Target Risk Funds

by

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Abstract

There is a vast literature which shows that investors don't make rational decisions in allocating resources among both different types of investments and different individual investments. Target risk funds and target date funds are two types of mutual funds that make the asset allocation decision for an investor. However they control for risk in very different ways. Target risk funds have not been studied. This article is the first comprehensive study of their characteristics and performance and how they compare to target date funds as an investment.

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I. Introduction

There is a vast literature which shows that investors don't make rational decisions in allocating resources among both different types of investments and different individual investments.[1] While the bulk of the evidence concerns participant choices in pension funds there is reason to suspect that this will be even truer for individual investors, for he or she is confronted with a number of investment choices many times greater than those offered in a pension plan.

While there are many types of asset allocation funds, two types are of particular interest because of their frequent use in retirement plans: target date funds and target risk funds. They are also of interest because they both purport to manage risk, but they do it in very different ways. Target risk funds are generally fund of funds which attempt to hold risk constant over time. These funds are sometimes called lifestyle funds. The name of the fund usually contains reference to the intended risk, e.g. conservative, moderate or aggressive. Target date funds attempt to change allocation over time to reduce risk as a target date approaches. These funds are identified by the inclusion of a target date in their name. A lot has been written about TDFs, both in the popular press and in the academic literature, while TRFs have been largely ignored. The attention paid to TDFs have been fed by their recent growth and their increasing use as an option in 401(k) plans. However, the theoretical models examining asset allocation over time provide both supporting and contradictory evidence as to whether this is optimal.[2] Furthermore, the empirical analysis suggests that 100% in equity or a fixed proportion strategy dominates

[1] See Benartzi and Thaler (2001), Elton, Gruber, Blake (2007), Huberman and Sengmuller (2004), Liang and Weisbenner (2006) and Agnew and Balduzzi (2003)

[2] See Bodie, Merton and Samuelson (1991), Campbell and Viceira (2002), Campbell, Cocco, Gomez and Maenhout (2001), Cocco, Gomes, Maenhout (2005) and Shiller (2005).

decreasing the amount invested in equity over time[3]. Finally, theory suggests that time to retirement is not the only factor that should be considered by the investor making asset allocation decisions: labor income, wealth and especially risk preference may be important, TRFs may be a better vehicle to allow the investor to manage his portfolio to account for these factors.

Thus both theory and empirical evidence suggests that target risk funds which hold risk constant time may be a viable alternative to target date funds for inclusion in retirement plans. In fact in 2013, 43% of the assets in TRFs was held by retirement accounts. In addition target risk funds are important in their own right. In 2013 they had over $350 billion under management. Their growth rate in the period 2008-2013 was 15.4% per year, while assets under management by all mutual funds grew by 9.4% per year. In addition, it was not until 2009 that TDFs had more assets under management than TRFs, and it was not until 2008 that there was a larger number of TRFs than there were of TDFs. Despite their size, their reasonableness as an alternative to target date funds in retirement plans, and their use in retirement plans, they have not been carefully studied.

This article is the first comprehensive study of the characteristics and performance of target risk funds. An additional purpose of this article is to analyze whether these funds are a reasonable alternative to target date funds. This article is divided into 5 sections. In the first section we describe the sample of funds used throughout this paper. In the second section we examine the characteristics of target risk funds. These characteristics include the expense ratio charged both by the funds they hold and at the TRF level itself, their types of holdings and how this has changed over time, the commonality of holdings across TRFs with different declared risk profiles and how risk is held constant over time. In the third section we examine the

[3] See Poterba, Raul, Venti and Wise (2005)

performance of TRFs using a multi factor model to measure performance. In the fourth section we compare the performance of target risk funds with several replicating portfolios including one using exchange traded funds. In the fifth section we examine whether mimicking the performance of target date funds with a portfolio of target risk funds produces superior or inferior performance. Finally our summary and conclusions are in the sixth section.

I. Sample

Our initial sample consists of all funds identified as asset allocation funds in Morningstar or CRSP at any time between 2001 and 2014. We then examined the website, for each fund as well as annual reports to determine if it was a target risk fund, if there were other TRFs offered by the family but not designated as such by Morningstar or CRSP, and if the fund family offered two or more target risk funds. This procedure resulted in selecting 213 distinct TRFs offered by 50 fund families. Many of these have multiple share classes.[4] If we count all share classes we have a total of 666 funds. Our sample starts in January 2001 and ends in August 2014. Target risk funds have been around for a long time; 97 of the funds were in existence at the start of our sample while only 14 funds have been started in the last four years.

Our sample of TRFs is divided by risk strategy into aggressive funds (88), moderate funds (52) and conservative funds (73). Many families offer two or more TRFs of the same type; for example, in the category of aggressive funds a family might offer a very aggressive and an aggressive fund. We examined each fund and assigned it to one of our three categories based on fund objectives and name

II. Characteristics of Target Risk Funds

[4] The multiplicity of share classes offered by TDFs shown in table 1 indicates that TRFs are offered to many different types of investors.

In this section, we examine a number of characteristics of target risk funds. Target risk funds like target date funds are funds of funds investing in other publicly traded mutual funds.[5] In the first part we examine the expense ratios of the underlying funds the TDF holds the additional expenses the TRF charges and the total expense ratios of the TRFs and compare them to the expense ratios of target date funds. In the second part, we examine the types of funds held by target risk funds and find they hold many categories other than U.S. stock and bond funds. In the third part, we examine similarity of holdings across TRFs of different risk offered by the same family. Finally, we examine funds over time to see if the percentage in each type of investment is held constant.

