JOIM
www.joim.com

Journal Of Investment Management, Vol. 15, No. 4, (2017), pp. 4–19
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THE IMPACT OF COSTS ON RECENT TARGET DATE FUND PERFORMANCE

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Target date funds (TDFs) are rapidly becoming a common means to prepare for retirement. Given the swelling demand for these funds, this research is a timely look at TDFs' most recent decade. As of March 2016, 518 TDFs have been in existence for over ten years, providing a good sample period by which to assess their performance. Analysis of the entire universe of TDFs with ten years of data reveals that a significant factor in differentiating between better and worse TDF investment performance is their expenses and loads. Among the TDFs with the lowest 25% of expenses, we find significantly better returns without an appreciable impact on standard deviation of returns or beta. Selecting TDFs without loads increases both returns and risk measures. Risk-adjusted returns using standard deviation, negative return variance, or beta all demonstrate the value of avoiding high expenses and load/commission fees.

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Target date funds (TDFs) are designed to help investors with asset allocation as they move towards a pre-determined retirement date. Also known as "age-based funds" and "life-cycle funds," fund managers of these investment vehicles adjust their asset mixes to become more conservative as their investors approach retirement age. TDFs are rapidly becoming a common means to prepare for retirement. Morningstar reports that TDF investment soared sevenfold from 51 billion in 2005 to $378 billion in 2011 (Morningstar, 2012). This growth and the marketing of funds as a simple way to prepare for financial security after

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one's working years elicited an uncommon warning by the SEC that the stock, bond, and even cash component of TDFs do not provide guaranteed returns (SEC, 2012). Nonetheless, by the end of 2014, TDF investment had reached the $650 billion mark (Carolozo, 2014). By 2015, TDFs had reached $763 billion (ICI, 2016, p. 162), a compound growth rate of 31.1% over the decade! According to financial experts, there are no signs of a slowdown in the demand for these funds, especially among 401(k) plan participants. A front-page article in Barron's anticipates that the TDFs could amass $2 trillion dollars by 2018 (Bery, 2014). The investment advisory firm Casey Quirk expects 48% of defined contribution investment by 2020 to be in TDFs (Morningstar, 2012). While this research focuses on 401(k) plans, the results are generalizable to 403(b) plans which primarily differ in terms of the section of the IRS tax code which permits their creation (CNN Money, 2016).

Target date funds provide periodic portfolio changes that hopefully will benefit their investors and help them achieve their retirement goals. The funds are typically aggressive at first, when they rely on equity to provide a higher rate of return. At this point there is less money invested and there is time to recover from any serious market correction. There is an increase in the allocation to debt-oriented securities as the planned retirement date draws near, making the portfolio more conservative. The logic of this approach is to initially seek higher returns through a more risky portfolio in the early years and to transition to a less risky portfolio as the emphasis shifts from performance to asset protection.

Given the swelling demand for these funds, this research is a timely look at TDFs' most recent decade. As of March 2016, 518 TDFs have been in existence for over ten years, providing a good sample period by which to assess their performance. The return and risk measures are all net of expenses and loads. This study aims to examine the extent to which costs (expenses and loads) affect return, risk, and risk-adjusted return measures. We demonstrate that common sense practices like avoiding TDFs with high expenses and loads can greatly assist investors to find better performing retirement investments.

1 Literature review

The three components present in all target date funds are a risky asset pool, a protective asset pool, and a scheduled shift from a greater reliance on the risky asset pool to a greater reliance on the protective asset pool over time which is called a "glide path". TDFs display a spectrum of possible allocations of stocks and bonds. Investors are not required to select a fund that is consistent with when they anticipate reaching full retirement age. They may choose a later TDF category if they prefer a higher risk/return allocation with a greater reliance on stocks. If the investor is more risk averse, he/she may want to select an earlier TDF category to emphasize asset protection at an earlier date. The risky asset pool is ideally a well-diversified portfolio composed of a wide variety of higher risk (i.e., equity) assets. Such a portfolio supposedly provides the best returns for the least amount of risk according to Modern Portfolio Theory. The protective asset pool focuses on both preservation of principal and purchasing power. Appropriate assets for the more conservative protective asset pool include investments like Treasury Inflation-Protected bonds (TIPs), variable rate bonds, and Treasury bills (Surz and Israelsen, 2007/2008).

Glide paths generally seek to achieve high returns in the early years when retirement is many years in the future and at some point begin to adjust the portfolio into a more protective allocation. Two key decisions that need to be made are when to begin the transformation and how quickly the transformation should happen. Surz and Israelsen

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(2007/2008) suggest using their "risk-of-loss" rule as a guide, wherein the portfolio changes should begin about 20 years before the target date. Prior to this point, portfolios should rely very heavily on the risky asset pool in hopes of achieving high returns on their investment. The "risk-of-loss rule" date is the date after which staying with the more aggressive initial portfolio might cause the investor to have a portfolio value at retirement that is less than what he/she might have achieved at the retirement target date if he/she had invested in a riskless portfolio from the beginning.

