A BETTER BANG FOR THE BUCK 3.0

POST-RETIREMENT EXPERIENCE DRIVES PENSION COST ADVANTAGE

By William B. Fornia, FSA and Dan Doonan

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I. INTRODUCTION

Over the past four decades, private employers have shifted away from defined benefit (DB) pensions that provide employees with a steady retirement income stream. Instead, many private sector employers have moved towards defined contribution (DC) retirement accounts—such as 401(k) plans—citing costs. Under DC accounts, individual workers manage their own investments and bear all the risks. Many public sector employers faced pressure following the 2008 financial crisis to make a similar change.

Whether this transition meant that employer costs were reduced (or simply shifted to workers along with the risks), it wasn't the result of DC retirement accounts being less costly than a DB pension per dollar of benefit. In fact, DB pensions continue to have substantial economic efficiencies that cannot be replicated by individual DC accounts. Switching from a DB to a DC system saves money only if it involves substantial cuts to employee benefits.

Public sector employers largely have retained DB pensions as the primary retirement plan to ensure state and local workers have a modest but secure retirement. However, because of the concerns over the plans' long-term sustainability, nearly every state and local government in recent years has made significant changes to their DB plans, such as requiring higher employee contributions and increasing retirement ages. At the same time, the DC industry has been working on strategies that seek to close the gap on the advantages that DB plan participants benefit from—like longevity pooling, more competitive investment management fees, and lifetime income.

In fact, DB pensions feature critical efficiencies that make them significantly less expensive to provide a given level of retirement benefit compared to DC plans. These cost savings were documented by the 2008 National Institute on Retirement Security (NIRS) study, "A Better Bang for the Buck: The Economic Efficiencies of Defined Benefit Pensions" and a 2014 follow-up study, "Still a Better Bang for the Buck: an Update on the Economic Efficiencies of Defined Benefit Pensions."[1] These studies found that a typical large DB pension plan provides a given level of retirement benefit at about half the cost of a 401(k)-style plan, because of three factors:

- **Longevity risk pooling.** The pooling of longevity risk in DB pensions enables them to fund benefits based on average life expectancy, and yet pay each worker monthly income no matter how long they live. In contrast, DC plans must receive excess contributions to enable each worker to self-insure against the possibility of living longer than average.

- **Higher investment returns.** DB pensions realize higher net investment returns due to professional management and lower fees from economies of scale

- **Optimally balanced investment portfolios.** DB pensions are "ageless" and therefore can perpetually maintain an optimally balanced investment portfolio rather than the typical individual strategy of down-shifting over time to a lower risk/return asset allocation. This means that over a lifetime, DB pensions earn higher investment returns as compared to DC accounts.

In summary, when it comes to providing retirement income, DB pensions are substantially more economically efficient than individual retirement accounts because of risk pooling across a large number of individuals, a longer investment time horizon, and lower expenses and higher returns.

These facts have not fundamentally changed from the previous two studies. This report updates the comparison of retirement benefit funding costs based on an enhanced methodology that takes into account key changes in the DB and DC plan landscapes with regard to investment strategies and fees. A notable change includes the development of different assumptions for pre- and post-retirement years in DC plans, because DC plans generally have been successful at lowering costs for participants during their working years. However, costs and returns continue to lag dramatically during the post-retirement period.

This study, as in the 2014 update, compares:

1. A typical large public sector DB pension to two kinds of DC plans;

2. An "ideal" DC plan with a typical target date fund (TDF) asset allocation pattern, fees below industry average,

and asset class investment performance as strong as that managed by professionals; and

3. An individually directed DC plan with industry average fees and reduced investment returns based on typical individual investor behavior.

All three plans—the typical DB plan, the ideal DC plan, and the individually directed DC plan—are modeled with the same underlying demographic and economic assumptions regarding employee wage growth, retirement age, life expectancy, target monthly retirement income, inflation, and projected rates of return for each asset class. This new analysis also assumes that all plans receive consistent, adequate contributions required to fund target benefits.

This study contains two new elements that were not included in the previous studies. First, it considers the impact on all three plans if the current low interest rate environment continues and compares that to a baseline scenario. Second, it analyzes how costs are affected by beginning to save mid-career rather than early career, and how that late start reduces total savings at retirement.

Even with updated assumptions and methodology, DB pensions still offer substantial cost advantage over DC plans. The analysis finds:

- A typical DB plan, with advantages based on longevity risk pooling, asset allocation, low fees and professional management, has a 49 percent cost advantage compared to a typical individually directed DC plan:
    - The longevity risk pooling that occurs in the DB plan accounts for 7 percent cost savings;
    - The DB plan's ability to maintain a more diversified portfolio drives another 12 percent cost savings;
    - Superior net investment returns, due to lower fees and professional management, generate an additional 30 percent reduction in cost.
- A DB pension costs 27 percent less than an "ideal" DC plan with below-average fees and no individual investor deficiencies.
- Roughly four-fifths of the difference in costs between the DB plan and the individually directed DC plan occurs during the post-retirement period, as retirees move from an environment that benefits from a long investment horizon and fiduciary protections to one where they manage their spend-down on a short-term individual basis without the benefits associated with longevity-risk pooling.

In other words, a typical DC plan costs nearly twice as much to provide the same level of retirement benefit as a DB plan, with four-fifths of the difference occurring post-retirement.

Specifically, it would be 96 percent and 37 percent more expensive for a typical DC plan and an ideal DC plan, respectively, to deliver the same level of retirement income as a typical DB plan. Thus, DB pensions continue to offer significant cost advantage. While shifting from a DB pension to a DC plan offers a way to reduce the investment risk borne by employers and taxpayers, this comes with an unavoidable tradeoff—either increased benefit costs or, more likely, significant retirement benefit cuts that are larger than the savings realized by the employer.

II. DEFINED BENEFIT AND DEFINED CONTRIBUTION PLANS

Employers who offer retirement benefits generally consider two basic approaches: a traditional defined benefit (DB) pension plan and a defined contribution (DC) retirement savings plan. The DB plan is designed to provide predictable retirement *income* throughout a worker's retirement years. Assets are pooled, and investments are managed by professionals who are responsible for acting in the best interest of participants. The DC plan, in contrast, is focused on accumulating retirement *wealth* expressed as a lump sum, with individual participants ultimately responsible for garnering adequate investment returns and managing their own accumulated wealth throughout their retirement years. This would entail estimating how much they can safely withdraw each year of retirement without running out of money, attempting to evaluate the best annuitization alternative in the open market, or some combination of the two.

Each type of plan has certain distinguishing characteristics that influence its cost to employers and employees.

