly, *External* FOFs were introduced only around this period. Hence, the period before 2006 might be systematically different from the period after 2006. To control for this possibility, we include a dummy variable that takes the value 1 for the period 2006 to 2008. Our results for under-performance of *Internal* FOFs is stronger as seen in the third alternate specification of Table XI.

5. While the comparison of *Internal* FOFs with *External* FOFs provides a clear case for agency problems, it is possible that funds investing internally may be systematically different from those investing externally. For instance, *Internal* FOFs might provide greater exposure to international equity funds thereby enabling greater diversification. Moreover, if these funds also have higher expense ratios, the under-performance documented could be attributed to the additional diversification which may not be captured by our linear multi-factor model. To test this possibility, we define three variables to capture the three main asset classes; domestic equity, international equity and bonds. We do not distinguish between international and domestic bonds as most fund families as well as Morningstar do not make this distinction. In alternate specification

four, we present the results for under-performance of *Internal* FOFs relative to *External* FOFs after controlling for the exposure to different asset classes. We find the under-performance to be slightly weaker than our base case.

To summarize, our battery of robustness checks corroborate our key findings that TDFs under-perform BFs. Further, variation in asset allocation over time does not seem to drive this result as TDFs with FOF structure are the ones with poor performance and not TDFs with SF structure that perform at par with BFs. Finally, dual layer of fees or diversification across funds do not seem to explain the poor performance as TDFs with *Internal* FOF structure under-perform those with *External* FOF structure. These findings together point towards agency problems in TDFs, more specifically towards those structured as FOFs and investing in funds within their own family.

VIII Conclusion

Retirement plan contributions to mutual funds have grown to $3.1 trillion, representing a third of total mutual fund assets, at the end of 2008.[17] Recently, there have been concerns raised about the significant cross-sectional variation in the performance of the Target-Date Funds (TDFs), whose assets are predominantly held in retirement accounts. Ours is the first empirical study examining the variation in performance across TDFs to show that agency problems may be responsible for the poor performance of certain TDFs. In particular, we find that the problems originate in TDFs that invest in other mutual funds within the fund

[17] http://www.icifactbook.org/fb_sec7.html

families as it provides the families with opportunities to redirect flows to poorly performing and high-fee funds. A potential reason for agency problems is that flows do not respond to past performance indicating that investors of TDFs neither reward good performance nor punish poor performance. We show that agency problems can translate to losses in the range of half a billion to one and a half billion dollars annually for the investors whose retirement funds are automatically allocated to TDFs subsequent to their approval as a Qualified Default Investment Alternative in 401(k) plans.

A future area of research is to study other avenues of agency problems in TDFs. In particular, TDFs are required to rebalance their portfolios based on a predetermined asset allocation called the "glide path". Following the findings in this paper, it is possible that TDFs may be strategically using their discretion in deviating from the glide path to serve their incentives. These issues are part of our ongoing research agenda.

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Table I: **Growth in Target-Date Funds (2001 - 2008)**

This table presents the number of funds (# Funds) as well as the assets under management (AUM) in billions of dollars for each year during our sample period, January 2001 - December 2008. Top panel provides the statistics for Target-Date Funds (TDFs), and balanced funds (BFs) where BFs are identified based on their Lipper objective code. Middle panel reports the statistics for the two major subcategories of TDFs, namely fund that invest in other mutual funds (FOF) and funds that invest in stocks and bonds (SF) and bottom panel presents the three sub groups of TDFs with FOF structure; funds that invest within the family, funds that invest outside the family and funds that invest within the family as well as outside the family.

	Target-Date Funds		**Balanced Funds**	
Years	**# Funds**	**AUM**	**# Funds**	**AUM**
2001	16	11.287	264	146.135
2002	20	13.411	277	140.034
2003	41	22.786	282	166.655
2004	69	34.553	301	187.024
2005	112	53.284	280	193.603
2006	158	84.633	285	204.415
2007	200	131.737	307	227.734
2008	280	126.792	383	214.883

	Fund-of-Funds		**Single Funds**	
Years	**# Funds**	**AUM**	**# Funds**	**AUM**
2001	7	9.700	9	1.587
2002	11	12.073	9	1.338
2003	28	20.746	13	2.040
2004	56	31.536	13	3.016
2005	99	49.308	13	3.976
2006	145	79.547	13	5.086
2007	187	124.299	13	7.439
2008	266	121.082	14	5.710

	Invest within family		**Invest outside family**		**Invest in both**	
Years	**# Funds**	**AUM**	**# Funds**	**AUM**	**# Funds**	**AUM**
2001	7	9.700	0	0.000	0	0.000
2002	11	12.073	0	0.000	0	0.000
2003	28	20.746	0	0.000	0	0.000
2004	56	31.536	0	0.000	0	0.000
2005	86	49.159	2	0.009	11	0.141
2006	119	78.023	12	0.065	14	1.459
2007	161	120.364	12	0.798	14	3.137
2008	209	114.446	19	1.584	38	5.052

Table II: **Differences in Factor Loadings over Time**

This table presents the average difference in factor loadings over consecutive time spans, based on the six-factor model. The six-factors used in the model consists of the Carhart (1997) four-factors along with factors to capture the risks due to exposure to bonds as well international equity. Our sample consists of all TDFs and Balanced funds from January 2001 to December 2008. We divide the eight year period into four two year periods and compute the betas over the shorter intervals. Thus, Period 1 spans from January 2001 to December 2002, Period 2 from January 2003 to December 2004, Period 3 from January 2005 to December 2006 and Period 4 from January 2007 to December 2008. The second column reports the difference in the loadings from Period 1 to Period 2, the third reports the difference between Period 3 and Period 2 while the fourth reports the difference between Period 4 and Period 3. Standard errors are reported below the differences in square brackets. Differences marked with ***, **, * denote significance at 1%, 5% and 10% level, respectively.

