THE BENEFIT CONNECTION
GLIDE • PATH • DESIGN

# The Importance of Defined Benefit Plan Design

Defined benefit plans don’t all impact glide paths the same way.

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## KEY INSIGHTS

- It is an oversimplification to assume all defined benefit (DB) plans impact glide path design for an accompanying defined contribution (DC) plan the same way.
- Accrual formulas and forms of payment within a DB plan are the features that seem to have the greatest potential impact on an accompanying DC glide path.
- Using scenario analysis, we evaluated several common DB plan designs to show how each one affected the equity level and slope of a hypothetical glide path.

There are considerations that DC plan sponsors face when they want to optimize outcomes holistically across their retirement benefit offerings, including their defined benefit plan. DB plans encompass more structures than the common perception of a fixed dollar pension payable for life.

In this fifth installment of our *Making the Benefit Connection* series, we expand the notion of defined benefits to cover more of the category space. To this end, we used our proprietary models to construct a collection of hypothetical DC glide paths designed to be optimal complements for DB plans featuring varying benefit levels and payment patterns.

We used scenario analysis to compare these complementary glide paths across several features, including their shape and our full suite of metrics. This allowed us to explore the impact that the specific structure of a sponsor’s DB benefits can have on the characteristics of an accompanying DC glide path.[1]

Our results highlight the fact that it is a critical oversimplification to assume that different DB plan structures will influence the glide path for a companion DC plan in essentially the same way. In reality, the type of plan and its structural features—such as the form of payment, the accrual formula, and the inclusion or absence of cost-of-living indexing—can have a major impact on the level and slope of equity exposure in the glide path design.

### Representative Plan Designs and Considerations

Up to this point in our series, we have assumed that defined benefit plans

[1] For the key parameters used in our simulations, see the technical appendix. Also see the Additional Disclosure about Monte Carlo analysis at the end of this paper.

adhere to a structure like that of a fixed annuity. More specifically, we've assumed that payments are derived via a benefit formula incorporating tenure and salary:

*Normal retirement benefit at normal retirement date = 1% x average of final five years of pay x years of service.*

Traditionally, this type of final average pay (FAP) plan was common in corporate plans. Many sponsors understand that they can, for example, provide richer benefits by offering a replacement multiplier greater than 1% or provide lower-valued benefits (the more common trend recently) by considering the career salary average rather than the final five years, by capping the years of tenure used in the benefit calculation, or simply by reducing the multiplier.

Other changes have had more profound impacts. For example, like Social Security benefits, a defined benefit can include a cost-of-living adjustment (COLA) to attempt to maintain the real value of the payout over time. This is a more common feature in public pension plans. Historically, equity has often been considered a hedge against inflation in DC plans. But if an inflation hedge is built directly into the in-plan source of guaranteed income, DC plan participants may not need as much equity in their glide paths to perform this function, allowing sponsors to try to reduce balance variability by lowering the allocation to equity.

Cash balance (CB) plans, which often offer participants lump-sum options at retirement, have an entirely different benefit accrual and payout structure than their FAP counterparts. During employment, the plan sponsor issues credits to the employee, who accumulates a notional account balance.

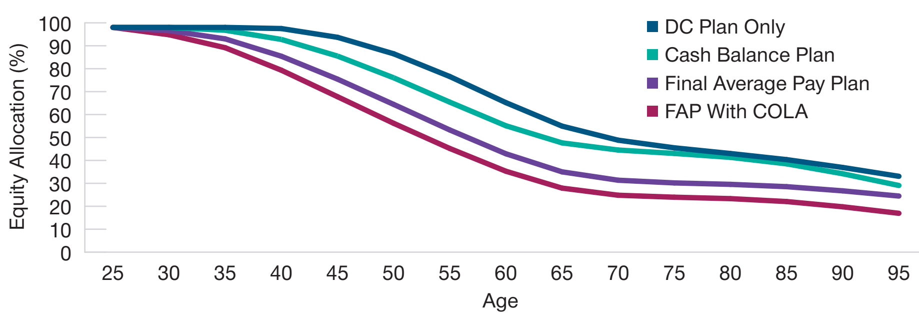
There are two types of credits common to these plans: pay credits determined by a predefined formula, and interest credits, which often have an annually changing yield or investment return that determines the size of the credit.

