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Has the Lack of Asset Diversification in DC Retirement Plans Been a Costly Missed Opportunity?

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Executive Summary

For several decades, the predominant trend in the retirement industry in the United States has been a move away from defined benefit (DB) style plans toward defined contribution (DC) plans. This trend is not confined to the U.S. — similar shifts are occurring around the globe in many mature retirement markets, including Canada, the United Kingdom, and Australia.

As DC plans have become the main source of retirement savings for a growing number of individuals, investment options and line-ups have had to evolve significantly because of the growing importance of these plans as a major source of retirement income. The emergence and growth of target date funds (TDFs) is undoubtedly the largest and most important change seen since the 1990s.

Did You Know?

Many North American plan sponsors are either implementing or seriously considering the merits of private equity and real asset strategies in their DC plans. For example, the $12 billion (CAD) Public Employees Pension Plan (PEPP) in Saskatchewan, Canada, has invested in Canadian private real estate in their target date/risk strategies for many years. In the past three years, PEPP has begun investing in private equity, infrastructure and foreign real estate as well. Many U.S. public sector DC retirement plans also are studying the merits and drawbacks of investment alternatives in their target date funds, like the $32 billion University of California Retirement Savings Program.

An Evolving Asset Mix for DC Plans. In 2006, CEM reported that U.S. DB plans had outperformed the average return of DC plans by 1.80% (180 basis points) a year from 1998–2005: an enormous gap. When CEM updated this research in 2017, it found that in the 2007–2016 period, DC plans had narrowed the gap to 0.46% (46 basis points).[1] Most of this narrowing was attributed to an improved average asset mix held by DC participants, an improvement driven by assets flowing into TDF options that are professionally managed. The full impact of the TDF revolution has still not fully arrived, because the huge inflows into target date default options mean that an increasingly larger and larger proportion of DC assets will be held within them over time.

But it is not just DC plans that have evolved; investment strategies used within DB plans have also evolved. One of the more significant trends has been the increased investment in private, illiquid asset classes such as private equity, real estate, and infrastructure due to the potential for improved total-return performance, less reliance on traditional stocks and bonds, greater diversification, and lower volatility of asset values over the longer term.

Evaluating the Introduction of Private Assets. This study asks the question, "Should DC plan sponsors emulate DB plans by increasing (or, in most cases, introducing) allocations to illiquid assets within target date fund options?" It analyzes the potential impact of allocations to illiquid assets within target date options on the returns (growth in assets) plan participants might have obtained over the study period.

The analysis, which focuses on the period 2011–2020, leverages CEM's United States database of reported DC TDF allocations and returns in combination with reported DB plan allocations and return data. It assesses how DC plan participants' experiences would have changed had DC TDFs made higher allocations to illiquid assets during this time period.

The analysis used the actual range of reported annual real asset and private equity portfolio return series of DB pension plans, net of all costs to implement the portfolios, to calculate a range of adjusted outcomes assuming the adoption of investment alternatives under a set of DC target date scenarios. The range of outcomes for the adjusted DC target date scenarios was then compared against unadjusted DC target date options to assess the impact of illiquid asset allocations on target date performance.

[1] "Defined Contribution plans have come a long way," CEM Benchmarking.

Exhibit ES1 presents the summary of results. These are the three scenarios modeled.

- **Scenario 1, "Add a 10% Private Equity Sleeve":** Allocations to private equity that substituted for publicly traded stocks had the strongest impact on returns, boosting the median return by 0.22% (22 basis points) a year. The proportion of outcomes that were improved was also high, at 80%. While investors usually say they target "top quartile" managers in private equity, this analysis found that second- and even third-quartile portfolios outperformed (had outcomes that outperformed the portfolio without private equity) over the period of the study.

- **Scenario 2, "Add a 10% Real Asset Sleeve":** Allocations to real assets that substituted for mixtures of U.S. large-cap and core bonds showed improved target date performance in most outcomes. Notably, 72% of potential outcomes had higher 10-year returns than the original performance without real assets. The median improvement in return was 0.11% (11 basis points) per year.

- **Scenario 3, "50/50 of Scenarios 1 and 2":** Smaller allocations of both private equity and real assets had a performance impact between Scenarios 1 and 2, with a median improvement of 0.15% (15 basis points) per year. The diversification impact was the most compelling, with the highest percentage of improved outcomes: 82% improved outcomes over the same 10-year period.

Summary Exhibit ES1: Outcomes by Adding Private Equity and Real Assets

	Scenario 1	Scenario 2	Scenario 3
Add:	Up to 10% Private Equity	Up to 10% Real Assets	Up to 10% Illiquid Assets
Replace:	Mix of all listed stock	U.S. large-cap + Core bonds	Combines half of Scenario 1 with half of Scenario 2
Replacement rule:	Pro-rata	Equal portfolio risk	
Glide Path of added assets:	Highest far from retirement	Highest before retirement	
% Better outcomes	**80%**	**72%**	**82%**
Median change in annual return	**+0.22%**	**+0.11%**	**+0.15%**

Greater Asset Diversification Can Materially Improve Outcomes. A reasonable question from a plan sponsor is, "Why should private equity or real asset investments be included in the target date options of a DC plan?" And more importantly, "How significant are the gains or benefits of doing so relative to the operational challenges to address?"

In short, the net impact is materially positive. This analysis changed the asset allocation on, at most, 10% of the portfolio without substantially changing risk. Over time, such a modest adjustment can have a material impact.

As illustrated in Exhibit ES2, the 0.15% (15 basis points) per year return improvement in Scenario 3, which had the highest proportion of improved outcomes, would represent about *$5 billion* per year in additional net return if applied to all U.S. target date options.[2] A 0.15% return improvement to the entire U.S. DC market would represent *$35 billion* per year in additional net return. Using reasonable assumptions for an individual DC participant who saves for 40 years and then draws down for 20, the return

Summary Exhibit ES2: Approximate Impact of Improved Return

How much difference does a change in return of 0.15% per year make?

On the system	
Impact applied to all current U.S. target date assets	*$5 billion/year*
Impact applied to all U.S. DC assets	*$35 billion/year*
On an individual	
% Change in yearly spending power for a retiree who saves for 40 years, then draws down for 20	*5%*
$ Change in yearly spending power for the same retiree earning $48,000 per year in retirement	*$2,400/year*

Assumes base returns of 6%/year, salary growth of 3%/year

[2] Size of target date and total U.S DC market from Morningstar 2022 Target-Date Strategy Landscape.

improvement might represent an additional $2,400 per year ($200 per month) in spending power for a retiree already drawing $4,000 per month or $48,000 per year in retirement income.

The results of the analysis show there can be significant benefits to adding private equity and real assets to TDFs. Private equity has provided return enhancement while offering greater diversification among equity sub-asset classes and improved outcomes for investors. Real assets have served as a diversifier alongside stocks and bonds, with an additional benefit of offering inflation sensitivity.

DC Plan Considerations. This paper refers to other work about some of the DC-specific considerations in adding private assets, while providing additional commentary about others, but does not focus on them directly; rather, it attempts to highlight whether potential financial benefits for plan participants justify implementing the solutions.

These considerations are briefly summarized here.

*Liquidity and Valuation***.** DC plans have requirements for liquidity and valuation frequency that can be higher or of a different nature than those of typical DB plans. These requirements can be addressed and many DC plans, both in and outside the United States, have done so. In some markets, such as Australia, inclusion of illiquid assets in DC options is common.

Did You Know?

The U.S. Department of Labor issued an "Information Letter" on June 3, 2020, about the use of alternatives in DC plans that stated, "a plan fiduciary would not, in the view of the Department, violate the fiduciary's duties under Section 403 and 404 of ERISA solely because the fiduciary offers a professionally managed asset allocation fund with a private equity component …"

Observed Volatility. Private assets obtain market prices when bought or sold, but otherwise report valuations produced by appraisal or similar processes. This approach produces returns that are less volatile, having less fluctuation between higher and lower returns, than the returns seen in public markets for comparable assets. Due to this reduction in observable volatility, all three scenarios displayed a reduction in volatility of returns for the target date options in 100% of outcomes.

Cost. Just as DB plans with private assets have higher costs, so would DC plans. What is meaningful to plan participants is the value of the strategy being pursued in terms of expected impact on total return and risk. The strong performance shown by all three scenarios is calculated after the impact of higher costs, since the net (after cost) returns of DB pension plan portfolios are used. These returns are net of not only manager fees, commitment fees, and performance fees, but also of asset class-specific consulting costs, and the internal staff costs at the DB plans required to oversee these portfolios. The net returns used reflect the true returns available to plan participants after the full incremental cost of implementing a private asset portfolio.

It is important to note that the efficiency with which the average DB plan accesses private asset investment expertise is not a ceiling. Structural innovation could connect DC participants' assets, perhaps through very large multi-employer pools (MEPs) such as Pooled Employer Plans (PEPs) today or in off-the-shelf options from large providers, with skilled private investors, in ways that are more efficient, which reduces fees and makes the case for their inclusion even more compelling.[3]

Conclusion

Public equity markets have delivered strong returns to retirement savers over the past four decades, supported by a long-term decline in interest rates. Many investment strategists foresee a different interest rate environment going forward, where simply allocating to public stocks alone may not generate the same returns as in the past. As a result, it will be increasingly important for plan sponsors to diversify and optimize the asset allocation of their target date funds.

[3] Callan Institute. 2023 Defined Contribution Trends Survey: 71% of their 99 DC plan respondents said they are "very unlikely" to join a PEP, with "loss of control" cited as the number one reason for avoiding PEPs.

The success of DB plan sponsors as investors in private equity and real assets encourages plan sponsors and their investment fiduciaries to closely consider and examine opportunities to adopt real assets and/or private equity for their TDFs and/or further increase their current investment policy allocations to such asset classes. Those without the scale to access these asset classes efficiently may consider what sort of structures (PEPs or an Outsourced Chief Investment Officer (OCIO)) might broaden the investment opportunities they can deliver to their participants to achieve better results.

Large providers of TDFs can use their scale and buying power to deliver above-average value in these asset classes via their offerings to plan sponsors and their participants. Plan sponsors should continue to further demand that their service providers, specifically their investment managers, TDF providers, and investment consultants, create, find, and deliver compelling real asset and private equity investment vehicles that can deliver successes like those achieved by DB plans.

Regulators can continue to provide a clear framework for responsible fiduciaries to include private assets within DC plans. Doing so removes a key barrier to adoption by prudent sponsors who see a compelling investment case on behalf of their participants.

Introduction

In the past 30 years, there have been many changes in the retirement investment landscape, including new asset classes, increased global diversification, and large plans using their scale to deliver efficiency. Perhaps the most significant is the emergence and growth of target date funds (TDFs) in DC plans. TDFs provide DC participants with easy access to a risk-appropriate and professionally managed investment asset mix.

All DC market data continues to emphasize how TDFs dominate as default options and therefore in asset growth. In particular, the latest Plan Sponsor Council of America (PSCA) survey of more than 500 DC plans illustrates that over 80% use TDFs for their default option, and today, almost one-third of all assets are invested in target date funds.[4] This mirrors CEM's database of large U.S. DC plans, within which 85% of plans representing $1.38 trillion in assets defaulted their participants into TDFs in 2020.[5]

While celebrating this success, the industry continues to seek improvements to TDF offerings. One question frequently raised is whether such offerings should include allocations to illiquid assets, as is common with DB plans. This research report uses CEM's data to perform a simulation, based on actual pension investor experience, to assess whether an earlier inclusion of illiquid assets in U.S. DC plan TDFs would have been beneficial for plan participants.

Asset Allocations in U.S Target Date Funds. As shown in Exhibit 1, the use of private market assets in DC TDFs is very low relative to the allocations of DB plans.[6] For example, unlisted real estate, while growing, still represents less than 1% of target date assets. Private equity has not, to date, consistently appeared among this group of target date options. This relatively low use of illiquid assets in DC TDFs stands in contrast to the larger, and growing, use of such assets by DB plans.

Exhibit 1: Allocations of U.S. Target Date Options

Data shown is the average allocation for all target date options in the CEM database where unbroken survey data is available from 2011 to 2020. Given that it is a consistent set of options, we might expect to see some evidence of movement along glide paths over the decade.

Average Asset Allocation Trend for U.S. Target Date Options

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Stock	U.S. Large & Broad	43.1%	41.0%	39.3%	39.5%	37.8%	37.5%	34.8%	34.8%	33.4%	33.6%
	U.S. Small & Mid	6.0%	5.6%	5.3%	5.2%	5.2%	5.2%	4.9%	4.7%	5.7%	5.4%
	Non-U.S.	21.7%	22.2%	22.9%	23.6%	25.0%	25.1%	24.0%	23.3%	24.2%	24.2%
	Emerging	2.1%	2.2%	2.2%	2.2%	2.1%	2.1%	2.1%	2.5%	2.5%	2.3%
Fixed Income	Core	19.4%	19.9%	21.4%	20.3%	20.7%	20.4%	20.9%	21.1%	21.0%	23.0%
	TIPS	3.1%	3.3%	3.5%	3.4%	3.5%	3.4%	3.5%	4.0%	4.5%	4.4%
	Stable Value	0.4%	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.7%	0.6%
	Cash / Money Market	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.7%	0.4%	0.8%
	Other	1.4%	1.5%	1.7%	1.7%	1.7%	1.5%	1.6%	2.2%	2.3%	1.6%
Real Assets	Commodities	0.6%	0.9%	0.8%	0.6%	0.6%	0.8%	1.7%	1.3%	1.0%	0.7%
	Listed Equity REITs	0.6%	1.1%	1.0%	1.1%	1.0%	1.1%	3.0%	2.8%	1.8%	1.4%
	Unlisted Real Estate	0.2%	0.4%	0.1%	0.2%	0.2%	0.2%	0.4%	0.7%	0.9%	0.7%
Other	Hedge Funds & Risk Parity	0.4%	0.6%	0.2%	0.5%	0.5%	0.8%	0.9%	1.0%	1.0%	0.9%
	Private Equity	0.3%	0.2%	0.2%	0.2%	0.3%	0.2%	0.3%	0.0%	0.0%	0.0%
	Other	0.2%	0.2%	0.4%	0.5%	0.3%	0.5%	0.7%	0.4%	0.6%	0.5%

Data prior to 2017 was captured by four categories: U.S. Stock, foreign stock (which is later split into "Non-U.S. and emerging"), bonds and alternatives. These four asset classes have been subdivided into the fifteen asset classes captured from 2017 based on the relative composition of those larger asset classes observed in 2017. For example, if a given option had an allocation of 18% to Non-U.S. stock and 2% to emerging stock in 2017, a 10% allocation to "foreign stock" in 2011 is assumed to be composed of 9% Non-U.S. stock and 1% emerging stock.