	Period 2 - Period 1	**Period 3 - Period 2**	**Period 4 - Period 3**
Market	-0.200^{***}	-0.023	-0.502^{***}
	[0.039]	[0.165]	[0.092]
SMB	0.260^{***}	0.050	0.138^{**}
	[0.049]	[0.157]	[0.071]
HML	0.411^{***}	-0.054	-0.075
	[0.032]	[0.047]	[0.067]
UMD	-0.277^{***}	-0.001	0.341^{***}
	[0.026]	[0.069]	[0.062]
Bond	-0.522^{***}	0.312^{***}	-0.523^{***}
	[0.042]	[0.068]	[0.049]
International Equity	-0.092^{***}	0.038	-0.088^{***}
	[0.010]	[0.079]	[0.015]

Table III: **Flow - Performance Relation**

This table presents the relation of flows to past performance for Target-Date Funds (TDFs) and balanced funds (BFs) during the period January 2003 to December 2008. In the first four columns we present the results using linear regression model while in the last four columns we use a piece-wise linear model. We use three different variables to measure next period flows. Net flows for TDFs and BFs is defined as $Netflow_{it} = (AUM_{i,t} - AUM_{i,t-1} * (1 + R_{i,t}))/(AUM_{i,t-1})$, while Inflows and Outflows for TDFs are directly obtained from the NSAR filings. For the linear model, the explanatory variable is Performance (quarterly net-of-fee six-factor alpha). For the piece-wise linear model, we calculate the fractional ranks (RANK) within each investment objective for each quarter. Low performance (Low Perf) is defined as Min(0.2,RANK) while Medium Performance (Medium Perf) is defined as Min(0.6,RANK-Low Perf) and High performance (High Perf) is defined as RANK - (Low Perf + Medium Perf). The control variables are the log of lagged AUM, lagged expense ratio, flows to funds with same investment objective and the standard deviation of monthly returns for the prior 24 months. The standard errors are reported in square brackets. Coefficients marked with ***, **, * are significant at 1%, 5% and 10% level, respectively.

	Linear Model				Piece-wise Linear Model			
	BFs	TDFs			BFs	TDFs		
Variables	Net Flow	Net Flow	Inflow	Outflow	Net Flow	Net Flow	Inflow	Outflow
Performance	0.189***	−0.094	−0.108	6.894				
	[0.052]	[0.166]	[0.094]	[6.444]				
Low Perf					6.150	25.247	−3.427	9.076
					[7.096]	[79.257]	[18.631]	[8.969]
Medium Perf					4.657***	12.463	−4.197	−4.955***
					[1.778]	[10.247]	[2.652]	[1.087]
High Perf					19.272**	−24.913	4.149	15.168***
					[7.954]	[21.372]	[8.828]	[4.587]
Log Lag AUM	−1.311***	−4.682**	−0.256	0.410	−1.336***	−4.570*	−0.233	0.419
	[0.255]	[2.354]	[0.493]	[0.412]	[0.259]	[2.519]	[0.513]	[0.426]
Lag Exp Ratio	−2.765***	−15.743	2.955	0.552	−2.663***	−0.161	3.884	0.541
	[0.671]	[11.883]	[2.973]	[1.937]	[0.681]	[0.122]	[2.812]	[1.581]
Flows to Obj	−2.254	0.145	0.049	−0.073***	−3.071	0.116	0.055	−0.045**
	[6.567]	[0.194]	[0.117]	[0.014]	[5.936]	[0.168]	[0.119]	[0.018]
Std Dev	0.925***	2.027	1.700**	−0.081	0.906***	2.374	1.400	−0.061
	[0.274]	[2.005]	[0.839]	[0.534]	[0.253]	[1.855]	[0.929]	[0.627]
Constant	1.461	2.632	9.156***	6.595***	−2.519	−5.897	12.325***	5.597**
	[1.431]	[5.287]	[2.273]	[1.400]	[1.996]	[16.864]	[3.620]	[2.315]
Observations	10321	236	236	236	10321	236	236	236
Adjusted R^2	0.021	0.049	0.088	0.012	0.024	0.058	0.082	0.048

Table IV: **Fund Characteristics of TDFs and BFs**

This table presents the average annual fund characteristics for balanced funds (BFs) and Target-Date Funds (TDFs) for the years 2001 to 2008. The performance measures are the four-factor alphas (annualized monthly alphas estimated over two year periods using Carhart (1997) four-factor model) and six-factor alphas (annualized monthly alphas estimated over two year periods using a six-factor model which includes a bond factor and international equity factor along with Carhart's four-factors). Other fund characteristics are assets under management in billions of dollars, age of funds in years, turnover ratio, net flows to the fund, expense ratio, asset allocation to equities & bonds and annualized monthly volatility of fund returns*. For TDFs that invest in other mutual funds, constituent expense ratio (turnover ratio) is the average expense ratio (turnover ratio) of the constituent funds. The third column provides the results of a t-test that compares the means of BFs to TDFs. Differences marked with ***, **, * denote significance at 1%, 5% and 10% level, respectively.