As an example of the use of a glide path, Spitzer and Singh (2011) contrast the Vanguard Target Retirement Fund 2045 and the Vanguard Target Retirement Income Fund portfolios. The Retirement Income Fund is for people already in retirement. They find that the TDF maturing in 2045 had a 90% equity and 10% fixed income and cash allocation, while the income fund had a 30% equity and 70% fixed income and cash allocation. The term "glide" is used to denote that instead of abrupt revisions, there tends to be a steady movement of about 2% of the allocation (i.e., $(90\% - 30\%) \div (2045 - 2010)$) from equity to bonds as retirement approaches. The glide path figure presented in the article for the T. Rowe Price target date funds begins the transformation from being 90% equity at 25 years before retirement and is approximately 50% equity at retirement. Then the proportion of equity linearly declines until 30 years after retirement where it stabilizes at about 20% equity.

Target date funds are marketed for their management ease and their perceived safety in the long run, including after retirement for some TDFs. Those who elect target date funds in retirement believe that decreasing equity exposure in retirement provides more income certainty over time. Spitzer and Singh (2008) use a bootstrap simulation to study the shortfall (longevity) risk of target date funds. Contrary to the perceived advantage of the TDF investment, Spitzer and Singh find that after retirement a fixed-allocation of 50/50 outperformed both other fixed proportions of debt/equity and variable "glide" methods employed by target date funds. In subsequent research, Spitzer and Singh (2011) look at the effectiveness of target date funds during the accumulation phase. They report that target date funds during the accumulation phase are also inferior to investing in fixed proportion portfolios with at least 80% stock.

Kacperczyk *et al.* (2008) find that after fees, fund performance is indistinguishable from market indexes. This finding suggests that fund gross returns beat market averages. On the other hand, Guercio and Reuter (2014) find that active management (which is burdened with greater expenses) generally does not underperform index funds (which typically have lower fees). The implication of this finding is that active managers can earn sufficient returns to offset the higher fees. In fact, Berk and van Binsbergen (2015) show that investors are willing to pay to have successful managers direct the investment of their funds. In support of the value of active managers and the notion that the Efficient Markets Hypothesis (EMH) is not true, Warren Buffet was quoted by Davis (1990) saying "I think it's fascinating how the ruling orthodoxy can cause a lot of people to think the earth is flat. Investing in a market where people believe in efficiency is like playing bridge with someone who's been told it doesn't do any good to look at the cards."

One means to compare fund performance is through the Morningstar star system. A study initially published by Morningstar (Kinnel, 2010) and expounded on by the *Wall Street Journal* (Kim, 2010) concludes that picking mutual funds on the basis of expenses is more likely to achieve superior investment performance when compared to investments based on the highly-regarded

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Morningstar stars system. Like Kinnel, in this study we divide expense ratios into quartiles but we expand upon his research by including loads in our analysis of TDFs. In 2016, Morningstar published an article by its research director, Russel Kinnel, asserting that fund fees were a good means to predict fund success and failure over the 2010–2015 period. Kinnel's (2016) findings are based on domestic and foreign stock funds, taxable and tax-exempt bond funds, and balanced funds. Although one might assume that consistent findings would be found for TDFs, Kinnel does not address this type of mutual fund. Our sample period is also twice as long as the one used by Kinnel.

Although the mutual fund literature is replete with studies on expense ratios, there has been relatively little focusing on loads themselves. Part of this may be due to the comprehensive analysis done by researchers such as Morey (2003), who finds that performance of no-load funds is statistically better than load funds at the 1% level. Interestingly, Morey finds little post-load expense difference in firms with high and low load charges. Huesler *et al.* (2014) show that investor perception of manager skills plays a significant role in the load-setting behavior. In fact, they document that many mutual funds increased loads during the bullish 2003 to 2007 period. The net impact was a need to outperform the S&P 500 index by 1.5% to justify the revised load fee. While the avoidance of load charges seems to be logical from a monetary sense, Khorana and Servaes (2012) uncover non-financial advantages to paying loads. They report a positive relationship between fund family load fees and market share, resulting in a wider range of products and greater liquidity.

In summary, a number of factors impact the investment performance of TDFs. This research will explore the role that expenses and loads play in achieving the goals of investors in TDFs.

2 Data and research methods

2.1 Data and sampling

2.1.1 Data

Data was collected using Morningstar's Advisor Workstation 2.0 for a ten-year period ending on March 31, 2016. TDFs are managed for investors planning to retire, or to begin withdrawing substantial portions of their investments, in a particular year. There are three types of TDFs. Target Date ("post") Retirement TDFs are designed for those already in retirement. They seek current income with modest price appreciation. The allocation of the Vanguard Target Retirement Income Fund is 30% equities and 70% bonds, which is the allocation targeted by all Vanguard TDFs within seven years of reaching their target retirement date (Vanguard, 2016a). At BlackRock's LifePath Index Retirement Fund, the allocation is 40% stock and 60% bonds (BlackRock, 2016). As shown in the first row of Table 1, as of March 31, 2016, there are 189 Target Date Retirement TDFs, 78 of which are in existence for ten years, and 40 funds of 78 are no-load TDFs. These 78 Target Date Retirement TDFs represent 15% of the empirical sample of 518 TDFs.