A. Expense Ratios

Since TRFs are funds of funds the expenses paid by any investor consist of two parts: the expense the TRF pays on the funds it holds and the expense the TRF adds on top of this. Table 1 presents a breakdown of these expenses as of 2014.[6]

Let's start by examining the expenses a TRF incurs on the underlying funds it holds. Most TRFs offer several share classes. However, each share class of the TRF holds the same share class of the same underlying funds. Thus, the expense ratio on the underlying funds is the same for each share class offered by any one TRF. The only reason there are differences in the column titled "underlying expenses" is because any TRF does not necessarily offer every share class. Thus differences in the column titled "underlying expenses" are due to a difference in the sample of funds offering any share class. However if we examine the most frequently offered

[5] All of the funds in our sample invested in mutual funds. However, some choose to report the securities of their underlying funds rather than identify the funds they hold. Using their fillings and website we identified the funds they held over the latter part of their lives.

[6] In table 1 and some subsequent tables we present data as of 2014. We have examined all years and using the last year, earlier years or all years would result in the same conclusions.

share classes, there is only a very small difference in underlying fund expenses. For each of the aggressive, moderate and conservative TDFs, in examining the five TRF share classes with the most representation in our sample, the difference in underlying fund expenses is five basis points or less.

Notice that there are much larger differences across share classes in the expenses which are added at the TRF fund level. For example for the five most frequently offered share classes cited above for the aggressive risk class the spread in expenses added is 111 basis points. In EGDB(2015)'s study of target date funds they found the expenses added at the level of the target date fund had the effect of bringing total expenses up to the level that is close to what an investor who can only hold funds of a particular share class would have to pay to construct the TDF himself. The same phenomena appears to be true for target risk funds which also are buying low expense shares of the underlying fund. For example an investor who can only buy B class shares is only paying 66 to 76 basis points to hold the underlying funds well below what this investor would have to pay to buy these funds directly. The fees added at the level of the TRF have the effect of capturing for the company offering the TRF much of the advantage to the investor of the funds buying lower cost shares. Table 2 presents a detailed analysis of the share classes the TRFs hold. Note that most of the holdings are in share classes not generally available to individuals and all institutions: because of the minimum purchase size, or because they are restricted to certain types of institutions. Over 85.6% of the TRF's assets are invested in institutional, investor, retirement, M, N, S or NAV classes. These are classes that have low expense ratios for investors who are eligible to invest in them. Likewise classes like ETFs, no load, and index funds (11.3%) that are available to any investor also have low expense ratios. Only A, administrative, advisor, B, C and D are high expense classes, and these represent only

2.1% of the total assets held by TDFs. Thus target risk funds, which are funds of funds, keep their expenses lower by investing in relatively low cost funds.

Another fact to note from Table 1 is that the underlying expenses and the total expenses tend to decrease slightly as we move to lower risk TRFs (from aggressive to conservative). For example the average underlying expenses decrease from 75 basis points to 65 basis points. The reason for this is that the more conservative funds (as we will see shortly) tend to hold a lower percentage in stock funds and a higher percentage in bond funds. Stock funds tend to have higher expenses than bond funds and thus the expenses on the underlying funds are lower for the more conservative funds.

Since target risk funds are alternatives to target date funds but have different and well-defined risk patterns, it is logical to compare the expenses on target risk funds with the expenses on target date funds. Target date funds like target risk funds tend to hold share classes with low expense ratios. Table 3 compares the expense of the TRFs with the expense of target date funds reported in Elton, Gruber, De Souza and Blake (2015)[7]. Note that the expenses of the underlying funds invested in by TRFs are higher in every category except no load funds and that the average total expenses are higher in each category. Target risk funds have higher total expenses of from 4 b.p. to 28 b.p. per year depending on the share class. This will have an impact on the performance of target date and target risk funds which we study later in the paper.

B. Composition of Holdings

Tables 4, 5 and 6 show various measures of the composition of the holdings of the target risk funds. The data in Table 4 and 5 are as of 2014. Table 4 uses a classification employed by

[7] EGDB (2014) do not report expenses for all share categories shown in this paper.

Morningstar in which Morningstar identifies all holdings as belonging to one of five categories, cash, domestic or international bonds and domestic or international equity. Note that the classification of TRFs as aggressive, moderate and conservative by the fund families and across fund families is consistent with what is normally thought of as risk. The percentage invested in equity is highest for aggressive funds and lowest for conservative funds while the amount invested in bonds is the reverse. Note also there is no overlap among risk classes. The aggressive fund with the lowest amount invested in equity has more in equity than the moderate fund with the most invested in equity. A similar pattern exists when comparing moderate and conservative funds; thus, the percentages held in equity and debt for different classifications are similar for different fund families. The pattern when we examine the foreign domestic split is somewhat ambiguous. Foreign investment is generally considered more risky than domestic. When examining foreign bonds the pattern follows the risk expectations. Aggressive funds have the least invested in bonds but have the highest percentage of their bond portfolio invested internationally. However, when we examine foreign equity the order is not uniform with moderate funds having a lower percentage of their stock portfolio invested in foreign equity than conservative. However, the differences in the domestic international split are quite small.

Table 5 shows a much more detailed breakdown of TRF holdings than that presented in Table 4. This table is constructed using the TRF's actual holdings combined with using Morningstar classification of each of the holdings.[8] In table 5, we examine not only the percent of assets in each category but the number of TRFs that hold each category. For example, examining panel B shows that 26 percent or 23 aggressive funds have zero percent invested in

[8] Note the investment pattern across the major investment categories is consistent with that discussed above.

U.S. bonds. One conservative fund has zero percent invested in U.S. stock. While most funds invest in foreign stock, only 36% have invested in foreign bonds.

