

PGIM DC SOLUTIONS ENHANCING CORE MENUS TO HELP GET 401 (K) S IN BETTER SHAPE FOR RETIREMENT

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INTRODUCTION

The role of the core menu in defined contribution (DC) plans has changed considerably over the last decade as default investments, in particular target-date funds, continue to capture plan sponsor attention and participant assets. For example, today target-date funds (TDFs) have roughly \$3 trillion in assets, up from roughly \$1 trillion in assets in 2014 and from less than \$200 billion in 2008 (Morningstar 2023). This evolution requires plan sponsors and consultants to revisit key assumptions about optimal core menu design, especially as plan sponsors increasingly seek to retain participant assets during retirement, since older participants are more likely to use the core menu and invest conservatively. For readers not familiar with core menus, they are a menu of investments, such as mutual funds, determined by the DC plan sponsor that a participant can allocate their balance among.

This paper uses data from 8,271 401(k) plans to explore where asset class coverage gaps exist in core menus and quantifies the portfolio implications associated with the gaps. Equity funds clearly dominate core menus today, with roughly three times as many equity funds on core menus versus bonds funds, on average, which can make it difficult to build efficient conservative (i.e., retirement) portfolios and may lead to excess risk-taking among participants (i.e., if the participant follows a naïve allocation strategy or chases returns).

Efficient retirement portfolios look different than efficient accumulation portfolios given the more focused objective of generating an income stream. In turn, the benefits of including certain asset classes can result in higher risk-adjusted returns that could result in four more years of retirement income for participants leveraging the core menu over their lifetimes. The most notable gaps in asset class availability today are likely inflation-linked bonds, commodities, and real estate, although other asset classes, such as long-term bonds and high yield bonds, deserve wider consideration as well.

While some plan sponsors may hesitate to expand core menus given past research on the topic (e.g., research finding a negative relationship between core menu size and plan participation¹), it is important to recognize that DC participant behaviors have evolved and adapted in response to wider adoption of plan design features, including automatic enrollment and the usage of default investments. Better core menus do not necessarily have to be larger, but rather more intelligently designed. This could be achieved by consolidating many of the existing riskier options to make room for those asset classes that are missing, especially more conservative (i.e., bond) options and those featured more prominently in retirement portfolios.

In summary, enhancing DC core menus presents an opportunity to improve outcomes for DC participants that many plan sponsors should be actively exploring today.

¹ Iyengar, Jiang, and Huberman (2003).

THE CHANGING ROLE OF THE CORE MENU

The role of the core menu in DC plans has changed considerably over time. Initially, as the DC market evolved from a single-pooled portfolio to daily-valued individual accounts, the core menu took center stage with participants primarily building portfolios themselves from the various options available. Early research explored topics like how core menu design impacted participant decisions around allocations (Benartzi and Thaler 2001) and even whether or not to participate in the plan itself (Iyengar, Jiang, and Huberman 2003).

Given the rise in plan features such as automatic enrollment, and in particular, the rise of default investments, such as target-date funds, core menus have increasingly been taking on a more supporting role in DC plans.

Target-date funds have become progressively prevalent, and utilized, by DC participants. For example, in 2004 only 13% of plans recordkept at Vanguard offered target-date funds, versus 96% in 2022 (Vanguard 2023). Exhibit 1 provides additional context on the general usage and availability of target-date funds in DC plans that are recordkept at Vanguard (2023) since 2011.



Exhibit I: Target-Date Fund Availability and Usage for DC Plans Recordkept at Vanguard

Source: Vanguard 2023.

The growth in the usage of target-date funds, especially since most are prepackaged (i.e., do not leverage the core menu), means that fewer participants are using the core menu, and in turn, are no longer directly driving their allocation decisions. There are also important differences in terms of which types of participants are more likely to use professionally managed strategies, such as target-date funds, in particular those who are younger with lower incomes (Blanchett and Bruns 2019).

Vanguard (2023) has relatively detailed information about how demographics are related to using any type of a professionally managed portfolio among its DC participants, which would include holding a single target-date fund, using a target risk (or balanced) fund, as well as a managed account program. Exhibit 2 provides context as to how utilization of professionally managed investment solutions varied at Vanguard in 2022 by age (Panel A), income (Panel B), and account balance (Panel C), based on Exhibit 79 in the Vanguard report.

Exhibit 2: Participant Utilization of Professionally Managed Solutions in 401(k) Plans by Demographics

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Age	<25	25-34	35-44	45-54	55-64	65+
% Using	88	80	70	60	53	44

Panel A: By Participant Age

Panel B: By Participant Income

Income	<\$15,000	\$15,000- \$29,999	\$30,000- \$49,999	\$50,000- \$74,999	\$75,000- \$99,999	\$100,000- \$149,999	\$150,000+
% Using	88	88	79	70	63	57	51

Panel C: By Participant Balance

Balance	<\$10,000	\$10,000- \$24,999	\$25,000- \$49,999	\$50,000- \$99,999	\$100,000- \$149,999	\$150,000- \$199,999	\$200,000- \$249,999	\$250,000+
% Using	87	75	66	58	51	45	41	28

Source: Vanguard 2023.