[4] PSCA, pp. 45 and 60.
[5] See appendix Exhibit A1 for greater detail about the CEM DC dataset.
[6] Averages are shown for all allocations, because medians of allocations will not add up to 100%.

CEM has collected the asset allocation of TDFs held by DC plan sponsors from 2008 to 2016 in a simplified form (using the asset classes "U.S. stock," "foreign stock," "fixed income," "alternatives"), and in a more detailed form from 2017 onward. Exhibit 1 shows the detailed asset allocations, as well as details of the methods used to backfill the detailed allocation for years before 2017. The dataset here is restricted to target date options where allocation data was provided from 2011–2020 in uninterrupted form, which avoids distortions caused by plan sponsors entering or exiting the database. Target date 2060 and 2065 funds were excluded from the analysis due to their rarity in 2011, meaning uninterrupted data was rarely available.

This analysis groups TDFs for 2010 with retirement income funds. Excluding the 2060 and 2065 funds that were introduced over the decade results in the overall average allocations changing over time, as the funds that existed in 2011 move along their glide paths. Average allocations also reflect trends in asset allocations for TDFs in general, due to plan sponsors modifying asset allocations to reflect changing risk preferences and other factors.

Asset Allocations and Returns in U.S. DB Plans. Exhibit 2 shows not only a much higher use of illiquid assets in U.S. DB plans, but a long history of using them. Allocations to private real estate, private equity, and other real assets have all increased significantly since 2001, with most of this increase seen during the first decade of this period. It should be noted that slight declines in allocations to these asset classes in 2020 probably reflect high returns in publicly traded markets shifting allocations, rather than a conscious decision to reduce exposure to these assets.

Exhibit 2: Allocations of U.S. Defined Benefit Pension Plans

Data for this exhibit and Exhibit 3 are reproduced from the report "Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the United States, 1998–2020," found at https://www.cembenchmarking.com/ri/insight/40. Some asset classes shown are aggregations; the specific categories in each aggregate are described in that report.

Average Asset Allocation for U.S. Defined Benefit Pension Plans

	Stock			Fixed Income				Real Assets			Other	
Year	U.S. Large-Cap	U.S. Small-Cap	Non-U.S.	U.S. Broad	U.S. Long	U.S. Other	Non-U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds /TAA	Private Equity
2020	14.0%	2.4%	20.4%	12.5%	22.2%	6.0%	4.4%	4.6%	0.7%	1.4%	5.3%	6.1%
2019	13.7%	2.2%	18.8%	12.6%	23.5%	6.3%	2.7%	5.3%	0.6%	1.5%	6.1%	6.7%
2018	15.5%	3.4%	21.0%	12.7%	21.3%	4.5%	2.7%	5.2%	0.8%	1.4%	5.8%	5.8%
2017	17.0%	3.6%	21.8%	11.1%	19.4%	5.0%	2.6%	5.0%	0.7%	1.7%	6.6%	5.6%
2016	17.5%	3.7%	20.7%	11.7%	17.0%	5.3%	3.3%	5.3%	0.6%	1.7%	7.4%	5.9%
2015	18.2%	3.1%	20.5%	12.7%	16.9%	4.9%	2.8%	4.9%	0.7%	1.4%	8.3%	5.7%
2014	18.7%	3.4%	20.9%	12.1%	16.4%	4.8%	2.9%	4.5%	0.6%	1.4%	8.4%	5.9%
2013	20.9%	4.0%	20.9%	13.1%	14.6%	4.9%	2.6%	4.2%	0.6%	1.4%	7.1%	5.6%
2012	21.6%	4.5%	18.9%	15.1%	14.4%	4.8%	2.3%	4.1%	0.6%	1.4%	6.6%	5.9%
2011	22.6%	4.8%	18.9%	14.9%	13.2%	5.1%	2.8%	3.7%	0.6%	1.3%	6.4%	5.7%
2010	25.5%	5.5%	19.9%	17.0%	9.7%	5.0%	2.2%	3.4%	0.5%	1.2%	5.1%	5.1%
2009	25.8%	5.2%	18.3%	20.4%	7.8%	5.7%	1.9%	3.9%	0.5%	0.9%	4.6%	5.0%
2008	28.9%	5.2%	18.1%	20.6%	6.6%	4.5%	1.9%	4.3%	0.7%	0.7%	4.1%	4.3%
2007	32.8%	6.1%	20.1%	19.2%	4.1%	4.0%	1.7%	3.8%	0.7%	0.6%	3.5%	3.4%
2006	35.5%	6.8%	19.7%	20.5%	1.8%	4.0%	1.3%	3.5%	0.9%	0.3%	2.9%	2.7%
2005	37.4%	6.8%	18.6%	21.1%	1.4%	4.1%	1.5%	3.0%	0.9%	0.2%	2.4%	2.5%
2004	38.6%	6.8%	17.9%	21.6%	1.4%	4.2%	1.4%	2.7%	0.8%	0.2%	1.7%	2.7%
2003	38.1%	6.3%	16.8%	23.7%	1.6%	3.6%	1.8%	2.9%	0.8%	0.2%	1.4%	2.9%
2002	37.4%	6.1%	15.4%	27.2%	1.4%	2.4%	2.0%	3.3%	0.6%	0.1%	1.4%	2.7%
2001	37.8%	7.2%	15.3%	27.4%	0.8%	1.6%	1.8%	3.0%	0.5%	0.1%	1.5%	3.0%

Exhibit 3 shows the average[7] asset class returns by year of DB pension plans from 2001–2020. While target date fund data goes back to the mid-1990s, it is sparse at best for the first 10 + years due to the lack of product development and adoption. For this reason, it is not possible to extend the analysis to this earlier period. However, based on the

[7] The compound returns shown in Exhibit 3 are the compound of annual averages, which tend to be slightly higher for private assets than the average compound return, due to higher volatility of individual investors than the average. The analysis that follows in this report will not be subject to this bias, because the actual 10-year return series of individual DB funds will be used and then compounded before any averaging.

experience of DB plan sponsors who were invested in private equity and real assets from 2001–2010, it is possible to make observations on the impact of that return environment on the simulated options in our scenarios, by comparing DB plans' returns in private equity or real assets to their returns in the assets that would be substituted. Those observations are at the end of the Study Findings section below.

Exhibit 3: Returns of U.S. Defined Benefit Pension Plans

Data for this exhibit and Exhibit 2 are reproduced from the report "Asset Allocation and Fund Performance of Defined Benefit Pension Funds in the United States, 1998–2020," found at https://www.cembenchmarking.com/ri/insight/40.

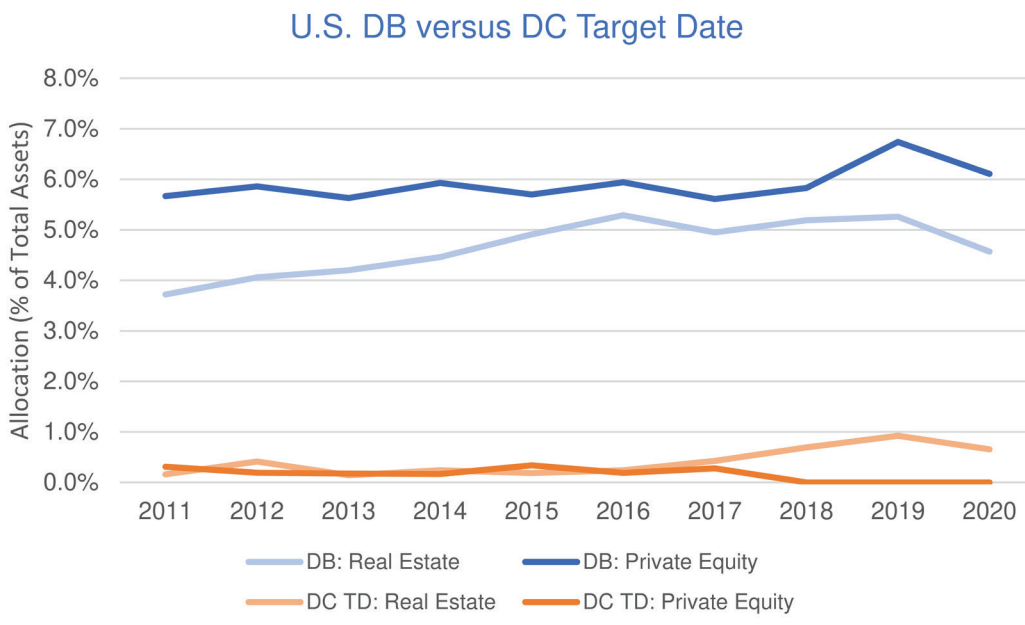
Average Asset Net Returns for U.S. Defined Benefit Pension Plans

	Stock			Fixed Income				Real Assets			Other	
Year	U.S. Large-Cap	U.S. Small-Cap	Non-U.S.	U.S. Broad	U.S. Long	U.S. Other	Non-U.S.	Unlisted Real Estate	Listed Equity REITs	Other	Hedge Funds/ TAA	Private Equity
2020	17.73%	19.54%	15.27%	10.32%	16.22%	3.22%	8.11%	-0.05%	-3.85%	-2.28%	5.47%	14.86%
2019	29.97%	26.89%	23.25%	10.69%	20.05%	5.71%	12.24%	5.40%	21.05%	7.10%	5.93%	9.66%
2018	-5.36%	-10.74%	-13.16%	-0.52%	-5.24%	-0.36%	-3.59%	6.79%	-4.20%	-0.84%	-1.98%	14.49%
2017	21.45%	16.24%	27.77%	4.66%	11.20%	2.98%	9.46%	7.05%	7.96%	6.20%	5.90%	15.38%
2016	11.56%	17.40%	5.06%	4.14%	7.50%	5.25%	8.73%	8.00%	4.88%	8.99%	2.42%	8.87%
2015	0.67%	-3.72%	-3.25%	-0.13%	-3.51%	-0.90%	-3.35%	12.74%	1.74%	-9.88%	-1.05%	8.39%
2014	12.52%	5.03%	-1.78%	6.91%	19.39%	1.79%	2.85%	12.73%	20.19%	2.37%	4.75%	15.37%
2013	33.38%	38.39%	17.84%	-2.09%	-7.72%	1.35%	-0.39%	12.00%	3.99%	2.88%	9.10%	15.43%
2012	16.27%	16.00%	17.72%	7.14%	10.51%	5.41%	11.54%	9.74%	20.55%	3.84%	7.54%	11.91%
2011	0.90%	-3.08%	-12.71%	8.48%	22.17%	3.61%	3.77%	13.37%	2.05%	-1.53%	0.80%	10.53%
2010	16.22%	26.41%	12.45%	8.61%	11.03%	5.10%	13.62%	9.01%	23.51%	10.93%	9.26%	12.42%
2009	29.52%	33.41%	39.57%	11.88%	4.18%	13.13%	20.38%	-29.69%	29.89%	5.65%	14.84%	-3.97%
2008	-38.10%	-37.65%	-44.44%	0.07%	13.96%	-5.39%	-8.67%	-8.14%	-38.20%	-9.66%	-17.84%	-10.79%
2007	5.81%	2.24%	14.30%	6.51%	7.66%	4.89%	7.88%	15.42%	-10.75%	14.40%	8.07%	20.46%
2006	14.67%	14.68%	25.72%	4.80%	2.67%	5.68%	7.79%	19.08%	34.75%	14.86%	11.03%	16.99%
2005	6.75%	7.21%	16.72%	3.15%	5.99%	3.32%	1.93%	23.12%	14.16%	19.19%	7.44%	18.94%
2004	12.02%	16.76%	19.62%	5.29%	9.07%	4.92%	10.31%	13.51%	32.43%	18.18%	7.42%	15.64%
2003	30.80%	43.17%	37.56%	6.11%	6.87%	8.12%	18.10%	9.63%	33.09%	9.56%	15.61%	9.02%
2002	-21.45%	-19.33%	-14.12%	9.38%	15.21%	2.35%	14.11%	5.22%	5.17%	9.24%	-12.17%	-12.19%
2001	-9.94%	-1.27%	-17.36%	8.17%	6.57%	4.54%	2.11%	6.00%	10.94%	4.44%	-5.02%	-18.19%
Compound of average return:												
2011-2020	13.27%	11.26%	6.66%	4.87%	8.54%	2.78%	4.78%	8.70%	7.04%	1.55%	3.83%	12.45%
2001-2010	2.26%	5.81%	5.50%	6.35%	8.25%	4.57%	8.44%	5.16%	10.84%	9.37%	3.25%	3.87%

The compound return shown here is the compound return of each year's average annual net return. This can be slightly higher than the actual compound return experienced by the average fund: Dispersion of results within years means that the average fund has higher volatility than the volatility of the annual averages.

Asset Allocations in U.S. DB Plans vs. U.S. Target Date Funds. Exhibit 4 graphically highlights the allocation differences between DB pension plans and the target date options of DC plans. As illustrated, DB plans have much higher levels of private equity and private real estate than TDFs over all time periods. TDFs show investments in private equity and real assets that are well below what might be expected if DB plan investment policy practices were used as a guide or measurement tool.

Exhibit 4: Relative Allocations to Private Equity and Real Estate



Methodology

This research study attempts to answer one main question: "Should DC plan sponsors emulate DB plans by increasing (or introducing) allocations to illiquid assets within target date options?" The analysis, which focuses on the period 2011–2020, leverages CEM's database of reported DC TDF allocations and returns in combination with reported DB plan allocations and return data to assess how DC plan participants' outcomes would have changed had DC TDFs held higher allocations to illiquid assets during this period.