How DB Plans Work

While employers have a large degree of flexibility in designing the features of a DB plan, there are some features all DB plans share. DB plans are designed to provide employees with a predictable monthly benefit in retirement. The amount of the monthly pension is typically a function of the number of years an employee devotes to the job and the worker's pay—usually at the end of their career.[2] For example, the plan might provide a benefit in the amount of 1.5 percent of final average pay for each year worked. Thus, a worker whose final average salary was $50,000, and who had devoted 30 years to the job, would earn a monthly benefit of $1,875 ($22,500 per year), a sum that would "replace" 45 percent of their final average salary after they stop working. This plan design is attractive to employees because of the security it provides. Employees know in advance of making the decision to retire that they will have a steady, predictable income that will enable them to maintain a fairly stable portion of their pre-retirement standard of living.[3]

Benefits in DB plans are pre-funded. That is, employers (and, in the public sector, most employees) make contributions to a common pension trust fund over the course of a worker's career. These funds are invested by professional asset managers whose activities are overseen by trustees and other fiduciaries. A typical DB pension fund's asset allocation policy—i.e., the share of holdings allotted to different asset classes such as stock, bonds, and treasuries—is based on a careful analysis of plan demographics and liabilities as well as short- and long-term financial market projections.[4] The earnings that build up in the fund, along with the dollars initially contributed, pay for the lifetime benefits a worker receives at retirement.

How DC Plans Work

DC plans function very differently than DB plans. First, there is no promise of retirement income in a DC plan. Rather, the level of retirement income that an account will provide depends on a number of factors, such as the level of employer and employee contributions to the plan, the investment returns earned on assets, whether loans are taken or funds are withdrawn prior to retirement, and the individual's lifespan.

While DC plan assets also are held in a trust, that trust is comprised of a large number of individual accounts. DC plans are typically "participant directed," meaning that each individual employee can decide how much to save, how to invest the funds in the account, how to modify these investments over time, and how to withdraw the funds during retirement.

Retirement experts typically advise individuals in DC plans to change their investment patterns over their lifecycle. In other words, at younger ages, because retirement is a long way off, workers should allocate more funds to stocks, which have higher expected returns but also higher risks. As one gets closer to retirement, experts suggest moving money away from stocks and into safer but lower return assets like bonds. This is to guard against a large drop in retirement savings on the eve of retirement, or in one's retirement years.

The high degree of participant direction makes DC plans very flexible in accommodating individuals' desires, decisions, and control. Unfortunately, a substantial body of empirical and experimental research indicates that this flexibility tends to lead to adverse outcomes. First, too many workers fail to contribute sufficient amounts to the plans.[5] Second, individuals' lack of expertise in making investment

decisions can subject individual accounts to extremely unbalanced portfolios with too little or too much invested in one particular asset, such as stocks, bonds, or cash.[6] One team of researchers thus concluded, "The likelihood of investment success increases as the participant's involvement in investment decisions decreases."[7]

Fortunately, the DC industry recognizes these dynamics and has been moving toward offering default investment products where no decision is a good decision, such as Target Date Funds (TDFs) or Lifetime Funds. In addition, legislation has increased the acceptable default contribution levels to be more realistic in terms of what a typical retirement would cost.

Another important difference between DB and DC plans becomes apparent at retirement. Unlike in DB plans, where workers receive regular monthly pension payments, in DC plans it is typically left to the retiree to decide how to spend their retirement savings. Research suggests that many individuals struggle with this task, either drawing down funds too quickly and running out of money, or holding on to funds too tightly and enjoying a lower standard of living as a result. In theory, employers that offer DC plans could provide annuity payout options, but in practice they rarely do.[8]

The Changing Retirement Benefit Landscape

Changing Asset Allocation and Risk Management Strategies among DB Pension Funds

Changes in the financial and regulatory environments for DB pensions during the past several decades have prompted funds to shift financial risk management strategies. Notably, while governmental and corporate DB pension funds had similar asset allocations until 2008, including the share of investments in equities, different regulatory and demographic considerations led to diverging asset allocation after 2008. Given this divergence, and the concentration of DB pension benefits and assets in the governmental sector, this study models a typical public pension's asset allocation.

In the private sector, corporations began introducing 401(k) plans in the 1980s. Then in the early 21st century, many firms began to close or freeze existing DB pension plans. The long bull market in stocks from the 1980s to 2000 enabled corporate pension sponsors to maintain pension plans with little or no cash contributions and use their overfunded pensions as a source of income. Plan costs increased after the financial bubble burst. Then after the passage of the Pension Protection Act of 2006, private employers faced more onerous pension funding rules. While the intention was to safeguard retirement benefits promised to private sector workers, these regulations made pension funding and reported liabilities more volatile, and contributed to additional DB pension plan freezes and terminations.[9] Other accounting and regulatory actions over the decades have added to this trend.

With no new workers entering the system, closed corporate pension plans face a shorter investment horizon. This dynamic, combined with the pension expense volatility created by new funding and accounting rules, motivated corporate DB pension sponsors to de-risk their portfolios by purchasing expensive annuities through third parties instead of continuing to invest in stocks, bonds, and other typical DB investment classes.[10]

Public pension plans, in particular state and local government pensions, faced unprecedented challenges in the aftermath of the 2008 financial crisis. Almost every state legislature enacted plan changes to enhance sustainability, and most included measures to increase employee contributions and reduce benefits for at least some employees.[11] Very few of these changes included eliminating the core DB plan, though some added combination plans that featured both DB and DC plans, or offered a choice.

Particularly germane to this study are the investment policy decisions made by many public pension funds. First, in response to a desire for reduced volatility and the low interest rate environment, pension fund trustees have reduced plan exposure to US stocks and traditional fixed income securities, and further diversified funds by increasing the share of global stocks and alternative investments such as real estate, private equity, and commodities. Second, the changing financial landscape also has prompted public pension funds to lower their rate of return assumptions. The median investment return assumption dropped from 8.00 percent in 2011 to 7.75 percent in 2014 and 7.00 percent in 2021 (net of expenses).[12]

Efforts to Improve DC Plans

The DC landscape has changed as well. Experts and policymakers have focused on addressing key problems in 401(k) type plans related to fees, investment options, investor behavior, and retirement income outcomes.