There is a notable difference in the percentage of participants using professionally managed portfolios and assets. For example, we see in Exhibit 1 that while roughly 80% of participants in 2022 were using target-date funds, they only represented approximately 40% of assets. This can be attributed to the fact participants who have higher balances (who tend to be older and have higher incomes) are less likely to use a professionally managed portfolio option in DC plans. In Exhibit 2 for example, while 87% of participants with balances less than \$10,000 were using a professionally managed portfolio, only 28% of participants with a balance greater than \$250,000 were doing so.

These dynamics of who uses the core menu has important implications on core menu design. For example, the fact that older participants are more likely to use the core menu (Panel A in Exhibit 2) suggests that it's important that those participants have the ability to build efficient portfolios, which are generally less aggressive (than younger participants). Exhibit 3 demonstrates how equity allocations vary by age among DC participants who are self-directing their accounts, based on research by Blanchett (2020). The equity allocation for the S&P Target Date Index series has been included for reference purposes.





Source: Blanchett (2020), Exhibit 5, data as of December 31, 2019.

While there is a relatively wide spectrum in risk levels that tends to increase at older ages, older participants are clearly investing more conservatively than younger participants, on average. There is evidence that participants who self-direct their accounts tend to be more aggressive than the equity allocations in target funds, when comparing the median equity allocation of participants self-directing their accounts to the S&P Target Date Index equity levels.

The wide dispersion in equity allocations among older participants, and the more conservative allocations on average, could be problematic given existing core menu designs, since core menus are largely dominated by more aggressive options (e.g., equity funds) that can make it difficult to build efficient, lower risk portfolios. In other words, core menus are being built for participants who are the least likely to use them. In the following section we explore these gaps in considerable detail.

CORE MENU DATASET

To better understand the current state of core menus in 401(k) plans, data was obtained from RightPond Intelligence (RPI), specifically 2020 plan year filings. RPI, owned by Morningstar, is a provider of business intelligence data and analytics on defined contribution and defined benefit plans for financial services firms.

To be included in the test dataset, the DC plan had to meet a number of requirements, which include the plan being coded as a total participant directed 401(k) plan, offering at least 10 funds, of which both 95% of funds and 95% of the plans fund weighted assets reside in funds that are identifiable by Morningstar with an available Morningstar Category (the classification approach for investment style). A total of 8,271 plans met the required filters.

Exhibit 4 includes information about the total number of 401(k) plans for the five different plan asset size thresholds considered for the analysis. The relatively few large plans available (i.e., with assets exceeding \$100 million) can be attributed to the fact that there are simply more smaller 401(k) plans than larger plans today, as well as the fact that there is a growing use of collective investment trusts (CITs) in 401(k) plans. CITs are notably more common in larger 401(k) plans and more difficult for RPI to identify and categorize. For example, according to BrightScope/ICI (2023), CITs represented 55% of investment options in DC plans with assets exceeding \$1 billion versus only 7% of plans with assets under \$1 million.

Exhibit 4: Number of 401(k) Plans by Total Plan Assets

Plan Size	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	Total
Number	320	2,909	4,145	482	415	8,271

Source: RPI and Authors' Calculations. Data as of 2020 Plan Year Filings.

While this analysis focuses on a single plan year (2020), the size of core menus has been relatively constant for quite some time, especially when controlling for target-date funds (since target-date funds tend to offer a number of vintages). This effect is demonstrated in Exhibit 5, which includes data on the average core menu size from 2006 to 2020 based on research from BrightScope/ICI (2023).





Source: BrightScope/ICI (2023). Data as of 2020 Plan Year Filings.

While the average total number of funds in core menus has increased since 2006, this effect can largely be attributed to the growing use of target-date funds, which can have ten (or more) separate funds (referred to as vintages) within their series. Once the target-date fund vintage effect is controlled for, though, core menu sizes have changed relatively little since 2006, an effect that is consistent across plan sizes (based on additional data in the BrightScope/ICI report).

BROAD ASSET CLASS CORE MENU COVERAGE

This section provides some perspective about broad asset class coverage for the five plan size asset groups considered. Investment styles are grouped into the following broad asset class groups, again where investment style is based on the fund's respective Morningstar Category:

