



PGIM

DC SOLUTIONS

THE BUILDING BLOCKS FOR BETTER RETIREMENT PORTFOLIOS





INTRODUCTION

Today's defined contribution (DC) system was built with the mindset of helping workers save and accumulate wealth, not generate retirement income. Optimally depleting savings involves addressing a myriad of unique risks faced by retirees, such as inflation risk, sequence of returns risk, spend-down risk, and interest rate risk, to name a few.

A majority of plan sponsors support allocations to alternative investments as a means to enhance diversification, yet these classes are not prevalent in defined contribution plans (DC Solutions Plan Sponsor Landscape Survey, 2025). To help deliver better outcomes for retirees, we think more diversifying asset classes need to be included in DC plans. In this paper, we demonstrate that more extensive asset class coverage could increase expected riskadjusted returns by more than approximately 100 bps, generating potentially five years of additional income for retirees, in exhibits 5 and 7, respectively.

Overall, this analysis suggests plan sponsors should proactively reevaluate their investment offerings to ensure they offer the essential building blocks necessary to help participants and retirees build more optimal portfolios that can generate better retirement outcomes.

EXTENDING ASSET CLASS COVERAGE TO BUILD MORE EFFICIENT PORTFOLIOS

The role of the core menu has evolved considerably over time. For example, the mass adoption of default investments, in particular target-date funds, over the last few decades have resulted in fewer participants selecting core menu funds, especially those who would generally be considered less sophisticated (*Blanchett, Finke, and Liu 2022*). While early research which suggested larger core menus could negatively affect plan participation (e.g., *Iyengar, Jiang, and Huberman 2003*) these concerns are significantly less relevant in the age of default investments and automatic enrollment. That said, certain asset classes are still better offered through pre-packaged portfolios, whether that’s target-date funds or multi-asset solutions available on the core menu.

When thinking about overall plan sponsor interest and general availability (e.g., see *PGIM DC Solutions, 2024*) of asset classes, we can place them into three general groups, which are included in the exhibit below.

Exhibit 1: Asset Classes by Coverage Level

| Basic | Enhanced | Extended |
|-------------------|-------------------------|----------------------------|
| US Large Cap | Emerging Markets Equity | Long Duration Bonds |
| US Small Cap | REITs | Infrastructure Equity |
| Non-US Equity | Emerging Markets Bonds | Commodities |
| Core Fixed Income | High Yield Bonds | Private Real Estate Equity |
| Cash | TIPS | Private Real Estate Debt |

Extending the breadth of the asset classes available to participants and retirees in particular, can result in notable potential diversification benefits. We demonstrate this effect in Exhibit 2, which includes correlations of the Basic asset classes to the three different potential coverage levels (basic, enhanced, and extended) when US stock market returns are positive and negative. The analysis uses quarterly returns from Q1 2000 to Q4 2024, with asset class definitions included in Appendix 1 using data obtained from Morningstar Direct.

Exhibit 2: Asset Class Correlations Across US Historical Market Return Environments: 2000-2024