The second type of TDFs are those which have already met their target retirement date. Two sets of TDFs fit into this category. One set is those TDFs which had a target date in the prior decade (e.g., 2000–2010), while another set had target dates in the 2011–2015 timeframe. The former has the lowest frequency, with only 139 being 2000–2010 TDFs and 40% of these funds have ten years of data. We find 45 more TDFs in the 2011–2015 period despite being only five years long. The primary reason for the low number of 2000–2010 funds is that these TDFs often merge into the Target Date Retirement fund category after a fixed period of time. For instance, Vanguard's 2010 fund will merge into Vanguard's Retirement Income Fund in 2017 (Vanguard, 2016b).

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Table 1 Numbers[a] of target date funds (TDFs) as of March 31, 2016.

Morningstar category	All TDFs	With ten-year data	No-load
Target Date Retirement	189	78	40
Target Date 2000–2010	139	56	36
Target Date 2011–2015	184	17	12
Target Date 2016–2020	262	85	49
Target Date 2021–2025	233	35	19
Target Date 2026–2030	262	85	49
Target Date 2031–2035	233	35	19
Target Date 2036–2040	262	85	49
Target Date 2041–2045	233	22	10
Target Date 2046–2050	251	20	10
Total	2,248	518	293

[a]There were another 380 Target Date 2051+ TDFs, which are not part of the analysis because they are shorter than ten years in existence.

The third type of TDF is those funds which have not reached their retirement date. Given that our study is based on data available in March 2016, most of the 2016 TDFs had not yet reached their retirement date. There are over 200 TDFs available in each subsequent five-year period. TDFs with maturities over 45 years in the future, the Target Date 2051+ funds, have a plurality of observations. However, none of these 380 funds had ten years of data as of March 31, 2016. Hence, this group is effectively excluded from future consideration.

In total, as of March 31, 2016, there were 2,628 TDFs. For investors retiring between 2016 and 2050, there are about 50 TDFs available each year (i.e., $(2{,}628 - 189 - 139 - 184 - 380)/35$). However, most TDFs have a target date set at one of the five-year intervals. Of the 2,248 TDFs reaching their target date by 2050, 518 TDFs (or 23.0% of the total) have been in existence for ten years. Of the 518 TDFs in existence for over ten years, over half (i.e., 56.6%) are no-load funds. By using a ten-year investment horizon, we are able to include a variety of market conditions.

2.1.2 Analytical models

In order to pair up funds properly, we use the Morningstar category classification. Given its widespread use by financial advisors and investors, we rely on Morningstar for the proper categorization of funds. Funds in each Morningstar category are used only if there is at least one fund in each category. This requirement eliminates the Target Date 2046–2050 category from further consideration. Performance of multiple funds within a single remaining category is averaged, which results in one observation per Morningstar category.

Standard investment risk and performance measures include annual average return, total risk-based measures (standard deviation, Sharpe ratio, and Sortino ratio), and market risk-based measures (beta, Treynor ratio, and Alpha). All fund-level risk and return measures were collected using Morningstar's Advisor Workstation 2.0. The statistical testing method applied in our analysis is a paired t-test for difference in investment performance metrics between one group of TDFs (for example lower expense ratio or no-load) and another group of TDFs (for example higher expense ratio and load) in the same category. With the noise from random variation in averages within categories eliminated, the paired t-test can better detect differences in averages between fund groups and is more powerful than an otherwise similar unpaired t-test. The null hypothesis in all

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tests is an equality of means, with the alternative hypothesis being an inequality of means. Standard pairwise *t*-test statistics are computed using Excel and are used to assess the statistical significance of the differences in these means.

2.2 TDF management fees

2.2.1 Expense ratios

Fund managers charge fees for the management of mutual funds. The expense ratio is the annual fee that funds charge their shareholders. It expresses the percentage of assets deducted each fiscal year for fund expenses, including 12b-1 fees, management fees, administrative fees, operating costs, and all other asset-based costs incurred by the fund. Portfolio transaction fees, or brokerage costs, as well as initial or deferred sales charges (a.k.a. load) are not included in the expense ratio.

This study uses prospectus disclosed net expense ratios as the measure of expense ratio so that we can compare a consistent value across the different investment types. This value is the percentage of fund assets paid for operating expenses and fund management. The expense ratio typically includes the following types of fees: accounting, administrator, advisor, auditor, board of directors, custodial, distribution (12b-1), legal, organizational, professional, registration, shareholder reporting, sub-advisor, and transfer agency fees. The expense ratio does not reflect the fund's brokerage costs or any transaction costs at the investor level. In contrast to the gross expense ratio, the net expense ratio reflects fee waivers in effect during the time period. Beyond the temporary reductions employed by new funds to attract customers, Blackman (2014) notes that waivers are popular mechanisms used during economic downturns to offset client losses and end as soon as the market rebounds. The returns and adjusted-return measures in this paper are post-expense and pre-load values. Their values have adjusted for expense ratios but have not been adjusted for loads.