TRFs hold a number of surprising investment categories. For example a few funds invest in municipal bonds. Since municipal bonds have lower expected returns than taxable bonds of the same risk and the funds don't attempt to tax manage other investments, any investment in this category is unusual. An investment in municipal bonds has to be based a belief that the sector is temporarily undervalued and will offer a higher short term return as it becomes fairly valued. This is usually referred to as a sector bet. There are two other categories that are similar: single country and single sector. Single sector is an investment choice for 26% of the TRF funds and single country for 7%. These are not risk reducing but rather are bets on a country or sector outperforming the more general market. Investment in emerging stocks and debt is also an overweight in one section of a general foreign (non-U.S.) portfolio. Emerging market stock is held by 58% to 73% of TRFs depending on risk class while emerging market debt is held by over 24% of the funds. Tactical funds which involve active timing are invested in by 25% of the funds. Commodities and futures can be an attempt at risk reduction or a sector bet. Elton, Gruber and Rentzler (1987, 1996) and Gorton, Hayashi and Rouwenhorst (2013) have shown that in general these funds are a poor investment. Thus most target risk funds are making decisions to overinvest in countries or sectors in an attempt to earn a higher return. However note that despite the high percentage of funds which hold non-standard investments examining part A of Table 5 shows that percentage of assets invested in these categories is small.

The investment in asset categories in addition to domestic stocks and bonds and international stock and bonds is the same general pattern found in target date funds (see Elton, Gruber, de Souza and Blake (2015)). However, slightly more target date funds hold each of

these asset categories. For example, 40% of target date funds invest in commodities compared to 28% of target risk funds.

Table 6 examines the percentage of funds holding investment categories other than stock and bond over time. The pattern is clear across all risk classes and in most asset categories. A higher percentage of TRF's have invested in sectors other than stocks and bonds over time. For example the percent of funds investing in market neutral and tactical categories went from 1% in 2005 to 25% by 2014, and in global real estate it went from 1% in 2005 to over 30% by 2014. TRF's are investing in many sectors other than U.S. and foreign stocks and bonds and more funds are investing in these sectors more recently.

C. Commonality in Holdings

Most target risk funds are managed by a team of managers. For the fifty families that offer target risk funds, forty-six have exactly the same management team, or manager, managing all of their target risk funds as of 2014. For each of the four families where the same management team doesn't manage all of the target risk funds, only one fund in each family had a different management team and that fund had only one additional manager. In all cases this manager is listed last on the team.

This common management team or manager suggests they should have common holdings across the different risk classes of the target risk funds offered by the same family. This is indeed the case. The principal difference in investment patterns across the different risk classes of the target risk funds offered by the same family is the percentage invested in each holding with the aggressive funds investing a higher percentage in stock holdings and conservative a higher percentage in bond holdings. Table 7 shows the extent of the commonality as of 2014. The rows

correspond to the risk type whose holdings are being examined and the columns show what percentage of their holdings is held by the risk type shown in the column. For example, there are 29 aggressive funds where there is at least one other aggressive fund in the same family and we compute the percentage of each aggressive funds holdings that are in common with each other fund. Note that if there are two aggressive funds in a family each enters separately. Label these funds as A and B. We first compute the percentage of the holdings in A that are found in B and then the percentage of holdings in B that are found in A. We have two measures of percentage: equally weighted and value weighted. Equally weighted counts the percentage in common as the number of funds in common divided by the total number of funds, while value weighted is the percentage of the dollar holdings in common. This is calculated as the market value of the holdings in A where B also invests in the fund divided by the total assets of A. The lowest percentage in common is conservative with aggressive which for value weighting is 71.7%. The remainder of the combinations are all 81% or more. The greatest commonality is aggressive with moderate where the commonality is over 95%. Thus, most target risk funds have common management and common holdings with the principal difference being the percentage invested in each holding.[9]

Earlier we showed that target risk funds hold a number of funds other than stock funds and bond funds. How does the commonality in holdings of these type of securities differ across the various risk categories? Table 8 shows for the 9 non-standard investment types shown in Table 6, the number of fund families that hold these non-standard investments in both their aggressive and conservative funds. In 119 cases where an investment type is held by a family for

[9] Note that when fund families have two funds of the same type such as aggressive, these funds have less commonality than funds of that type with funds of an adjacent type (e.g. aggressive and moderate). It seems when fund families offer more than one fund of the same type they have an incentive to make them somewhat different.

the conservative fund it also is held in the aggressive fund. In only 19 cases did a fund family hold an investment type for the conservative or aggressive risk fund without holding it in the other fund. The extreme case was six fund families who invested in emerging market stock for the aggressive fund without also investing in emerging markets in the conservative fund (compared to 30 who did both). The next highest case where a family did not invest in both is domestic real estate. Three fund families invested in domestic real estate with their aggressive fund but not with their conservative and one fund family did the reverse, while 17 invested in domestic real estate for both their conservative and aggressive funds. Thus the pattern of common types of investments across funds with different risk objectives holds not only for domestic and international stocks and bonds, but also for the other categories of investments held by TRFs.

D. Risk over Time

Unlike target date funds, target risk funds have as an objective to hold risk constant over time. The most natural way to implement this objective is to hold the percentage invested in stocks and bonds constant over time. Table 9 examines this conjecture. It compares the average allocation to cash, equity and bonds in the second and third year of a fund's existence to the average allocation in the last two years. We eliminated the first year because of concerns that in some cases the fund had not yet reached its target allocation. The sample is slightly different from the sample used in earlier sections because funds that existed less than 5 years are eliminated from this table. Examining the allocation to cash, equity and bond there is almost no difference in allocation between the two periods. The maximum difference is slightly over 1%. Examining subdivisions of these broad categories reveals some changes. Examining foreign investment in Table 6 shows that across all risk classes there has been an increase in foreign

investment. Also examining Table 6 we can see that funds over time have increased their investment in specialized sectors. Thus target risk funds seem to keep their percentage invested in cash, stocks and bonds close to constant but within these broad categories there are changes in allocation.