| | Positive Market Environments | | | | | Negative Market Environments | | | | |
|----------------------------|------------------------------|-------|-------|-------|-------|------------------------------|-------|-------|-------|-------|
| | Asset Classes | | | | | Asset Classes | | | | |
| | LC | SC | Intl | Bond | Cash | LC | SC | Intl | Bond | Cash |
| Basic | | | | | | | | | | |
| US Large Cap (LC) | 1.00 | 0.80 | 0.72 | 0.18 | -0.13 | 1.00 | 0.88 | 0.82 | -0.43 | 0.13 |
| US Small Cap (SC) | 0.80 | 1.00 | 0.68 | 0.09 | -0.15 | 0.88 | 1.00 | 0.74 | -0.40 | 0.21 |
| Non-US Equity (Intl) | 0.72 | 0.68 | 1.00 | 0.24 | -0.11 | 0.82 | 0.74 | 1.00 | -0.25 | 0.28 |
| Core Fixed Income (Bond) | 0.18 | 0.09 | 0.24 | 1.00 | 0.23 | -0.43 | -0.40 | -0.25 | 1.00 | 0.19 |
| Cash (Cash) | -0.13 | -0.15 | -0.11 | 0.23 | 1.00 | 0.13 | 0.21 | 0.28 | 0.19 | 1.00 |
| Enhanced | | | | | | | | | | |
| Emerging Markets Equity | 0.60 | 0.62 | 0.82 | 0.25 | -0.01 | 0.71 | 0.61 | 0.77 | -0.28 | 0.07 |
| REITs | 0.52 | 0.54 | 0.48 | 0.53 | -0.09 | 0.51 | 0.62 | 0.49 | 0.04 | 0.34 |
| Emerging Markets Bonds | 0.44 | 0.35 | 0.55 | 0.73 | 0.10 | 0.48 | 0.44 | 0.39 | 0.38 | 0.14 |
| High Yield Bond | 0.68 | 0.61 | 0.73 | 0.39 | -0.19 | 0.67 | 0.61 | 0.49 | -0.09 | 0.15 |
| TIPS | 0.17 | 0.08 | 0.22 | 0.80 | 0.11 | -0.09 | -0.10 | 0.03 | 0.73 | 0.17 |
| Extended | | | | | | | | | | |
| Long Duration Bonds | 0.19 | 0.06 | 0.21 | 0.95 | 0.11 | -0.39 | -0.41 | -0.29 | 0.91 | -0.04 |
| Infrastructure Equity | 0.59 | 0.46 | 0.75 | 0.42 | 0.03 | 0.61 | 0.44 | 0.67 | -0.27 | -0.10 |
| Commodities | 0.22 | 0.23 | 0.30 | -0.01 | -0.07 | 0.61 | 0.51 | 0.73 | -0.30 | 0.20 |
| Private Real Estate Equity | -0.40 | -0.28 | -0.34 | -0.21 | -0.10 | 0.37 | 0.32 | 0.39 | -0.08 | 0.15 |
| Private Real Estate Debt | 0.16 | 0.04 | 0.17 | 0.86 | 0.12 | -0.07 | 0.00 | 0.02 | 0.57 | 0.19 |

Source: Morningstar Direct. See Appendix 1 for asset class definitions.

We can see that the correlations among US large cap, US small cap and non-US equity, the risky asset classes included in the Basic group, had relatively high correlations regardless of the market return environment (positive or negative). In contrast, the correlations of emerging markets equity, REITs, and commodities, the riskier asset classes in the Enhanced and Extended (long duration bonds, infrastructure and private real estate) groups, are notably lower and can vary across market environments.

We can also see the potential benefits of including the Enhanced and Extended asset classes when we look at the correlations of asset classes in the varying coverage groups in different inflationary environments. This is included in Exhibit 3, which also leverages quarterly returns from Q1 2000 to Q4 2024. The low inflationary environment is defined as a quarter when inflation was less than 1%, and a high inflationary environment is defined as when inflation for the quarter is 1% or more (which is approximately one third of the quarters over the period).

Exhibit 3: Asset Class Correlations Across Historical Inflation Environments: 2000-2024