- **Domestic Equity:** Large Growth, Large Blend, Large Value, Mid-Cap Growth, Mid-Cap Blend, Mid-Cap Value, Small Growth, Small Blend, Small Value
- Foreign Equity: Foreign Large Growth, Foreign Large Blend, Foreign Large Value, Foreign Small/Mid Growth, Foreign Small/Mid Blend, Foreign Small/Mid Growth, Emerging Markets, Global Large Stock, Global Small/Mid Stock
- Alternative Equity: Bear Market, China Region, Communications, Consumer Cyclical, Consumer Defensive, Diversified Pacific/Asia, Energy Limited Partnership, Equity Energy, Equity Precious Metals, Financial, Health, India Equity, Industrials, Infrastructure, Japan Stock, Latin America Stock, Long-Short Equity, Miscellaneous Region, Natural Resources, Pacific/Asia ex-Japan Stk, Technology, and Utilities
- Cash: Money Market, Stable Value, and Ultrashort Bond
- **Domestic Bond:** Short-term Bond, Short Government Bond, Intermediate Core Bond, Intermediate Core-Plus Bond, Intermediate Government, Long-term Bond, Long-term Government, Bank Loan, Corporate Bond, High Yield Bond, Inflation-Protected Bond, Multisector Bond, Nontraditional Bond
- Foreign Bond: Emerging Markets Bond and World Bond
- Alternative: Commodities Broad Basket, Commodities Focused, Real Estate, Global Real Estate
- Allocation (non-TDF): Allocation--15% to 30% Equity, Allocation--30% to 50% Equity, Allocation--50% to 70% Equity, Allocation-70% to 85% Equity, Allocation--85%+ Equity, Global Allocation
- Target-Date Fund: Target-Date 2000-2010, Target-Date 2015, Target-Date 2020, Target-Date 2025, Target-Date 2030, Target-Date 2035, Target-Date 2040, Target-Date 2045, Target-Date 2050, Target-Date 2055, Target-Date 2060, Target-Date Retirement, Target-Date 2065+
- Other: any asset class not included in the above classes

Exhibit 6 includes information about the percentage of plans within each plan size group offering at least one fund within the respective broad category. The slope of the relation between the five plan size groups (included as one through five) and the variable of interest is also provided to provide context about how the relation changes by plan size.

As a reminder, while filters were included to capture only 401(k) plans in which a majority of their core menu funds could be identified, there are going to be funds that were not identified (and therefore not captured for this analysis). This is more likely to affect certain broad asset classes than others, such as Cash, given the higher general usage of non-publicly traded funds within the group, in particular Stable Value funds. Therefore, these results should be viewed as being directionally useful, they are not going to perfectly capture the comprehensive set of funds in each 401(k) plan included given the issues associated with mapping funds to an identifiable security (that exists in the Morningstar database).

			401(k) Plan Asset	ts		
Broad Asset Class	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	Slope
Domestic Equity	100.0	100.0	99.9	99.8	99.8	-0.1
Foreign Equity	88.4	97.4	98.8	98.5	93.0	1.0
Alternative Equity	10.9	19.7	19.3	12.7	5.3	-1.8
Cash	73.8	80.5	87.1	92.3	93.3	5.1
Domestic Bond	89.7	98.0	99.2	99.0	94.7	1.1
Foreign Bond	22.2	25.1	23.4	21.0	13.3	-2.2
Alternatives	38.1	47.2	47.3	34.9	26.0	-3.7
Allocation (non-TDF)	47.2	59.1	61.3	55.4	51.1	0.4
Target-Date Fund	90.6	91.2	92.8	94.8	97.1	1.7
Other	0.3	0.1	0.1	0.0	0.0	-0.1

Exhibit 6: Percentage of Plans Offering at Least One Fund Within a Broad Asset Class Group

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

Certain broad asset class groups are very well represented among 401(k) core menus, in particular domestic equity, foreign equity, domestic bond, and target-date funds. The high availability of target-date funds is not necessarily a surprise given the information in Exhibit 1, with well over 90% of plans in this dataset offering target-date funds, regardless of plan size.

Exhibit 7 provides context on the average number of funds across broad asset classes available in core menus by plan size groups. Again, the slope is included to provide context about how the relation for each broad asset class group varies by plan size.

Exhibit 7: Average Number of Funds Available

			401(k) Plan Asset	ts		
Broad Asset Class	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	Slope
Domestic Equity	7	8	8	8	7	0.10
Foreign Equity	3	3	3	3	3	-0.10
Alternative Equity	0	1	0	0	0	-0.10
Cash	1	1	1	1	2	0.20
Domestic Bond	2	3	3	3	3	0.00
Foreign Bond	0	0	0	0	0	0.00
Alternatives	0	1	1	0	0	0.00
Allocation (non-TDF)	1	2	1	1	1	-0.10
Target-Date Fund	8	8	9	10	11	0.80
Other	0	0	0	0	0	0.00
Total	22	27	26	26	27	-
Total ex-TDF	15	18	18	17	15	-

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

The largest average number of funds available across broad asset groups is target-date funds, with an average of approximately eight funds for plans with less than \$1 million in assets versus 11 for those with over \$250 million in assets. The high number of target-date funds is not a surprise, since target-date funds typically consist of a number of different vintages to reflect different expected ages of retirement (typically varying in five-year increments), as noted previously. We can see that the number of target-date funds offered increases by plan size. This effect will be explored more in a future section, but can be attributed to the higher incidence of the further dated target-date funds being available in larger 401(k) plans (e.g., the target-date 2065 fund).