Summary of Analysis

This analysis examines how the outcomes of DC plan participants in target date options without illiquid assets would have changed if these TDFs had included illiquid assets. To do this, a set of hypothetical TDFs has been constructed based on the actual TDFs reported that include allocations to private equity and/or real assets. The analysis creates hypothetical TDFs under three scenarios:

- **Scenario 1, "Add a 10% Private Equity Sleeve":** Adds up to 10% private equity to each target date option and replaces a pro-rata mix of the various stock components (e.g., large-cap, foreign stock) in the option. An assumed glide path is used here as well, with total private equity falling slowly to, and then more dramatically beyond, retirement.

- **Scenario 2, "Add a 10% Real Assets Sleeve"**: Adds up to 10% real assets to each target date option. In keeping with other glide path work, a lower allocation to real assets is added for very long dated or retirement income options. In all cases, a mixture of large-cap (domestic) stocks and core bonds is replaced, so the new asset allocation has the same expected portfolio volatility using a covariance-based risk model (a model that calculates the expected volatility of a portfolio based on its asset allocation, using the historical volatility of each asset class, along with a measure of how the returns of each asset class have historically moved with the returns of every other asset class.)

- **Scenario 3, "50/50 Sleeve of Scenarios 1 and 2"**: Combines half the substitution from Scenario 1 and half from Scenario 2.

For all three scenarios, the analysis calculates the return from 2011–2020 for each hypothetical target date option assuming it achieved the private equity or real asset net return of a single actual U.S. DB plan for each year of the decade. The study calls the resulting 10-year compound return an "outcome." This is repeated for each DB series available, creating a range of 10-year outcomes for each hypothetical target date option. The results focus on the distribution (medians, quartile breaks, etc.) of increased or decreased outcome returns relative to the original target date fund's 10-year return.

The discussion focuses particularly on two metrics: the median improvement in 10-year return and the percentage of "better outcomes" — the percentage of outcomes that outperform their original TDF's return. The average, quartiles, and top and bottom deciles of differences between outcome returns and their original funds' returns are also reported.

Adding Illiquid Assets: Private Equity and Real Assets

This study focuses on two illiquid asset classes: private equity and real assets, with real assets including real estate and infrastructure. The longest-standing and largest allocations of DB pension plans to private markets have been in real estate and private equity.

Private equity portfolios commonly contain buyout, mezzanine, growth equity, and venture capital investments. These assets are a different form of equity, and the public equity market can be the origin, or destination, for some private equity assets. Some DB plans have an overall target allocation to equity with no predefined mixture of public versus private equity, viewing them as parts of the same major asset class and substituting private equity for public equity as opportunities arise. Following this approach, Scenario 1 replaces a pro rata mixture of public equity (U.S. large-cap, mid-small-cap, foreign, and emerging stock) with private equity.

For the purposes of this analysis, real assets include only private real estate and infrastructure, while excluding some other, less commonly used real assets, such as timberland. By treating real assets (real estate and infrastructure) as a single asset class in this analysis, rather than separating infrastructure from real estate, it is possible to include the experience of DB plans that may have begun the period with no infrastructure but added infrastructure to their real asset allocation over the decade. The methodology used assumes some DC plans might have followed a similar path.

Target date options do not hold sufficient listed real assets to replace with unlisted real assets, so Scenario 2 substitutes a mixture of stock and core bonds to add real assets. The analysis attempts to select a stock-bond mixture to replace for each option so the option's risk (on a covariance model) remains unchanged. In this way, it attempts to mimic how a glide path manager who had established a given risk tolerance was likely to have allocated to real assets, in line with their typical use as diversifiers and an alternate asset class that delivers inflation-linked cash flows.

Assumed Maximum Allocation to Illiquid Assets

The analysis considers the impact of allocations to private equity and real assets, in both isolation and combination. For all the scenarios, a total allocation to private assets of up to 10% has been inserted, which is broadly inspired by the average allocation to illiquid assets by DB plans over the study period, which ranged from 11% to 13% (see Exhibit 2).

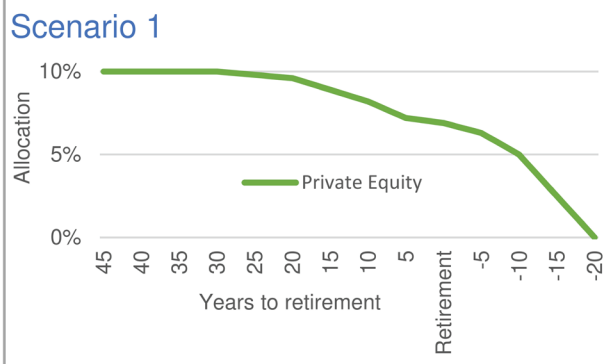
Scenario 3, which includes allocations to both private equity and real assets, assumes that maximal allocations to private equity and real assets are evenly split, based on the relatively proportionate allocations reported within the U.S. DB plan database for period 2011–2020 (see Exhibit 2). The scenario has maximum allocations of 5% private equity and 5% real assets for each target date option.

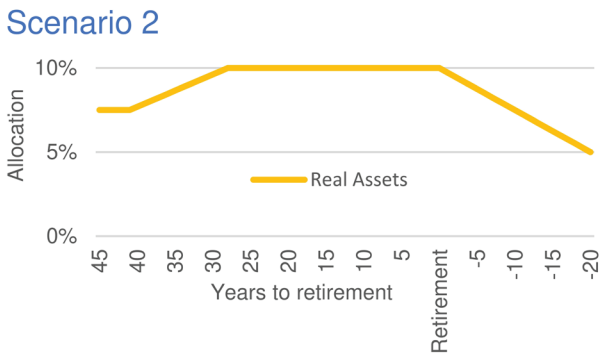
Assumed Glide Paths

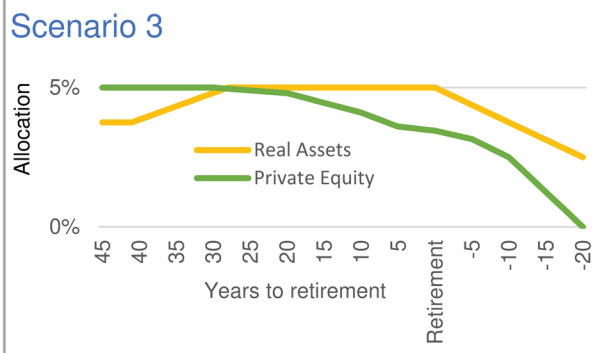
While both private equity and real assets peak at 10% in Scenarios 1 and 2, respectively, there is an assumed shift in allocation reflecting a glide path. There is no attempt to provide optimized glide paths here, merely reasonable ones for the purposes of the analysis. Glide paths are shown in Exhibit 5. The paths broadly follow that of the "Expanded TDF" as described by the Georgetown University Center for Retirement Initiatives (CRI) in conjunction with Willis Towers Watson.[8]

Scenario 1 maximizes private equity allocations far from retirement and then begins to decline very slowly, starting 30 years from retirement until the time of retirement. The allocation curves downward more aggressively at this point, falling below 7% at retirement and to zero by 20 years post-retirement.

Exhibit 5: Assumed Glide Paths by Scenario







Scenario 1 starts at 10% private equity, begins falling at 30 years before retirement, and curves down to 0% 20 years post-retirement.

Scenario 2 has a "humped" glide path with real assets rising to 10% at 28 years from retirement, holding until retirement, and then falling to 5% 20 years post-retirement.

Scenario 3 takes half of Scenario 1, plus half of Scenario 2.

Scenario 2 assumes allocations to real assets of 7.5% for TDFs for participants 45 years from retirement, recognizing the very high risk tolerance of these options as the demand for very high equity allocations crowds out the less risky real assets. The allocation begins to rise at 40 years before retirement, reaching the maximum 10% at 28 years before retirement. The 10% allocation is maintained to the time of retirement, at which point, it begins to fall, reaching 5% by 20 years post-retirement.

Scenario 3 takes half of the allocation from Scenario 1 and Scenario 2 and combines them, beginning with 5% private equity and 3.75% real assets decades from retirement, with real assets then rising to 5% at 28 years from retirement. Private equity begins to decline toward retirement very slowly, while real assets are still at 5% at retirement. Beyond retirement, private equity allocations drop to zero at 20 years post-retirement, while real assets decline more modestly to 2.5% in retirement.

[8] Angela M. Antonelli, "Can Asset Diversification & Access to Private Markets Improve Retirement Income Outcomes?"

Determining Asset Replacement

The insertion of an allocation of new assets must, naturally, remove or lower some other allocation. Theoretically, any combination of asset classes could be lowered to allow for the new allocations to private assets.

Insertion of Private Equity: Pro Rata Replacement of Listed Stock

Private equity is treated as "another form of equity" from an asset allocation standpoint. The analysis assumes that private equity will replace its most natural alternative: other stock allocations within each option, in the same proportion they are found in the option in the year. This leaves the relative ratios of the other stock allocations unchanged.

For instance, if a given target date option held 40% U.S. large-cap, 20% U.S. small-cap, 20% non-U.S. stock, and 20% bonds in 2017, the addition of 10% private equity would replace 5% U.S. large-cap, 2.5% U.S. small-cap, and 2.5% non-U.S. stock in the simulated option's 2017 asset allocation. Other asset classes within target date options would remain untouched.

Insertion of Real Assets: Replacement of U.S. Large-Cap and Core Bonds

Having a less natural asset to replace in existing target date portfolios that do not have large listed real asset allocations, the analysis requires a somewhat more complex rule for determining what assets to replace when inserting real assets. The largest component of real assets (investment property) is not directly comparable to either stock ownership or bond ownership, and functions as a new asset class being added to the allocation. In the analysis, only the allocations to the largest stock and bond categories are adjusted: U.S. large-cap stock and core bonds.

There are several advantages to this approach. First, U.S. DB plan allocations to real assets have displayed significant home country bias, so this assumption reduces the likelihood that results are affected by unintentional changes in geographical exposure. Second, reducing the two largest asset classes maximizes the likely intent of a glide path manager to diversify by adding real assets. The exact mix of large-cap stock and core bonds substituted in each option and year is calculated for the expected portfolio risk to remain unchanged. This attempts to mimic the decision a glide path manager might make in maintaining a desired tolerance for risk at each point on the glide path.

Calculation of Forward-Looking Risk of the Target Date Fund

To create the equal-risk hypothetical TDFs for Scenario 2, it was necessary to analyze the expected risk of each target date option individually before making any changes. Expected risk is calculated separately in each year for each option (because each option's allocation shifts as it moves along its glide path), using a standard variance-covariance model based on its asset allocation. The covariance table used is shown in the Appendix in Exhibit A2.

Public asset class risks in the covariance table are based on long-term volatility and correlations of standard market indices. Both unlisted real estate and private infrastructure are modeled using listed proxies with appropriate reductions in leverage, since listed equity real estate insurance trusts (REITs), for instance, typically exhibit higher leverage than unlisted real estate portfolios. For real estate, for example, the analysis used a proxy of 60% REITs and 40% fixed income to calculate volatility and correlations to other asset classes. This mixture is more volatile than and has a higher correlation to stocks than observed private real estate returns, due largely to appraisal-driven valuations. There is a continuing debate over how much of this difference in volatility is caused purely by differences in valuation, as opposed to features of the listed vs. unlisted market.

For the purposes of this analysis, the proxy is a conservative one, because it treats all the lower observed volatility in private markets (for instance, in unlisted real estate versus de-levered REITs) as a function of appraisal smoothing and lag. The scenarios do not take advantage of any of the lower observed volatility of private real assets relative to these proxies when creating an "equal risk" hypothetical target date option by increasing risk to compensate. Instead, the modeled options in the scenarios will be expected to exhibit this lower observed volatility. As is commented on in the summary of results, an allocator who viewed some of this lower observed volatility as lower risk would replace less stock and more core bonds with real assets. In most market environments, that replacement would increase the option's return by more than what is seen in this analysis.

A starting risk level for each option in each year and a target real asset level (based on years to retirement) makes it possible to follow a substitution rule by replacing U.S. large-cap and core bonds with the target real assets. The unique ratio of stocks and bonds were selected to be replaced, so that risk is unchanged, to create new hypothetical option allocations.[9]

Creating Hypothetical Target Date Funds with Private Equity and/or Real Assets

The following assumptions and constraints were used to adjust the reported allocations of the TDFs in all three scenarios:

- Allocations must still add up to 100%, so in total, the allocation to liquid assets must be reduced by the amount of illiquid assets added.

- Private equity will replace a mixture of stock asset classes found in the original allocation, while preserving the ratios between the other stock classes.

- Real assets will replace a mixture of U.S. large-cap and core bonds while preserving expected portfolio risk.

These assumptions allow a computational solution of the new allocation weights to the various stocks and core bonds within the respective risk constraints of the scenario. The analysis also filters out options under these scenarios:

- Allocations were not allowed to become negative (that is, explicit leverage would not be introduced). For a small number of long-dated funds (e.g., 2050 funds), existing allocations produced expected risk levels and allocations to fixed income meant that it was not possible to insert the target sleeve of real assets while maintaining equivalent risk without levering the portfolio — they did not have enough core bonds to replace. These options are excluded from the scenario.

- Certain target date funds in the database contained existing allocations to illiquid assets. Those options are excluded rather than "topping up" their allocation to illiquid assets, because the reduced impact of the change on those options clouds the analysis. A version of Exhibit 1, which provided the average allocations of target date options, but only including the options used in the analysis, is in Exhibit A8.

In both the target date allocations and the DB datasets, U.S. large-cap and U.S. broad cap are usually combined into one category. U.S. broad-cap mandates include a small portion of small-cap and mid-cap stocks; however, they are dominated by large-cap. The combined asset category (broad and large combined) is even more dominated by large-cap. In Exhibit 2 and elsewhere in this report, these assets are simply referred to as "large-cap stock."