| | Positive Market Environments | | | | | Negative Market Environments | | | | |
|----------------------------|------------------------------|-------|-------|-------|-------|------------------------------|-------|-------|-------|-------|
| | Asset Classes | | | | | Asset Classes | | | | |
| | LC | SC | Intl | Bond | Cash | LC | SC | Intl | Bond | Cash |
| Basic | | | | | | | | | | |
| US Large Cap (LC) | 1.00 | 0.89 | 0.88 | 0.25 | -0.03 | 1.00 | 0.93 | 0.89 | -0.22 | 0.17 |
| US Small Cap (SC) | 0.89 | 1.00 | 0.83 | 0.25 | 0.03 | 0.93 | 1.00 | 0.85 | -0.23 | 0.18 |
| Non-US Equity (Intl) | 0.88 | 0.83 | 1.00 | 0.22 | -0.11 | 0.89 | 0.85 | 1.00 | -0.07 | -0.13 |
| Core Fixed Income (Bond) | 0.25 | 0.25 | 0.22 | 1.00 | 0.25 | -0.22 | -0.23 | -0.07 | 1.00 | 0.23 |
| Cash (Cash) | -0.03 | 0.03 | -0.01 | 0.25 | 1.00 | -0.17 | -0.18 | -0.13 | 0.23 | 1.00 |
| Enhanced | | | | | | | | | | |
| Emerging Markets Equity | 0.64 | 0.70 | 0.82 | 0.26 | 0.03 | 0.84 | 0.80 | 0.91 | -0.06 | -0.11 |
| REITs | 0.69 | 0.78 | 0.69 | 0.42 | -0.06 | 0.69 | 0.71 | 0.66 | 0.14 | 0.01 |
| Emerging Markets Bonds | 0.44 | 0.46 | 0.42 | 0.81 | 0.12 | 0.66 | 0.59 | 0.71 | 0.35 | 0.01 |
| High Yield Bond | 0.47 | 0.49 | 0.55 | 0.52 | -0.13 | 0.88 | 0.82 | 0.83 | -0.05 | -0.12 |
| TIPS | 0.03 | 0.00 | -0.07 | 0.85 | 0.14 | 0.00 | -0.03 | 0.13 | 0.75 | 0.13 |
| Extended | | | | | | | | | | |
| Long Duration Bonds | 0.37 | 0.30 | 0.29 | 0.92 | 0.18 | -0.21 | -0.23 | -0.09 | 0.93 | 0.01 |
| Infrastructure Equity | 0.76 | 0.70 | 0.84 | 0.06 | -0.05 | 0.80 | 0.70 | 0.85 | 0.09 | -0.11 |
| Commodities | 0.07 | 0.09 | 0.19 | -0.12 | -0.19 | 0.51 | 0.47 | 0.57 | -0.08 | 0.10 |
| Private Real Estate Equity | -0.06 | -0.04 | -0.07 | -0.20 | -0.01 | 0.07 | 0.06 | 0.06 | -0.12 | -0.04 |
| Private Real Estate Debt | 0.20 | 0.20 | 0.14 | 0.88 | 0.10 | -0.01 | -0.02 | 0.06 | 0.61 | 0.17 |

Source: Morningstar Direct. See Appendix 1 for asset class definitions.

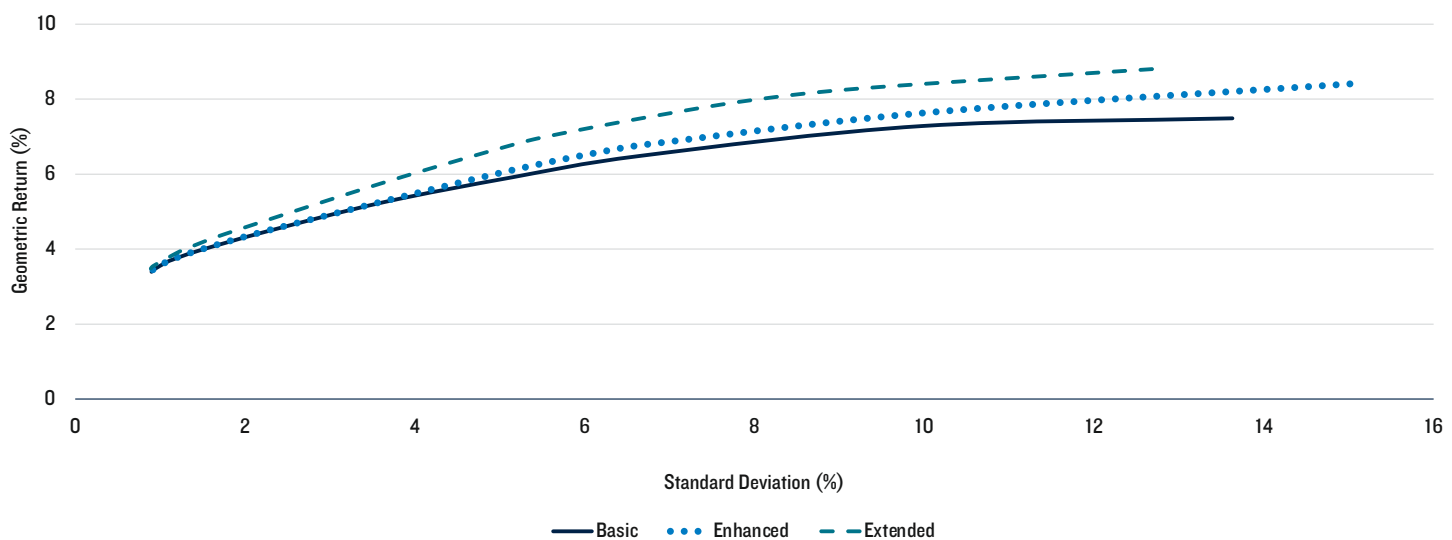
We can see that the correlations between many of the Basic asset classes, especially the risky assets, are relatively high during both the low and high inflationary periods (i.e., they do not change). In contrast, the correlations are generally lower for the Enhanced and Extended asset classes, but also more stable across the two regimes, if not lower in high inflationary periods. For example, the correlation of Commodities to US Large Cap equity has been 0.66 when inflation is high but only 0.44 when inflation has been relatively low, an effect that was especially salient during the 2022 calendar year. In other words, certain asset classes have historically been better diversifiers in different inflationary environments.