Average TDF expense ratios, within Morningstar categories, range from 0.83% to 1.02%, as shown in the second column of Panel A in Table 2. TDFs which have been retired or past their retirement date have average expense ratios of 0.86%, while TDFs reaching their retirement date in 2036 or sometime afterwards have an average expense ratio of 1.00%. Across all TDFs, the average expense ratio is 0.94%.

Median expense ratios, which are displayed in the third column of Table 2, are always equal to or lower than the average, indicating that there is a greater propensity for expense ratios to be below the mean than above it. However, across all Morningstar categories, the difference between the average and median is less than 0.02%. Minimum expense ratios in each category are always 0.10%, as shown in the fourth column of Table 2.

By comparison, maximum expense ratios have the widest range in values across Morningstar categories, as shown in the fifth column of Table 2. The average maximum expense ratio across all TDFs is 1.87%. However, maximum values range from 1.60% for funds that reached their retirement date in the 2000–2010 period to 2.10% for those that first reach their retirement date in the 2046–2050 period, which have the longest term to maturity.

In this study, TDFs are grouped by expense ratios in two manners. First, we will present return, risk, and risk-adjusted return for TDFs in the top half and bottom half of the expense ratio continuum, which is a classification system that is frequently used in investments research (i.e., Kahn and Rudd, 1995; Krueger and Wrolstad, 2016). The second grouping is done by quartiles, which is a technique commonly used by researchers including Bogle (1998), founder of the Vanguard

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Table 2 Expense ratio and load of target date funds in existence for ten years.

Morningstar category	Average (%)	Median (%)	Minimum (%)	Maximum (%)
Panel A. Expense ratio for all TDFs				
Target Date Retirement	0.89	0.84	0.10	1.82
Target Date 2000–2010	0.83	0.81	0.10	1.60
Target Date 2011–2015	0.87	0.86	0.10	1.72
Target Date 2016–2020	0.93	0.91	0.10	1.85
Target Date 2021–2025	0.92	0.92	0.10	1.87
Target Date 2026–2030	0.97	0.96	0.10	1.91
Target Date 2031–2035	0.95	0.94	0.10	1.93
Target Date 2036–2040	1.00	0.98	0.10	1.99
Target Date 2041–2045	0.97	0.95	0.10	1.95
Target Date 2046–2050	1.02	1.00	0.10	2.10
Average	0.94	0.92	0.10	1.87

	Average (%)		Median (%)		Minimum (%)		Maximum (%)	
	Front (%)	Deferred (%)	Front (%)	Deferred (%)	Front (%)	Deferred (%)	Front (%)	Deferred (%)
Panel B. Load for all load TDFs								
Target Date Retirement	4.94	2.25	5.50	1.00	3.00	1.00	5.75	5.00
Target Date 2000–2010	5.10	2.60	5.63	1.00	3.50	1.00	5.75	5.00
Target Date 2011–2015	5.33	2.10	5.75	1.00	3.50	1.00	5.75	5.00
Target Date 2016–2020	5.17	2.32	5.50	1.00	3.00	1.00	5.75	5.00
Target Date 2021–2025	5.31	2.07	5.75	1.00	3.50	1.00	5.75	5.00
Target Date 2026–2030	5.17	2.32	5.50	1.00	3.00	1.00	5.75	5.00
Target Date 2031–2035	5.31	2.07	5.75	1.00	3.50	1.00	5.75	5.00
Target Date 2036–2040	5.17	2.32	5.50	1.00	3.00	1.00	5.75	5.00
Target Date 2041–2045	5.31	2.07	5.75	1.00	3.50	1.00	5.75	5.00
Target Date 2046–2050	5.24	2.00	5.50	1.00	3.50	1.00	5.75	5.00
Average	5.21	2.21	5.61	1.00	3.30	1.00	5.75	5.00

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Group as well as blogs regarding mutual fund selection (i.e., Piper, 2017, which discusses both the 50/50 expense and top 25/bottom 25 expense categories).

2.2.2 Load charges

Load denotes either a fund's maximum initial or deferred sales charge. For initial, or front-end loads, this figure is expressed as a percentage of the initial investment and is assessed upon the purchase of fund shares. For deferred sales charges (also known as back-end loads or contingent deferred sales charges), the amount charged is based on the lesser of the initial or final value of the shares sold.

No-load funds in this research include load-waived funds, which currently are typically offered in 401(k) plans where loaded funds are not an option (Thune, 2017). These funds may charge a higher 12b-1 fee. Such information is not clearly shown and likely beyond the grasp of many investors, especially smaller ones without sufficient resources to command a fee waiver (Morgenson, 2008). As with Navone and Nacera's (2016) study of hidden distribution charges, we acknowledge that duration of investment and subsequent charges may impact the true size of the load. Our research is limited to Morningstar's classification of funds by load charges as well as the percentage itself.