First, investment fees within employer-provided plans have been cut by half since 2000. In addition to competitive pressures, the fees have been reduced due to increased regulatory scrutiny of 401(k) and IRA fees, and growing use of lower cost index funds.[13] The U.S. Department of Labor issued regulations in 2010 and 2012 concerning the disclosure of 401(k) fees. According to the Investment Company Institute, the asset-weighted average equity mutual fund expense ratio declined from 99 basis points in 2000 to 50 basis points in 2020.[14]

Annuities have continued to garner increasing interest among policymakers and regulators as a means to convert DC account balances into a lifetime income stream. Individual investment accounts are framed in terms of lump-sum retirement *wealth*, while the challenge facing retirees is securing adequate *income* to last through their lifetime. Annuities are financial products in which a third party (typically an insurance company) promises a stream of income in return for a lump sum. Despite the interest among legislators and plan providers, the availability of annuities as a 401(k) payout option remains limited, and overall participation rates remain low. They tend to be expensive due to today's low interest environment, insurer profit objectives, marketing and administrative costs, and adverse selection. But, as demonstrated by the results of this analysis, the greatest potential for improving the DC plan experience for participants lies in figuring out a safe and economically efficient means of generating post-retirement income. Provisions in the SECURE Act provided more legal protections to plans offering lifetime income options within 401(k) plans, and Section 203 of the SECURE Act will require DC plans to provide members with information about what level of income they might expect from their savings, helping individuals better understand this complex issue.

Growing use of target asset allocation funds. The consensus resulting from a decade of behavioral finance research is that 401(k) participants routinely make asset allocation and investment mistakes, such as buying and selling holdings at the wrong time, failing to regularly rebalance their portfolios, or taking too little or too much risk in their asset allocation. Target asset allocation funds address part of this problem through automatic rebalancing. One such type of fund, called Target Date Funds (TDFs) or lifecycle funds, has gained favor among policymakers, retirement experts, and large employers in the US and has continued to see broader use among DC plans.[15] TDFs gradually and automatically shift their asset allocation from risky stocks to less risky bonds as a worker ages, based on their target retirement year. TDFs were held by 56 percent of 401(k) participants in 2018 and by 62 percent of participants in their 20's. In total, 27 percent of 401(k) assets were held in TDFs at the end of 2018.[16] These funds now account for the largest share of new 401(k) contributions. While they are not a panacea for individual investor error, the investment behavioral gap is much lower among individuals investing in TDFs compared to most other types of funds.[17]

A Note on Hybrid Retirement Benefits

There is ongoing interest in "hybrid" retirement benefits that combine some of the features of DB and DC plans, and offload some risks onto employees while maintaining some of the retirement security offered by traditional DB pensions. There are three main approaches to maintaining a DB but reducing cost volatility: risk-sharing DB plans, Cash Balance (CB) plans, and combination DB/DC plans, as described in *The Hybrid Handbook*.[18] A CB plan is legally a DB plan—benefits are guaranteed, albeit as a lump sum, and assets are pooled in a trust and managed professionally. However, CB plan benefits typically are less generous than a traditional DB pension and too often participants do not obtain longevity protection when choosing a lump sum.

Importantly, the relative costs of hybrid plans depend largely on benefit structure. To the extent that hybrid benefits emphasize DB-like characteristics, they remain more cost effective depending on how plan types are combined.

III. METHODOLOGY

This study compares the relative costs of DB plans and DC accounts by constructing a model that first calculates the cost of achieving a target retirement benefit in a typical public sector DB plan. This includes calculating this cost as a level percent of payroll over a career, then calculating the cost of providing the same retirement benefit under two different types of DC plans—an "ideal" DC plan modeled with generous assumptions and a typical individually directed DC plan. Additional details on the methodology that account for the impact of alternative economic and demographic assumptions can be found in the Technical Appendix to this report.

Demographic Assumptions

The model is based on a group of 1,000 newly-hired employees. For the purposes of simplicity, all individuals have a common set of features. All newly-hired employees are female teachers aged 30 on the starting date of their employment. They work for three years and then take a two-year break from their careers for child rearing. They return to work at age 35 and continue working until age 62. Thus, the length of the career is 30 years. By their final year of work, their salary has reached $60,000, having grown by 3.31 percent each year.[19] For modeling purposes, the analysis assumes that prior to retirement, no one dies and there is no turnover within the pool of teachers.

The analysis maintains the same $60,000 age-62 salary that was used in the 2008 report, even though wages have grown in the intervening period. This was done so that the absolute numbers can be compared. The amount of salary does not matter in terms of the most important outcomes of this study – comparing the costs (as a percent of payroll) of providing target benefits under different types of plans and finding that DB plans can provide the same value as DC plans at about half the cost.

Target Benefits

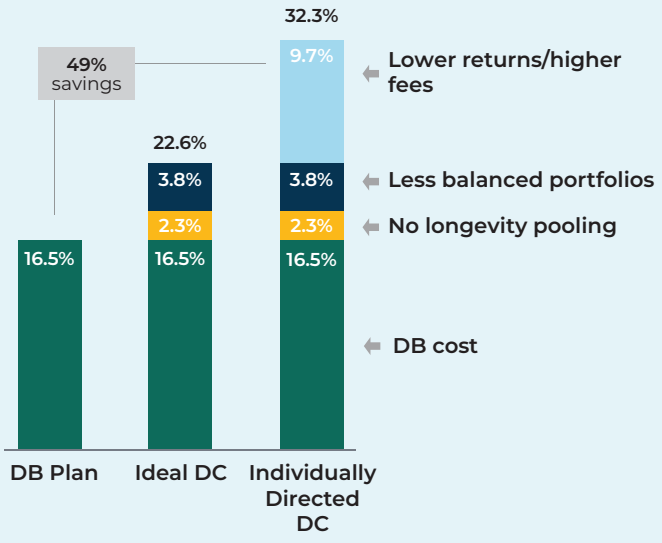
Next, the study defines a target retirement benefit that, combined with Social Security benefits, will allow the 1,000 teachers to achieve generally accepted standards of retirement income adequacy. The target benefit is $32,036 per year or $2,670 per month. A cost-of-living adjustment is provided to ensure the benefit maintains its purchasing power during retirement. Thus, each teacher will receive a benefit equal to 53 percent of her final year's salary that adjusts with inflation, which is assumed to be 2.31 percent per year. With this benefit and Social Security benefits, each teacher can expect to receive roughly 83 percent of her pre-retirement income—a level of retirement income that can be considered adequate, but not extravagant. The study defines certain parameters for longevity and investment returns. On the basis of all these inputs, the analysis calculates the contribution—as a percentage of payroll—that will be required to fund the target retirement benefit through the DB plan over the course of a career. The analysis does the same for the DC plans.