By increasing the opportunity set of asset classes it's possible to build more diversified portfolios, an effect demonstrated in the next section.

PORTFOLIO OPTIMIZATIONS

To demonstrate the potential benefits of increasing the opportunity set of asset classes when building portfolios, we run a series of portfolio optimizations using PGIM Quantitative Solutions' Q1 2025 Capital Market Assumptions (CMAs)¹. First, we run an “asset-only” optimization, which is a traditional mean variance optimization approach. The optimizations include a maximum 40% allocation to a single asset class, other than cash, to ensure the resulting portfolios are reasonably diversified. The efficient frontiers for the three opportunity sets are included in the exhibit below.

Exhibit 4: Asset Only Efficient Frontier Using Capital Market Assumptions

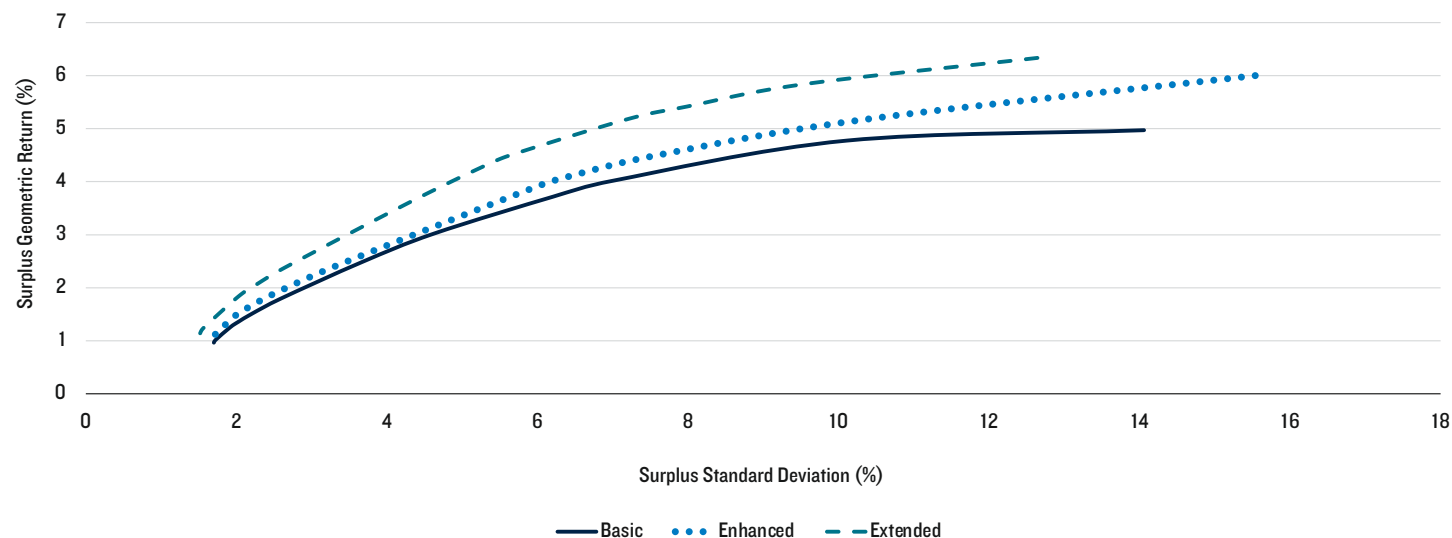


For illustrative purposes only. Forecasts may not be achieved and are not a guarantee or reliable indicator of future results.

We can see clearly that as the opportunity set moves from Basic to include Enhanced and then Extended asset classes, the expected risk-adjusted returns for the portfolio improve. For example, if we focus on the asset-only optimizations for portfolios with a standard deviation of 6%, the efficient Basic + Enhanced portfolio has a return that is 0.26% higher than the efficient Basic Only while the efficient portfolio that also includes Extended asset classes has a return that is 0.96% higher than the Basic portfolio.