One of the most important contributions of this research to the TDF literature is the comparison of front-end and deferred load charges, which is exhibited in Panel B of Table 2. We find that front-end loads are over twice as large as deferred loads, with the former averaging 5.21% and the latter averaging 2.21%. The difference across Morningstar TDF categories is not nearly as large, ranging from 4.94% to 5.33% for front-end loads and 2.00% to 2.60% for deferred loads. Front-end loads of TDFs which have already reached their retirement age and those which reach retirement after 2035 have similar front-end loads. On average, TDFs already in retirement have a front-end load that is 0.12% lower. By comparison, TDFs that are in retirement have an average deferred load that is 0.19% higher than the after-2035 TDFs.

Median load charges, which are shown in the second set of columns in Table 2's Panel B, also show an interesting, diverse pattern. Specifically, the median of front-end loads is 0.40% higher than the average, with the largest difference being in the top, Target Date Retirement category. By comparison, the median deferred load charge across all Morningstar categories is 1.0%, or half the average deferred load charge.

Minimum load charges are very consistent within each type of load charge, as exhibited in the third set of columns in Table 2's Panel B. Minimum front-end loads are either 3.00% or 3.50%, while minimum deferred loads are always 1.0%. Given that the median and minimum of the deferred load charges are the same, we can surmise that a plurality of deferred loads is 1.00%.

Maximum load charges, within Morningstar TDF categories, are also very consistent within the load type. Maximum front-end loads are always 5.75%, while maximum deferred loads are always 0.75% lower at 5.00%. The similarity of these fees may come as a surprise, in light of the fact that the Securities and Exchange Commission does not impose a limit on mutual fund fees. Instead, the limitations arise from restrictions set by the Financial Industry Regulatory Authority (FINRA), which sets maximum loads to 8.5% (SEC, 2017). FINRA rules allow a fund to call itself a "no-load" fund if annual 12b-1 fees do not exceed 0.25%. Back in 1988, American Funds which had been charging the highest load fees succumbed to market pressure and cut its fee to the competitive maximum being charged by other

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funds of 5.75% (Schiffres and Goldwasser, 1988) and then to be even more competitive to a no-load structure (Biller, 2016).

Presumably, TDF investors would be indifferent between a low-load/expense fund offering a lower level of investment performance and a higher load/expense fund that offered superior performance to offset the additional expenses. This research seeks to examine whether the higher expenses/loads funds do in fact offer investors higher returns to justify the higher expenses.

3 Research findings

3.1 Trailing return and total risk

3.1.1 Expense ratios

Theoretically, investors would only pay expense charges up to the point where their return was sufficient to compensate them for the additional expenses. Up to this point, additional return would exceed additional expenses, resulting in positive marginal income. Following a parallel line of reasoning, one might also predict that funds with load charges would do better.

In order to provide more insight to the reader, TDFs are first split into two groups on the basis of expense ratios. In the 50/50 split columns presented in Table 3, the trailing returns and standard deviation of the half of TDFs with lower expense ratios are presented first. TDFs are next split into quartiles, with the trailing return and standard deviation presented first for the TDFs with the lowest quartile of expense charges. For ease of reading the preferred value (i.e., higher return or lower risk) is exhibited in bold print in this and subsequent tables.

As shown in the 50/50 split columns of Table 3, higher returns are not earned by TDFs with higher expense ratios. In fact, the funds with lower expense ratios earned 0.75% (i.e., 4.69% − 3.94%) more, which was significantly higher at the 0.01 level. Although 75 basis points may seem small, that difference when compounded over the ten-year sample period, would amount to a 7.8 (i.e., $1.0075^{10} - 1$) percent higher terminal value. While a $1,000 investment by those paying high expense ratios would amount to $1,472, those incurring a lower expense ratio would have a terminal value of $1,581. The difference in standard deviation is not significant, indicating that lower risk cannot be used to explain the lower return on the 50% of funds with higher expense ratios. TDFs with higher expense ratio have more risk.

Table 3 Measures of trailing return and total risk (4/2006–3/2016).

Measure	Expense charges				Load charges	
	50/50 Split of TDFs		Quartile Split of TDFs		No-load	Load
	Lower expense ratio	Higher expense ratio	Lowest quartile of expense charges	Highest quartile of expense charges		
Trailing Return	**4.69%**	3.94%	**4.85%**	3.50%	**4.36%**	3.63%
	0.000**		0.000**		0.000**	
Standard Deviation	12.20%	12.37%	11.51%	11.93%	12.40%	**12.11%**
	0.101		0.081		0.001**	

Preferred values are displayed in **bold** lettering in those instances where statistical significance exists.
** and *: Significant at 1% and 5% levels of significance, respectively.