Fund Characteristics	**BF**	**TDF**	**BF - TDF**
4 Factor Alpha (%) Net	−0.856	−2.139	1.283***
6 Factor Alpha (%) Net	−0.881	−2.231	1.350***
4 Factor Alpha (%) Gross	0.732	−1.246	1.978***
6 Factor Alpha (%) Gross	0.704	−1.36	2.064***
Assets in Billions	0.656	0.618	0.038
Age in Years	13.601	3.452	10.149***
Turnover Ratio (%)	82.492	31.093	51.398***
Constituent Turnover Ratio(%)	NA	76.36	NA
Flows (%)	3.451	32.352	−28.900***
Expense Ratio (basis points)	113.280	43.199	70.080***
Constituent Expense Ratio (basis points)	NA	69.788	NA
Equity Component (%)	59.994	72.390	−12.400***
Bond Component (%)	29.278	19.612	9.666***
Volatility of Returns (%)	2.752	4.283	−1.530***

* Equity and Bond Components do not add to 100 as a portion of assets are held as cash.

Table V: **Fund Characteristics of FOFs and SFs**

This table presents the average annual fund characteristics for the two subcategories of Target-Date Funds, namely funds with fund-of-fund (FOF) structure and Single fund (SF) structure, over the years 2001 to 2008. The performance measures are the four-factor alphas and six-factor alphas which are obtained as explained in Table IV. Other fund characteristics are assets under management in billions of dollars, age of funds in years, turnover ratio, net flows to the fund, expense ratio, asset allocation to equities & bonds and annualized monthly volatility of fund returns*. Constituent expense ratio (turnover ratio) of FOFs includes the average expense ratios (turnover ratios) of the constituent funds. The third column provides the results of a t-test that compares the means of FOFs to SFs. Differences marked with ***, **, * denote significance at 1%, 5% and 10% level, respectively.

Fund Characteristics	**FOF**	**SF**	**FOF - SF**
4 Factor Alpha (%) Net	−2.347	−0.614	−1.733***
6 Factor Alpha (%) Net	−2.442	−0.681	−1.761***
4 Factor Alpha (%) Gross	−1.812	0.872	−2.684***
6 Factor Alpha (%) Gross	−1.936	0.797	−2.733***
Assets in Billions	0.657	0.331	0.327***
Age in Years	2.552	10.039	−7.487***
Turnover Ratio (%)	28.221	45.867	−17.650***
Constituent Turnover Ratio(%)	76.360	NA	NA
Flows (%)	36.324	4.548	31.776***
Expense Ratio (basis points)	31.831	101.880	−70.050***
Constituent Expense Ratio (basis points)	69.788	NA	NA
Equity Component (%)	73.717	62.648	11.069***
Bond Component (%)	18.077	29.497	−11.420***
Volatility of Returns (%)	4.479	2.844	1.635***

* Equity and Bond Components do not add to 100 as a portion of assets are held as cash.

Table VI: **Fund Characteristics of *Internal*, *External*, and *Mixed* FOFs**

This table presents the average fund characteristics for the three sub-categories of Target-Date Funds with fund-of-fund structure (funds that invest within the family (*Internal* FOF), funds that invest outside the family (*External* FOF), and funds that invest within and outside the family (*Mixed* FOF)) for the sample period January 2005 to December 2008^{+}. The performance measures are the four-factor alphas (annualized monthly alphas estimated over two year periods using Carhart (1997) four-factor model) and six-factor alphas (annualized monthly alphas estimated over two year periods using a six-factor model which includes a bond factor and international equity factor along with Carhart's four-factors). Other fund characteristics are assets under management in billions of dollars, age of funds in years, turnover ratio of the fund, average turnover ratio of the constituent funds, net flows to the fund, expense ratio of the fund, average expense ratio of the constituent funds, composition of the funds in the two main asset classes namely Equity and Bond and annualized monthly volatility of fund returns*. Expense ratio (turnover ratio) of the fund includes the average expense ratios (turnover ratios) of the constituent funds. Columns two, three and four present the average values of fund characteristics for *Internal*, *External*, and *Mixed* FOF. Columns five (six / seven) provides the results of a t-test that compares the means of *External* (*Mixed* / *Mixed*) FOF to *Internal* (*External* / *Internal*) FOF. Differences marked with ***, **, * denote significance at 1%, 5% and 10% level, respectively.