III. Performance

In order to measure the overall performance of target risk funds we use a variant of the standard multi index model. The general model can be described as

$$R_{it} - R_{Ft} = \propto_i + \sum_{k=1}^{K} B_{ik} I_{kt} + e_{it}$$

Where R_{it} is the return on i^{th} TRF in period t

R_{Ft} is the riskless rate in period t

I_{kt} is the return on index k in period t

B_{ik} is the sensitivity of the i^{th} TRF to index k

$\propto_i$ is the average return of the i^{th} TRF unexplained by the indexes

e_{it} is the residual of i^{th} TRF in period t

While the model can be estimated with any set of indexes the first question that has to be answered is the choice of an appropriate set of indexes. Since the vast majority of the assets of TRFs are held in stock and bond funds holding US securities, the first set of indexes chosen represented these categories. For stocks we used the standard Fama French three factor model.

This model contains a market index in excess of the risk free rate, a size index, and a growth index.[10]

For a general index for US bonds we used Barclays U.S. aggregate bond index. The question remained as to which other indexes to use. From Table 5 it is clear that the largest percentage held in other categories were held in foreign stock and foreign bond. For foreign stock we used the MSCI world ex USA value weighted index and for foreign bonds we used the Bank of America global broad market ex US dollar bond index. Both were stated in return above the US 30-day Treasury bill. While we could have used these indexes directly in the model we orthogonalized the indexes respectively to the excess return on the US stock market and the excess return on the US bond market. While the orthogonalization has no impact on the alpha or the coefficient of determination it does allow for a more convenient interpretation of the regression coefficients. The correlation between the US and foreign stock indexes described above is .88 while for the US and foreign bond index it is .57. By orthogonalizing the international stock and bond indexes it allows the regression coefficient to be interpreted as the impact of foreign stocks (bonds) where all joint impact with American stocks (bonds) has been removed.

Three other indexes were included in this model. EGB (1993) have shown that in addition to a generalized bond index two other indexes are necessary to capture the return on bond funds. Following EGB (1993) we used a high yield bond index (Barclays US high yield notes) and a mortgage index (Barclays US mortgage backed security index) both stated in excess return form. Because the mortgage index had a very high correlation with US bonds (.89) we orthogonalized it to that index. In addition since the high yield bond index has a very high

[10] All indexes were downloaded from French's website.

correlation with the stock market index, we orthogonalized it to the stock market index. Because TRFs were investing in emerging stock markets we added an emerging stock market index.

For each fund we ran a time series regression on these 9 indexes. The results are summarized in Table 10. While our purpose was to estimate alpha, the results from examining the regression coefficients for our model and the overall explanatory power of our model support the level of confidence we have in the model. The average R^2 is .98 for the aggressive group, .96 for the moderate group and .99 for the conservative group. Clearly the model has captured the vast majority of the return variation on the TRFs. Furthermore the pattern of the coefficients across risk classes of TRFs is exactly what we would expect. As we move from aggressive to moderate to conservative the coefficients on US stock, small stock, growth stocks, non-US stocks, emerging market stocks, all go down while the coefficients on US bonds and non-US bonds go up. The only surprise is the coefficients on high yield bonds which goes up. This is explained by the fact that the conservative group of TRFs hold such a large proportion of their assets in bonds and therefore they also hold a higher percentage of high yield bonds.

Table 10 also presents two alternative measures of risk. As shown in this table both the standard deviation of return and the standard deviation of residuals support the fact that management has been successful in designing TRFs is a manner consistent with their names and objectives.

Since the model does a sensible job of explaining returns we examine alpha from the model. The overall alpha produced by the model shows performance of -5.6 basis points per

month or -62 b.p. per year, which is significant at the .01 level.[11] Furthermore, the alphas are large negative numbers and statistically significant for each of the three groups – aggressive, moderate and conservative. This is the alpha after expenses of the underlying funds held by the TRF but before the fees added by the target risk funds. The size of the negative alpha is just slightly less than the average expenses on the underlying funds shown in Table 1. In other words the alpha before fees on the underlying funds is close to but slightly above zero. Given the average fees of the underlying funds this would suggest that the managers of target date funds are earning very little from their ability to select individual funds. This is surprising since managers of TRFs are part of the fund family from which they are selecting funds. Thus they should possess information not available to other investors. The inability of fund managers to select better performing funds within their fund family is a new result in the general performance literature.

To summarize target risk funds produce negative alphas, they don't seem to show any ability to select superior performing individual mutual funds but they do help investors by selecting the low cost share classes of the funds they hold. However, they take this benefit away from the investor by adding another layer of fees at the TRF level.

IV. Comparison to a Portfolio of Exchange Traded Funds

Target risk funds serve a useful diversification role. Could an individual or institutional investor mimic their investment strategy and be better off? We measure this in three ways.[12] First we performed the following experiment. We assumed that each January the investor

[11] Stephen Brown suggested that because of the option-like quality of TRFs rebalancing, one might observe negative timing ability and an increased tail risk. We found that this was true for some TDFs.

[12] To compute mimicking portfolios we need to have holding data for the life of the TRF. In some cases we could not obtain holding data on the underlying mutual funds over the earlier years of the TRF's existence. This limited the sample size to 171 TRFs for this section of the study.

observed the latest reported holdings and in which category Morningstar designated each holding. The investor then buys the cheapest ETF in the same Morningstar category or if an ETF doesn't exist the cheapest index fund in that category.[13] We then compute the monthly mean return, standard deviation of return and Sharpe ratio for the mimicking portfolio and the TRF where the TRF return is computed before the TRF charges expenses but after the expenses charged on the underlying funds. The results for the mimicking portfolio minus the actual portfolio are shown in Panel A of Table 11. For each of the three risk classes the Sharpe ratio is higher for the mimicking portfolio than the TRF. For both the aggressive funds and moderate funds these results are significant at the 1% level.