One of the more notable effects in Exhibit 7 is how overrepresented equity funds are compared to fixed income funds. For example, there are roughly over three times as many equity funds available as fixed income offerings. There is also a notable home bias with respect to funds, where domestic equity funds represent approximately 70% of total available equity funds and domestic fixed income funds represent approximately 93% of all available fixed income funds. Generally, the fund counts suggest participants who are building more aggressive portfolios are going to have more options available than those building more conservative portfolios, something we explore in greater detail in future sections (along with the efficiency implications).

Exhibit 8 provides some perspective about the average total assets by broad asset class.

			401(k) Plan Asse	ts		
Broad Asset Class	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	Slope
Domestic Equity	20.5	27.1	33.4	35.7	35.0	3.8
Foreign Equity	5.2	5.9	6.3	6.4	5.9	0.2
Alternative Equity	0.3	0.8	0.8	0.5	0.2	-0.1
Cash	4.1	4.9	6.2	7.3	7.0	0.8
Domestic Bond	5.2	5.4	6.5	6.8	6.2	0.3
Foreign Bond	0.4	0.3	0.2	0.1	0.1	-0.1
Alternatives	0.5	0.5	0.5	0.3	0.2	-0.1
Allocation (non-TDF)	3.1	5.2	4.1	3.0	2.5	-0.3
Target-Date Fund	60.0	48.9	41.0	38.8	41.6	-4.7
Other	0.0	0.0	0.0	0.0	0.0	0.0
Total	99.48	99.03	98.97	98.95	98.69	-
Total ex-TDF	39.53	50.13	57.96	60.18	57.10	-

Exhibit 8: Average Total Assets by 401(k) Plan Size and Broad Asset Class

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

Consistent with expectations, target-date funds are the broad asset class with most plan assets, followed by equity funds, in particular domestic equity funds. Target-date funds held approximately 45% of assets across plans, but the percentage of assets in target-date funds declined as the plan size increased.

Exhibit 9 provides some perspective about the average total assets per average fund by broad asset class. This provides context on how well utilized the average fund is within each broad asset class group.

		4	401(k) Plan Asset	s		
Broad Asset Class	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	Slope
Domestic Equity	3.3	3.4	3.9	4.6	5.1	0.5
Foreign Equity	2.3	2.1	2.1	2.3	2.3	0.0
Alternative Equity	1.7	1.7	1.8	2.1	1.8	0.1
Cash	4.9	5.0	5.0	4.8	4.4	-0.1
Domestic Bond	2.1	1.9	2.1	2.5	2.5	0.1
Foreign Bond	1.7	1.1	0.9	0.6	0.6	-0.3
Alternatives	1.2	1.0	0.9	0.8	0.8	-0.1
Allocation (non-TDF)	3.9	4.7	3.8	4.0	3.5	-0.2
Target-Date Fund	7.2	5.4	4.0	3.4	3.5	-0.9
Other	0.0	1.5	0.1	0.0	0.0	-0.2
Average	2.8	2.8	2.5	2.5	2.4	-

Exhibit 9: Average Total Assets per Average Number of Funds by Broad Asset Class

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

Funds in certain broad asset classes appear to capture more assets than others. For example, cash, allocation (non-TDF) and target-date fund broad asset classes tend to have a relatively high share of assets within a given plan.

Domestic equity tends to have a higher average level of total assets than domestic bond, this is despite the fact there are significantly more domestic equity funds than domestic bond funds. This effect can likely be attributed to the fact 401(k) investors are relatively aggressive (e.g., with an average equity allocation of approximately 75%).

INDIVIDUAL INVESTMENT STYLE COVERAGE

The previous section provided information about asset class coverage and in this section we explore coverage at a more granular investment style level, where investment style is defined using Morningstar Category, with data obtained from Morningstar Direct.

Exhibit 10 includes information about the percentage of plans offering various fixed income investment styles by plan assets size group. Note, even if a plan has multiple funds for a given investment style, it would only be included once for that plan.