Fund Characteristics	**External**	**Internal**	**Mixed**	**Ext - Int**	**Mix - Ext**	**Mix - Int**
4 Factor Alpha (%) Net	−1.559	−1.857	−1.903	0.298**	−0.343**	−0.045
6 Factor Alpha (%) Net	−1.618	−1.907	−1.859	0.289**	−0.240	0.048
4 Factor Alpha (%) Gross	−0.487	−0.781	−0.968	0.294*	−0.481*	−0.187
6 Factor Alpha (%) Gross	−0.548	−0.828	−0.907	0.280*	−0.360*	−0.079
Assets in Billions	0.083	0.557	0.280	−0.473***	0.196***	−0.277***
Age in Years	1.692	2.706	2.428	−1.014***	0.737***	−0.277
Turnover Ratio (%)	15.544	32.458	43.529	−16.910***	27.985***	11.071**
Constituent Turnover Ratio(%)	30.962	79.229	109.170	−48.270***	78.213***	29.946***
Flows (%)	34.706	23.055	42.674	11.650***	7.9682	19.618**
Expense Ratio (basis points)	60.040	28.366	25.245	31.674***	−34.790***	−3.120
Constituent Expense Ratio (basis points)	44.456	78.739	64.793	−34.280***	20.337***	−13.95***
Equity Component (%)	86.335	72.249	73.543	14.087***	−12.790***	1.295
Bond Component (%)	10.626	16.918	22.737	−6.293***	12.112***	5.819**
Volatility of Returns (%)	4.982	4.142	4.586	0.840***	−0.397***	0.443***

$^{+}$ TDFs with *External* and *Mixed* FOF structure came into existence only since 2005 .

* Equity and Bond Components do not add to 100 as a portion of assets are held as cash.

Table VII: **Under-performance of TDFs over BFs**

This table reports the results for the hypothesis that Target-Date Funds (TDFs) under-perform balanced funds (BFs) using quarterly data for the period Jan 2001 - Dec 2008. The dependent variable is fund performance measured using four-factor (annualized monthly alphas estimated over two year periods using Carhart (1997) four-factor model) and six-factor (annualized monthly alphas estimated over two year periods using a six-factor model which includes a bond factor and international equity factor along with Carhart's four-factors) alphas expressed as percentages. The explanatory variable TDF is a dummy variable which takes the value 1 when the fund is a TDF and 0 when the fund is a BF. The control variables include the expense ratio (Expense Ratio) and turnover ratio (Turnover) expressed as percentages, the log of fund age expressed in years (Log Age), log of assets under management expressed in billions of dollars (Log AUM), net flows to the fund for the quarter (Net Flow), the percentage composition allocated to bonds (BOND), and the total assets under management of the fund family (Family AUM) expressed in billions of dollars. The second column provides the expected sign for the explanatory variables. The third and fourth columns contain the results on a net-of-fee basis while the last two columns report them on a gross-of-fee basis. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund family and quarter) are reported below the coefficients in square brackets. Coefficients marked with ***, **, and * are significant at 1%, 5%, and 10% level, respectively.

		Net-of-fee alphas		Gross-of-fee alphas	
Variables	Exp Sign	four-factor	six-factor	four-factor	six-factor
TDF	Negative	-0.473^{***}	-0.475^{***}	-0.862^{***}	-0.855^{***}
		[0.148]	[0.144]	[0.250]	[0.245]
Expense Ratio		-0.095^{**}	-0.038	1.291^{***}	1.345^{***}
		[0.047]	[0.067]	[0.064]	[0.078]
Log Age		0.065^{*}	0.058	0.168^{***}	0.162^{***}
		[0.035]	[0.039]	[0.051]	[0.052]
Log AUM		0.000	-0.013	0.001	-0.014
		[0.012]	[0.017]	[0.015]	[0.020]
Turnover		-0.009	-0.033	-0.048	-0.076^{*}
		[0.030]	[0.035]	[0.037]	[0.041]
Net Flow		-0.173^{*}	-0.091	-0.176	-0.087
		[0.103]	[0.103]	[0.121]	[0.121]
Log Family AUM		-0.005	-0.002	-0.008	-0.006
		[0.011]	[0.015]	[0.014]	[0.018]
BOND		0.010^{***}	0.011^{***}	0.012^{***}	0.014^{***}
		[0.001]	[0.002]	[0.002]	[0.002]
Constant		-1.004^{***}	-1.141^{***}	-1.196^{***}	-1.340^{***}
		[0.168]	[0.186]	[0.192]	[0.203]
# of Observations		11895	11895	11895	11895
Adjusted R^2		0.087	0.049	0.427	0.329

Table VIII: **Under-performance of FOFs over SFs**

This table reports the results for the hypothesis that Target-Date Funds (TDFs) with fund-of-fund (FOF) structure under-perform those with Single fund (SF) structure using quarterly data for the period Jan 2001-Dec 2008. The dependent variable is fund performance measured using four-factor (annualized monthly alphas estimated over two year periods using Carhart (1997) four-factor model) and six-factor (annualized monthly alphas estimated over two year periods using a six-factor model which includes a bond factor and international equity factor along with Carhart's four-factors) alphas expressed as percentages. The explanatory variable FOF (SF) is a dummy variable which takes the value 1 when a TDF has a FOF (SF) structure and 0 otherwise. We use the same set of control variables as in Table VIII. The second column provides the expected sign for the explanatory variables. The third and fourth columns contain the results on a net-of-fee basis while last two columns report them on a gross-of-fee basis. In the case of FOFs, we divide the sum of the equal weighted average of the expense ratios of the constituent funds and the expense ratio of the fund by 12 and add to the monthly returns of the TDF to get the gross-of-fee returns. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund families and quarters) are reported below the coefficients in square brackets. Coefficients marked with ***, **, and * are significant at 1%, 5%, and 10% level, respectively.