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Going back to the initial premise that higher expenses would be justified when funds earn a higher return, we took a look at the funds with the highest expense ratios. Returns and risk for TDFs with the highest 25% of expense ratios are contrasted with funds with the lowest 25% of expense ratios in the Quartile Split columns exhibited in Table 3. The annual return of funds with the lowest 25% of expense ratios is 1.35% (i.e., 4.85% − 3.50%) higher than the returns of TDFs with the highest 25% expense ratios. The 4.85% is also higher than the return of the portfolio consisting of the 50% of TDFs with lower expense ratios. The 1.35% difference, would compound to a 14.4% (i.e., $1.0135^{10} - 1$) difference in terminal values over ten years. In monetary terms, for every $1,411 earned by retirees paying the top 25% of expense ratios, those paying the lowest 25% of expense ratios would have $1,606. Differences in risk cannot justify the higher expense ratios. In fact, the quartile of TDFs with the highest expense ratios again had a higher, though not statistically different, level of risk.

3.1.2 Load charges

The same underlying assertion that TDFs charging higher load fees should also be earning a higher rate of return seems logical. The underlying assumption is that insightful investing by load funds would lead to investments earning returns sufficiently high to more than justify load fees. Otherwise, investors would avoid TDFs carrying loads. There are a sufficient number of TDFs available to allow investors to easily find an alternative fund with a better net return/risk ratio. In short, TDFs charging load fees would be expected to claim that their higher returns justify this charge. Looking at the Load Charges columns on the right side of Table 3, we see that this expectation does not materialize. No-load TDFs earned 0.73% (i.e., 4.36% − 3.63%) more. Continuing with the monetary illustration from above assuming a $1,000 investment in 2006, an investor would have a terminal value of $1,532 in 2016 if invested in a no-load TDF and only $1,428 if the money were invested in a load fund. Looking at the second row of data, we see that no-load funds also had a significantly higher level of return variation. Hence, it will be necessary to consider risk-adjusted returns to determine whether no-load TDFs or load TDFs provided investors better performance.

3.2 Total risk-adjusted return

Statistical analyses were conducted using two measures of return relative to return volatility. Findings are exhibited in Table 4 for the Sharpe and Sortino ratios. The Sharpe ratio considers return in excess of the risk-free rate relative to excess return standard deviation. Positive Sharpe ratios indicate that TDF returns exceeded the risk-free rate. The Sortino ratio divides return in excess of the risk-free rate by the downside portion of total risk, and hence is typically higher than the Sharpe ratio. If returns are not normally distributed, there can be a different ranking of investments based on the Sharpe and Sortino ratios.

As shown in Table 4's first set of rows, TDFs with low expenses have higher Sharpe ratios. The difference is the greatest when comparing the lowest quartile of expense charges with the highest quartile, while the difference is least when comparing load with no-load funds. In each of the three comparisons, Sharpe ratio differences are consistently significant at the 0.01 level.

As shown in Table 4's second set of rows, TDFs with low expenses have higher Sortino ratios. The difference is again the greatest when comparing the lowest quartile of expense charges with the highest quartile, while the difference is least when comparing load with no-load funds. Sortino ratio differences are consistently significant at the 0.01

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Table 4 Measures of total risk-adjusted return (4/2006–3/2016).

Measure	Expense charges				Load charges	
	50/50 Split of TDFs		Quartile Split of TDFs		No-load	Load
	Lower expense ratio	Higher expense ratio	Lowest quartile of expense charges	Highest quartile of expense charges		
Sharpe Ratio	**0.37**	0.30	**0.41**	0.27	**0.34**	0.29
	0.000**		0.001**		0.000**	
Sortino Ratio	**0.52**	0.42	**0.59**	0.37	**0.48**	0.39
	0.000*		0.001**		0.000**	

Preferred values are displayed in **bold** lettering in those instances where statistical significance exists.
** and *: Significant at 1% and 5% levels of significance, respectively.

level. The highly significant findings reported in Table 4 imply a consistent dominance of the TDFs with lower fees.

3.3 Morningstar return, risk, and ratings

Morningstar provides an objective means to compare mutual fund performance. The Morningstar "star" rating system is officially used for the analysis of risk-adjusted returns. Mutual fund returns and risk and risk-adjusted returns net of expenses are measured in comparison to similar funds. In each Morningstar category, the top 10% of funds in terms of return and risk-adjusted return receive a rating of "5" and the bottom 10% receive a rating of "1." The next 22.5% of funds with above average (or a below average) performance on these measures receive a rating of "4" (or "2"), respectively. This assignment leaves the middle 35% of funds, which earn the median level of performance and a rating of "3." Risk is measured in terms of variation around the mean return. Lower ratings represent less risk and would be preferable to a risk-averse investor. That is, while a rating of 5 on return or five stars on risk-adjusted returns is preferable, a low rating of 1 on the Morningstar risk metric is considered better by risk-averse investors. For more information, the reader is urged to review the Morningstar website. Through its rating system, Morningstar relieves investors of the need to do the analysis necessary to contrast returns of the various possible investments. It should be noted that we are not attempting to use the Morningstar rating as a means to forecast future returns, which some researchers find possible (see, for example, Khorana and Nelling, 1998; Bolster *et al.*, 2016), while others find impossible (see for instance, Blake and Morey, 2000; Gerrans, 2006).