Since the balance in a CB plan often acts like an allocation to low-risk fixed income assets during the benefit accrual phase, a participant's remaining wealth held in a DC plan potentially could be invested in assets with a higher growth orientation than would be the case for a participant with an FAP plan.

Since most employees do take lump-sum benefits when offered, our analysis assumed that once a cash balance benefit had been paid, it was

## Different DB Plan Structures May Have Different Impacts

(Fig. 1) Glide paths for a hypothetical DC plan only vs. DC plan + various DB types




Source: T. Rowe Price.
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invested and allocated according to the accompanying DC glide path.[2] Further details of the assumptions behind our cash balance plan example can be found in the appendix.

### Glide Path Comparison

Figure 1 shows the plots of the optimal hypothetical glide paths calculated by our model for the baseline case of a standalone DC plan, and for the same DC plan design accompanied by examples of three different DB designs:

1. fixed yearly benefits based on a final average pay formula;
2. the same FAP plan with a COLA indexed to the U.S. Consumer Price Index with a 0% floor;
3. a CB plan.

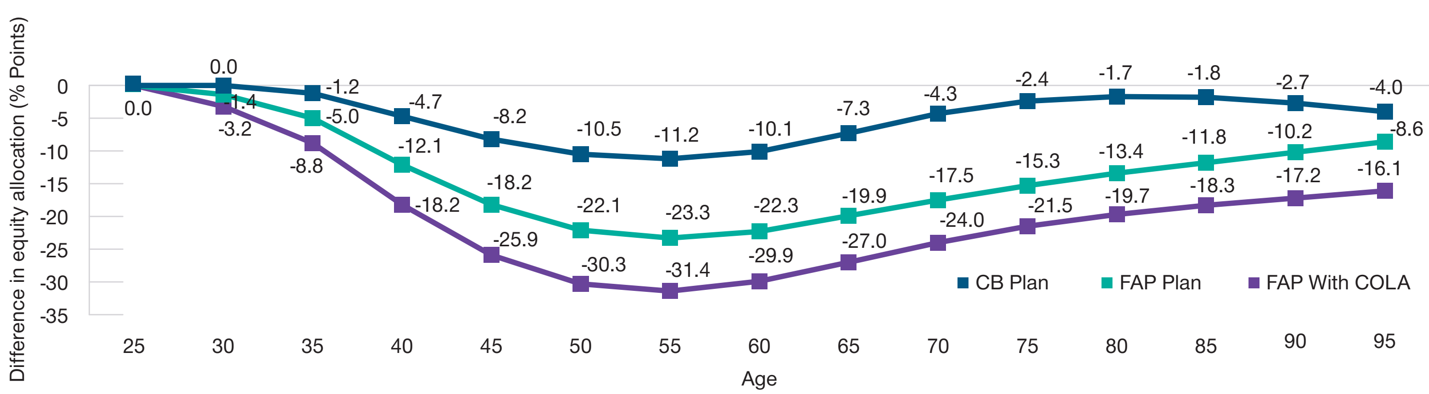
Figure 2 shows the relative differences in equity allocation at various points along these glide paths with respect to the baseline case of a hypothetical optimal glide path without an accompanying DB plan.

In our simulations, the CB plan indeed acted like a low-risk asset, resulting in higher optimal equity levels in the glide path for the accompanying DC plan during working years compared with the FAP plan and significantly higher equity exposure during retirement. This is because the lump-sum infusion of cash from the CB benefit had to continue to work hard during retirement to maintain preretirement consumption levels in the absence of guaranteed payments. In fact, in our simulations, the glide path for a DC plan accompanied by a CB plan that paid out in lump sums looked quite similar to the glide path for DC participants who did not have access to a DB plan after retirement.