Next, we run a series of “surplus” optimizations, where inflation is held short as a liability in the optimization routine. This reflects the goal, for example, for a retiree to generate income for life, adjusted by inflation. Inflation protection for a portfolio is less important when someone is working because human capital (i.e., wages) are a natural inflation hedge. Exhibit 5 includes the respective surplus efficient frontiers.

Exhibit 5: Surplus Optimization Efficient Frontier Using Capital Market Assumptions



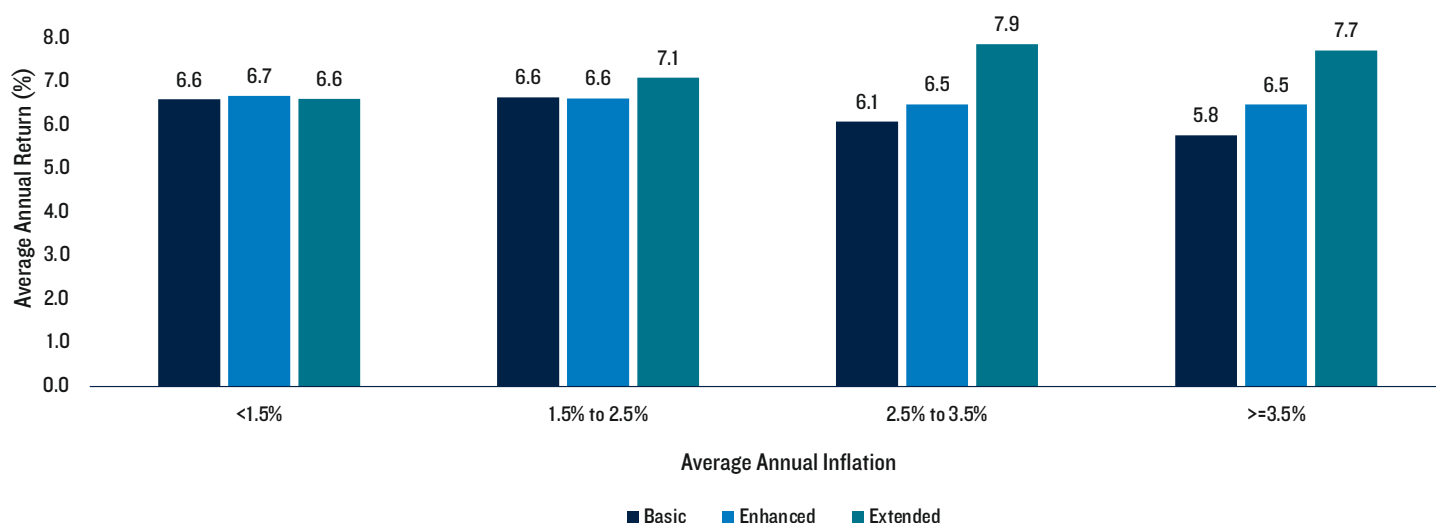
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Again, we see that increasing the opportunity set to include the Enhanced and Extended asset classes improves portfolio efficiency; however, the improvements are even greater for the surplus optimizations, which is more relevant to retirees, compared to the asset-only optimizations. For example, if we focus on the portfolios with a 6% surplus standard deviation, the efficient Basic + Enhanced portfolio and efficient Basic + Enhanced + Extended portfolio have higher expected returns of 0.29% and 1.03% respectively.