IV. FINDINGS: DB PLANS ARE STILL MORE COST EFFECTIVE

The cost of either a DB or DC plan depends, in the first instance, on the generosity of the benefits that it provides. However, for any given level of benefit, a DC plan will cost more than a DB plan. On average a dollar invested in a DB plan will generate more retirement income than a DC plan. In other words, DB plans are more efficient.

The study finds that the cost to fund the target retirement benefit under the DB plan comes to 16.5 percent of payroll each year. By comparison, the analysis finds that the cost to provide the same target retirement benefit is 32.3 percent under the individually directed DC plan and 22.6 percent of payroll under the ideal DC plan. As illustrated in **Figure 1A**, the DB plan can provide the same benefit at a cost that is 49 percent lower than the individually directed DC plan and 27 percent lower than the ideal DC plan.

Figure 1A: Cost of DB and DC Plan as Percentage of Payroll, Baseline Scenario



The DB cost advantage stems from differences in how benefits are paid out in each type of plan, how investment allocations shift in DC plans as individuals age, and how actual investment returns in DC plans compare with those in DB plans.

There are three primary reasons behind DB plans' cost advantage.

- First, because DB plans pool the longevity risks of a large number of individuals, these plans need only accumulate enough funds to provide benefits for the *average* life expectancy of the group. If individuals did this in a DC plan, they would face a 50 percent chance of running out of money in retirement. To reduce the risk of running out of funds to a reasonable level, individuals need to accumulate enough funds to last several years past average life expectancy. Using the 75th percentile life expectancy requires more funding in a DC plan (without longevity risk pooling), but also exposes participants to a one-in-four chance of either running out of money or needing to reduce the amount they withdraw for income.

- Second, because DB plans have a much longer investment horizon than individuals, they take advantage of the enhanced investment returns from maintaining a balanced portfolio over a long period of time. The reason behind the longer investment horizon is that a mature DB plan has a mix of younger workers, older workers, and retirees. By contrast, individuals in DC plans must gradually shift to a more conservative asset allocation as they age to protect against financial market shocks later in life. This means DB plans can withstand bear markets and keep a larger share of their investments in stocks and other assets that offer higher returns over the long term but fluctuate more in the short term compared to bonds and other fixed income securities. DB plans also are better positioned to take advantage of "illiquid" investments that offer premium returns—for instance, real estate and private equity. These factors allow DB pensions to ultimately earn higher returns based on asset allocation.

- Third, DB plans achieve even greater investment returns compared with typical individually directed DC plans based on lower fees and professional management. Superior returns can be attributed partly to lower fees that stem from economies of scale: assets are pooled in DB plans, where DC plans consist of individual accounts. In addition, because of professional management of assets, DB plans achieve superior investment performance compared to the average individual

investor. DB investment managers have fiduciary duty and must meet the standard of prudence. In contrast, it is well documented that individual investors make inappropriate decisions regarding both asset allocation and market timing—and thus tend to earn returns that lag behind market returns.[20] This effect is sometimes called "behavioral drag."

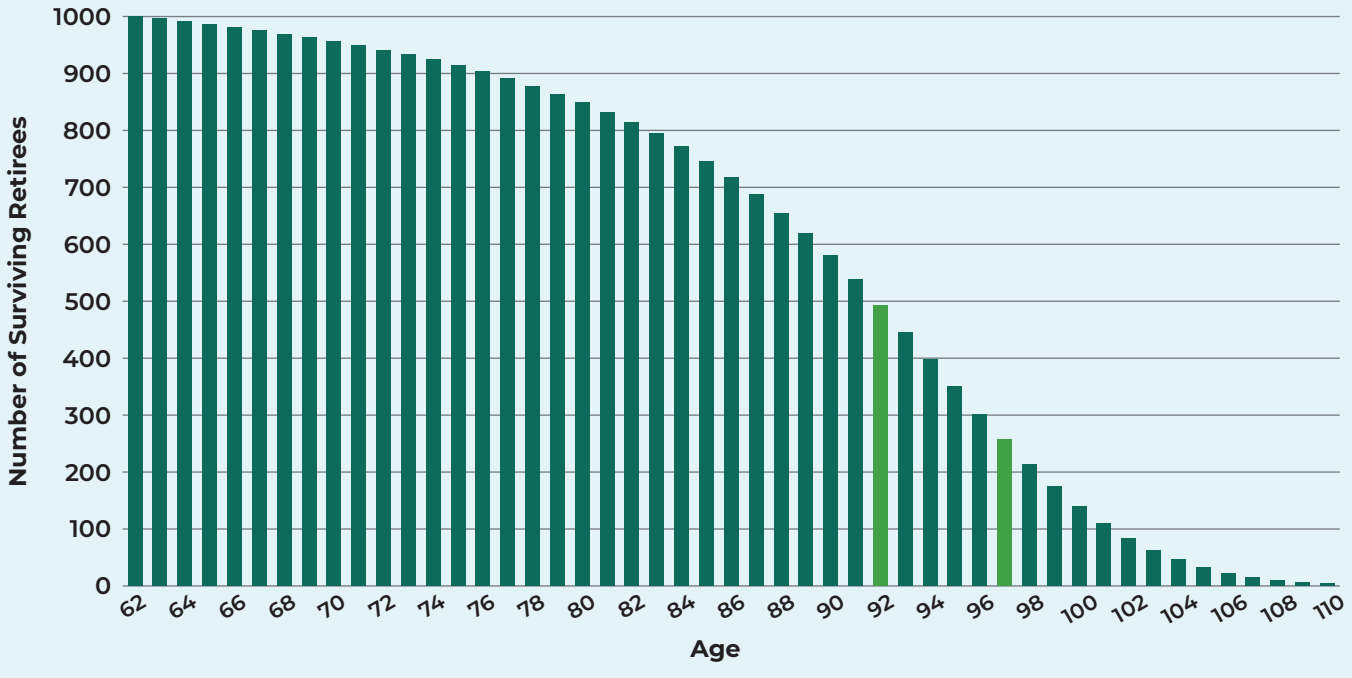
Longevity Risk Pooling

Longevity risk describes the uncertainty an individual faces with respect to their exact lifespan. While actuaries reasonably can predict that, on average, a pool of female teachers who are 30 today and who will retire at age 62 will live to be 92, they also can predict that some will live only a short time, and some will live to be over 100. **Figure 2** illustrates the longevity patterns among the 1,000 teachers. With each passing year, fewer retirees are still living. Age 92 corresponds to the year when roughly half of retirees are still alive.