Calculation of Hypothetical Returns for Comparison

The returns for the hypothetical target date funds were determined as follows. For each option and year (2011–2020):

1. Calculate an estimated return of the original target date fund; take the option's reported asset mix in that year multiplied by estimated returns for each asset class. These estimates are taken from the reported asset class level returns for DB plans, as shown in Exhibit 3, in that year.

2. Calculate the "unexplained" return for each year — the reported return minus the estimated return.

3. Adjust the reported target date return to account for the liquid assets being removed by:
    a. Subtracting the estimated return from the liquid assets being removed.

    b. Subtracting an asset-weighted proportion of the unexplained return, to account for the fact that some value added would also no longer be captured with the lower liquid asset allocation.

[9] As illustrated in Exhibit A3, the 2011 fund in the "Methodology Example" had a 13.22% level of Expected Volatility and this level of risk remains materially unchanged across all years, with a tolerance of +/- 20 basis points on the Expected Volatility at most, while increasing the levels of private equity and real assets for the simulation runs.

For example, to replace 4% U.S. large-cap and 6% core bonds with 10% real assets, subtract 4% times the average return on U.S. large-cap + 6% times the average return on core bonds + 10% times unexplained return).

4. Create an array of outcomes for each option using the 76 discrete 10-year return series for real assets and 69 return series for private equity:
    a. For Scenario 1, the array contains the returns determined by using the 69 return series for private equity.

    b. For Scenario 2, the array contains the returns determined by using the 76 return series for real assets.

    c. For Scenario 3, the array contains the returns determined by using the 69 return series for private equity each matched to the 76 return series for real assets, creating 5,244 return series combinations.

    d. In all scenarios, adjust the return series to reflect the respective allocation of the asset class.

This process creates a distribution of potential 10-year outcomes for each option based on reported return series. Since each outcome is based on a single, continuous set of returns from a DB plan, the outcomes realistically capture whatever persistence exists in higher or lower private asset portfolio performance.

Study Findings

The analysis compares the returns obtained by DC plan participants invested in TDFs without illiquid assets to the modeled range of returns that would have been obtained had those funds included private equity, real assets, or both. This is done by creating a set of hypothetical TDFs, based on the actual TDFs reported, that include allocations to private equity and/or real assets, and then generating a range of hypothetical outcomes based on adjusting the actual TDFs ' returns by injecting the actual range of multiyear returns generated by the private equity or real asset portfolios of U.S. DB plans. The results of this analysis are shown in Exhibits 6–8 and repeated with additional output metrics in Exhibits A4–A6. In all cases, attention focuses on the percentage of hypothetical outcomes that are superior to the original (without private assets) returns, and the median improvement in compound return.

Scenario 1: Addition of an Allocation of up to 10% to Private Equity

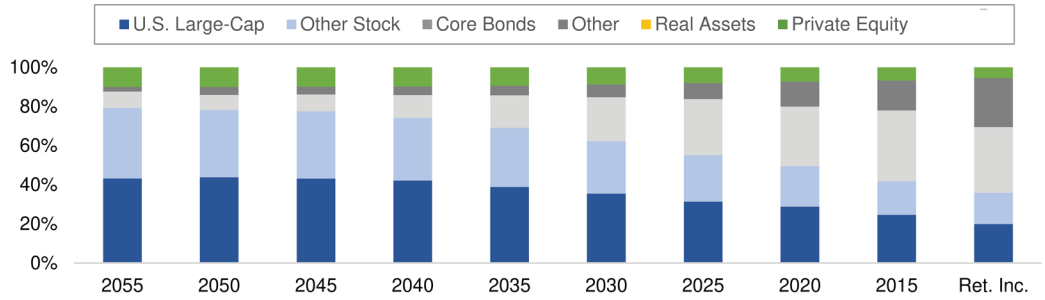
Scenario 1 adds private equity, tapering off at and through retirement, displacing whatever mixture of listed stock (U.S. large-cap, U.S. small-cap, non-U.S., and emerging) held by the option in that year. The adjusted TDFs outperformed the original options in 80% of scenarios, with a median improvement of 0.22% per year. Results are symmetrical; that is, the top quartile beat the median by 0.17% with a 0.39% improvement, while the bottom quartile did 0.17% worse than the median, yet still outperformed the original allocations by 0.05%.

Exhibit 6: Add up to 10% Private Equity

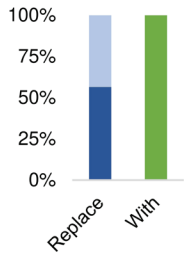
Scenario 1: Add Private Equity

Private equity is added, replacing a proportional mix of the public stock present in each option on a year-by-year basis. On average, each dollar of private equity displaces 57% U.S. large-cap and 43% other stock sub-asset classes (U.S. small, non-U.S. and emerging). The substitution resulted in better outcomes over the decade 80% of the time, with a median net return improvement of 0.22% per year.

Simulated glide path — average asset mix over 10 years, averaged for all options with the same retirement year



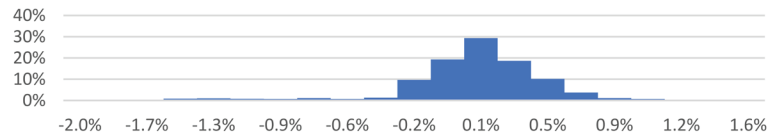
Average substitution



Change in 10-year compound return (simulated versus actual): range of outcomes

	2055	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Inc.	All options
90th	+0.61%	+0.67%	+0.67%	+0.64%	+0.61%	+0.55%	+0.49%	+0.41%	+0.36%	+0.27%	**+0.57%**
75th	+0.42%	+0.47%	+0.48%	+0.45%	+0.43%	+0.39%	+0.35%	+0.29%	+0.24%	+0.17%	**+0.39%**
Median	+0.25%	+0.27%	+0.28%	+0.26%	+0.25%	+0.22%	+0.20%	+0.16%	+0.13%	+0.06%	**+0.22%**
25th	+0.05%	+0.09%	+0.09%	+0.09%	+0.08%	+0.06%	+0.06%	+0.02%	-0.00%	-0.08%	**+0.05%**
10th	-0.22%	-0.14%	-0.14%	-0.14%	-0.14%	-0.14%	-0.14%	-0.16%	-0.18%	-0.68%	**-0.16%**
Average	+0.17%	+0.25%	+0.24%	+0.23%	+0.22%	+0.19%	+0.16%	+0.11%	+0.08%	-0.03%	**+0.18%**
% Better Outcome:	**79%**	**83%**	**83%**	**82%**	**82%**	**82%**	**81%**	**78%**	**75%**	**64%**	**80%**

Change in 10-year compound return (simulated versus actual): distribution of outcomes



Median Return Change: **+0.22%**
% Better outcome: **80%**

Performance improvement was strongest for 2045 options, which saw a median improvement of +0.28% and 83% of outcomes being superior to the original TDF's return.

Scenario 2: Addition of an Allocation of up to 10% to Real Assets

Scenario 2 adds up to 10% real assets, in a humped glide path (slightly less than 10% real assets are added more than 30 years before retirement, or post-retirement; see Exhibit 5). Large-cap stock and core bonds were substituted in each option and year to maintain the expected risk. On average, the removed assets were 44% large-cap stock and 56% core bonds.

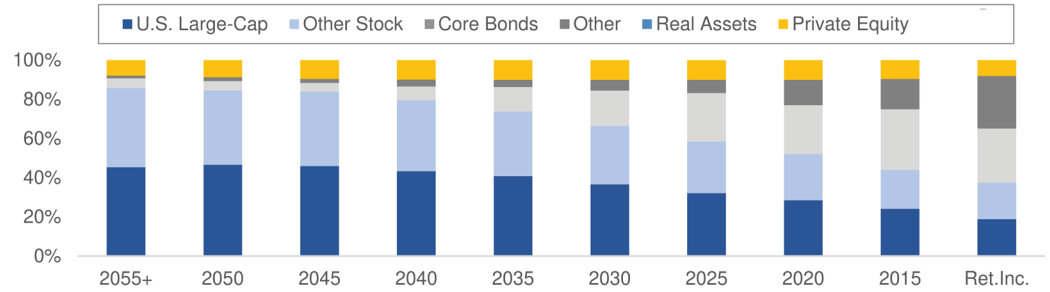
Exhibit 7 shows the resulting performance of the hypothetical target date funds. They exceed the returns of actual TDFs in 72% of cases, with the median outcome being an increase in annual returns of 0.11% (11 basis points). The 2035–2045 options had the highest incidence of positive outcomes, with 76%–77% of outcomes being better. Shorter-dated TDFs, including retirement income funds, had slightly more modest results. The lower overall risk of these options required real assets to replace a marginally higher stock percentage, which resulted in somewhat fewer (although still a majority of) outcomes outperforming the original portfolio. The longest-dated options had slightly more-muted results because they receive smaller allocations to real assets from the "humped" glide path.

Exhibit 7: Add up to 10% to Real Assets

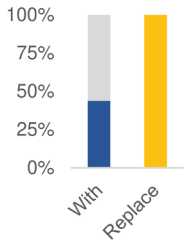
Scenario 2: Add Real Assets

Real assets replaced, on average, a mixture of 44% large-cap stock and 56% core bonds from target date options. Slightly more stock was replaced on shorter-date and retirement options. Substituting in real assets resulted in better outcomes 72% of the time, with a median net return improvement of 0.11% per year. Improvements were maximized for 2045 dated options, which had better outcomes 77% of the time.

Simulated glide path — average asset mix over 10 years, averaged for all options with the same retirement year



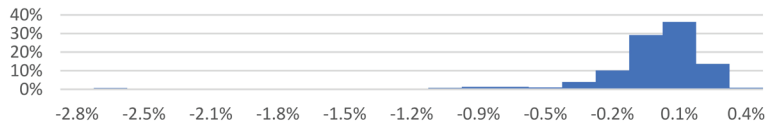
Average substitution



Change in 10-year compound return (simulated versus actual): range of outcomes

	2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
90th	+0.23%	+0.28%	+0.32%	+0.34%	+0.33%	+0.31%	+0.30%	+0.30%	+0.28%	+0.23%	**+0.30%**
75th	+0.16%	+0.20%	+0.23%	+0.24%	+0.25%	+0.23%	+0.22%	+0.21%	+0.20%	+0.15%	**+0.22%**
Median	+0.09%	+0.11%	+0.13%	+0.14%	+0.14%	+0.12%	+0.12%	+0.10%	+0.10%	+0.06%	**+0.11%**
25th	-0.01%	-0.01%	+0.01%	+0.00%	+0.00%	-0.02%	-0.01%	-0.03%	-0.02%	-0.05%	**-0.01%**
10th	-0.18%	-0.18%	-0.19%	-0.20%	-0.20%	-0.22%	-0.23%	-0.24%	-0.22%	-0.21%	**-0.21%**
Average	+0.02%	+0.04%	+0.06%	+0.06%	+0.06%	+0.04%	+0.04%	+0.02%	+0.03%	-0.00%	**+0.04%**
% Better Outcome:	**71%**	**73%**	**77%**	**76%**	**76%**	**72%**	**72%**	**68%**	**69%**	**63%**	**72%**

Change in 10-year compound return (simulated versus actual): distribution of outcomes



Median Return Change: **+0.11%**
% Better outcome: **72%**

As noted in the Methodology section, the risk model proxies used to determine the mixture of stocks and bonds replaced by real assets are quite conservative. Proxies of listed real estate (REITs) or listed infrastructure that have had their leverage reduced to match private real assets are used to calculate risk model correlations and volatility. These listed market-based proxies move significantly with listed stock markets. However, the actual returns that DB plans report in private real assets do not move as quickly as listed markets. Investors who believe that some portion of private real assets' lower volatility reflects real economic differences in private markets would, following the approach in all other ways, substitute less stock and more core bonds in introducing real assets, and see higher return improvements in most market scenarios.

A major reason for DB sponsors to invest in real assets is as a hedge against the inflation sensitivity of their liability. Higher inflation leads to higher career or final average salaries that enter pension formulas, and at some plans, higher CPI linked retirement payouts. DB sponsors then seek investments — like real assets — that might match these inflation sensitive cash flow needs. Glide path managers who incorporate a desire to provide inflation linked retirement income into their view of risk would likely follow DB plans in more aggressively adding real assets. In terms of this analysis, maintaining "expected risk" against inflation (rather than in absolute terms) would suggest substituting less stock and more core bonds than we have here when introducing real assets, improving returns in most market environments.

Scenario 3: Addition of an Allocation of up to 5% to Private Equity and up to 5% to Real Assets

Scenario 3 considers adding allocations of up to 5% real assets and 5% private equity, using half of each replacement from Scenarios 1 and 2. The median improvement in 10-year return, as shown in Exhibit 8, is 0.15%, falling just below the midpoint of Scenarios 1 and 2. The percentage of better outcomes,[10] however, was better than either of the other scenarios, at 82%. Where either private equity or real assets in a given outcome scenario reduced performance over the decade, there was an opportunity for the other asset to improve performance sufficiently to offset it.

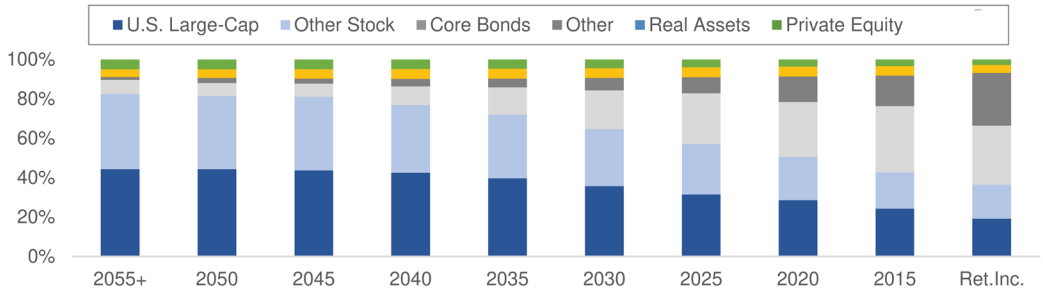
[10] "Better outcomes" refers to higher compound returns over the 2011–2020 time period.