Why do these results come about? For all three risk classifications the standard deviations are lower for the mimicking portfolio compared to the target risk funds and the results are statistically significant at the 1% level for conservative funds. In addition, the mimicking portfolio has a higher mean return than the TRF's for aggressive and moderate TRF's and slightly lower for conservative funds. The difference in returns is strongly influenced by the lower expense ratios of exchange traded funds.[14] Thus higher Sharpe ratios for mimicking portfolios for all risk classifications come about because of the mimicking portfolios having lower standard deviation and lower expense ratios.

As stated earlier the TRF's return was computed prior to the expenses added by the TRFs but after expenses on the underlying funds. If we subtract the expenses on the lowest cost share class from the TRF's return (to represent the return an investor would actually earn if the investor could buy the lowest cost shares of the TRF) all of the Sharpe ratios are statistically

[13] The funds held by the TRFs and the lowest cost ETFs change very slowly over time. After the first year this generally involves looking up the classification for 1 or 2 funds held in the TRF and the low cost ETF.
[14] This is true even though the TRFs are holding underlying funds with very low expense ratios.

significant higher at the 1% level for the mimicking portfolio. The lowest cost share class is generally the institutional class. This is not a share class individuals can buy. If we take the expenses on the lowest share class an individual can buy the results are even stronger.

We did two other experiments. First we compute the return standard deviation and Sharpe ratio on each TRF as if they only held stocks and bonds in their mimicking portfolio. To compute the return on the mimicking portfolio we first eliminated from each TRF's holdings all non-standard stock and bond funds (eliminating all investment categories shown in Table 6.) We then scaled the stock and bond holdings so that they represented the full holdings (scaled to 100%). For each stock and bond holding we once again found the lowest cost exchange traded fund (or index fund, if an exchanged traded fund didn't exist) having the same Morningstar category. We then computed the monthly mean return, standard deviation of return and Sharpe ratio over the same time period as the TRF using the latest reported holding data prior to January 1 of each year. The results are shown in Table 11 panel B.

Since the return on each TRF is the same in panel A and B the difference in the numbers between panel A and B shows what would happen if the TRF using exchange traded funds invested only in stocks and bonds rather than the category they invested in. All of the returns are higher on the mimicking portfolio (using only stocks and bonds) for each of the three risk classes and all of the standard deviations are lower. This suggests that TRF's are not improving performance by diversifying into non stock and bond categories.

Part of this result can be due to the superior performance of exchange traded index funds. We next examine whether similar results arise when we repeated the analysis of panel B using only the actual funds that the TRF is holding rather than the exchange traded or index funds to

construct the mimicking portfolio. The results are shown in Panel C of Table 11. In this case we compute the difference in return between what the TRF would have earned if it only held the stock and bond funds they actually held, rescaled to 100% (again excluding all investment categories show in Table 6) and the return they actually earned. If the TRF only invested in the bond and stock funds they actually held the returns would have been significantly higher at the 1% level. Many of the categories shown in Table 6 are sector bets. The sector bets and other categories led to lower returns. The aggressive funds and conservative funds have a higher standard deviation while the moderate fund has a lower standard deviation. However, neither of these differential standard deviations nor the differential standard deviations when we use exchange traded funds to match the standard stock and bond portfolio are close to significant. The Sharpe ratios are all higher when only stocks and bonds are held and the Sharpe ratios for aggressive and moderate TRFs are significant at the 1% level. This strongly suggests that TRFs have not improved performance by adding additional categories of assets and taking sector bets.

While we examined the Sharpe ratios for the TRF and their mimicking portfolios it is meaningful to compare them in a utility framework. If we assume a power utility function of the form W_{t+1}^{γ} / 1- γ and we assume that returns are lognormally distributed then the utility of any investment i is[15]

$$U_i = 1 + \overline{R_i} - \frac{\gamma}{2} \text{var ln } (1+R_i).$$

[15] See Odean, Ahmed and Barber (2014) for one derivation of this equation.

We compare the utility of the replicating portfolio (constructed as described in panel A of Table 11) to the utility of the TRF using this equation and a range of values for γ.[16] For γ equal to 2 the replicating portfolio has a higher utility than the TRFs for 60 of 69 aggressive funds, 30 of 44 moderate funds and 31 of 58 conservative funds. For values equal to 10 the numbers change slightly with replicating portfolios having higher utility in 55 cases for aggressive funds, 32 for moderate funds and 35 for conservative funds. Values between 2 and 10 produce results that are intermediate between these numbers; thus, whether we look at Sharpe ratios or employ a utility framework, for most TRFs a portfolio of exchange traded funds is superior.[17]

V. Target Risk Funds and Target Date Funds

In this section we examine whether for those cases where a family offers both TDF's and TRF's can an investor use the target risk funds to replicate the important risk characteristics of target date funds and if so is the investor better off or worse off by doing so. While the details of matching are defined below we perform the matching on the basis of the bond stock mix. This metric was selected because changing the bond stock mix is the principal way risk is differentiated in TRF's and the principal way TDF's change risk with changing horizon.

There are 30 fund families that offer both target date funds and target risk funds at some point. Some of the 30 fund families offer more than one target date fund series each with different names. This gives us an initial sample of 43 target date fund series that were different from each other. Three of these TDFs had to be dropped because at the end of our sample period

[16] See Odean, Ahmed and Barber (2014) for a discussion of appropriate values of γ in a retirement setting. We investigate the utility of the replicating portfolio and the TRF for a range of γ from 2 to 10 which is wider than the range explored in the above article.

[17] When we apply the utility framework to the method used in part B of table 11 the results are even stronger.

they had been in existence less than one year. An additional fund had to be dropped because it did not report asset allocations.

Each of the target date funds which are offered by families which also offer target risk funds had either a 2035 fund (35 cases) or a 2030 fund (4 cases). These were selected as the target date funds to match. For each year after the first year of existence we collected return data and data on the bond stock mix on both TRFs and TDFs, after underlying fund expresses but before the expenses added by the TRF and TDF.