In a DB plan, the normal form of benefit is a lifetime annuity, that is, a series of monthly payments that lasts until death. A DB plan with a large number of participants can anticipate the fact that some individuals will live longer lives and others will live shorter lives. Thus, a DB plan needs only to ensure that it has enough assets set aside to pay for the average life expectancy of all individuals in the plan, or in this case, to age 92. Based on the target benefit level, the DB plan needs to have accumulated approximately $520,000 for each participant in the plan by the time they turn 62. This amount is projected to be sufficient for every individual in the plan to receive a regular, inflation-adjusted monthly pension payment that lasts as long as they live. The contribution level required to fund this benefit over a career comes to 16.5 percent of payroll.

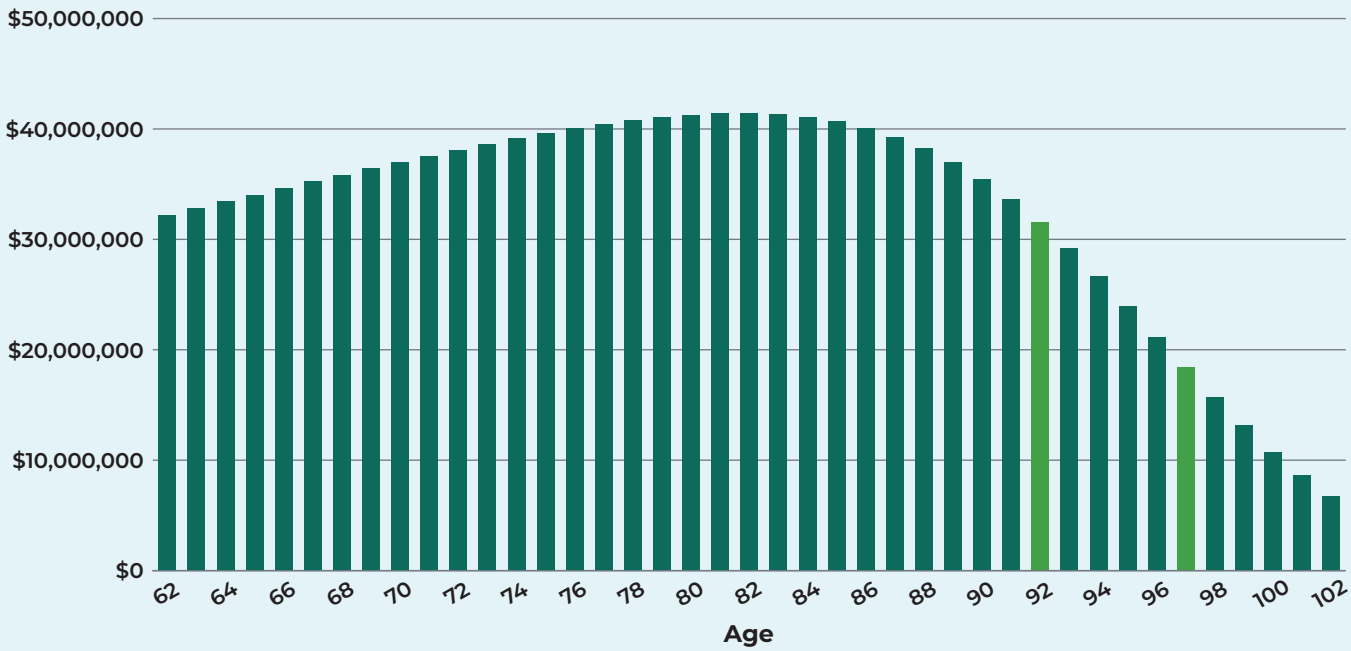
Total annual payments out of the DB plan will have a hump shaped pattern as seen in **Figure 3**. The amount of benefits paid out will increase for a number of years, because the effect of inflation adjustments is greater than the effect of individuals gradually dying off. At age 82, the impact of retiree deaths overtakes the effect of the cost-of-living adjustments and payments decline with each passing year. In the DB plan, every retiree receives a steady inflation-adjusted monthly income that lasts until her death.

Figure 2: Longevity of 1,000 Retired Female Teachers



Note: Chart represents life expectancy at age 62 for female teachers hired at age 30 in 2021.

Figure 3: Total Payments Under the Defined Benefit Plan



Next, the study contrasts this situation with that in a DC plan. In the vast majority of cases, individuals must self-insure longevity risks (or purchase an annuity as discussed below). This can be an expensive proposition.

Because an individual in a DC plan does not know exactly how long they will live, they probably will not be satisfied with a benefit sufficient to last only for the *average* life span, for if they live past age 92, they will have depleted retirement savings. For this reason, an individual probably will want to be sure that they have enough money saved to last for several years past average life expectancy.

The analysis models the DC plan to provide income for the 75th percentile life expectancy, age 97. It corresponds to the age beyond which only 25 percent of individuals survive.[21] This is a conservative target. In fact, the mortality table indicates that it is likely that one individual out of the 1,000 will celebrate their 112th birthday. It is not clear that most individuals will be satisfied with a 75 percent chance of not outliving their money, and in using this life expectancy, the study understates the cost of the DC plan. **Figure 4** illustrates the payout pattern under the DC plan, where individuals withdraw funds on an equivalent basis to the DB plan until age 97—that is, in a series of regular, inflation adjusted payments. At age 97, there are no more withdrawals. The money has simply run out.

Of course, those 25 percent of individuals who do survive to age 97 and beyond would want to avoid the possibility of having their retirement income reduced to zero. It is likely that individuals will respond to longer lives by gradually reducing their withdrawals from the plan to avoid running out of money. This means that those with very long lives will see their standard of living reduced significantly. At the same time, it is difficult to exactly predict one's lifespan, some retirees who live past age 96 will reduce their withdrawals more than they actually need to. Finally, if a retiree dies before exhausting all of her retirement savings, the money in the account passes to her estate. The funds that were intended to be retirement income become death benefits paid to heirs instead. **Figure 5** illustrates the combined effect of reduced withdrawals and estate payments.