The larger difference for the surplus optimization is a function of the unique benefits of including inflation-sensitive assets in a retirement portfolio.

Including the additional diversifier asset classes within the Enhanced and Extended groups can be especially valuable during periods of high inflation. We demonstrate this effect focusing on the expected returns for the efficient portfolios with a 6% surplus standard deviation, but break out the returns by the annual inflation rate in the simulation in Exhibit 6.

Exhibit 6: Average Forecasted Portfolio Geometric Return by Annual Inflation Rate



Bar order corresponds with the order of the legend.

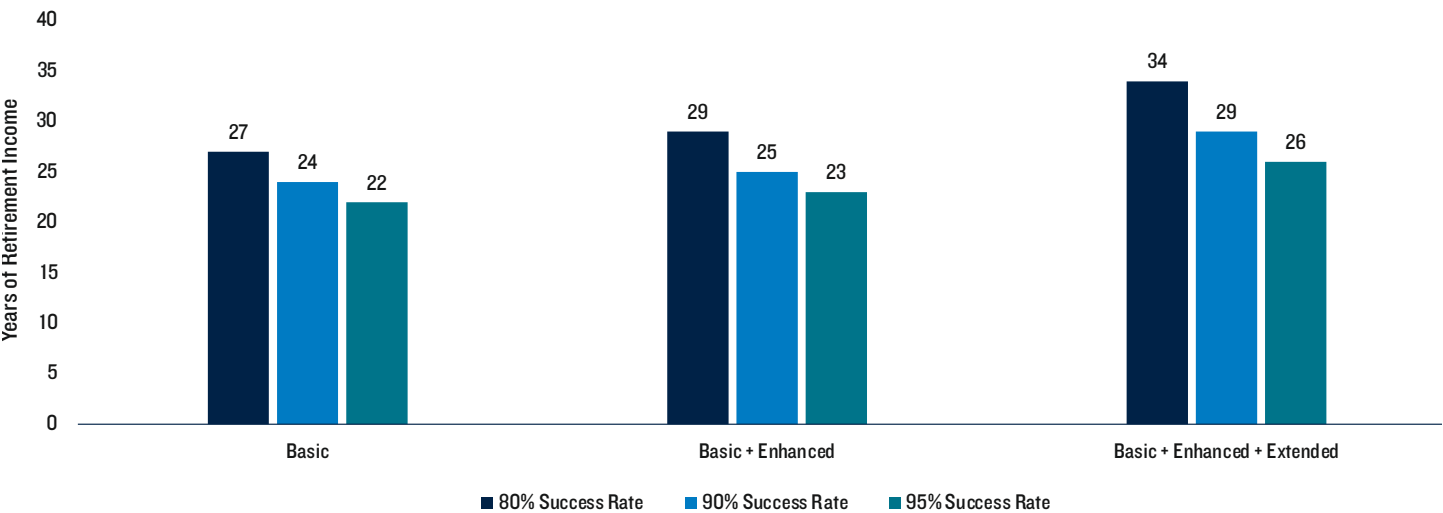
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We can see that introducing the Enhanced and Extended asset classes results in higher forecasted average portfolio returns when inflation is higher. This is when the value of the inflation projection is technically the highest because these are the periods a retiree is going to be most challenged at accomplishing his or her goals. In other words, increasing the opportunity set of asset classes has the potential to not only increase portfolio efficiency, but also increases the likelihood of a retiree accomplishing his or her income goals.