Our assumed FAP plan with a COLA was, by explicit design, richer than a non-indexed FAP plan (whereas our CB plan was designed to be roughly cost and benefit equivalent to the non-indexed FAP plan). For the FAP plan with COLA, as for the non-indexed FAP, the resulting lower-equity glide path was an example of what we call the wealth effect. In short, since wealth is one source of utility in our

### Optimal Equity Levels Can Vary Widely

(Fig. 2) Percentage point changes in glide path equity relative to a DC plan only baseline




Source: T. Rowe Price.
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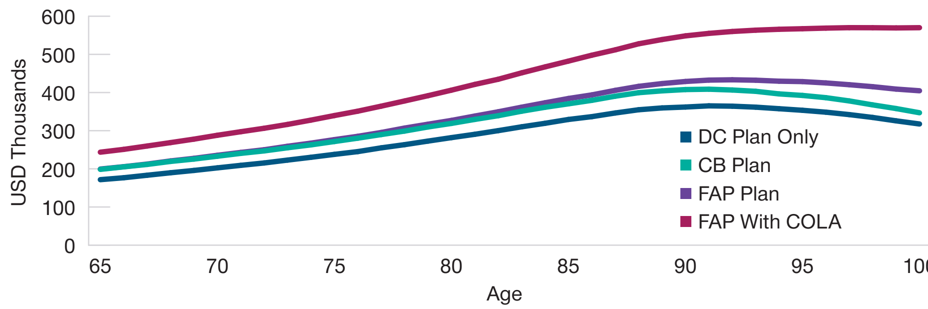
[2] For an analysis of historical participant behavior when receiving lump-sum benefits, see: James H. Moore, Jr., and Leslie A. Muller, An analysis of lump-sum pension distribution recipients, Monthly Labor Review, Bureau of Labor Statistics, May 2002. On the Web at https://www.bls.gov/opub/mlr/2002/05/art3full.pdf.

## FAP Plans May Support Higher Retirement Consumption

(Fig. 3) Median consumption support from a hypothetical DC plan only vs. DC plan + various DB structures




Source: T. Rowe Price.

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model, having the added wealth from a DB plan led our model to decide that there was less need for utility from DC plan-supported consumption, allowing the DC plan to reduce risk and still achieve a good outcome, in our view.

However, the optimal glide path for an FAP plan with a COLA was even steeper during the working years because not as much real growth was needed from equities, thanks to the inflation hedge provided by the indexed DB benefit. Consequently, under our assumed preferences, the model lowered glide path equity levels in an effort to reduce risk and maintain utility from wealth. Meanwhile, the DB pension payments, in addition to Social Security benefits, provided consumption-based utility.

### Consumption Comparison

Consumption during retirement is not limited to the sum of Social Security and pension payments, but having both sources of income—each including its own method of real income replacement—can significantly reduce withdrawals from savings, represented here by the DC plan.

Figure 3 shows the median level of total consumption supported by each plan. Understanding the sources of consumption (shown here as median results from a broader Monte Carlo simulation) helped inform why the glide path shapes in Figure 3 differed, particularly after retirement. Figure 4 shows the sources of the consumption totals.

Notice that the consumption levels supported by the CB plan dropped most quickly after age 90, when they started to diverge noticeably from those provided by the non-indexed FAP plan. This is because the dwindling balance in the CB plan could not keep pace with the continued guaranteed payments in the FAP plan.