Figure 4: Total Benefit Payments Under the DC Plan Based on Life Expectancy of 97

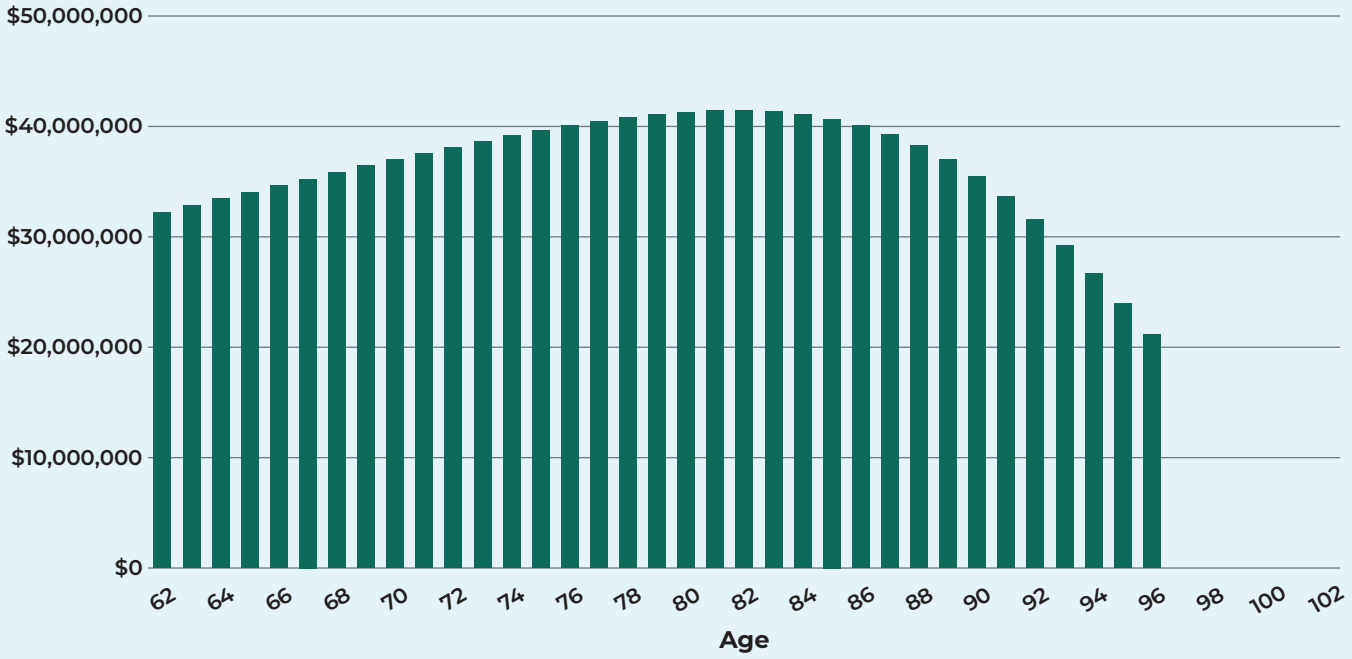
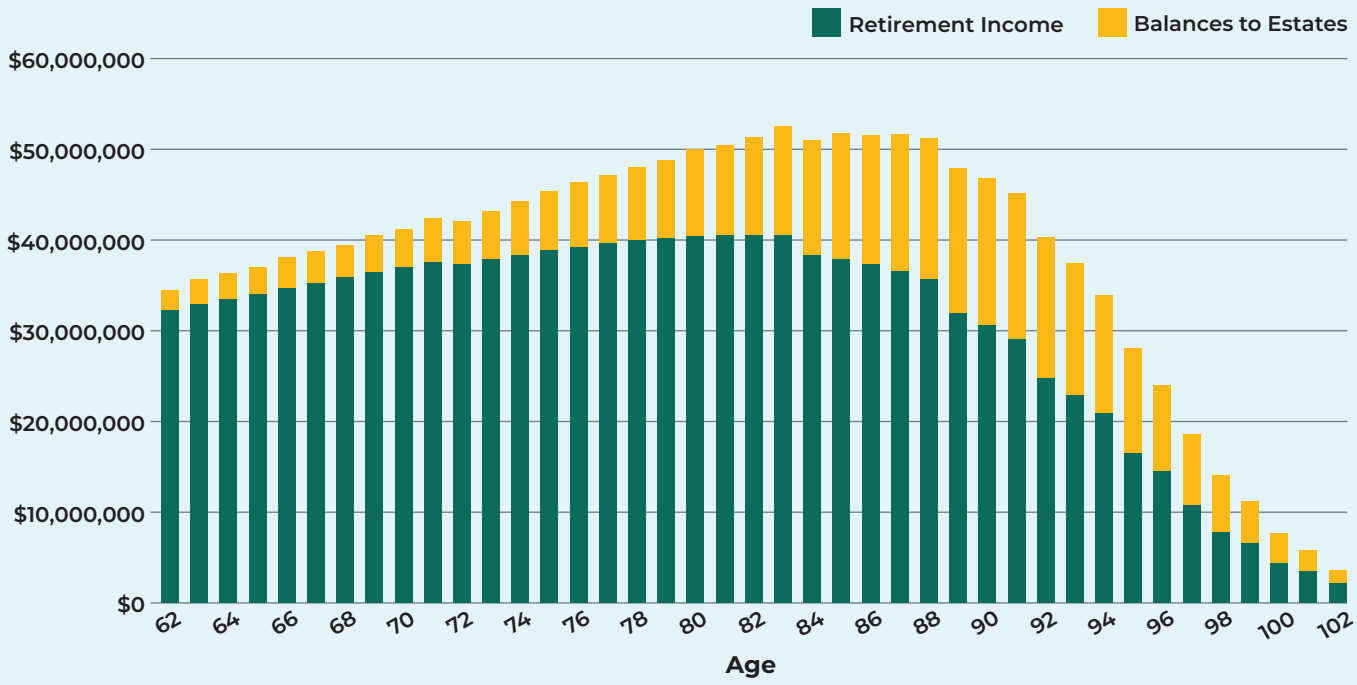


Figure 5: Total Benefit and Estate Payments Under the DC Plan Based on Adjusted Withdrawal Strategy



The aggregate amount of money transferred to estates is substantial—15 percent of the value of the DC plan. While some individual heirs will benefit from these intergenerational transfers of wealth, such transfers are not economically efficient from a taxpayer or employer perspective. Because heirs did not provide services from which the employer/taxpayer benefited, providing additional benefits to heirs is economically inefficient. Moreover, the amount of these additional "death benefits" are not tied in any direct way to an individual employee's productivity during her working years.

In addition, although annuities purchased through private insurance companies may offer full protection against longevity risk, this protection comes at a significantly higher cost than the same protection provided by a DB pension.[22]

DB plans avoid this problem entirely. By pooling longevity risks, DB plans not only provide all participants in the plan with enough money to last a lifetime, but also accomplish this goal with less money than would be required in a DC plan. Because DB plans need to fund only the *average* life expectancy of the group, rather than the *maximum* life expectancy for all individuals in the plan, less money needs to be accumulated in the pension fund. Remember that the DB plan needs to accumulate about $520,000 for each participant in the plan by the time they turn 62 in order to fund the target level of benefit.