We demonstrate this effect in Exhibit 7, which includes the results of Monte Carlo projection*, using these same three portfolios, with an assumed 5% initial withdrawal rate, where we estimate the number of years the portfolio can sustain the income goal given varying target probabilities of success.

Exhibit 7: Years of Retirement Income by Success Rate and Asset Class Coverage



Bar order corresponds with the order of the legend.
For illustrative purposes only. Forecasts may not be achieved and are not a guarantee or reliable indicator of future results.

As demonstrated in Exhibit 7, increasing the asset class coverage may result in a notable improvement in years of retirement income. For example, if a retiree is targeting a 90% success rate, moving from Basic to Basic + Enhanced can result in five years of additional retirement income (24 years to 29 years). This is a significant improvement that has the potential to meaningfully improve outcomes for retirees.



CONCLUSION

Defined contribution investment options are not currently designed to be “retirement ready.” Efficient retirement portfolios look different than efficient accumulation portfolios given the more focused objective of generating an income stream, and unfortunately the key building blocks for efficient retirement portfolios are often missing. There is real opportunity to incorporate alternative asset classes within professionally managed solutions in defined contribution plans. The portfolio efficiency costs of these gaps can be staggering, exceeding approximately 100 bps on an alpha-equivalent basis. By adding more extended asset classes, there is the potential to generate five years of additional retirement income as seen in Exhibits 5 and 7, respectively. Therefore, we think it is essential that DC plan sponsors review their core menus and investment offerings to ensure they are designed to truly optimize outcomes for plan participants, especially because many of these asset classes could be particularly beneficial to pre-retirees and retirees given the characteristics of such asset classes that have historically protected against downside risk and inflation.

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Blanchett, David, Michael Finke, and Zhikun Liu. 2022. “Save More with Less: The Impact of Employer Defaults and Match Rates on Retirement Saving.” Financial Planning Review, vol. 5, no. 4. e1152.

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APPENDICES

Appendix 1: Asset Class Definitions

| Asset Class | Index Proxy Name |
|----------------------------|---|
| US Large Cap | Russell 1000 TR USD |
| US Small Cap | Russell 2000 TR USD |
| Non-US Equity | MSCI EAFE GR USD |
| Core Fixed Income | Bloomberg US Agg Bond TR USD |
| Cash | ICE BofA US 3M Trsy Bill TR USD |
| Emerging Markets Equity | MSCI EM GR USD |
| REITs | FTSE Nareit All Equity REITs TR USD |
| Commodities | Bloomberg Commodity TR USD |
| High Yield Bond | Bloomberg US Corporate High Yield TR USD |
| TIPS | Bloomberg Gbl Infl Linked US TIPS TR USD |
| Private Real Estate Equity | NCREIF Property |
| Private Real Estate Debt | Giliberto-Levy Real Estate Total Return Index |
| Long Duration Bonds | Bloomberg US Govt/Credit Long TR USD |
| Infrastructure Equity | MSCI ACWI Infrastructure NR USD |
| Emerging Markets Bond | JPM EMBI Global TR USD |

All indexes are unmanaged. An investment cannot be made directly in an index. Past performance does not guarantee future results.

AUTHORS

DAVID BLANCHETT, PHD, CFA, CFP®
Managing Director, Portfolio Manager and
Head of Retirement Research

JEREMY STEMPIEN
Managing Director, Portfolio Manager
and Strategist

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As the retirement solutions provider of PGIM, we plan to deliver innovative defined contribution solutions founded on market-leading research and capabilities. Our highly-experienced team partners with clients on customized solutions that seek to solve for current challenges facing DC participants. As of 9/30/2025, PGIM has \$189 billion** DC assets under management and PGIM DC Solutions AUM is \$1.47 billion.

* PGIM DC Solutions does not establish or operate pension plans.

** Reported data reflects the assets under management by PGIM and its investment adviser affiliates for defined contribution investment purposes only.

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