Balancing Income and Bequest Goals in a DB/DC Hybrid Pension Plan

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ABSTRACT

Defined benefit (DB) plans can provide guaranteed income for life; however, there is no potential for wealth accumulation and they often offer little or no death benefits.

Defined contribution (DC) plans offer the potential for wealth accumulation and bequest. However, participants also face the possibility of outliving their wealth since they bear all of the investment and longevity risk.

We examine hybrids of DB and DC plans. We simulate investment returns and time of death and we measure the hybrid plans' performance relative to income and bequest goals. Through this analysis, we quantify the trade-offs between the income security of a DB plan and the potential for wealth accumulation in a DC plan. In addition, we suggest allocations between DB and DC that perform particularly well relative to given metrics.

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INTRODUCTION

Individuals face competing objectives in retirement planning: do they want a steady stream of guaranteed income? Do they want to accumulate wealth for healthcare costs bequest, or unforeseen expenses? Or do they want some combination of the two?

We quantify the trade-offs between the income security of a DB plan and the potential for wealth accumulation in a DC plan by simulating the investment returns and the time of death and examining the following outcomes for different combination of DB and DC:

- Probability of depleting DC assets
- Age of depletion of the DC fund
- Probability of reaching the bequest goal
- Bequest amount, conditional on not depleting DC assets
- Mean, standard deviation and coefficient of variation of discounted lifetime retirement income

Thus, we are able to quantify the bequest potential forfeited by increased focus on retirement income, and vice versa.

METHODOLOGY

To calculate the DB normal cost and DC contribution rate, we started with pure DB and pure DC plans on a **deterministic basis**, assuming the market return happens to be the **median** rate of return. The DB multiplier, DB normal cost, and the DC contribution rate are calculated so that they provide a 70% replacement ratio on a deterministic basis.

We then consider an employee who can choose how much to contribute to the DB and DC plans. Let $\alpha \in [0,1]$ be the allocation to the DB plan. To get the target replacement ratio (70%), we scale the DB multiplier by α and the DC contribution rate by 1- α.

We simulate random returns each year for the funds using a lognormal distribution with pre-determined mean and standard deviation and we simulate the time of death using RP-2014 Mortality Tables, with fully generational mortality improvement.

RESULTS

1. Probability of Depletion (DC Plan)

Our simulation result suggests that nearly half of the participants (47%) will outlive their DC assets regardless of the allocation to the DB plan because we used the median rate of return to compute DC contribution rate. Among these, we calculated the depletion age, the age at which a retiree's asset runs out. Figures 1 and 2 show the mean, the median and various percentiles of the simulated age of death and DC plan age of depletion.

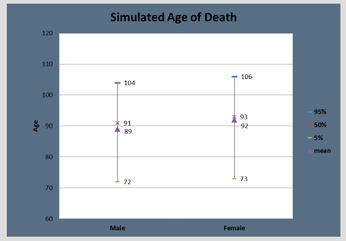

Figure 1

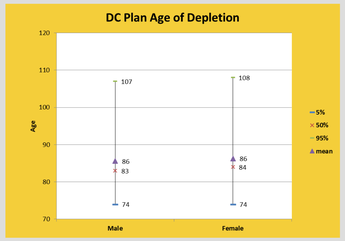

Figure 2

2. "Payout Risk"

Our model suggests that the expected discounted value of lifetime income increases linearly (or almost linearly) with α. However, the standard deviation of discounted lifetime payout is not monotonic. To have a better sense of the risk-return tradeoff, we adopted another measurement – the reciprocal of coefficient of variation (CV). It measures how many dollars of expected discounted lifetime payout one receives per dollar of risk.

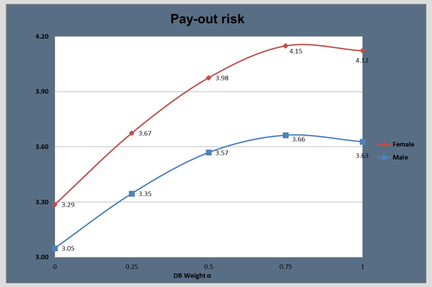

Figure 3

In Figure 3 , we see that the payout-risk is not strictly increasing with DB weight α. This non-monotonicity is caused by the different influences of investment and longevity risks on the retiree's payout.

3. Wealth Accumulation in DC Plan

An attractive feature of DC plan is the potential for significant wealth accumulation. In Figures 4 and 5, we examine the distribution of the total death benefit (from both DB and DC plans) for those retirees who do NOT deplete their DC savings. For example, we found that over 8% of males who are enrolled in the pure DC plan reach a bequest of over $5 million.

RESULTS (cont'd)

Thus, if a retiree is willing to take more risk by investing more in the DC (smaller α), she might end up with a large bequest.

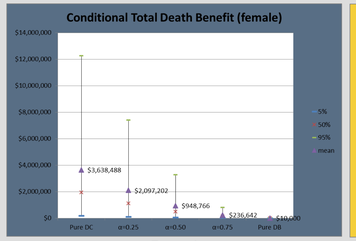

Figure 4

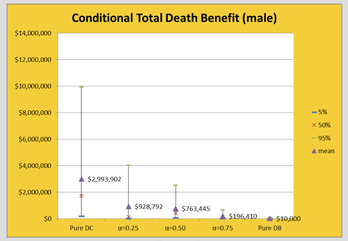

Figure 5

4. Probability of Reaching Bequest Goal (Probability of Success)

Suppose the retiree has a bequest goal of M, and the pure DB has a death benefit of M', which is small compared to M. For a hybrid pension plan, the total death benefit is given by αM + max{0, DC assets at death}. Here, we call the event of reaching the bequest goal "success".
In our model, we let pure DB death benefit M be $10,000 and examined the relationship between DB weight and probability of success with a small ($100,000) and large ($500,000) bequest goal.

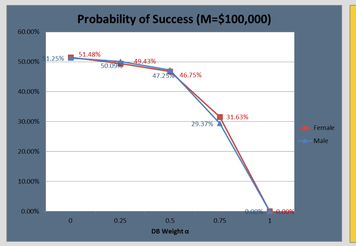

Figure 6

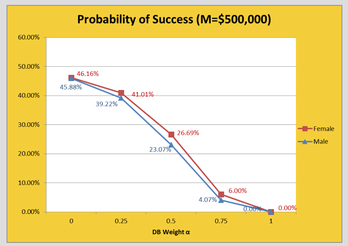

Figure 7

In Figure 6, we see that when M=$100,000, the probability of success decreases only slightly as we increase the allocation to the DB plan from α=0 to α=0.5. However, when M=$500,000, the probability of reaching the bequest goal declines more steeply; see Figure 7.

CONCLUSION

Individuals who are concerned with both retirement income and bequest should invest in a hybrid plan. There is no unique "best α" – the choice of α depends on the retiree's bequest goal and her preference retirement income and bequest. However, we observed some values of alpha that performed particularly well relative to the metrics under the assumptions of our model.