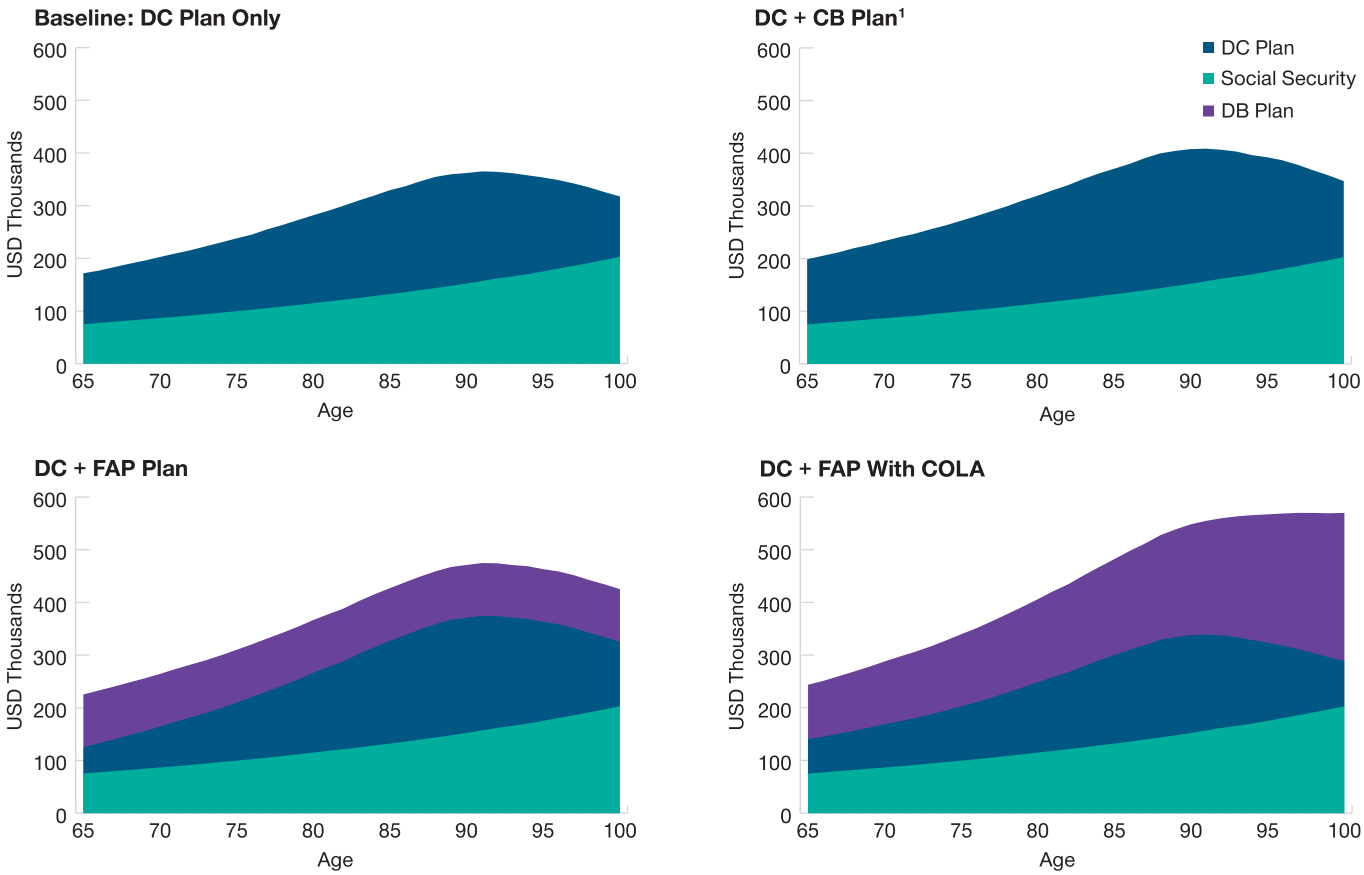
In the baseline case where there was no companion DB plan, the significantly higher equity allocation in the glide path throughout the accumulation phase provided a sufficient cushion, at the median, to meet consumption needs. In the simulations that included either a non-indexed FAP plan or an FAP with COLA, the guaranteed income streams alleviated the burden on savings, supporting consumption late into life.

### Sensitivity to Inputs

Under our standard assumptions, the structure of a DB plan is an important consideration in determining an optimal glide path. These assumptions represent what we believe are reasonable sponsor

## Consumption Is Supported by Various Plan Design Combinations

(Fig. 4) Consumption sources for a hypothetical DC plan only and a DC plan + various DB structures




[1] Assumes full balance rollover into DC plan at retirement.