Morningstar's rating of TDFs is highly correlated with expense ratios and loads, as shown in Table 5. In the top panel, which reports Morningstar's perception of fund returns, TDFs with lower expense ratios earn an average of 3.31 points, which is slightly above the average value of 3.0. In contrast, TDFs with higher expense ratios earned only 2.26 points, on average, on the return variable. The difference of 1.05 is significant at the 0.01 level. When the second quartile of expenses is excluded from the lower half, the return rating rises to 3.44. Excluding the third quartile of expenses from the top half of expense ratios reduces the performance ratio to 1.86. It is important to note that the return performance of TDFs with high expense ratios is frequently in the lowest 10% of funds since the Morningstar rating is under 2.0. The reader is reminded that although

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Table 5 Morningstar return, risk and (Star) rating (4/2006–3/2016).

Measure	Expense charges				Load charges	
	50/50 Split of TDFs		Quartile Split of TDFs		No-load	Load
	Lower expense ratio	Higher expense ratio	Lowest quartile of expense charges	Highest quartile of expense charges		
Morningstar Return	**3.31**	2.26	**3.44**	1.86	**2.93**	1.71
	0.000**		0.000**		0.000**	
Morningstar Risk	2.82	2.93	2.54	2.84	3.02	**2.64**
	0.397		0.373		0.012*	
Morningstar Rating	**3.29**	2.26	**3.64**	1.86	**2.91**	1.79
	0.000**		0.000**		0.000**	

Preferred values are displayed in **bold** lettering in those instances where statistical significance exists.
** and *: Significant at 1% and 5% levels of significance, respectively.

this may seem logical, one would expect investors to agree to higher expenses only if they were receiving compensating higher returns.

Load charges appear to be more of a hindrance to return than expense ratios. Specifically, the load charges drop the return rating to 1.71, the lowest value in the Morningstar Return set of rows, which is well below the 2.93 level of no-load funds. The difference is significant at the 0.01 level. Again, it should be noted that the no-load funds do not automatically have performance level in excess of 3.0 because no-load funds may have higher expense ratios in order to compensate for the lack of a load fee.

Morningstar's evaluation of fund risk does not vary systematically with expense ratios, as depicted by the Morningstar Risk rows in Table 5. TDF risk ratings on this dimension are typically close to average or slightly below this Morningstar metric's average value of 3.0. No-load TDFs have a Morningstar risk rating slightly higher than the average of 3.0, while load TDFs have a lower risk rating that is significantly lower at the 0.05 level. The value 2.64 is in bold lettering because less risk is preferable.

Given the higher returns and no significant difference in risk, it is not surprising that TDFs with lower expenses earn a significantly higher Morningstar star rating. The greatest difference exists in the extreme expense-ratio quartiles, where TDFs in the lowest quartile of expense charges have almost 4 (3.64) Morningstar stars, while TDFs in the highest quartile of expense ratios earn less than 2 (1.86) stars. The higher return-based performance of no-load funds is of sufficient magnitude to offset the additional risk, resulting in a Morningstar star rating that is significantly higher at the 0.01 level of significance.

3.4 Market-related risk and risk-adjusted performance

TDFs are likely to be only a portion of an investors' investment portfolio. Hence, the correlation of TDF returns with the market and related risk-adjusted return measurements are relevant. The first step is the measurement of systematic risk, which is presented in the first set of rows in Table 6. Betas do not appear to vary systematically with expense ratios, which is similar to findings reported in Table 3 for standard

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Table 6 Measures of market risk and market risk-adjusted return (4/2006–3/2016).

Measure	Expense charges				Load charges	
	50/50 Split of TDFs		Quartile Split of TDFs		No-load	Load
	Lower expense ratio	Higher expense ratio	Lowest quartile of expense charges	Highest quartile of expense charges		
Beta	1.21	1.22	1.14	1.18	1.23	**1.19**
	0.160		0.158		0.001**	
Treynor Ratio	**3.25%**	2.53%	**3.78%**	2.21%	**2.90%**	2.33%
	0.000**		0.002**		0.000**	
Alpha	**−1.41%**	−2.19%	**−1.00%**	−2.45%	**−1.80%**	−2.37%
	0.000**		0.000**		0.000**	

Preferred values are displayed in **bold** lettering in those instances where statistical significance exists.
** and *: Significant at 1% and 5% levels of significance, respectively.

deviations and Table 5 for Morningstar risk rankings. However, it is worthy of note that all of the TDFs have beta values that are above average and are relatively aggressive. No-load funds are the most aggressive, with average betas equal to 1.23. No-load TDFs have beta values that are significantly higher than the beta values of TDF carrying a load fee at the 0.01 level.

Given the higher return of low-fee TDFs and their similar levels of systematic risk, it is not surprising that the all of the Treynor ratios reported in Table 6 are significantly different at the 0.01 level. Relative to the higher expense-ratio TDFs in the 50/50 split, the low expense TDFs earned an additional 72 basis points per unit of systematic risk. Relative to the quartile of TDFs with the highest expense ratios, TDFs in the lowest quartile of expense ratios earned an additional 157 basis points annually. Relative to TDFs charging a load, no-load TDFs earned 57 basis points more per year.