We then examined whether an investor could match at the beginning of each year the bond stock mix of the target date fund with a combination of target risk funds which had the same bond stock mix. Since we wanted to formulate a simple strategy which an investor could follow we assumed that the investor

1. observes the latest reported prior years bond stock mix
2. selects two target risk funds from the same family as the target date fund and selects one with a higher percentage in stock than the target date fund and one with a lower percentage in stock. In the case of more than one with a higher or lower percentage in stock the investor selects the one with the closest percentage to the target date fund.
3. forms a portfolio of target risk funds with the same percentage in stocks as the target date fund at the beginning of each year.

We then computed the return on the target date fund and the portfolio of two target risk funds. This resulted in a series of monthly returns for both the target date fund and the portfolio of target risk funds over the life of the shorter lived fund. While we started with 39 target date funds, 3 TDFs had to be eliminated because matching funds (step two) existed for less than one

year of the TDF's existence. It is interesting to note that of the 36 remaining 64% had exactly the same manager or team of managers, while only 11% had manager teams with no overlaps. Finally 8 funds had to be eliminated because target risk funds could not be found that had a higher percentage in stock.[18]

The matching target risk fund portfolios had a mean return 40 basis points higher per year compared to the target date funds before expenses added by the TRFs and the TDFs. They also had a lower monthly standard deviation by .027 and of course a higher monthly Sharpe ratio. The mean return difference is significant at the 1% level and the Sharpe ratio at the 5% level.

Generally target date funds have lower expense ratios than target risk funds. The results just discussed are before the TRF and TDF add expenses but after the expense ratios on the funds they hold. Depending on the share class held, the difference in expenses (TRF – TDF) for families that offer both TRFs and TDFs varies from -5 b.p. to 10 b.p., with an average of 7 b.p. TRF still have higher mean returns, lower standard deviations and higher Sharpe ratios but the difference in Sharpe ratios is no longer statistically significant.

A second simpler matching rule was also examined. The procedure is analogous to that described above except that the investor matches the target risk fund only once at the beginning of the life of the shorter lived fund (normally the TDF) and holds their starting weights for the life of the target date fund. The results are qualitatively the same. However the returns on the target date fund portfolio and the standard deviation of the return are higher, while the Sharpe ratio is about the same as that found with annual rebalancing.

[18] In all cases where no target risk fund had a higher percentage in equity than the target date fund we could have selected an all-equity fund from the equity funds offered by the fund family as an alternative, but there was no rational way to select one fund from all of the equity funds offered by a fund family.

The empirical results suggest that an investor can be as well or better off holding target risk funds as he or she is holding target date funds. However holding target risk funds allows the investor greater choice in the pattern of risk he or she desires.

VI. Summary and Conclusions

Both theorists and empiricists have recognized that investors generally make poor asset allocation decisions. Two types of asset allocation schemes have been developed to help the investor deal with the asset allocation decisions. Target risk funds which attempt to hold risk constant and target date funds which lower risk over time.

Target date funds have received a lot of attention in the academic literature and the popular press. This is true despite the theoretical and empirical literature questioning the optimality of decreasing risk in an investor portfolio over time.

The second alternative risk target risk fund has received very little attention and indeed very little is known about their characteristics and behavior. This paper attempts to rectify this omission. A second purpose is to see on the basis of performance if target risk funds provide a reasonable alternative to target date funds.

There are a number of interesting characteristics of TRFs. Target risk funds primarily invest in low cost share classes of the funds they hold, most of which could not be held by most types of investors; however, as we show, most or all of this advantage is eliminated by the fees charged by the TRF itself. Target risk funds hold many asset categories other than U.S. and foreign stocks and bonds. We find that this lowers return and increases risk. Individual TRFs attempt to manage risk by holding the proportion invested in equity and debt close to constant over time. TRFs in the same family are almost always managed by the same manager and hold

the same underlying funds with the managers varying the percentage invested in each underlying fund to vary the risk across the different TRFs.

The performance of TRFs can be captured with a great deal of precision with a nine index model based on the literature of financial economics. When this is done we show that target risk funds produce a negative alpha of 62 b.p. per year on their investments. This is similar to the performance of all mutual funds and the managers show no ability to select superior funds. This is true despite the fact that managers of TRFs are almost always selecting funds from their own family so should have superior information. We show that an individual using a simple rule to replicate the TRF holding exchange traded funds would generally have a higher Sharpe ratio and higher utility of wealth than that obtained by holding the TRF itself.

Finally when we compare the performance of the TRF and TDF for families that offer both we find that a portfolio of TRFs matched by risk to TDFs produces 40 basis points higher return a lower risk and a higher Sharpe ratio. TRFs are a reasonable alternative to target date funds for pension plans and individuals.

Why then have assets under management by target date funds grown so much faster than assets in target risk funds? We can only speculate that since the answer does not seem to be in performance, it must be in the appeal to the investor of having a predetermined lifetime asset allocation that purports to be optimum for his or her optimum planning horizon.