		Net-of-fee alphas		Gross-of-fee alphas	
Variables	Exp Sign	four-factor	six-factor	four-factor	six-factor
FOF	Negative	-0.675^{***}	-0.669^{***}	-1.189^{***}	-1.172^{***}
		[0.157]	[0.149]	[0.278]	[0.269]
SF	Not Negative	0.145^{***}	0.121	0.141^{***}	0.116^{*}
		[0.051]	[0.075]	[0.034]	[0.064]
Expense Ratio		-0.114^{**}	−0.056	1.261^{***}	1.316^{***}
		[0.046]	[0.068]	[0.060]	[0.076]
Log Age		0.036	0.031	0.121^{***}	0.116^{**}
		[0.033]	[0.038]	[0.046]	[0.048]
Log AUM		0.002	−0.011	0.004	−0.010
		[0.012]	[0.018]	[0.015]	[0.020]
Turnover		−0.002	−0.027	−0.037	−0.065
		[0.029]	[0.034]	[0.035]	[0.040]
Net Flow		−0.144	−0.063	−0.129	−0.041
		[0.096]	[0.098]	[0.118]	[0.121]
Log Family AUM		−0.005	−0.001	−0.007	−0.005
		[0.011]	[0.016]	[0.014]	[0.018]
BOND		0.009^{***}	0.010^{***}	0.011^{***}	0.013^{***}
		[0.001]	[0.002]	[0.002]	[0.002]
Constant		-0.909^{***}	-1.050^{***}	-1.043^{***}	-1.192^{***}
		[0.169]	[0.192]	[0.181]	[0.199]
FOF - SF	Negative	-0.820^{***}	-0.789^{***}	-1.329^{***}	-1.287^{***}
Observations		11895	11895	11895	11895
Adjusted R^2		0.101	0.056	0.443	0.339

Table IX: **Under-performance of *Internal* FOFs over *External* FOFs**

This table reports the results for the hypothesis that Target-Date Funds with fund-of-fund structure that invest in funds within the family (*Internal* FOFs) under-perform those investing in funds from other families (*External* FOFs) using quarterly data for the period Jan 2005 - Dec 2008. The dependent variable is fund performance measured using four-factor (annualized monthly alphas estimated over two year periods using Carhart (1997) four-factor model) and six-factor (annualized monthly alphas estimated over two year periods using a six-factor model which includes a bond factor and international equity factor along with Carhart's four-factors) alphas expressed as percentages. The explanatory variable Internal (External) is a dummy variable which takes the value 1 when the FOF invests internally (externally) and 0 otherwise. The control variables are as defined in Table VIII. The second column provides the expected sign for the explanatory variables while the third and fourth columns contain the results on a net-of-fee basis and the last two columns report them on a gross-of-fee basis. We divide the sum of the equal weighted average of the expense ratios of the constituent funds and the expense ratio of the fund by 12 and add to the monthly returns to get the gross-of-fee returns. The difference between the coefficients on Internal and External (*Int - Ext*) is also reported, and an F-test for the significance of this difference is performed. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund families and quarters) are reported below the coefficients in square brackets. Coefficients and differences marked with ***, **, and * are significant at 1%, 5%, and 10% level, respectively.

		Net-of-fee alphas		Gross-of-fee alphas	
Variables	Exp Sign	four-factor	six-factor	four-factor	six-factor
Internal	Negative	-0.561^{**}	-0.579^{**}	-1.301^{***}	-1.317^{***}
		[0.259]	[0.281]	[0.320]	[0.338]
External	Not negative	-0.145	-0.033	-0.806^{**}	-0.691^{*}
		[0.328]	[0.310]	[0.369]	[0.359]
Expense Ratio		-0.300	-0.174	0.182	0.306
		[0.270]	[0.312]	[0.276]	[0.324]
Log Age		0.286^{*}	0.255^{*}	0.391^{**}	0.356^{**}
		[0.153]	[0.154]	[0.165]	[0.173]
Log AUM		0.070	0.095	0.062	0.088
		[0.096]	[0.131]	[0.109]	[0.145]
Turnover		-0.002	-0.027	-0.278^{**}	-0.300^{**}
		[0.083]	[0.085]	[0.112]	[0.118]
Net Flow		-0.407^{***}	-0.223	-0.418^{***}	-0.225
		[0.126]	[0.182]	[0.140]	[0.189]
BOND		0.005	0.004	0.007^{*}	0.006^{*}
		[0.003]	[0.003]	[0.003]	[0.003]
Log Family AUM		0.053	0.043	0.008	-0.005
		[0.064]	[0.075]	[0.081]	[0.093]
Constant		-1.238^{*}	-1.268^{*}	-0.227	-0.249
		[0.641]	[0.674]	[0.694]	[0.738]
Int - Ext	Negative	-0.417^{*}	-0.547^{*}	-0.495^{*}	-0.627^{*}
# of Observations		1974	1974	1974	1974
Adjusted R^2		0.249	0.176	0.384	0.317