Exhibit 8: Add up to 5% to Private Equity and 5% to Real Assets

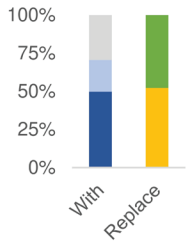
Scenario 3: Add both Private Equity and Real Assets

Half of each of the prior scenarios' substitutions are used here. Due to the separate glide pathing, a full 10% of private assets is never actually added: The highest substitution is on 2040 options where 9.9% private assets are added. On average, a mixture of 50% U.S. large-cap, 21% other stock, and 29% core bonds is being replaced by 52% real assets and 48% private equity. Substitutions vary by year: longer date funds receiving more PE. The median improvement of 0.15% per year falls almost midway between the prior two scenarios, but better outcomes are reached 82% of the time: higher than either other scenario. Using both private assets diversifies away some implementation risk (risk of a higher- or lower-performing program).

Simulated glide path — average asset mix over 10 years, averaged for all options with the same retirement year



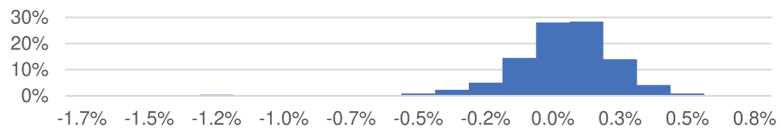
Average substitution



Change in 10-year compound return (simulated versus actual): range of outcomes

	2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
90th	+0.37%	+0.39%	+0.41%	+0.40%	+0.39%	+0.35%	+0.33%	+0.30%	+0.27%	+0.21%	**+0.36%**
75th	+0.27%	+0.28%	+0.30%	+0.30%	+0.29%	+0.26%	+0.24%	+0.22%	+0.20%	+0.14%	**+0.26%**
Median	+0.16%	+0.18%	+0.19%	+0.19%	+0.18%	+0.16%	+0.15%	+0.13%	+0.11%	+0.07%	**+0.15%**
25th	+0.05%	+0.06%	+0.07%	+0.06%	+0.06%	+0.05%	+0.04%	+0.02%	+0.02%	-0.01%	**+0.04%**
10th	-0.07%	-0.07%	-0.06%	-0.07%	-0.07%	-0.09%	-0.09%	-0.11%	-0.10%	-0.11%	**-0.09%**
Average	+0.14%	+0.15%	+0.17%	+0.16%	+0.15%	+0.13%	+0.12%	+0.10%	+0.08%	+0.05%	**+0.13%**
% Better Outcome:	**82%**	**83%**	**85%**	**84%**	**84%**	**82%**	**81%**	**78%**	**78%**	**71%**	**82%**

Change in 10-year compound return (simulated versus actual): distribution of outcomes



Median Return Change: **+0.15%**
% Better outcome: **82%**

Impact on Observed Volatility and Risk

In addition to the change in returns, the analysis considered the change in annual volatility of returns for every scenario path in comparison with the annual volatility of the original TDF over the 2011–2020 period. These results are available in the lower half of Exhibits A4–A6. They can be summarized very simply here: Every option, in every scenario, showed less volatility in 100% of outcome paths.

This result is driven by differences in valuation between public and private markets.

While public market returns are usually based on observable and frequent trades of identical assets, private market assets are most frequently valued by appraisal or valuation experts. This process incorporates changing conditions more slowly than public markets, and the need to be careful and seek confirmation from multiple private market transactions yields both a smoother return series and one that tends to lag behind public markets, especially for real assets.[11] Reported portfolio returns containing assets that recognize market events at different times will appear less volatile simply due to the underlying asset returns being desynchronized.

[11] A clear example of this lag effect can be observed in Exhibit 3, looking specifically at 2008 and 2009 — the years of the global financial crisis. In 2008, U.S. Large-Cap, U.S. Small-Cap, and Listed Equity REITs (a listed real asset) all returned about -38% to DB plans. In 2009, they exhibit strong recovery (although still not back to the start of 2008) with returns of 30–33%. Over the same two-year period, Private Equity shows a much more muted -10.79% return in 2008, followed by a -3.97% return in 2009 (which yields a superior two-year compound return to the other equity classes). Real estate displays even more lag, with a mild down in 2008 being followed by a larger — 30% — decline in 2009.

A reduction in volatility of public market assets is often taken as a sign of lower risk, but the market-price volatility of publicly traded assets and the appraisal-based volatility of private assets simply aren't comparable. This analysis takes the conservative position of neither using the reduced volatility as a reason to increase the exposure to higher risk assets in the simulated portfolios, nor proclaiming that the simulated portfolios have lower risk. They simply show less volatile returns.

Ultimately, short-term volatility is not the most important risk measure for a participant who is one to four decades from retirement. The potential downside in the scenarios, as expressed by the relatively low percent of outcomes that underperform over a decade, is more significant than whether there is unseen volatility in the interim period.

2001–2010: What Similar Analysis Might Have Shown

As noted previously, detailed TDF data from 2001–2010 is not available to extend the study to that time period. However, simple observations might be made if three assumptions are used:

1. TDFs would have had asset mixes in the 2001–2010 period similar to the 2011–2020 period.
2. TDFs returns in public stocks and bonds would have been comparable to DB plans' performance in public market assets.
3. Real asset investments by target date funds in the 2001–2010 period would have been dominated by unlisted real estate, as it was for DB plans.

The first assumption means very similar substitutions would have been calculated in each scenario. In Scenario 1, private equity would be replacing, on average, close to 57% U.S. large-cap and 43% other stock. In Scenario 2, real estate would have been replacing 44% U.S. large-cap and 56% core bonds.

Would these substitutions have been beneficial, on average? The answer appears to be yes. As shown in Exhibit 9, the weighted average return of the stock components replaced under these assumptions was 3.68%, while private equity's 10-year return was 3.87%. Real estate had even stronger performance: while a 44%/56% mix of U.S. large-cap and core bonds would have had a 10-year return of 4.55%, the 10-year return on unlisted real estate was 5.16%, easily outperforming the mixture.

Exhibit 9: A Simple View of 2001–2010 Results

Target date allocations and returns from 2001–2010 are not available to perform identical analysis to the 2011–2020 period. It is possible, however, to compare how similar substitutions would have performed based on the DB plan returns in Exhibit 3.

Private Equity

Did private equity outperform a 57%/43% mix of large-cap and other (foreign and small-cap) stock from 2001–2010?

	Assets to replace				Private Equity
	U.S. Large-Cap	Foreign + Emerging	U.S. Small-Cap	Total Replaced	
Weight	57%	35.5%	7.5%	100%	
2001–2010 Return	2.26%	5.50%	5.81%	**3.68%**	**3.87%**

Real Assets (Real Estate only)

Did real estate outperform a 44%/56% mix of large-cap and core bonds from 2001–2010?

	Assets to replace			Unlisted Real Estate
	U.S. Large-Cap	Core (U.S. Broad) Bonds	Total Replaced	
Weight	44%	56%	100%	
10-year DB Return	2.26%	6.35%	**4.55%**	**5.16%**

For both private equity and real estate, their 2001–2010 compound return outperformed the weighted average of compound returns of the assets substituted for each in Scenarios 1 and 2.

DC-Specific Considerations

There are several challenges to including illiquid assets in target date options not faced by DB plans, such as potentially higher liquidity needs, fee disclosure, and daily valuation requirements. Those challenges have been addressed in previous work,[12] including by the Georgetown University CRI[13] and the U.S. Department of Labor in its 2020 "Information Letter."[14] This work focuses on whether the challenges, which can be dealt with, are worth addressing for the financial benefit of plan members.

Valuation

DB plans have, historically, been more tolerant than DC plans are likely to be, with respect to delays in valuation, lower valuation frequency, and a need to wait for a detailed valuation before adjusting values on private assets where they may expect either an increase or decrease in value. Increased DC plan entry into private assets is expected to push the adoption of more timely practices, which might involve both interim valuations being used to calculate daily prices, and more frequent and direct information flowing directly from investment managers. Valuation practices for private investment vehicles in daily valued daily liquid DC investment programs must be fair to members who are entering and exiting options, in particular, to discourage attempts by participants to time the market. It is quite possible that market adoption of these practices will affect not only the observed returns of DC plans, but DB plans as well, since they are likely to take advantage of innovations developed to meet the needs of the DC market.

Even if private asset valuations been more timely and more frequent during the study period, the core findings are not likely to have changed. The asset replacement decisions in all three scenarios would be unaffected. Private equity would still replace listed equity. The decision rule used to replace stocks and bonds with real assets in Scenario 2 already uses what is effectively a very aggressive interim valuation approach. Volatility is calculated using leverage-adjusted REITs or listed infrastructure, which already have market-priced volatility and are synchronized with other public markets in responding to market events. Long-term compound returns would be unaffected.

Two elements would change. First, with less smoothing, the average (not compounded) annual return of private equity and real assets would be higher. The 10-year performance seen to date has already been reduced by the impact of volatility. If more volatility is exposed, there would be higher high returns, lower low returns, and a higher average return before compounding.

Second, the current study outcome, shown in the Appendix, where 100% of options in all scenarios have their observed volatility reduced, would almost certainly change. It is challenging to predict whether Scenario 1 outcomes would end up being slightly more volatile due to a wider range in returns for private equity investors or slightly less volatile due to diversification between private equity and other equity types. In either case, the significant risk measure for a participant in a DC plan is the likelihood of long-term under-performance, rather than short-term volatility. For Scenario 2, the more frequent and timely valuation becomes, the closer private real asset volatility is likely to match that of listed real assets. Assuming this happens, increasingly small differences would be expected between the scenario volatilities and the original target date option volatilities.

Costs

Investment costs are primarily functions of asset size, asset allocation, and decisions to use active versus passive management. An increase in private asset investment will almost always involve an increase in cost, with costs that are typically a multiple of those of investing in public markets. Given the often-higher staffing requirements for private market investment managers, for example, it should not be surprising that private market investing has higher fees.

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[12] For more information about moving from theory to implementation, see Kaminski, Sustarsic, and Vandolder, "Private Equity Within Defined Contribution Plans," pp. 6–8.
[13] Michael P. Kreps and Angela M. Antonelli, "Use of Alternative Assets in Target Date Funds: Challenges, Strategies, and Next Steps."
[14] U.S. Department of Labor, Information Letter.

The primary concern for DC participants should not, however, be cost in isolation, but value. As noted earlier in this paper, the performance in the scenario analysis used the returns of DB plans in private equity and real assets after deducting all costs associated with the portfolio: manager fees, commitment fees, transaction costs, carried interest, performance fees, asset class-specific consulting costs, fund-of-fund manager fees, internal staff costs for those who oversee fund selection or make co-investments or direct investments, and even allocations of overhead and support costs for those internal staff. Thus, the returns seen are the true net performance gained from the perspective of a plan member or participant whose fund elects to enter these asset classes.

This is not to suggest DC plans could ignore costs when adding these asset classes; rather, they could have a tolerance for higher option costs if delivering greater value. For U.S. DC plans to have obtained the results shown, they would have had to deliver the same performance that DB plans had in their real asset and private equity portfolios. This implies similar access to managers, similar skill in picking managers, and — perhaps most significantly — similar cost structures.

Prior CEM research has shown that implementation style has a significant impact on net returns in private equity, with direct and co-investment portfolios outperforming funds, which, in turn, outperform funds of funds.[15] CEM has observed similar differences in returns when comparing direct, fund, and fund-of-funds real asset portfolios. This suggests that DC plans would need to strive for a mix of co-investment, funds, and fund-of-funds similar to what was held by DB plans.

The historical cost efficiency of DB plans in accessing private markets, however, is almost certainly not a ceiling. Many DC plans are either using collective vehicles (target date options from very large providers) or could piggyback on existing large DB plans. DC participants represent not only a pool of long-term investor capital, but in many cases, a committed saving engine that offers fresh capital every year in a way that is highly attractive to private investment managers.

Is the mix of structures and limited partnerships chosen by DB plans the most efficient method of connecting the owners of capital with skilled investors? Quite simply, a more streamlined approach could yield better net returns and make the case for private asset inclusion in allocations even more compelling.

Conclusion

"Diversification is the only free lunch" — attributed to Harry Markowitz, Nobel Laureate in Economics

Diversification of risk is a fundamental strategy in investing. Combining investments that are not correlated reduces overall risk, allowing investors to either enjoy a less-risky portfolio or to overall deploy more assets to higher-returning assets while portfolio level risk remains unchanged. Diversification benefits are a large reason why DB plan sponsors have increased allocations to unlisted asset classes in the past 20 years.

U.S. DC plan sponsors have been much more cautious in implementing private assets within DC plan investment line-ups. Much of this caution stems from issues of liquidity, valuation, and costs, as well as possible adverse legal actions. Despite these potential challenges, though, the success of private asset programs within DB plans has prompted many in the DC industry to question whether this slow adoption of private assets is a missed opportunity for DC plan sponsors to improve participant outcomes without measurably increasing risk.

Has the lack of asset diversification in DC retirement plans been a potential missed opportunity? Based on the results of this study and analysis, the answer is yes.

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[15] See, for example, Beath, Flynn, and MacIntosh, "How Implementation Style and Costs Affect Private Equity Performance."

- Private equity is viewed as delivering a higher-return, higher-risk asset class with opportunities for skilled managers to outperform. With that backdrop, the study's results are very encouraging. Against the mix of listed stock asset classes used by DC plans, not only the top quartile of U.S. DB plans private equity portfolios, but the second and third quartile as well, offered outperformance over the decade studied. Scenario 1, which added only private equity to target date options, had the highest median return improvement: 0.22% (22 basis points) per year.

- Private real assets, with only moderate correlations to both stocks and bonds, add measurable diversification to portfolios, so the results of the analysis for real assets are, perhaps, unsurprising: a modest increase in return through an attractive asset-mix substitution where real assets replace more bonds than stocks in a risk-equivalent replacement. Scenario 2 shows a medium return improvement of 0.11% (11 basis points) per year.