Across this ten-year period, the second set of rows in Table 6 show the benefit of avoiding the 50% of TDFs with higher expense ratios is 7.2%, earning $1,377 instead of $1,284 per $1,000 invested. Using a TDF in the highest quartile of expense ratios instead of one in the lowest quartile of expense ratios is likely to decrease your terminal value 14.2% after ten years, having only $1,244 instead of $1,449 per $1,000 originally invested. If you avoid funds with loads, you can on average enhance your terminal value after ten years by 5.7%, on a beta-adjusted basis, to $1,331 per thousand invested instead of $1,259.

Higher betas stocks are typically chosen by investors anticipating market advances. Over the ten-year period under consideration the Standard & Poor's 500 provided an annualized rate of return of 7.18%. The remaining empirical question that we want to address is TDFs' ability to earn the required rate of return in light of the higher beta and positive market performance. To answer this question, alpha values were computed because these measures adjust returns for systematic risk, risk-free Treasury yields, and the market risk premium. As depicted in the bottom set of rows in Table 6, TDFs underperform the market on a beta-adjusted basis, also known as Jensen's alpha. However, this finding is not surprising in light of the fact that these funds are being

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matched to the equity market despite an allocation of funds to cash and bonds, plus charging a management fee. The important piece of information in the bottom rows of Table 6 is the relative performance of high-fee to low-fee TDFs. Relative to higher expense-ratio TDFs in the 50/50 split, the low expense TDFs' alpha value was 78 basis points higher. Though negative, TDFs in the lowest quartile of expense ratios had an alpha value that was 145 basis points higher than the high quartile counterpart. A loss of 2.45% per year would compound to a loss of 21.97% over ten years. The ten-year period's loss is less than 24.5% because the loss is being incurred by a lower typical beginning amount in each year.

During the decade studied, no-load TDFs ended up losing 57 fewer basis points per year than those with loads. Across a ten-year period, the benefit of avoiding the 50% of TDFs with higher expense ratios is 6.7% (a loss of 13.2% with low expense-ratio TDFs instead of a loss of 19.9%). Replacing a TDF in the highest quartile of expense ratios with one in the lowest quartile of expense ratios is likely to increase terminal value by 12.4% (a loss of 9.6% instead of a loss of 22.0%) after ten years. If you avoid load funds, you typically can reduce the loss of not investing in a stock market portfolio with an equivalent beta by 5.3% (a loss of 11.3% instead of 16.6%). All of the differences are significant at the 0.01 level, giving TDF investors who adhere to a low-fee selection preference confidence that they are making a good TDF choice.

4 Conclusion

Target date funds (TDFs) have been rapidly increasing in popularity in recent years. Their popularity arises from the automatic shift of funds from primarily a stock allocation to an increasing bond allocation based on a glide path chosen on the basis of investor targeted retirement year. Given the swelling demand for these funds, this research is a timely look at TDFs' most recent decade. As of March 2016, over 500 TDFs have been in existence for over ten years, providing a good sample size and period over which to assess TDF performance.

Analysis of the entire universe of TDFs with ten years of data reveals that a key to differentiating between better and worse TDF investments is their expenses and loads. Lower expenses, especially selecting among TDFs with the lowest 25% of expenses, have a significant effect on return without an appreciable impact on risk, whether measured using standard deviation or beta. Selecting TDFs with no loads increases both return and risk. Risk-adjusted return measures based on standard deviation, negative return variance, or beta all demonstrate the value of avoiding high costs. Differences in costs persist despite the generally-held notion that in a competitive environment, funds with excessively high fees would be avoided and over time would be forced to close. A related notion is that investors will only buy funds up to the point where marginal costs (i.e., expenses and loads) will equal marginal revenues (i.e., risk-adjusted returns). When looking at individual target date fund categories, we find further evidence that investors should avoid high expenses and load/commission fees.

There are multiple venues for further research. The importance of cost-based TDF selection may vary across market conditions. A corollary would be the assessment of TDFs across different market conditions. Given the vast amount of money being poured into the various TDFs, it may be valuable to assess the relative performance of various TDF managers. For instance, differences in prescribed asset allocations may lead to significantly different performance. Meanwhile, some TDF managers may select better assets for a given allocation. While this research looks at terminal

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dates, it may be possible to find differences in TDF performance based on how long the fund has been in existence. It may also be interesting to look at alphas from a factor-based regression including Fama–French factors plus credit and duration. Are TDFs charging a lot for simple blends of factor exposures? A comparison of no-load funds which do not charge 12b-1 fees with that do charge 12b-1 fees is likely to be informative. Finally, it may be useful to assess the importance of other TDF characteristics (i.e., minimum investment, varying glide paths, etc.). Target date ETFs are far less common but are increasing in number, potentially making analysis of their performance beneficial. Given the rapid and projected growth of TDFs, such research is of vital interest to the well-being of anyone saving for retirement.

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Keywords: Target date funds; expense ratios; load fees, returns; risk-adjusted returns

JEL Classification: G11

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