Table X: **Determinants of Constituents of *Internal* FOFs**

This table reports the results, using quarterly data for the period January 2005 - December 2008, for the probability of a fund becoming the constituent of an *Internal* FOF. In Panel A, the dependent variable $UF_{i,t} = \ln\left(\frac{prob(Fund_{it} \text{ is constituent of an Internal FOF})}{prob(Fund_{it} \text{ is not a constituent of an Internal FOF})}\right)$ and in Panel B, the dependent variable $UF_{i,t} = \ln\left(\frac{prob(Fund_{it} \text{ is constituent of an Internal FOF})}{prob(Fund_{it} \text{ is constituent of an External FOF})}\right)$. The explanatory variables are fund performance ($Perf_{i,t-1}$) measured using four-factor (annualized monthly alphas estimated over prior 24 months using Carhart (1997) four-factor model) and six-factor (annualized monthly alphas estimated over previous 24 months using a six-factor model which includes a bond factor and international equity factor along with Carhart's four-factors) net and gross of fee alphas, Expense Ratio ($ExpenseRatio_{i,t}$), and Net flows ($NetFlow_{i,t}$) expressed as percentages. The control variables are defined in Table VIII We use one-period lagged value of the explanatory and control variables. White standard errors adjusted to account for autocorrelation within clusters ("cluster" variables are fund family and quarter) are reported below the coefficients in square brackets. Coefficients marked with ***, **, and * are significant at 1%, 5%, and 10% level, respectively.

	Panel A				Panel B			
	Net-of-fee alphas		Gross-of-fee alphas		Net-of-fee alphas		Gross-of-fee alphas	
Variables	Four Factor	Six Factor	Four Factor	Six Factor	Four Factor	Six Factor	Four Factor	Six Factor
$Perf_{I,t-1}$	−0.050***	−0.046***	−0.043***	−0.039***	−0.100***	−0.068***	−0.092***	−0.063***
	[0.011]	[0.009]	[0.009]	[0.008]	[0.020]	[0.020]	[0.015]	[0.012]
$ExpRatio_{I,t-1}$	0.679*	0.686*	1.278***	1.228***	3.770***	3.833***	4.770***	4.532***
	[0.364]	[0.366]	[0.397]	[0.408]	[0.427]	[0.435]	[0.332]	[0.519]
$NetFlow_{I,t-1}$	−0.769**	−0.720*	−0.709**	−0.666	0.132	0.130	0.278	0.228
	[0.337]	[0.415]	[0.341]	[0.419]	[0.556]	[0.527]	[0.561]	[0.556]
$LogAge_{I,t-1}$	0.722***	0.724***	0.743***	0.742***	0.773***	0.683***	0.855***	0.719***
	[0.134]	[0.130]	[0.135]	[0.132]	[0.132]	[0.187]	[0.106]	[0.192]
$LogAUM_{I,t-1}$	−0.980***	−0.987***	−0.992***	−0.996***	−0.100	−0.111	−0.087	−0.098
	[0.156]	[0.153]	[0.159]	[0.155]	[0.161]	[0.154]	[0.165]	[0.162]
$Turnover_{I,t-1}$	−0.055	−0.044	−0.075	−0.064	0.292	0.266	0.275	0.250
	[0.315]	[0.320]	[0.303]	[0.308]	[0.223]	[0.229]	[0.215]	[0.222]
$Bond_{I,t-1}$	0.022***	0.023***	0.022***	0.023***	0.020***	0.017***	0.020***	0.017***
	[0.008]	[0.009]	[0.008]	[0.009]	[0.007]	[0.005]	[0.006]	[0.005]
$LogFamAUM_{I,t-1}$	0.025	0.048	0.030	0.053	0.050	0.046	0.016	0.028
	[0.113]	[0.115]	[0.112]	[0.113]	[0.089]	[0.079]	[0.104]	[0.089]
Constant	2.674***	2.454***	2.590***	2.378***	−5.222***	−4.755***	−5.091***	−4.643***
	[0.896]	[0.904]	[0.873]	[0.876]	[1.434]	[1.478]	[1.391]	[1.443]
# of Observations	26812	26812	26812	26812	169	169	169	169

Table XI: **Tests for Robustness**

This table presents the robustness of our results for various alternate specifications. For ease of comparison, we report only the coefficients of the extent of under-performance for all cases. The baseline refers to specification where alphas are estimated over twenty-four months. Coefficients and differences marked with ***, **, and * are significant at 1%, 5%, and 10% level, respectively.