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Table 1

TDF Expense Ratios Reported as of 2014

	Aggressive				Moderate				Conservative			
TDF class	num	underlying	fund	total	num	underlying	fund	total	num	underlying	fund	total
A	60	0.763	0.616	1.379	33	0.745	0.589	1.334	45	0.671	0.630	1.301
B	33	0.761	1.380	2.141	20	0.767	1.338	2.105	26	0.657	1.392	2.049
C	53	0.756	1.305	2.061	29	0.745	1.277	2.022	42	0.657	1.367	2.024
Retirement	47	0.731	0.621	1.353	24	0.737	0.614	1.351	36	0.624	0.596	1.220
Institutional	54	0.781	0.272	1.053	30	0.745	0.228	0.973	41	0.670	0.284	0.954
Investor	8	0.888	0.272	1.160	3	0.624	0.160	0.784	10	0.721	0.313	1.035
No Load	12	0.607	0.455	1.063	11	0.667	0.248	0.914	11	0.508	0.410	0.918
Administration	3	0.675	0.323	0.998	1	0.581	0.325	0.906	1	0.514	0.255	0.769
Advisor	17	0.671	0.371	1.042	6	0.684	0.404	1.088	10	0.571	0.436	1.007
Average		0.750	0.733	1.484		0.735	0.706	1.441		0.648	0.753	1.402

This Table shows the expense ratio on the underlying funds held by the target risk fund, the expense ratio added by the target risk fund and the total expenses a shareholder would pay for various share classes and risk profiles. Note that some fund families do not offer TRFs of each of the three risk classes. Some funds have different labels for the share classes shown in the table (e.g. R2 class for retirement.) They are included in the appropriate class by using the description in the prospectus. The row labeled average is a weighted average with each expense number multiplied by the percentage of funds in each share class.

Table 2

Share Classes of Underlying Funds Held by TRFs as of 2014

Share Class	Number	Percentage of total assets
A	24	1.69
Administrative	2	0.08
Advisor	5	0.27
B	1	0.03
C	1	0.04
CASH	213	0.80
D	1	0.01
ETF	64	4.43
INDEX	4	0.05
Institutional	650	60.02
Investor	53	9.12
M	1	0.01
N	13	0.95
NAV	65	2.35
NO LOAD	67	6.79
RETIREMENT	134	12.60
S	12	0.56

This table shows which share classes are held by target risk funds, the number of funds of any share class type held across all target risk funds and the percentage of total assets invested in that share class

Table 3

Expense Ratios For Target Risks and Target Date Funds as of 2014

	Average Total Expenses		Average Underlying Fund Expenses		Average Expenses Added by the Fund	
Share Class	**TRF**	**TDF**	**TRF**	**TDF**	**TRF**	**TDF**
A	1.343	1.135	0.724	0.609	0.614	0.527
C	2.046	1.822	0.720	0.62	1.326	1.202
Investor	0.771	0.731	0.778	0.483	0.276	0.249
No Load	0.968	0.810	0.594	0.678	0.376	0.132
Average Retirement	1.308	1.028	0.696	0.612	0.681	0.417

Average Total Expenses represents the annual expenses as a percent of assets that an investor who holds the class of shares indicated in the first column would pay. Average fund underlying expenses represent the fees (as a percent of assets) that are paid to the underlying funds held by the TRF or TDF. Average target fund expenses are the additional fees as a percent of assets charged by the TDF or TRF.

Table 4

Composition of TRF Portfolios (in percent) as of 2014

	Number	Cash	Equity	Bond	Min in Equity	Max in Equity	Percentage Foreign Equity	Percentage Foreign Bond
aggressive	88	5.05	83.25	11.70	73.73	89.18	30.90	15.86
moderate	52	7.36	58.63	34.01	51.22	65.35	26.63	12.61
conservative	73	11.44	33.39	55.16	25.13	42.19	28.25	12.07

This Table shows for each risk class of target risk funds the average percent held in cash, equity ,and debt and the minimum and maximum. This Table also shows the percentage of holdings of stocks and bonds which are invested in foreign securities.

Table 5

Investment Patterns of TRFs as of 2014

Panel A
Percentage of total investment held in each category as of 2014

	num	single country	single sector	emerging debt	emerging stock	commodities and futures	global real estate	us real estate	neutral & tactical	muni bond	foreign stock	us stock	us bond	foreign bond	money market
aggressive	88	0.135	1.324	0.409	4.480	0.872	0.797	0.816	1.046	0.110	22.368	55.724	10.146	1.057	0.282
moderate	52	0.113	0.936	0.778	2.341	0.830	0.701	1.288	1.523	0.131	12.759	42.602	32.088	2.395	0.674
conservative	73	0.054	0.725	1.689	1.637	0.875	0.625	0.599	2.432	0.086	8.643	23.532	52.264	3.759	1.314

Panel B
Percentage of funds that hold a particular category

aggressive	88	7.95%	25.00%	17.05%	72.73%	28.41%	30.68%	31.82%	20.45%	3.41%	98.86%	100.00%	73.86%	30.68%	26.14%
moderate	52	9.62%	26.92%	26.92%	63.46%	28.85%	30.77%	30.77%	26.92%	3.85%	90.38%	100.00%	100.00%	36.54%	36.54%
conservative	73	4.11%	26.03%	30.14%	57.53%	27.40%	32.88%	34.25%	28.77%	2.74%	95.89%	98.63%	100.00%	41.10%	39.73%

Panel A shows the percentage of total investment invested in each category by risk class of target risk funds.
Panel B shows the percentage of target risk funds that invest in each category.

Table 6

Percentage of TRFs Investing in Non-Standard Investments in Selected Years

Aggressive

Year	num.	Single country	Single sector	Emerging debt	Emerging equity	Commodity and future	Global real estate	Domestic real estate	Market neutral and tactical	Municipal
2005	43	0.00%	6.98%	9.30%	27.91%	0.00%	2.33%	39.53%	0.00%	0.00%
2010	65	3.08%	18.46%	16.92%	44.62%	16.92%	20.00%	38.46%	6.15%	0.00%
2014	88	7.95%	25.00%	'.05%	72.73%	28.41%	30.68%	31.82%	20.45%	3.41%

Moderate

Year	num.	Single country	Single sector	Emerging debt	Emerging equity	Commodity and future	Global real estate	Domestic real estate	Market neutral and tactical	Municipal
2005	13	0.00%	7.69%	7.69%	7.69%	0.00%	0.00%	46.15%	7.69%	0.00%
2010	42	2.38%	21.43%	26.19%	35.71%	14.29%	26.19%	38.10%	14.29%	0.00%
2014	52	9.62%	26.92%	26.92%	63.46%	28.85%	30.77%	30.77%	26.92%	3.85%

Conservative

Year	num.	Single country	Single sector	Emerging debt	Emerging equity	Commodity and future	Global real estate	Domestic real estate	Market neutral and tactical	Municipal
2005	18	0.00%	0.00%	5.56%	5.56%	0.00%	0.00%	38.89%	0.00%	0.00%
2010	55	5.45%	14.55%	18.18%	27.27%	12.73%	20.00%	36.36%	9.09%	0.00%
2014	73	4.11%	26.03%	30.14%	57.53%	27.40%	32.88%	34.25%	28.77%	2.74%

This table shows the percentage of target risk funds that hold various types of non standard investments in each of three years.