			401(k) Plan Asse	ts		
Asset Class	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	- Slope
Money Market	43.1	53.4	57.8	65.8	68.0	6.2
Stable Value	31.6	32.1	47.4	64.3	69.2	10.7
Ultrashort Bond	1.9	1.4	1.5	0.8	1.4	-0.1
Short-Term Bond	16.3	24.8	22.3	14.7	12.0	-1.8
Intermediate Core Bond	51.9	57.2	63.3	63.3 78.0		6.8
Intermediate Core-Plus Bond	46.3	46.3 54.9		67.6	67.2	5.5
Long-Term Bond	0.6	2.0	1.3	1.5	1.4	0.1
Short Government	7.2	4.6	4.8	3.7	2.2	-1.1
Intermediate Government	17.5	19.8	20.3	12.4	8.9	-2.5
Long Government	2.2	2.0	1.9	1.2	1.0	-0.3
Inflation-Protected Bond	33.1	30.3	31.7	31.3	33.3	0.1
Multisector Bond	12.5	21.0	22.9	16.6	9.2	-1.1
Corporate Bond	4.4	4.6	4.0	2.7	0.7	-0.9
Nontraditional Bond	1.6	2.6	2.6	1.0	1.4	-0.2
Bank Loan	1.3	2.0	2.0	0.6	0.5	-0.3
High Yield Bond	32.5	36.3	32.3	20.3	19.0	-4.3
World Bond	9.4	10.9	12.1	6.6	5.5	-1.2
World Bond-USD Hedged	12.2	12.8	10.1	11.8	8.2	-0.9
Emerging Markets Bond	1.6	2.8	2.9	2.3	0.5	-0.3
Emerging-Markets LC	0.0	0.1	0.1	0.6	0.0	0.0

Exhibit IO: Fixed Income Investment Style Coverage Availability (% of All Plans in Plan Size Group)

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

These results are obviously similar to the broad asset class coverage exhibits but provide a more granular perspective. Coverage for the individual bond investment tends to increase by plan size, but at different rates. For example, while larger plans are more likely to have a money market fund (versus stable value), the rate of including stable value increases faster than the rate of including money market funds as the plan size increases. Larger 401(k) plans are much more likely to offer intermediate core bonds, but less likely to offer high yield bonds or intermediate government bonds.

There is relatively little availability of long bond funds (either core or government), which is somewhat surprising given the literature noting the important role long bonds can play as part of a retirement strategy. While long bonds may be risky when viewed from an asset-only perspective (and have suffered performance-wise recently), when viewed in the context of funding a retirement liability (or potentially purchasing an annuity), they can become significantly more efficient (Idzorek and Blanchett 2019). In contrast, lack of short bond funds is not surprising given common bond maturity restrictions for plans offering stable value.



Exhibit 11 includes information about the percentage of plans offering various equity investment styles by plan assets size group.

			401(k) Plan Asse	ets		
Asset Class	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	Slope
Large Growth	78.8	88.1	91.0	87.1	79.3	0.0
Large Blend	90.3	95.8	97.8	97.7	94.7	1.1
Large Value	66.6	78.3	85.8	86.9	78.3	3.2
Mid-Cap Growth	37.5	53.2	61.1	57.1	46.7	2.2
Mid-Cap Blend	57.8	69.8	78.7	78.4	78.6	5.0
Mid-Cap Value	28.8	52.0	63.0	58.3	43.4	3.6
Small Growth	51.9	57.4	60.5	60.2	50.6	0.0
Small Blend	65.6	73.2	73.8	62.2	51.6	-3.9
Small Value	42.8	51.5	56.0	50.4	41.2	-0.4
Foreign Large Growth	35.9	52.4	64.2	68.5	65.8	7.6
Foreign Large Blend	65.9	66.3	73.1	79.0	75.2	3.1
Foreign Large Value	10.6	16.0	17.1	20.3	21.9	2.7
Foreign Small/Mid Growth	4.4	4.6	5.5	4.6	6.7	0.5
Foreign Small/Mid Blend	4.4	5.0	4.9	5.8	4.1	0.0
Foreign Small/Mid Value	1.6	2.1	1.9	1.0	1.9	0.0
Diversified Emerging Mkts	52.8	58.3	57.2	45.0	31.8	-5.5
Global Large-Stock Growth	12.2	15.5	14.7	9.5	6.3	-1.8
Global Large-Stock Blend	6.9	11.7	9.4	6.2	7.5	-0.4
Global Large-Stock Value	0.6	2.3	1.4	1.9	1.2	0.1
Global Small/Mid Stock	4.1	7.3	4.8	1.2	1.4	-1.1
Commodities Broad Basket	4.1	4.1	3.9	3.7	2.4	0.1
Real Estate	34.4	41.1	41.4	29.0	21.7	-0.4
Global Real Estate	4.7	7.2	6.5	5.2	4.6	-3.7

Exhibit II: Equity Investment Style Coverage Availability (% of All Plans in Plan Size Group)

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

While there were notable differences in fixed income investment style coverage by plan size, the changes in equity investment styles were more muted. There are interesting differences when focusing on the individual styles. For example, while larger plans were more likely to offer Foreign Large funds, they were less likely to offer Emerging Markets funds.

When looking at groups of funds, coverage for Domestic Large Cap is clearly the highest, followed by Foreign Large Cap, while Domestic Mid Cap and Domestic Small Cap are roughly tied. There is relatively little coverage of the more alternative-type asset classes, such as commodities and real estate (both domestic and global). Domestic Real Estate has the widest availability among the three considered.

Exhibit 12 includes information about the availability of various multi-asset funds, based on the percentage of plans in which the asset class appears by plan size group.