Specifications	TDF -BF	Adj R^2	FOF -SF	Adj R^2	Int -Ext	Adj R^2
Baseline: Alphas estimated using twenty-four months.						
Net-of-fee four-factor	-0.473^{***}	0.087	-0.820^{***}	0.101	-0.417^{*}	0.249
Net-of-fee six-factor	-0.475^{***}	0.049	-0.789^{***}	0.056	-0.547^{*}	0.176
Gross-of-fee four-factor	-0.862^{***}	0.427	-1.329^{***}	0.443	-0.495^{*}	0.384
Gross-of-fee six-factor	-0.855^{***}	0.329	-1.287^{***}	0.339	-0.627^{*}	0.317
# of observations	11895		11895		1974	
Alternate 1: TDFs are compared to BFs offered by the same family.						
Net-of-fee four-factor	-0.189^{*}	0.076	-0.551^{***}	0.092	-0.499^{**}	0.236
Net-of-fee six-factor	-0.159^{*}	0.030	-0.407^{***}	0.034	-0.812^{**}	0.131
Gross-of-fee four-factor	-0.201^{*}	0.419	-0.606^{***}	0.428	-0.522^{**}	0.380
Gross-of-fee six-factor	-0.166	0.282	-0.456^{***}	0.285	-0.831^{**}	0.305
# of observations	4402		4402		1348	
Alternate 2: Using share class with minimum fees						
Net of Fee four-factor	-0.239^{**}	0.048	-0.582^{***}	0.055	-0.510^{**}	0.239
Net of Fee six-factor	-0.196^{**}	0.026	-0.485^{***}	0.029	-0.822^{**}	0.135
Gross of Fee four-factor	-0.232^{**}	0.400	-0.596^{***}	0.404	-0.532^{**}	0.385
Gross of Fee six-factor	-0.178^{*}	0.296	-0.484^{***}	0.298	-0.839^{**}	0.309
# of observations	11537		11537		1350	
Alternate 3: Controlling for years to maturity and for time trends.						
Net of Fee four-factor					-0.543^{***}	0.332
Net of Fee six-factor					-0.679^{***}	0.252
Gross of Fee four-factor					-0.635^{***}	0.455
Gross of Fee six-factor					-0.774^{**}	0.386
# of observations					1974	
Alternate 4: Control for asset classes.						
Net of Fee four-factor					-0.387^{***}	0.240
Net of Fee six-factor					-0.457^{***}	0.210
Gross of Fee four-factor					-0.398^{***}	0.220
Gross of Fee six-factor					-0.467^{***}	0.190
# of observations					263	