- Scenario 3, which adds the most diversification by introducing both asset classes, shows the highest odds of improving participant outcomes over the decade. Splitting implementation risk between a private equity program and a real asset program reduces the odds of the total portfolio underperforming, with a median return improvement of 0.15% (15 basis points) per year and 82% of financial outcomes improved.

The improved returns shown in Scenario 3 would represent about *$5 billion* per year in additional net return if applied to all U.S. target date options.[16] A 0.15% return improvement to the entire U.S. DC market would represent *$35 billion* per year in additional net return. Using reasonable assumptions for an individual DC participant who saves for 40 years and then draws down for 20, the return improvement might represent an additional $2,400 per year ($200 per month) in spending power in retirement for a retiree already drawing $4,000 per month or $48,000 per year in retirement income.

Plan sponsors and their investment fiduciaries should challenge themselves and their industry partners to efficiently adopt private equity and real assets for their target date funds. The potential annual lost return for participants is measured in the billions of dollars per year. The consideration of private equity and real assets in glide paths for TDFs is a natural next step in their evolution, as they continue to be drivers of outcome success for all investors who are saving for a healthy and strong financial retirement.

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[16] Morningstar.

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Appendix: Additional Details on CEM's Methodology and Supplemental Data

Database Statistics

CEM Benchmarking's database includes statistics for elements such as holdings, policy weights, returns, and benchmarks for nearly 100 asset classes[17] and for four-plus investment styles.[18] CEM Benchmarking also collects detailed investment costs — both internal and external investment costs — that provide the primary motivation for plans to participate in the CEM Benchmarking service. With performance not being the primary motivation for working with CEM Benchmarking, and the data being provided by asset owners, rather than managers, the database shows essentially no survivorship bias.

The database has grown in both size and geographical diversity over time. Starting with participation from 164 DB plans from the U.S. and Canada in 1992, the database now has global coverage and includes more than 500 unique funds from more than 20 countries. Participants include DB plans, DC, sovereign wealth funds, social safety net and pension buffer funds, and other institutional asset managers.[19]

Exhibit A1: Database Statistics

CEM's global defined benefit database and U.S. defined contribution databases extend back to the 1990s. Total assets in the database, and average assets per plan are reported here for the past 20 years, in billions of U.S. dollars.

Total Reported Assets in CEM databases, by year, in $U.S. billions

	Defined Benefit				Defined Contribution	
	Total		Average per plan		Total	Average
Year	Global	U.S.	Global	U.S.	U.S.	U.S.
2020	$10,817	$4,115	$35	$26	$1,380	$10
2019	$10,496	$3,937	$34	$26	$1,186	$9
2018	$10,309	$4,160	$30	$24	$1,130	$8
2017	$9,994	$3,951	$28	$24	$1,060	$8
2016	$9,109	$3,599	$26	$21	$997	$7
2015	$9,085	$3,645	$25	$21	$937	$7
2014	$8,626	$3,643	$20	$20	$921	$7
2013	$7,975	$3,514	$18	$18	$840	$6
2012	$6,964	$3,234	$15	$16	$789	$5
2011	$6,310	$3,048	$17	$15	$1,034	$6
2010	$5,222	$2,676	$15	$13	$950	$5
2009	$4,618	$2,479	$14	$12	$826	$5
2008	$4,528	$2,684	$13	$13	$823	$5
2007	$4,698	$2,799	$13	$13	$911	$5
2006	$3,940	$2,326	$14	$16	$582	$5
2005	$3,353	$2,062	$11	$13	$505	$5
2004	$3,015	$2,061	$11	$12	$318	$4
2003	$2,626	$1,782	$9	$11	$276	$3
2002	$2,479	$1,687	$9	$11	$270	$4
2001	$2,684	$1,869	$9	$11	$277	$3

[17] Asset class examples include large-cap U.S. stock, EAFE, fixed income, hedge funds, LBO private equity, and unlisted real estate.
[18] Investment styles for public market assets include internal active, internal passive, external active, and external passive. Investment styles for private markets include internal direct, operating subsidiary, co-investment, fund, and funds of funds. Not all investment styles are applicable to all asset classes.
[19] Growth in the complexity of the information included in the database has mirrored the growth in investment complexity at institutional money managers — for example, data about hedge funds has only been collected since 2000 because before that year, few institutional managers in the database invested in this asset class, whereas nearly half of all funds do today.

Covariance Model and Assumptions

Exhibit A2: Assumed Volatilities and Correlations

Asset Volatility (expressed as annual standard deviation)

	Stock				Fixed Income					Real Assets				Other
	U.S. Large- & Broad-Cap	U.S. Small- & Mid-Cap	Non-U.S.	Emerging	Core	TIPS	Stable Value	Cash / Money Market	Other	Commodities	Listed Equity REITs	Unlisted Real Estate	Infrastructure	Hedge Funds & Risk Parity
	14.6%	17.0%	16.9%	22.7%	5.3%	5.5%	1.1%	1.1%	3.7%	19.9%	19.8%	9.3%	14.0%	8.6%

Asset Correlation

		Stock				Fixed Income					Real Assets				Other
		U.S. Large- & Broad-Cap	U.S. Small- & Mid-Cap	Non-U.S.	Emerging	Core	TIPS	Stable Value	Cash / Money Market	Other	Commodities	Listed Equity REITs	Unlisted Real Estate	Infrastructure	Hedge Funds & Risk Parity
Stock	U.S. Large- & Broad-Cap	1.00	0.91	0.82	0.74	-0.01	0.01	0.00	0.00	0.03	0.29	0.56	0.53	0.70	0.54
Stock	U.S. Small- & Mid-Cap	0.91	1.00	0.78	0.73	-0.04	0.02	-0.01	-0.01	-0.01	0.35	0.62	0.56	0.58	0.53
Stock	Non-U.S.	0.82	0.78	1.00	0.76	0.06	0.13	-0.03	-0.03	0.18	0.30	0.53	0.49	0.60	0.69
Stock	Emerging	0.74	0.73	0.76	1.00	0.02	0.15	0.00	0.00	0.08	0.29	0.48	0.44	0.47	0.64
Fixed Income	Core	-0.01	-0.04	0.06	0.02	1.00	0.48	0.28	0.28	0.65	-0.03	0.11	0.25	0.05	0.39
Fixed Income	TIPS	0.01	0.02	0.13	0.15	0.48	1.00	0.04	0.04	0.74	0.25	0.25	0.41	0.11	0.80
Fixed Income	Stable Value	0.00	-0.01	-0.03	0.00	0.28	0.04	1.00	1.00	0.13	0.05	-0.02	0.01	-0.06	-0.03
Fixed Income	Cash	0.00	-0.01	-0.03	0.00	0.28	0.04	1.00	1.00	0.13	0.05	-0.02	0.01	-0.06	-0.03
Fixed Income	Other	0.03	-0.01	0.18	0.08	0.65	0.74	0.13	0.13	1.00	0.04	0.21	0.41	0.07	0.66
Real Assets	Commodities	0.29	0.35	0.30	0.29	-0.03	0.25	0.05	0.05	0.04	1.00	0.17	0.16	0.19	0.57
Real Assets	Listed Equity REITs	0.56	0.62	0.53	0.48	0.11	0.25	-0.02	-0.02	0.21	0.17	1.00	0.96	0.47	0.64
Real Assets	Unlisted Real Estate	0.53	0.56	0.49	0.44	0.25	0.41	0.01	0.01	0.41	0.16	0.96	1.00	0.52	0.76
Real Assets	Infrastructure	0.70	0.58	0.60	0.47	0.05	0.11	-0.06	-0.06	0.07	0.19	0.47	0.52	1.00	0.39
	Hedge & Risk Parity	0.54	0.53	0.69	0.64	0.39	0.80	-0.03	-0.03	0.66	0.57	0.64	0.76	0.39	1.00

Asset volatilities and correlations for public asset classes are calculated using standard market benchmarks. For real estate and infrastructure, listed proxies with appropriate addition of fixed income to reduce the effective leverage to the level of private investment are used. Assumptions about the volatility of private equity were not required in this analysis; the above table is used only in calculating real asset allocations to be added to target date options without private assets while preserving expected portfolio volatility.

Methodology and Detailed Scenario Output

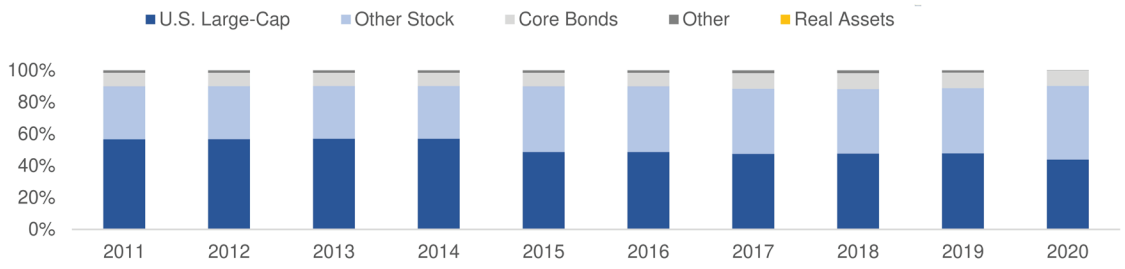
Exhibit A3 demonstrates the methodology used in the study by taking one particular TDF in the study (a 2040 target date option) and showing its original allocation and performance in each year of the study. The exhibit then traces how the option's Scenario 2 replacement ratios are calculated by year, and finally how new returns are calculated for a single outcome (that is, the introduction of one particular DB plan's real asset returns over the decade).

Exhibits A4–A6 repeat the scenario outcome exhibits, with additional metrics added — most significantly, the original and scenario range of observed return volatility.

Exhibit A3: Methodology Example

Example: add 10% Real Assets - walkthrough for a single option

The example below shows the methodology used applied to a single target date option, a 2040 target date option reported by one plan sponsor in the study. We begin with the actual reported asset allocation for the option in each of the 10 years of the study. The allocation moves slightly over time, in this case primarily as the glide path manager makes adjustments to the path. For simplicity in presentation, some asset classes have been combined here into "other stock" (small-/mid-cap, foreign stock and emerging stock) and "other" (stable value, TIPS, other bonds, commodities, REITs, etc.). Note that our own glide pathing means we will add slightly less than 10% real assets prior to 2015.

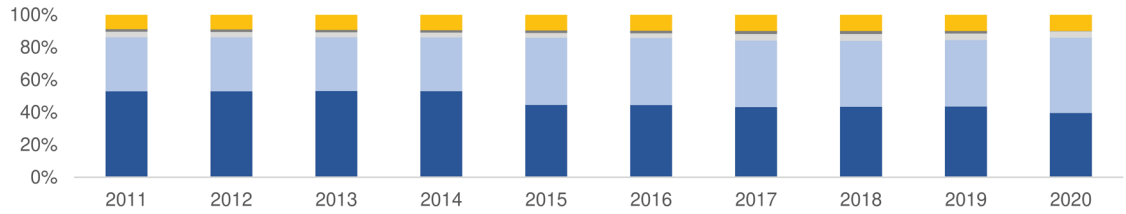


Using the covariance matrix shown in Exhibit A2, an expected portfolio volatility is calculated for each year:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Expected volatility:	13.22%	13.24%	13.25%	13.25%	13.35%	13.35%	13.13%	13.08%	13.17%	13.46%

For each year, we solve for the reduction in U.S. Large-Cap, such that a new portfolio, with the addition of the target % real assets (%T), the reduction in Large Cap solved for, and an adjustment to Core Bonds such that weights still add to 100% has the same expected volatility. The results are shown for this option here:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
U.S. Large-Cap	-3.7%	-3.8%	-3.9%	-4.0%	-4.1%	-4.2%	-4.2%	-4.2%	-4.2%	-4.3%
Core Bonds	-5.1%	-5.2%	-5.3%	-5.4%	-5.5%	-5.6%	-5.8%	-5.8%	-5.8%	-5.7%
Real Assets (%T)	+8.8%	+9.0%	+9.2%	+9.4%	+10%	+10%	+10%	+10%	+10%	+10%



Next, calculate explained return for the option, based on its original allocation and average asset class performance by year, and compare this to its reported return.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	10-year
Reported Return	-2.6%	+15.5%	+24.3%	+7.1%	-1.6%	+8.9%	+21.5%	-7.9%	+25.1%	+16.3%	+10.1%
- Explained Return	-2.2%	+15.6%	+24.8%	+7.6%	-1.3%	+9.1%	+21.6%	-7.8%	+25.4%	+17.0%	
= Unexplained Return	-0.4%	-0.1%	-0.5%	-0.6%	-0.3%	-0.2%	-0.1%	-0.1%	-0.3%	-0.8%	

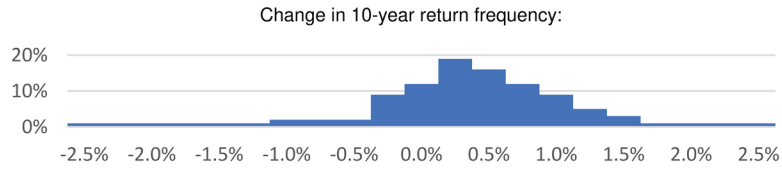
We then select the actual 10-year real asset returns of a DB pension fund: one series is shown here:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	10-year
Actual DB Series 1	-2%	+6%	+11%	+9%	+13%	+16%	+16%	+15%	+8%	+8%	+9.9%

We can now calculate the returns on our hypothetical option, using this 10-year real asset series. We remove the expected contribution of the removed U.S. Large-Cap and Core Bonds, remove T% of the unexplained return (which may have been attached to the removed assets) and add T% X the selected real asset return.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	10-year
Reported Return	-2.6%	+15.5%	+24.3%	+7.1%	-1.6%	+8.9%	+21.5%	-7.9%	+25.1%	+16.3%	+10.1%
- Replaced assets	-0.4%	-1.0%	-1.2%	-0.8%	-0.0%	-0.7%	-1.2%	+0.2%	-1.9%	-1.4%	
- T% X unexplained	-0.0%	-0.0%	-0.0%	-0.1%	-0.0%	-0.0%	-0.0%	-0.0%	-0.0%	-0.1%	
+ T% X DB Series 1	-0.1%	+0.6%	+1.0%	+0.9%	+1.2%	+1.5%	+1.6%	+1.5%	+0.8%	+0.8%	
= Hypothetical return	-3.2%	+15.1%	+24.1%	+7.0%	-0.4%	+9.7%	+22.0%	-6.1%	+23.9%	+15.6%	+10.2%

This provides a single scenario, with a new 10-year compound return. We repeat this for every available 10-year return series and obtain a distribution of outcomes, including an average change and a % of time that the outcomes are superior.