Source: T. Rowe Price.

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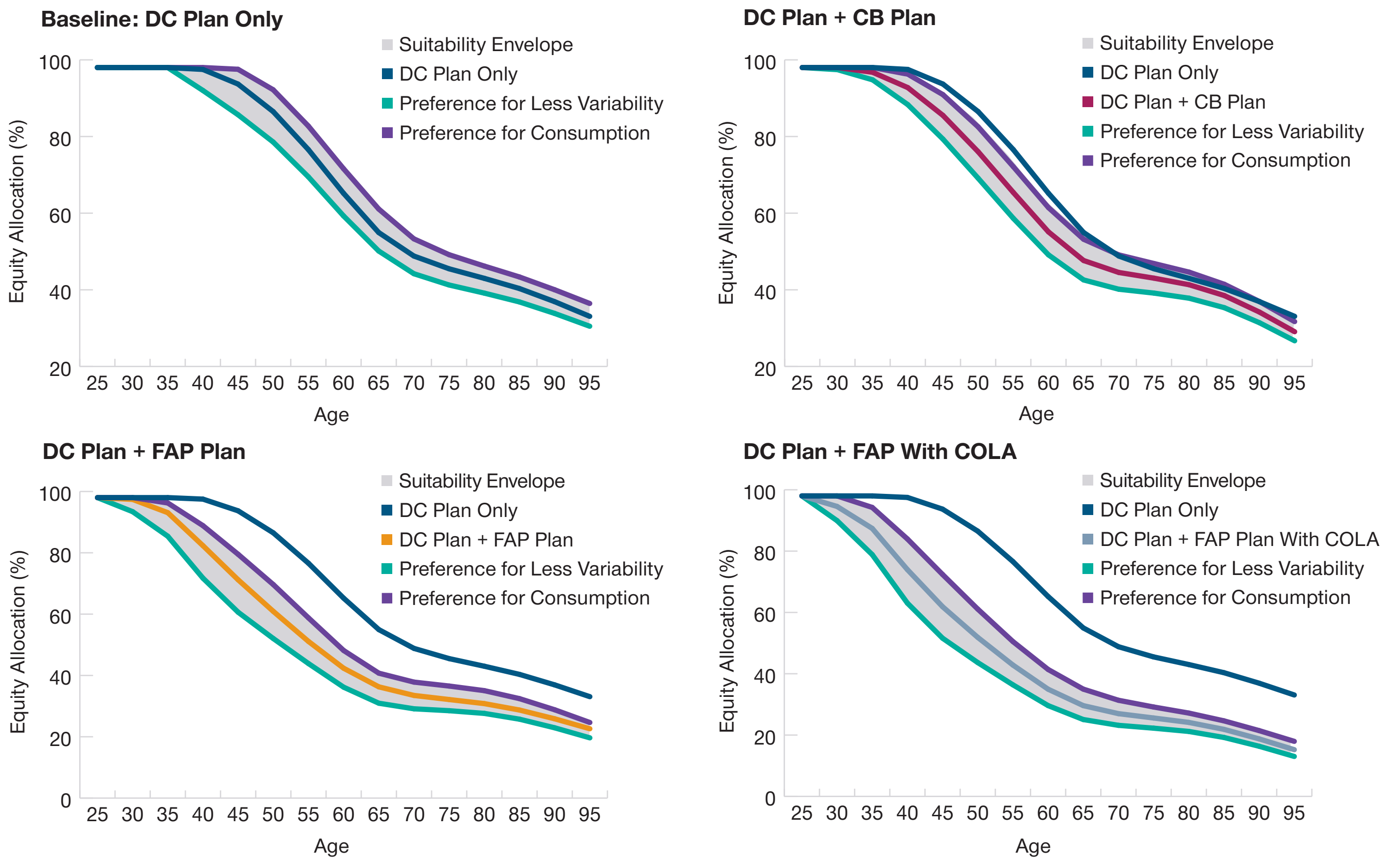
goals, participant preferences, and demographic characteristics. However, we realize that it is unlikely that a specific plan sponsor will map to all of these exact assumptions. This being the case, we wanted to investigate what happened to the DB plan's effect on the glide path when we modified certain assumptions. Specifically, we wanted to know if the results shown in Figures 1 and 2 still persisted.