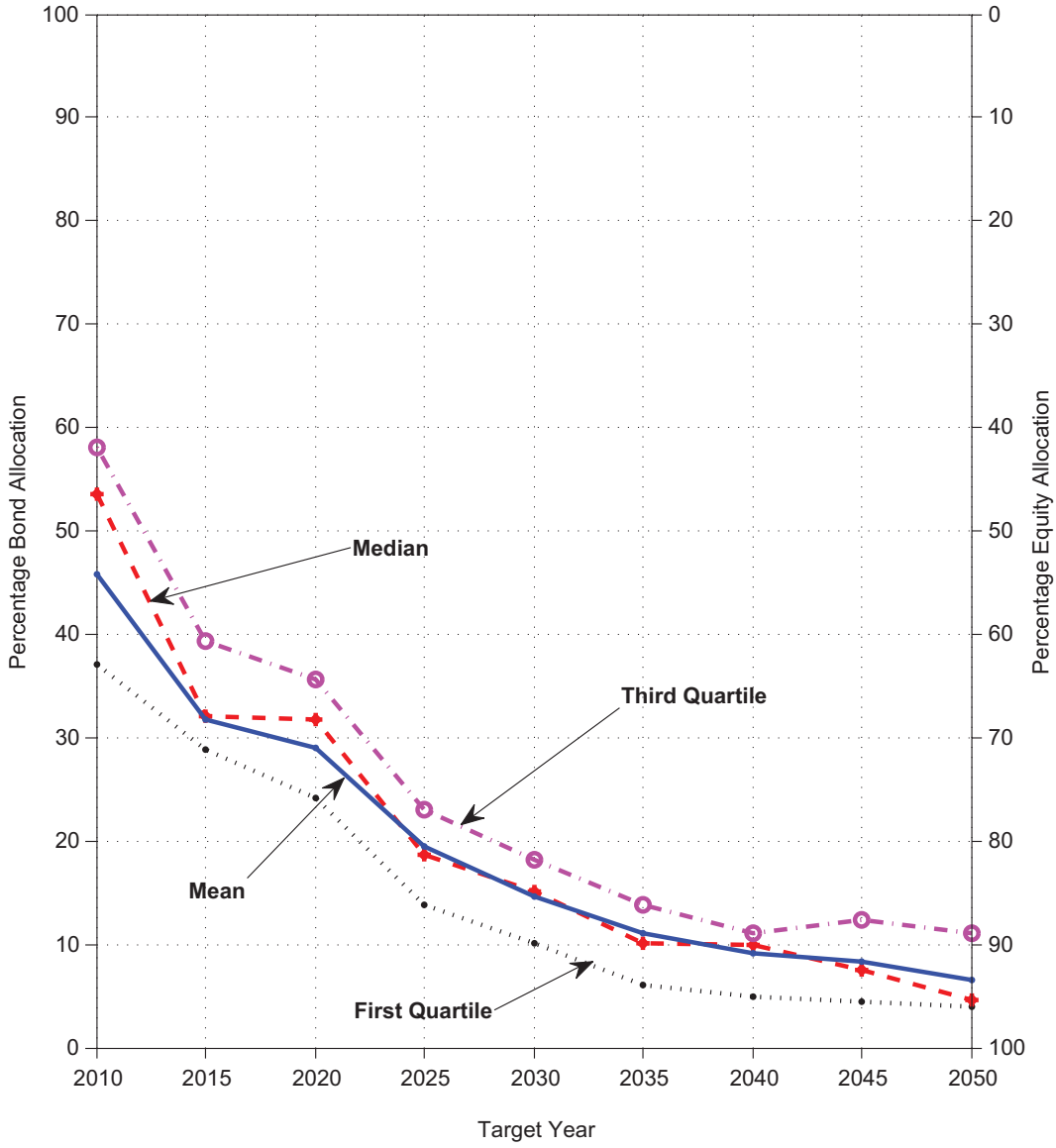

Figure 1: **Variation in Bond/Equity allocation in TDFs**
In this graph, we present the diversity in the percentage of assets allocated to bonds/equities across TDFs with different target years as of December 2008. The solid line represents the average percentage of assets invested in bonds/equities while the dashed line with pluses represents the median percentage. The dotted line and the dash-dot line with circles represent the first and third quartiles of assets invested in bonds/equities respectively.

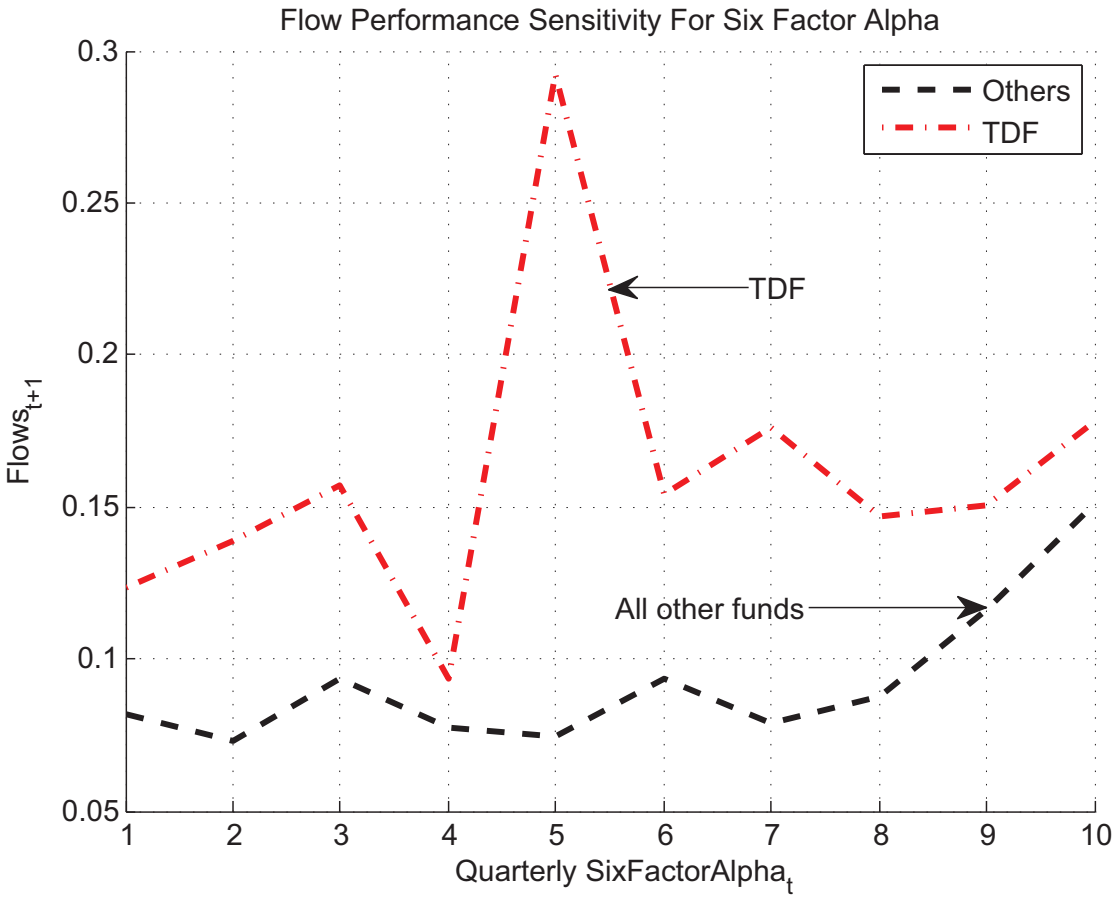

Figure 2: **Flow-Performance Sensitivity of Target-Date Funds using six-factor Alphas**

Presented above is the graph representing the flow-performance relation for Target-Date Funds (TDFs) and balanced funds (BFs) over the period January 2003 to December 2008. On the X axis, we have performance deciles based on net-of-fee six-factor alphas (estimated using net-of-fee returns for prior 24 months) and on the Y axis, we have the net flows for the subsequent period defined as in Table III. Performance decile 1 consists of funds with the worst performance while performance decile 10 consists of funds with the best performance. The dash-dot line represents the flows for TDFs, while the dashed line represents the flows for BFs.