Average Return Change: +0.15%
% Better outcome: +78%

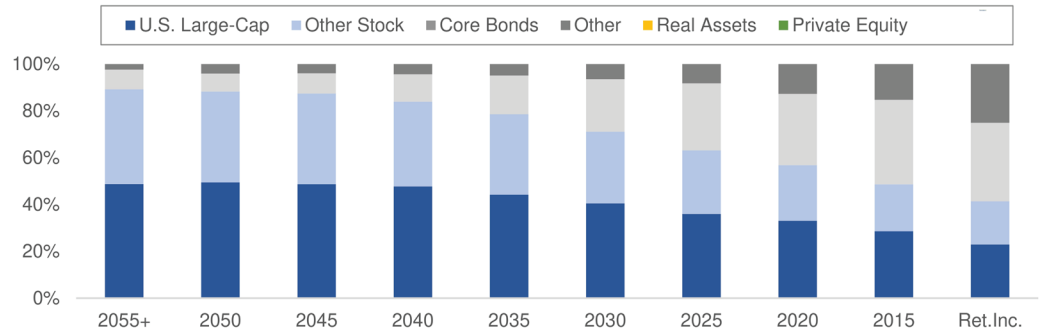
This method is repeated for every target date option in the sample.

Exhibit A4: Scenario 1 Detailed Results

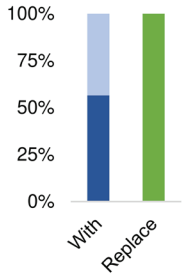
Scenario 1: Add Private Equity

Private equity is added, replacing a proportional mix of the public stock present in each option on a year-by-year basis. On average, each dollar displaced 57% U.S. large cap and 43% other stock sub-asset classes (U.S. small, non-U.S. and emerging). The substitution resulted in better outcomes 80% of the time, with a median net return improvement of 0.22% per year. Returns appeared smoother from a participant perspective in all cases.

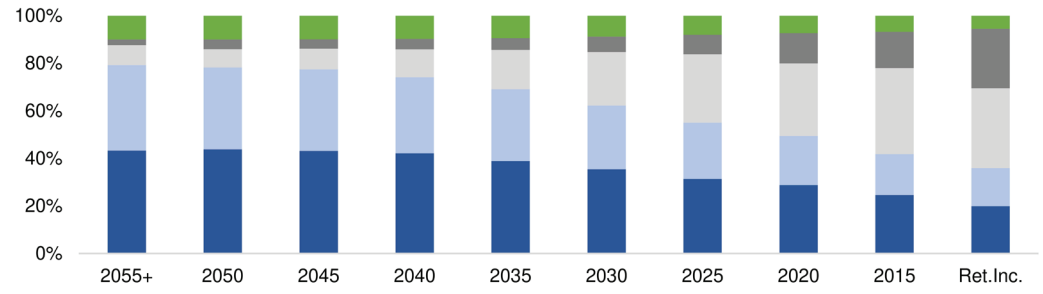
Unadjusted glide path: average 2011–2020, average all plan sponsors



Average substitution



Simulated glide path: average 2011–2020, average all plan sponsors

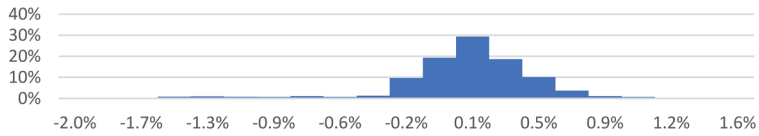


This scenario inserts up to 10% private equity into each target date option. It replaces a pro-rata mixture of the listed stock categories present in the option in the specific year: on average 57% of the replaced stock is U.S. large-cap, with the remainder small-cap, non-U.S. and emerging.

Change in 10-year compound return (simulated versus actual): range of outcomes

	2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
90th	+0.61%	+0.67%	+0.67%	+0.64%	+0.61%	+0.55%	+0.49%	+0.41%	+0.36%	+0.27%	+0.57%
75th	+0.42%	+0.47%	+0.48%	+0.45%	+0.43%	+0.39%	+0.35%	+0.29%	+0.24%	+0.17%	+0.39%
Median	+0.25%	+0.27%	+0.28%	+0.26%	+0.25%	+0.22%	+0.20%	+0.16%	+0.13%	+0.06%	+0.22%
25th	+0.05%	+0.09%	+0.09%	+0.09%	+0.08%	+0.06%	+0.06%	+0.02%	-0.00%	-0.08%	+0.05%
10th	-0.22%	-0.14%	-0.14%	-0.14%	-0.14%	-0.14%	-0.14%	-0.16%	-0.18%	-0.68%	-0.16%
Average	+0.17%	+0.25%	+0.24%	+0.23%	+0.22%	+0.19%	+0.16%	+0.11%	+0.08%	-0.03%	+0.18%
% Better Outcome:	**79%**	**83%**	**83%**	**82%**	**82%**	**82%**	**81%**	**78%**	**75%**	**64%**	**80%**

Change in 10-year compound return (simulated versus actual): distribution of outcomes



Median Return Change:	0.22%
% Better outcome:	**80%**

10-year observed volatility in annual return: actual versus simulations

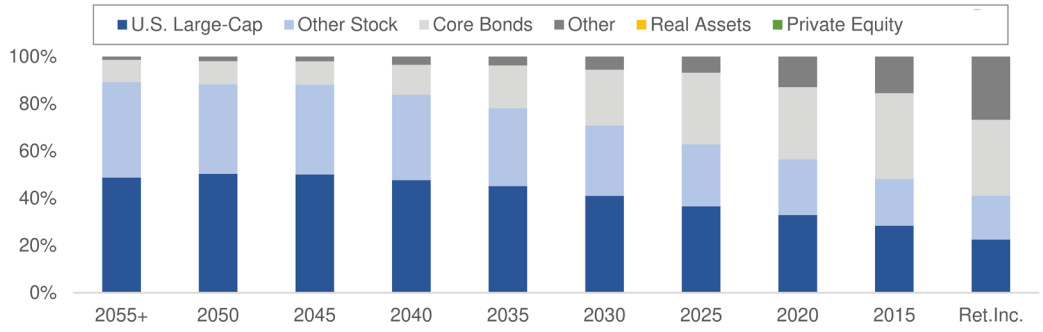
		2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
Actual:	90th	11.6%	11.7%	11.6%	11.5%	10.8%	9.9%	9.1%	8.3%	7.4%	6.4%	11.2%
	75th	11.4%	11.2%	11.2%	10.9%	10.1%	9.4%	8.3%	7.6%	6.7%	6.3%	11.1%
	Median	11.2%	11.2%	11.1%	10.6%	10.1%	9.1%	8.2%	7.1%	5.8%	5.9%	10.0%
	25th	11.1%	11.1%	10.8%	10.1%	9.6%	8.5%	7.7%	7.0%	5.8%	5.5%	8.2%
	10th	11.0%	11.0%	10.8%	10.0%	9.2%	8.2%	7.2%	6.6%	5.7%	4.9%	6.6%
	Average	11.2%	11.2%	11.1%	10.7%	10.0%	9.1%	8.2%	7.4%	6.2%	5.9%	9.4%
Simul.:	90th	10.4%	10.5%	10.4%	10.3%	9.7%	8.9%	8.0%	7.5%	6.7%	6.0%	10.2%
	75th	10.2%	10.2%	10.1%	9.8%	9.1%	8.4%	7.5%	6.7%	5.8%	5.5%	9.8%
	Median	10.0%	10.0%	9.8%	9.5%	8.9%	8.1%	7.2%	6.3%	5.1%	5.1%	8.8%
	25th	9.8%	9.8%	9.6%	9.0%	8.5%	7.5%	6.7%	6.2%	5.0%	4.7%	7.2%
	10th	9.6%	9.6%	9.4%	8.7%	8.0%	7.2%	6.3%	5.8%	4.9%	4.3%	5.8%
	Average	10.0%	10.0%	9.8%	9.5%	8.9%	8.1%	7.2%	6.5%	5.5%	5.2%	8.4%
	Percent lower	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Exhibit A5: Scenario 2 Detailed Results

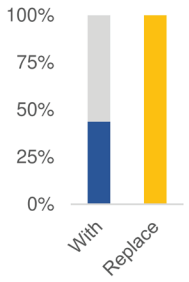
Scenario 2: Add Real Assets

Real assets replaced, on average, a mixture of 44% large-cap stock and 56% core bonds from target date options. Slightly more stock was replaced on shorter date and retirement options. Substituting in real assets resulted in better outcomes 72% of the time, with a median net return improvement of 0.11% per year. Improvements were maximized for 2045 dated options, which had better outcomes 77% of the time. Returns appeared smoother from a participant perspective in all cases.

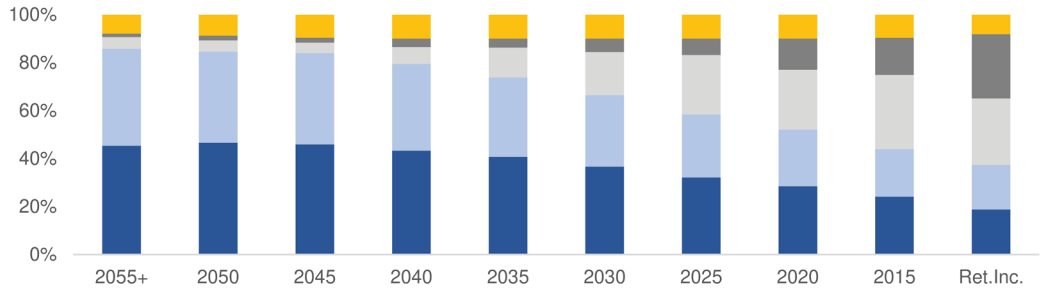
Unadjusted glide path: average 2011–2020, average all plan sponsors



Average substitution



Simulated glide path: average 2011–2020, average all plan sponsors

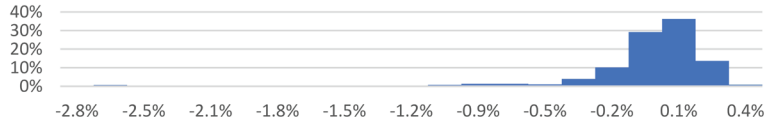


This scenario inserts up to 10% real assets into each target date option. The exact amount of Large-Cap stock and Core bonds displaced varies by option and by year, but on average, each dollar of real assets replaces a 44/56 mixture of Large-Cap/Core bonds.

Change in 10-year compound return (simulated versus actual): range of outcomes

	2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
90th	+0.23%	+0.28%	+0.32%	+0.34%	+0.33%	+0.31%	+0.30%	+0.30%	+0.28%	+0.23%	+0.30%
75th	+0.16%	+0.20%	+0.23%	+0.24%	+0.25%	+0.23%	+0.22%	+0.21%	+0.20%	+0.15%	+0.22%
Median	+0.09%	+0.11%	+0.13%	+0.14%	+0.14%	+0.12%	+0.12%	+0.10%	+0.10%	+0.06%	+0.11%
25th	-0.01%	-0.01%	+0.01%	+0.00%	+0.00%	-0.02%	-0.01%	-0.03%	-0.02%	-0.05%	-0.01%
10th	-0.18%	-0.18%	-0.19%	-0.20%	-0.20%	-0.22%	-0.23%	-0.24%	-0.22%	-0.21%	-0.21%
Average	+0.02%	+0.04%	+0.06%	+0.06%	+0.06%	+0.04%	+0.04%	+0.02%	+0.03%	-0.00%	+0.04%
% Better Outcome:	**71%**	**73%**	**77%**	**76%**	**76%**	**72%**	**72%**	**68%**	**69%**	**63%**	**72%**

Change in 10-year compound return (simulated versus actual): distribution of outcomes



Median Return Change:	0.11%
% Better outcome:	**72%**

10-year observed volatility in annual return: actual versus simulations

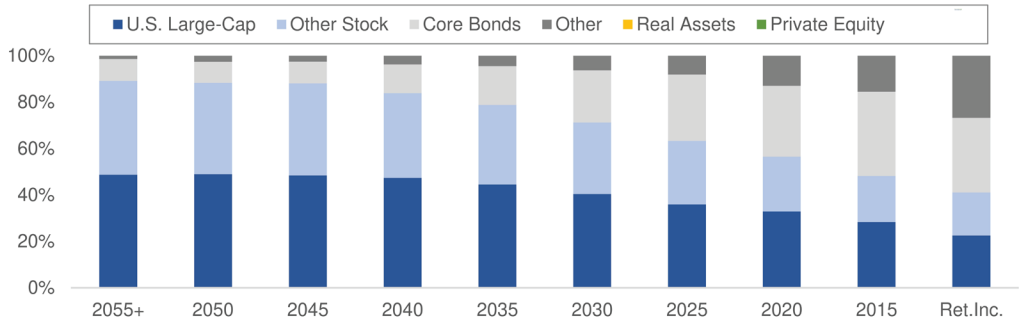
		2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
Actual:	90th	11.4%	11.3%	11.3%	11.1%	10.1%	9.8%	8.5%	8.3%	7.2%	6.4%	11.2%
	75th	11.2%	11.2%	11.2%	10.8%	10.1%	9.2%	8.2%	7.5%	6.5%	6.3%	10.8%
	Median	11.2%	11.2%	11.2%	10.6%	9.9%	9.1%	8.2%	7.1%	5.8%	5.9%	9.3%
	25th	11.0%	11.0%	11.0%	10.1%	9.6%	8.6%	7.9%	7.0%	5.7%	5.3%	7.6%
	10th	10.9%	10.8%	10.8%	10.0%	9.2%	8.2%	7.2%	6.6%	5.7%	4.8%	6.2%
	Average	11.2%	11.1%	11.1%	10.6%	9.9%	9.0%	8.1%	7.3%	6.2%	5.8%	9.1%
Simul.:	90th	10.9%	10.8%	10.7%	10.4%	9.8%	9.1%	7.9%	7.6%	6.8%	6.0%	10.6%
	75th	10.7%	10.6%	10.6%	10.2%	9.4%	8.6%	7.6%	6.8%	5.8%	5.7%	10.2%
	Median	10.6%	10.5%	10.5%	10.0%	9.3%	8.4%	7.4%	6.4%	5.1%	5.2%	8.6%
	25th	10.4%	10.3%	10.3%	9.4%	8.8%	7.8%	7.2%	6.3%	5.0%	4.6%	6.9%
	10th	10.3%	10.1%	10.0%	9.2%	8.4%	7.5%	6.5%	5.9%	5.0%	4.2%	5.5%
	Average	10.6%	10.4%	10.4%	9.9%	9.2%	8.3%	7.4%	6.6%	5.5%	5.2%	8.4%
	Percent lower	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Exhibit A6: Scenario 3 Detailed Results

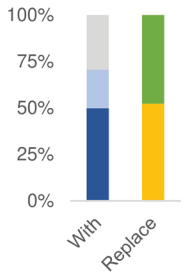
Scenario 3: Add both Private Equity and Real Assets

Half of each of the prior scenario's substitutions are used here. Due to the separate glide pathing, a full 10% of private assets is never actually added: the highest substitution is on 2040 options where 9.9% private assets are added. On average, a mixture of 50% U.S. large, 21% other stock, and 29% core bonds is being replaced by 52% real assets and 48% private equity. The median improvement of 0.15% per year falls almost midway between the prior two scenarios, but better outcomes are reached 82% of the time: higher than either other scenario. Using both private assets diversifies away some implementation risk (risk of a higher or lower performing program).