			401(k) Plan Asse	ets		
Asset Class	<\$1m	\$1m-\$10m	\$10m-\$100m	\$100m-\$250m	>=\$250m	Slope
Allocation15% to 30% Equity	1.88	5.29	4.29	1.24	1.69	-0.44
Allocation30% to 50% Equity	11.88	15.68	16.33	12.24	12.53	-0.21
Allocation50% to 70% Equity	36.25	45.79	46.88	41.70	38.07	-0.04
Allocation70% to 85% Equity	10.31	15.92	14.64	4.98	5.30	-2.10
Allocation85%+ Equity	1.88	3.71	2.68	1.04	0.48	-0.55
Global Allocation	8.13	11.41	10.23	6.64	4.34	-1.23
Target-Date 2000-2010	15.94	30.70	43.67	45.44	37.35	5.76
Target-Date 2015	33.13	51.12	66.20	80.50	82.17	12.75
Target-Date 2020	58.75	75.15	84.80	90.66	92.05	8.21
Target-Date 2025	78.44	82.54	86.63	92.32	92.29	3.75
Target-Date 2030	82.19	86.32	89.99	93.57	95.66	3.42
Target-Date 2035	85.94	84.53	87.58	92.32	92.77	2.15
Target-Date 2040	83.13	86.73	90.06	93.36	95.42	3.12
Target-Date 2045	84.38	84.19	87.31	92.53	92.29	2.42
Target-Date 2050	85.63	85.97	89.31	92.95	95.18	2.61
Target-Date 2055	80.31	81.54	86.22	91.91	92.77	3.53
Target-Date 2060	73.13	72.40	78.99	88.80	93.98	5.81
Target-Date 2065+	16.56	23.48	32.30	46.06	52.05	9.36
Target-Date Retirement	31.56	40.46	53.63	67.63	79.04	12.21

Exhibit 12: Allocation Fund Coverage Availability (% of All Plans in Plan Size Group)

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

Target-date funds are clearly the dominant type of allocation funds available in plans, which tends to increase by plan size, especially for the vintages targeted towards younger investors (e.g., the 2065+ vintage). Among the static options, balanced portfolios with equity allocations between 50% and 70% tend to be the most common, available in approximately 40% of 401(k) plans.

THE ECONOMIC COST OF COVERAGE GAPS

The previous analysis suggests that a variety of investment styles (or asset classes) are not generally available in DC plans today. In theory, a plan with more asset class coverage allows for participants (and their financial advisors) to potentially develop more efficient portfolios; however, it's not clear what the potential economic costs of lower availability (i.e., coverage) would be. In this section we attempt to quantify that gap.

For this analysis, we determine efficient portfolios based on a series of equity risk targets. Optimal portfolios are determined using an optimization approach where the goal is to maximize the certainty equivalent utility for some potential weights to the respective opportunity set based on a constant relative-risk aversion (CRRA) utility function. For those readers not familiar with utility functions, they are commonly used to quantify outcomes and preferences. A key component of utility (in particular, CRRA) is the concept of diminishing marginal utility, which means the first unit of consumption of a good or service yields more utility than the second and subsequent units. The level of risk aversion (γ) describes the "penalty" associated with a bad outcome; higher levels of risk aversion increasingly penalize bad outcomes (i.e., negative returns).

A utility approach is used since it allows for a more precise calibration of risk aversion with respect to "bad" outcomes versus compared to other metrics (e.g., standard deviation). Additionally, it easily allows for comparing the risk-adjusted differences in the respective portfolios by comparing the certainty equivalent wealth values within each simulation. The certainty equivalent wealth is effectively the utility-adjusted wealth from the respective portfolio and provides a relatively straightforward metric to quantify the differences in the efficiency of different portfolios via an alpha-equivalent metric.

The portfolios constructed are designed to span the risk and lifecycle spectrum, with risky asset targets of 10%, 25%, 50%, 75%, and 90%, with optimal portfolios determined for an investor who is in accumulation and retirement. Two different sets of portfolios are created to reflect the fact that the definition of risk changes when it comes to investing across the lifecycle. Younger investors should be primarily concerned with accumulating wealth. As an individual ages, the portfolio starts to focus more on generating income during retirement. This creates a different perspective on risk, since the goal of the portfolio is no longer to just maximize return, but rather maximize the probability that the investor will be able achieve a target consumption level in retirement. Some light constraints are included in the optimizations to ensure the results are reasonably consistent with portfolios that an investor would be wiling to implement (e.g., include minimum weights to intermediate bond and large cap equity).

The accumulation portfolios are effectively those with the highest return per unit of risk (i.e., are optimized in an asset-only space). The retirement portfolios are optimized by factoring in the retirement liability (i.e., a form of surplus optimization).

The underlying capital market assumptions are included in Appendix 1. We intentionally use a reduced opportunity set (e.g., exclude Growth and Value dimensions) in our analysis to limit overly precise estimates from our optimizations. The base capital market assumptions for the respective asset classes are based primarily on PGIM Quantitative Solutions' Q4 2023 Capital Market Assumptions (CMAs) but are supplemented with additional information, if necessary. Returns are assumed to follow a multivariate normal distribution.