In contrast, DC plans must accumulate almost $600,000 per participant, or nearly $75,000 more, in order to minimize the likelihood of that individual running out of funds. This additional amount extends retirement income from average life expectancy to the 75th percentile life expectancy. **In order to accumulate the additional amount necessary for DC plan participants to self-insure against this level of longevity risk, contributions to the plan would climb to 18.8 percent of pay, from 16.5 percent under the DB plan** (an increase of 14 percent). This assumes the same net investment returns, but as demonstrated below, the two remaining factors contribute to DC plans having inferior returns compared to the DB plan.

Maintenance of Portfolio Diversification (Staying Invested in Equities)

A retirement system that achieves higher investment returns can deliver a given level of benefit at a lower cost. All else being equal, the greater the level of investment earnings, the lower contributions to the plan will need to be. Prior research substantiates DB plans' significant advantage in investment returns, as compared with DC plans.

Part of the reason why DB plans tend to achieve higher investment returns as compared with DC plans is that they are long-lived. That is, unlike individuals, who have a finite career and a finite lifespan, a DB pension fund endures across generations; thus, a DB plan, unlike the individuals in it, can maintain a well-diversified portfolio over time. This well-diversified portfolio will include investments which are expected to earn higher returns, but which come with greater risk, whereas a less diversified portfolio in a DC plan will focus on more secure, but lower returning asset classes. In DC plans, individuals' sensitivity to the risk of financial market shocks increases as they age. The consequences of a sharp stock market downturn on retirement assets when one is in their late 50s are substantial, compared to when one is in their 20s with sufficient time to recover their losses.

For this reason, individuals are advised to gradually shift away from higher risk/higher return assets as they approach retirement, which is built into the design of TDFs. While this shift offers some insurance against the downside risk of a bear market, it also sacrifices expected return since more money will be held in bonds, cash, and similar assets that offer lower rates of return in exchange for more security. A reduction in expected investment returns will require greater contributions to be made to the plan in order to achieve the same target benefit.

Researchers have found a large and persistent gap when comparing individually directed investment returns against market performance. A 2018 report from CEM Benchmarking found that DB pensions outperformed DC plans in average net returns by 46 basis points, net of fees, over the 10 years ending in 2016. Note that this was considerably smaller than the 99 basis point difference found in their 2013 report. The analysis credits this narrowing gap to an improved asset mix, better plan design, and lower costs in DC plans.[23] The difference in returns has a long history and has been noted in prior reports as well, as Watson Wyatt found that DB plans outperformed DC plans by an annual average of 76 basis points, net of investment expenses, from 1995 to 2011.[24]

Within DC plans, the gap between individual and market performance seems to have narrowed, particularly for investors using TDFs. When participants use a fully self-directed approach rather than through the employer DC plans, however, the large gap seems to persist. Morningstar continues to find a 1.7 percent difference between actual investor returns and the total returns their funds generated over the same time period.[25] Morningstar also found that the gap was the smallest for investor dollars in allocation funds, such as TDFs, which combine stocks, bonds, and other asset classes, which they note are now core holdings in employer

401(k)s. The improvement within DC plans, but continued lagging performance overall, suggests that changes to DC plan design and offerings are helping participants significantly during their working years.

These studies aggregate asset allocation and investment returns. This does not present much of a problem for DB plans, because asset allocation is relatively consistent across large funds that tend to be mature and have roughly similar demographic profiles. However, aggregated DC plan data tells us less about the "typical" investor because there is a large dispersion of asset allocations and returns among individual investors. In addition, aggregated data is of limited usefulness in determining long-term returns over a typical individual's career and retirement years as their asset allocation shifts from equities to fixed income securities, as prescribed by the TDF or lifecycle investment strategy.

In order to estimate investment returns for the DB and DC plans over teachers' working and retirement years, the analysis starts with asset allocation for each plan and then applies a uniform set of assumptions about the long-term returns for each asset class. The DB plan is assumed to have an asset allocation typical of a large public sector DB plan. In the ideal and individually directed DC plans, participants are expected to gradually shift out of higher risk/higher return assets in favor of lower-risk/lower return assets.

Figures 6A and **6B** show the expected net annual investment return by age for the DB plan and both DC plans for the two scenarios studied. Figure 6A reflects a baseline scenario, while Figure 6B represents a future with persistently low interest rates. In the baseline model, the well-diversified DB plan is expected to achieve investment returns of 6.80 percent per year, net of fees. The low interest rate scenario begins with a DB return of only 5.68 percent. The net returns for the ideal DC plan (modeled with the same expenses and investment skill assumptions as the baseline DB plan, as explained later) show that while the typical TDF asset allocation glide path used for the DC plans in this study earns higher returns than the DB plan during the first half of a teacher's career, those returns drop below the DB plan when she is in her late 40s. To preserve her retirement wealth after she stops working, the teacher needs to reduce her exposure to equities even more. This results in a sacrifice of expected annual returns of 2.30 percent by age 96 in the ideal DC plan and 3.98 percent in the individually directed DC plan. For detailed DB and DC asset allocation and projected investment returns, including a discussion of the low interest rate scenario, see Table A1 in the Technical Appendix.

Figure 6A: Expected Annual Investment Return, Baseline Scenario (net of fees)