Table 7

Common Holdings Across Risk Types (as of 2014)

	Number			Equal weighted			Value weighted		
	Aggressive	Moderate	Conservative	Aggressive	Moderate	Conservative	Aggressive	Moderate	Conservative
Aggressive	29	44	49	81.7%	95.2%	87.1%	85.4%	95.9%	88.7%
Moderate	49	44	17	85.4%	87.5%	93.0%	85.6%	89.0%	95.5%
Conservative	44	5	44	79.2%	95.0%	89.7%	71.7%	94.6%	91.0%

This table shows The percentage of funds held in common across target risk funds with different risk as of 2014. There are two measures of commonality. Equally weighted is the percentage of funds held by target risk funds in the risk category shown in the row that are held by the risk category indicated by the column. Value weighted is the percentage of assets held by target risk funds in the risk category shown in the row that are held by the risk category indicated by the column.
The percentages are calculated after removing cash, money market investment and futures.

Table 8
Commonality of Specific Investment Types (as of 2014)

Investment types	number of families which hold	only in conservative	only in aggressive	held by both
Foreign single country	4	0	1	3
Domestic single sector	14	0	1	13
emerging market bond	14	2	1	11
emerging market equity	36	0	6	30
Commodity/Futures	18	1	2	15
Global real estate	17	0	0	17
domestic real estate	19	1	3	15
Market neutral and tactical	14	1	0	13
Municipal	2	0	0	2

This Table shows the number of fund families that hold various categories of funds and how many times they are held in their conservative fund, aggressive fund or both.

Table 9

Asset allocation over Time (in percent)

Years	Num.	Cash	Equity	Bond	non US bond	non US equity	Min. equity	Max equity
				Aggressive				
First	74	5.14	83.10	11.76	0.76	22.98	79.16	85.71
Last	74	5.51	82.03	12.46	2.77	27.30	78.45	85.05
				Moderate				
First	47	8.04	58.66	33.30	1.90	14.25	55.01	62.13
Last	47	7.11	58.74	34.15	6.02	16.78	55.62	61.59
				Conservative				
First	60	13.09	34.84	52.06	2.16	8.21	31.57	38.76
Last	60	10.84	33.45	55.71	9.79	11.01	29.38	36.86

This Table shows the average percent that Target risk funds, in each risk class, invest in the major asset categories in two periods of time. The first period is the second and third year of each funds existence while the second period is the latest and next to latest period. The equity, bond and min. and max. column report the sum of domestic and international holdings. The min. and max. columns report the minimum and maximum any target risk fund holds in equity in the respective periods.

Table 10

Sensitivities to factors

means

	num.	U.S. stock	small minus big	High minus low	non us stock	emerging markets stock	US bond	non us bond	high yield	mortgage backed securities	St. Dev. of Returns	St. Dev. of Resid.	R^2
Aggressive	88	0.889	0.045	-0.037	0.143	0.063	0.095	0.020	0.042	-0.173	4.036	0.557	.978
Moderate	52	0.635	0.023	-0.011	0.079	0.043	0.256	0.032	0.081	-0.160	2.997	0.425	.959
Conservative	73	0.385	-0.002	-0.001	0.044	0.028	0.419	0.037	0.087	-0.113	1.874	0.354	.989

This table shows the coefficients from a time series regression of the monthly return of each target risk fund on monthly returns on the nine indexes indicated above and described in detail in the text. It also shows the standard deviation for the target risk funds, and the standard deviation of residuals from the regression, and the R^2

Table 11
Attributes of the Mimicking Portfolio Minus the Target Risk Funds (monthly data)

Panel A
All Holdings Matched with ETFs

	Aggressive (69)	Moderate (44)	Conservative (58)
Return	.035*	.023*	-.015
Standard Deviation	-.035	-.023	-.077*
Sharpe Ratio	.011*	.011*	.003

Panel B
Stock and Bond Holdings Matched with ETFs

	Aggressive (69)	Moderate (44)	Conservative (58)
Return	.045*	.032*	-.010
Standard Deviation	- .048	-.081	-.123
Sharpe Ratio	.014*	.016*	.010

Panel C
Matched with Actual Stock and Bond Holdings

	Aggressive (69)	Moderate (44)	Conservative (58)
Return	.020*	.021*	.022*
Standard Deviation	.003	-.032	.005
Sharpe Ratio	.005*	.007*	.006

This table shows the difference in the return, standard deviation and Sharpe ratio between a mimicking portfolio and the target risk fund before the expense ratio on the target risk fund is charged. Panels A, B and C report the results with three different mimicking portfolios. Panel A uses an exchange traded fund or index fund with the same Morningstar classification as each of the TRF's holdings. Panel B uses exchange traded funds or index funds to only match the stock and bond holdings of the target risk fund (scaled to 100%). Panel C uses only the actual stock and bonds holdings of the target risk fund itself scaled to 100% (excludes all categories shown in Table 6). The number of funds differs from prior tables because for some TRFs we do not have data on the funds the TRF holds in some years prior to 2014. This occurs because they report security holdings of the funds they hold rather than data on the funds themselves.

*indicates statistical significance at the .01 level