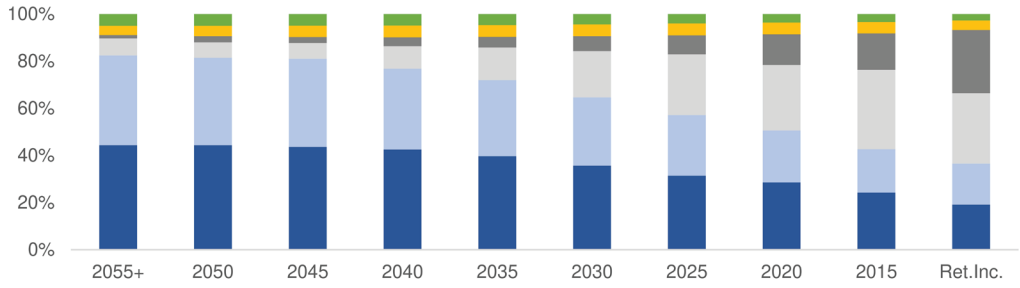
Unadjusted glide path: average 2011–2020, average all plan sponsors



Average substitution



Simulated glide path: average 2011–2020, average all plan sponsors

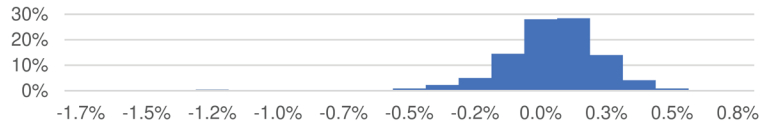


This scenario inserts up to 5% private equity and up to 5% real assets into each target date option. The average substitution is a 50/21/29 mix of U.S. large-cap/other stock/core bonds replaced with a mix of 52/48 real assets/PE. Substitutions vary by year: longer-date funds receiving more PE.

Change in 10-year compound return (simulated versus actual): range of outcomes

	2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
90th	+0.37%	+0.39%	+0.41%	+0.40%	+0.39%	+0.35%	+0.33%	+0.30%	+0.27%	+0.21%	+0.36%
75th	+0.27%	+0.28%	+0.30%	+0.30%	+0.29%	+0.26%	+0.24%	+0.22%	+0.20%	+0.14%	+0.26%
Median	+0.16%	+0.18%	+0.19%	+0.19%	+0.18%	+0.16%	+0.15%	+0.13%	+0.11%	+0.07%	+0.15%
25th	+0.05%	+0.06%	+0.07%	+0.06%	+0.06%	+0.05%	+0.04%	+0.02%	+0.02%	-0.01%	+0.04%
10th	-0.07%	-0.07%	-0.06%	-0.07%	-0.07%	-0.09%	-0.09%	-0.11%	-0.10%	-0.11%	-0.09%
Average	+0.14%	+0.15%	+0.17%	+0.16%	+0.15%	+0.13%	+0.12%	+0.10%	+0.08%	+0.05%	+0.13%
% Better Outcome:	**82%**	**83%**	**85%**	**84%**	**84%**	**82%**	**81%**	**78%**	**78%**	**71%**	**82%**

Change in 10-year compound return (simulated versus actual): distribution of outcomes



Median Return Change:	0.15%
% Better outcome:	**82%**

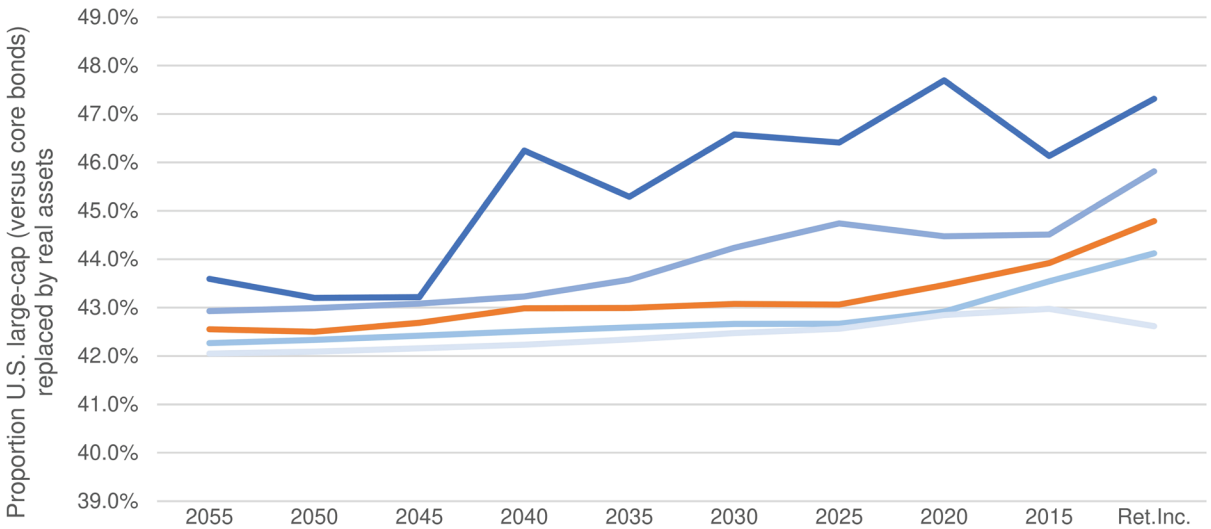
10-year observed volatility in annual return: actual versus simulations

		2055+	2050	2045	2040	2035	2030	2025	2020	2015	Ret. Income	All options
Actual:	90th	11.4%	11.7%	11.4%	11.2%	10.7%	9.9%	8.9%	8.3%	7.2%	6.4%	11.2%
	75th	11.2%	11.2%	11.2%	10.8%	10.1%	9.3%	8.2%	7.5%	6.5%	6.3%	11.0%
	Median	11.2%	11.2%	11.2%	10.6%	10.1%	9.1%	8.2%	7.1%	5.8%	5.9%	9.9%
	25th	11.0%	11.1%	11.0%	10.1%	9.8%	8.6%	8.0%	7.0%	5.7%	5.3%	8.0%
	10th	10.9%	10.8%	10.8%	10.0%	9.2%	8.2%	7.2%	6.6%	5.7%	4.8%	6.4%
	Average	11.2%	11.2%	11.1%	10.6%	10.0%	9.1%	8.2%	7.3%	6.2%	5.8%	9.3%
Simul.:	90th	10.6%	10.7%	10.7%	10.3%	9.9%	9.0%	8.1%	7.5%	6.8%	5.9%	10.3%
	75th	10.4%	10.4%	10.3%	10.0%	9.3%	8.6%	7.5%	6.7%	5.8%	5.6%	10.0%
	Median	10.3%	10.3%	10.2%	9.7%	9.1%	8.2%	7.3%	6.4%	5.1%	5.2%	8.9%
	25th	10.1%	10.1%	10.0%	9.2%	8.8%	7.7%	7.1%	6.2%	5.0%	4.6%	7.2%
	10th	10.0%	9.9%	9.8%	9.0%	8.3%	7.4%	6.4%	5.8%	4.9%	4.3%	5.7%
	Average	10.3%	10.3%	10.2%	9.7%	9.1%	8.3%	7.4%	6.5%	5.5%	5.2%	8.4%
	Percent lower	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Shifting Substitution for Real Assets by Target Date Year

Exhibit A7: Shifting Replacement Ratio by Target Date Year

Scenario 2: Add Real Assets: Proportion U.S. Large-Cap versus Core Bonds Replaced



	2055	2050	2045	2040	2035	2030	2025	2020	2015	Ret.Inc.
90th	43.6%	43.2%	43.2%	46.2%	45.3%	46.6%	46.4%	47.7%	46.1%	47.3%
75th	42.9%	43.0%	43.1%	43.2%	43.6%	44.2%	44.7%	44.5%	44.5%	45.8%
Median	42.6%	42.5%	42.7%	43.0%	43.0%	43.1%	43.1%	43.5%	43.9%	44.8%
25th	42.3%	42.3%	42.4%	42.5%	42.6%	42.7%	42.7%	42.9%	43.5%	44.1%
10th	42.1%	42.1%	42.2%	42.2%	42.3%	42.5%	42.6%	42.8%	43.0%	42.6%

For each target date option, for each year, the mixture of large-cap and core bonds to be removed when adding the target amount of real assets (up to 10%) was calculated. To normalize for the glide path, we then divide the large-cap replaced by the total replacement, to show the percentage of replaced assets that were U.S. large-cap stock. The graph above shows the range in this proportion large-cap of the replaced assets. The median proportion of stock in the replaced portfolio trended up as target date lowered, reaching 44.8% for retirement income options. The very long-dated options are so stock-heavy that a relatively small shift of stock into real assets provides large diversification benefits, allowing them to replace a more bond-heavy allocation while preserving risk. The dispersion between options widens significantly, initially at the 90th percentile from 2040 options onward, and then showing dispersion from the 25th–50th percentile by 2025. We attribute this to greater variance in asset allocation for shorter-dated options.

The proportion of large-cap stock versus core bonds removed in Scenario 2 (and 3) varies by option and year, based on each option's specific asset allocation in that year and how that allocation interacts with the real assets being added. Exhibit A7 shows the range of replacement proportions based on target date year. The median 2055 option requires a substitution that is 42.6% large-cap, while the median retirement income requires a substitution that is 44.8% large-cap versus 55.2% core bonds. This small shift explains why there are slightly different outcomes in terms of success by target date year.

There is also more dispersion in the substituted portfolio in shorter-date options. This reflects a greater range in asset allocations within the shorter-date options. Long-date options tend to be universally very stock-heavy. There are more ranges in glide paths closer to retirement, because allocations shift more rapidly, and there are more potential assets that might be attractive from a risk-return standpoint. This lack of differentiation in the asset mix of longer-dated funds can be seen in the very narrow range of observed volatility of the reported long-dated target date funds shown in Exhibits A4–A6.

Allocations of Target Date Options — Filtered

Exhibit A8 repeats Exhibit 1, showing the asset allocations of U.S. target date options in the CEM Database. The scenarios exclude those options that already held unlisted real estate or private equity, so the table is repeated here with those options excluded.

Exhibit A8: Allocations of U.S. Target Date Options

The analysis in this paper is restricted to those target date options with uninterrupted survey data that additionally held neither private equity nor real assets over the course of the decade. Unlike Exhibit 2, this table excludes those options holding either private equity or real assets, and thus represents the options used in the scenario analysis.

Average Asset Allocation Trend for U.S. Target Date Options Without Illiquid Assets

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Stock	U.S. Large- & Broad-	45.0%	44.4%	42.2%	42.1%	38.4%	37.9%	35.9%	35.4%	33.1%	33.0%
	U.S. Small- & Mid-	4.9%	4.8%	4.4%	4.2%	4.1%	4.1%	4.0%	4.0%	5.3%	5.0%
	Non-U.S.	20.7%	20.7%	21.6%	22.0%	25.2%	25.1%	23.9%	22.9%	23.7%	23.6%
	Emerging	1.3%	1.3%	1.3%	1.2%	1.3%	1.3%	1.2%	2.1%	1.4%	1.6%
Fixed Income	Core	22.3%	22.4%	23.5%	23.5%	23.7%	24.2%	25.3%	25.0%	25.6%	27.6%
	TIPS	3.3%	3.4%	3.6%	3.6%	3.7%	3.7%	3.9%	4.6%	5.1%	4.9%
	Stable Value	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Cash / Money Market	0.8%	0.8%	0.8%	0.8%	0.8%	0.9%	0.9%	0.8%	0.4%	1.0%
	Other	1.0%	1.0%	1.1%	1.1%	1.1%	1.1%	1.2%	2.0%	2.0%	0.9%
Real Assets	Commodities	0.4%	0.7%	0.8%	0.6%	0.6%	0.6%	1.4%	0.8%	0.9%	0.5%
	Listed Equity REITs	0.3%	0.5%	0.5%	0.5%	0.6%	0.6%	1.7%	1.5%	1.3%	1.0%
	Unlisted Real Estate	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other	Hedge Funds & Risk Parity	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.3%	0.5%	0.5%	0.4%
	Private Equity	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Other	0.0%	0.1%	0.2%	0.3%	0.2%	0.3%	0.4%	0.4%	0.7%	0.5%

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