In other words, were the optimal glide paths in our scenarios still as dependent on DB plan structure if we assumed that plan sponsors had different preferences than those incorporated in our original assumptions?

An important feature of our model is its explicit, numerical representations of plan sponsor goals for their DC plan. One such goal is setting the relative importance of consumption versus wealth. At the plan level, this manifests as a parameter in the model that can seek to limit exposure to market fluctuations in an effort to reduce balance variability over time. However, lower potential exposure to market fluctuations comes at the cost of an overall lower expected level of consumption over the long term. Alternatively, the model can seek higher

## Results Were Directionally Robust Regardless of Sponsor Preferences

(Fig. 5) Hypothetical suitability envelopes under differing wealth vs. consumption preferences

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growth in order to maintain higher consumption, at the risk of exposing participants to higher balance variability in the short term.

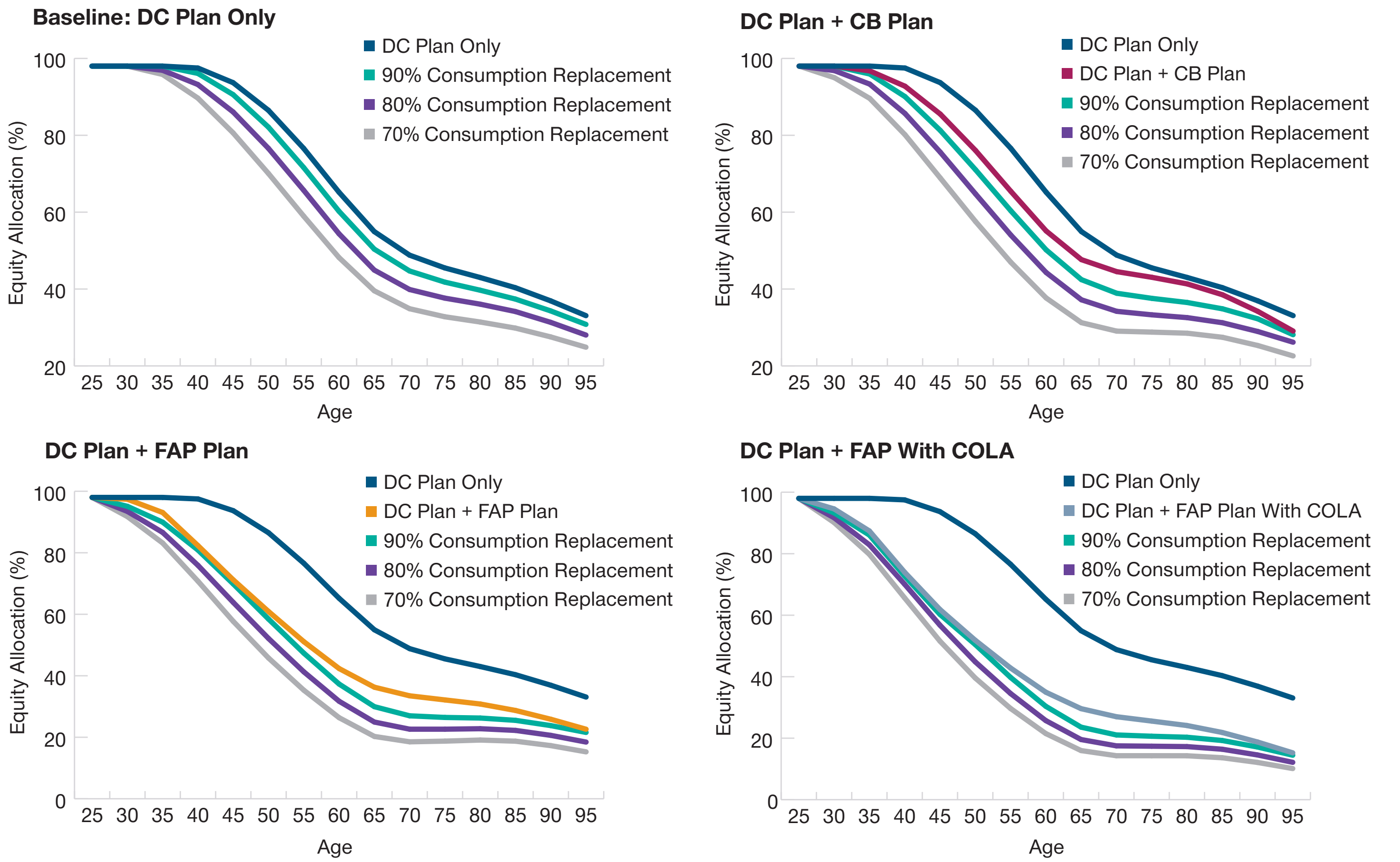
Rather than using one single set of assumed preferences, our practice is to vary them. This can produce a range of possible glide paths in our simulations that we call the suitability envelope. The boundaries of each of the envelopes shown in Figure 5 reflect slight adjustments to the specific parameter in our model representing the trade-off between consumption and wealth.