Unlike past research that assumes the liability is a more traditional investment asset class (e.g., TIPS) or something like inflation, we develop a model to estimate how the actual cost of income has evolved historically and build risk metrics based off of that to determine the efficient retirement portfolios.

Using historical mortality tables from the Social Security Administration, historical yields on AAA Corporate bonds, and historical implied inflation estimates from Cleveland Federal Reserve we estimate the respective cost of retirement income on a monthly basis from January 1982 to October 2023. This model does a relatively good job tracking actual nominal historical annuity payouts available from CANNEX over the period. The historical cost of \$1 of real income is included in Exhibit 13.



Exhibit 13: The Historical Cost of \$1 of Real Income

Source: Social Security Administration, Cleveland Federal Reserve, St Louis Federal Reserve, and Author's Calculations. As of October 2023.

Exhibit 14 includes the optimal allocations for the target portfolios, along with information about the differences in the weights.

	Accumulation Portfolios				Retirement Portfolios				Retirement - Accumulation						
	F	lisky A	sset Ta	rget (%	á)	Risky Asset Target (%)				Risky Asset Target (%)					
	10	25	50	75	90	10	25	50	75	90	10	25	50	75	90
Cash	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intermediate Bond	34	28	18	8	4	36	32	20	9	3	2	4	2	1	-1
Long Bond	8	6	4	2	1	8	7	5	2	1	1	1	1	0	0
Inflation-Protected Bond	25	21	13	6	3	27	24	15	7	2	2	3	2	1	-1
High Yield Bond	21	20	15	9	2	0	0	0	0	0	-21	-20	-15	-9	-2
World Bond	2	0	0	0	0	0	0	0	0	0	-2	0	0	0	0
Large Cap	2	5	13	21	26	6	6	10	17	21	4	1	-3	-4	-5
Small Cap	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign Large	3	7	17	27	33	0	0	13	21	26	-3	-7	-4	-5	-6
Emerging Markets	0	5	13	21	26	0	6	10	17	21	0	1	-3	-4	-5
Commodities	5	8	6	5	3	16	16	16	14	13	10	8	10	10	10
Real Estate	0	0	0	1	2	7	9	11	12	13	7	9	11	12	11
Total	100	100	100	100	100	100	100	100	100	100	0	0	0	0	0
Fixed Income	90	75	50	25	10	71	63	40	18	5	-19	-12	-11	-7	-5
Equity	5	17	44	70	85	6	13	33	56	69	1	-4	-11	-14	-16
Alternatives	5	8	6	5	5	23	24	27	26	26	17	17	21	21	21
Total	100	100	100	100	100	100	100	100	100	100	0	0	0	0	0

Exhibit 14: Optimal Portfolios by Equity Risk Target and Risk Definition

Source: Author's Calculations, PGIM Quantitative Solutions' Capital Market Assumptions. Data as of Q4 23.

We can see that while the portfolios are relatively similar, there are definitely some differences, especially across target risk levels. For example, the retirement optimized portfolios tend to have higher allocations to alternatives (defined as commodities and real estate) and lower allocations to fixed income and equities. This can likely be attributed to the ability of the alternative asset classes to provide attractive return exposure around things like inflation. Accumulation portfolios tend to have significantly higher allocations to high yield bonds, as well as large cap, foreign equity, and emerging markets equity.

Quite a few asset classes receive allocations that are not well represented in core menus today, such as real estate, commodities, and inflation-protected bonds, as well as long bonds and high yield bonds. These gaps can result in lower expected risk-adjusted returns, resulting in worse expected retirement outcomes for investors, something we seek to quantify in a future section.

CORE MENU ALPHA GAPS

In order to quantify the potential impact of asset class coverage gaps, we first map each of the funds in each plan to one of the twelve asset classes included in the analysis. We are only concerned with relatively general coverage. For example, a plan with either Large Growth, Large Blend, and Large Value, as well would be assumed to have a Large Cap equity fund. It is assumed, at a minimum, that all plans have at least a Cash, Intermediate Bond, and Large Cap fund for our analysis. In reality, most plans also typically have a Mid Cap, Small Cap, and Foreign Large, although these asset classes do differ slightly by plan.

For each plan, we estimate the efficient portfolio set that could be created given the respective asset classes available. There are technically 512 different combinations across the opportunity set. Differences in the alpha efficiency of the portfolios is determined using a certainty-equivalent wealth metric.

For readers not familiar with certainty-equivalence, it provides context for the guaranteed return (i.e., alpha) someone would take versus uncertain return. By subtracting the ending certainty-equivalent wealth for the optimal portfolios built using the plan line-up from the certainty-equivalent wealth for the portfolio using the entire opportunity set, it becomes possible to estimate the "alpha-equivalent cost" associated with not having access to the complete set of asset classes.