When we reran the simulations under different DB plan structures, we found that similarly sized suitability ranges were generated for all of them. This suggests that the initial results shown in Figures 1 and 2 were directionally robust, even for plan sponsors with different retirement objectives for their participants.

Another parameter we can adjust in our model is the percentage of preretirement consumption a participant is attempting to replace. The hypothetical glide paths shown so far in this paper incorporated our default assumption of a goal of fully replacing 100% of real preretirement spending. As we modified this target in 10% increments in our simulations, we again found that the model traced out comparable glide path ranges (Figure 6), confirming that the direction of the original

## Results Also Were Robust Regardless of Income Replacement Objectives

(Fig. 6) Hypothetical suitability ranges under varying consumption replacement targets

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analysis held even when different levels of retirement consumption were assumed.

### Conclusions

DB plans come with a variety of features we have investigated here, most notably the form of the benefit payments. (Plan benefits also may include early retirement subsidies—a feature we explore in a subsequent installment of the *Making the Benefit Connection* series.)

Generally, the existence of an inflation-indexed benefit option, as is common in many U.S. public DB plans, will cause a glide path to de-risk the equity level more quickly during the accumulation phase compared with an FAP plan that only offers nominal benefits—a more common feature in corporate plans.

However, because cash balance beneficiaries often roll their lump-sum benefits into their DC plans at retirement but generally do not assume market risk on these assets until retirement, our model reduces equity exposure more slowly during the accumulation phase when there is a companion CB plan but reduces it more quickly during the later postretirement years as the full value of the CB lump-sum benefit is exposed to market fluctuations.

# Appendix

In our view, these nuances suggest that plan sponsors should carefully consider not only the retirement preparedness (wealth) generated by their DB plans, but also the pattern of accrual and the timing of the payouts provided. In our analysis, these results held regardless of plan sponsor preferences for wealth accumulation and consumption.

### Key Modeling Plan Design Parameters

**Cash balance plan:** The plan modeled throughout this analysis had the benefit structure shown in Figure A1, with the lump-sum benefit payable at retirement and rolled entirely into the companion DC plan.

The annual interest credit was assumed to be a minimum of 3% or the current yield on the U.S. 10-year Treasury note.

**Hypothetical DC plan:** Our starting assumption was a safe harbor plan design with the employer matching up to 100% of the first 3% of employee deferrals and 50% of the next 2%. We assumed all contributions were pretax and that contributions increased over time according to our proprietary deferral rate growth model.

**Demographic analysis:** We assumed that participant incomes grew in line with a proprietary salary growth model calibrated on the T. Rowe Price DC recordkeeping platform. Participants were assumed to retire at age 65 and begin withdrawing income to support a steady, inflation-adjusted level of spending over retirement.

### (Fig. A1) Annual Pay Credit

| Age + Years of Service | Pay Credit Percentage |
|---|---|
| Less than 40 | 4% |
| 40–50 | 5% |
| 50–60 | 6% |
| 60–70 | 7% |
| 70–80 | 8% |
| 80 or More | 9% |

**DC objective preferences:** DC plan sponsors have various investment focuses and desired planning horizons. These include the relative preference for consumption support versus balance variability modeled in Figure 5. Both levers are a part of our utility model and can be calibrated using intuitive and comprehensible metrics, such as weighted balance volatility.

Projections or other information generated regarding the likelihood of certain outcomes are not guarantees of future results. This analysis is based on assumptions, and there can be no assurance that the projected results will be achieved or sustained. Actual results will vary, and such results may be better or worse than the assumed scenarios.

**Additional Disclosure**

**Monte Carlo simulations model future uncertainty. In contrast to tools generating average outcomes, Monte Carlo analyses produce outcome ranges based on probability —thus incorporating future uncertainty.**

**Material Assumptions include:**

- Underlying economic and behavioral inputs, including savings rates and cash flows, are generated from a structural model built up from factors relating to both financial markets and the broad economy as well as data calibrated based on T. Rowe Price's recordkeeping platform's participant population.
- The mortality weighting is sourced from the Society of Actuaries. Retirement age is assumed to be 65 years old.

**Material Limitations include:**

- The analysis relies on assumptions, combined with a return model that generates a wide range of possible return scenarios from these assumptions. Despite our best efforts, there is no certainty that the assumptions and the model will accurately predict asset class return ranges going forward. As a consequence, the results of the analysis should be viewed as approximations, and users should allow a margin for error and not place too much reliance on the apparent precision of the results.

**Users should also keep in mind that seemingly small changes in input parameters, including the initial values for the underlying factors, may have a significant impact on results, and this (as well as mere passage of time) may lead to considerable variation in results for repeat users.**

- Extreme market movements may occur more often than in the model.
- Market crises can cause asset classes to perform similarly, lowering the accuracy of our projected return assumptions, and diminishing the benefits of diversification (that is, of using many different asset classes) in ways not captured by the analysis. As a result, returns actually experienced by the investor may be more volatile than projected in our analysis.
- Asset class dynamics, including but not limited to risk, return and the duration of "bull" and "bear" markets, can differ than those in the modeled scenarios.
- The analysis does not use all asset classes. Other asset classes may be similar or superior to those used.
- Fees and transaction costs are not taken into account.
- The analysis models asset classes, not investment products. As a result, the actual experience of an investor in a given investment product may differ from the range of projections generated by the simulation, even if the broad asset allocation of the investment product is similar to the one being modeled. Possible reasons for divergence include, but are not limited to, active management by the manager of the investment product. Active management for any particular investment product—the selection of a portfolio of individual securities that differs from the broad asset classes modeled in this analysis—can lead to the investment product having higher or lower returns than the range of projections in this analysis.

**Modeling Assumptions:**

- The primary asset classes used for this analysis are stocks and bonds. An effectively diversified portfolio theoretically involves all investable asset classes including stocks, bonds, real estate, foreign investments, commodities, precious metals, currencies, and others. Since it is unlikely that investors will own all of these assets, we selected the ones we believed to be the most appropriate for long-term investors.
- The analysis includes 10,000 scenarios. Withdrawals are made annually at the beginning of each year.
- **IMPORTANT:** The projections or other information generated by T. Rowe Price regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results. The simulations are based on assumptions. There can be no assurance that the projected or simulated results will be achieved or sustained. The charts present only a range of possible outcomes. Actual results will vary with each use and over time, and such results may be better or worse than the simulated scenarios. Clients should be aware that the potential for loss (or gain) may be greater than demonstrated in the simulations.
- The results are not predictions, but they should be viewed as reasonable estimates.

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