Exhibit 15 includes the average estimated alpha-equivalent cost across all plans for each equity target and for the accumulation and retirement portfolios.





Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

We can see that the alpha costs for the retirement portfolios are significantly higher than the accumulation portfolios, especially for the more conservative options. For example, for the 10% equity target, the alpha-equivalent cost for the retirement portfolio is 260 bps versus only 12 bps for the accumulation portfolio. This suggests it is possible to build relatively efficient low risk portfolios for accumulation investors, but it is definitely less possible for retirement investors (who are generally more likely to invest conservatively).

There are notable differences if we focus on the distribution of plans, which is included in Exhibit 16 versus the averages (Exhibit 15).



Exhibit 16: Distribution of Alpha-Equivalent Costs

Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

While the estimated alpha costs for many plans is relatively low, especially for the accumulation portfolios, it can be sizeable for a few plans, roughly equal to, or exceeding, 50 bps for certain portfolios, especially the retirement portfolios. The distributions in Exhibit 16 suggest that plans are doing a better job enabling investors to create accumulation portfolios versus retirement portfolios.

Exhibit 17 provides context on how the average (Panel A) and median (Panel B) alpha-equivalent costs differ by plan size.

Exhibit 17: Alpha-Equivalent Cost of Lack of Diversification by 401(k) Plan Size and Portfolio Equity Allocation Target



Source: Morningstar, RPI, and Authors' Calculations. Data as of 2020 Plan Year Filings.

We can see that that there is no constant change by plan size, where the alpha costs interestingly tend to be the largest for the smallest and largest plan size groups.

THE POTENTIAL INCOME BENEFIT OF ENHANCED Core menus

The analysis suggests there are clearly gaps in core menus today that could result in relatively inefficient portfolios for participants, both in accumulation and in retirement. To provide some context around the economic implications we conduct an analysis to determine the potential benefit, in terms of additional years of lifetime income, that could be generated in each plan if it had a complete menu of funds.

For this analysis we assume the participant starts saving at the age of 25. The initial compensation is \$50,000, which increases by 1% a year in real terms (where inflation is 2.5% per year). The total savings rate, which includes employee deferrals and employer contributions, is 10% of pay, while the retirement age is 65 and the retirement end age is 95.

The equity allocation evolves over the participant's lifetime, based on the PGIM Target Date glide path, but is represented by the five equity target allocations considered in the analysis, with the specific allocations included in Exhibit 18. Note, the portfolios before age 65 would be the accumulation portfolios and those after age 65 would be the retirement portfolios. The model uses returns as based on CMAs included in Appendix 1.



Exhibit 18: Lifetime Equity Allocation

Source: PGIM DC Solutions. Data as of Q4 2023.

For our model we solve the additional number of years that could be generated if the plan offered a complete core menu. In other words, how many more years of income could be generated using the efficient portfolio set assuming the balance is exhausted at retirement versus the number of years of income that could be generated using the menu of funds available to participants. Exhibit 19 includes both the percentile distribution and the average number of years across plans.



Exhibit 19: Additional Potential Years of Retirement Income with More Complete Core Menus

Source: Morningstar, RPI, PGIM Quantitative Solutions, and Authors' Calculations. Data as of 2020 Plan Year Filings. CMAs as of 04 2023.

We estimate the average plan participant could generate approximately four more years of income if he or she had a complete menu of funds available. These are relatively staggering estimates that imply participants could realize significant potential benefits from addressing potential gaps in the core menu.



CONCLUSIONS

There is an increasing emphasis among plan sponsors to keep participants in the DC plan post-retirement. There are a number of potential benefits associated with staying in-plan, such as fiduciary oversight, economies of scale, access to institutionally priced investments, etc., that can prove to be a smart decision for participants. However, in order for a participant to want to stay in a DC plan (versus roll-out), the plan itself must be "retirement ready." A retirement ready DC plan needs to have a variety of features, one of which is access to a robust set of funds that enable participants to build diversified portfolios from the core menu, if they choose to do so.

This research suggests that while many DC plans offer a relatively diverse set of asset class exposures, there are notable gaps given the overweight of equity funds versus bond funds and the lack of availability of asset classes essential to building efficient retirement portfolios, such as inflation-linked bonds, commodities, and real estate, as well as potentially high yield bonds and long-term bonds. Three of these asset classes are typically used in "Real Asset" strategies, so adding a single multi-asset fund could be an approach, although this wouldn't necessarily allow a participant to more finely calibrate risk levels, especially if a participant is looking for specific risk exposures within the DC plan (i.e., given non-DC holdings).

While some plan sponsors may be hesitant to add more funds to the core menu, reducing existing overlap and focusing on breadth of coverage, versus depth, may be a smart strategy. For example, using a single (multi-asset) fund to represent large cap and adding a real estate and an inflation-protected bond fund is going to enable participants more diversification than having each of the nine common "style box" asset classes covered.

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