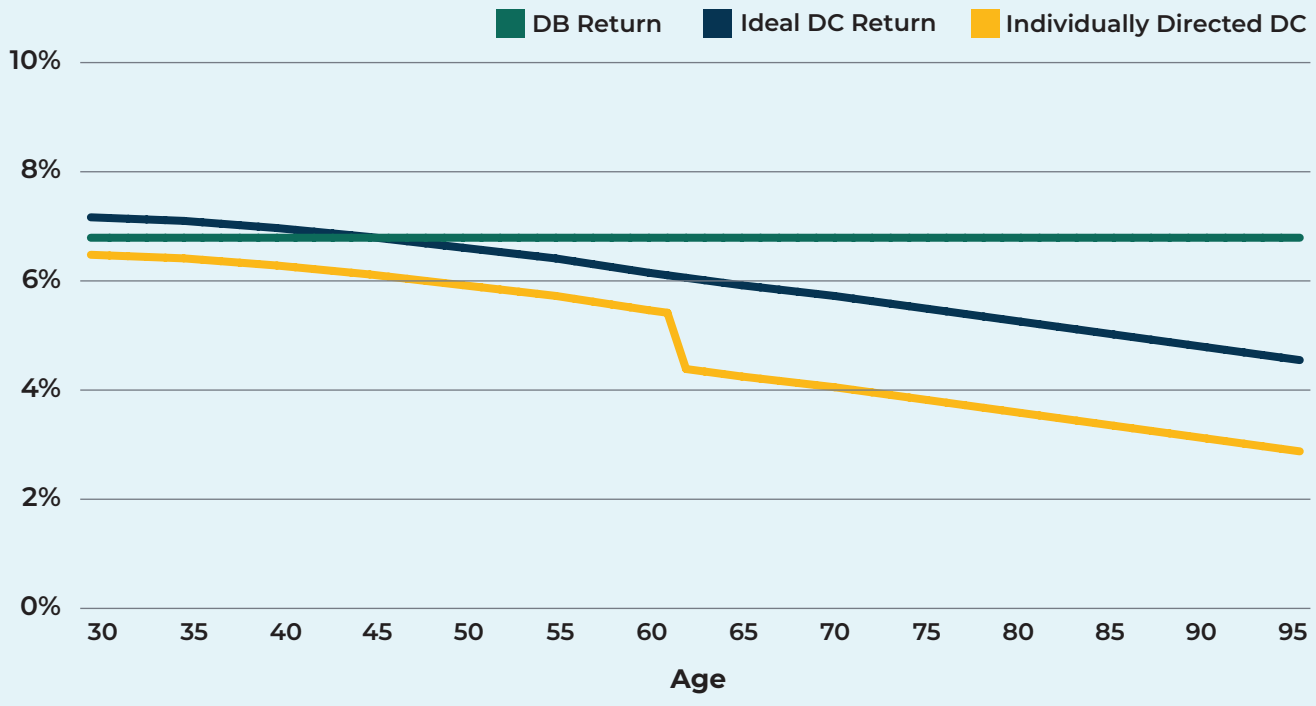
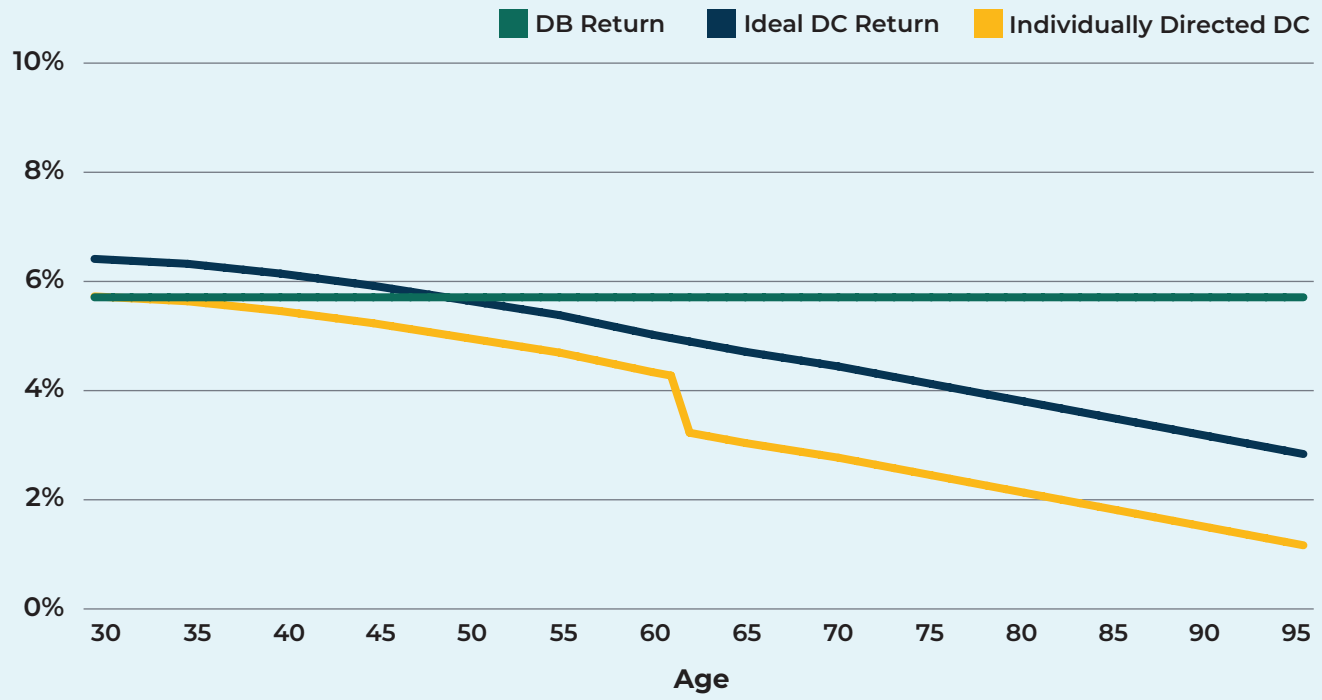


Figure 6B: Expected Annual Investment Return, Low Interest Rate Scenario (net of fees)



The analysis finds that the shift in portfolio allocation has a modest, but nonetheless significant, effect on cost. Specifically, the analysis finds that the per-retiree amount that must be accumulated in the DC plan by retirement age now climbs to nearly $700,000. By comparison, the DB plan requires just over $520,000. After accounting for asset allocation in addition to longevity risk, contributions required to fund the target benefit now climb to 22.6 percent of payroll in the DC plan compared to 16.5 percent of payroll under the DB plan (an increase of 37 percent). This summarizes the cost difference between the ideal DC plan and the DB plan. To arrive at the full cost difference for the individually directed DC plan, differences in investment expertise and expenses must be taken into account.

Superior Net Returns Compared to Individually Directed DC Plan

In addition to asset allocation, another important reason why DB plans achieve higher investment returns than DC plans is that DB pension assets are pooled and professionally managed. The model attributes a 69 basis point "drag" during the working years (up to age 62) and 168 basis point "drag" post-retirement in individually directed DC plans, based on fees and well-documented individual investor behavior.[26]

Expenses paid out of plan assets to cover the costs of administration and asset management reduce the amount of money available to provide benefits. As a result, a plan that can keep these costs down will require lower contributions. By pooling assets, large DB plans drive down asset management and other fees. On their face, these differentials may appear small, but over a long period of time, they compound to have a significant impact. To illustrate, over 40 years, a 100 basis point difference in returns compounds to a 24 percent reduction in the value of assets available to pay for retirement benefits.[27]

TDF expenses vary depending on whether the underlying funds are actively managed or passively managed (e.g., index funds). The Investment Company Institute's 2021 Fact Book noted that the median expense ratio for TDFs in 2020 was 65 basis points, down from 94 basis points in 2014 and 126 basis points for hybrid funds in 2008.[28] Because of the low fees of both well managed DB plans and well managed DC plans which utilize TDF's, we assume that the investment expenses in both plans are the same level.

Administrative costs are largely driven by scale. Thus, a large DB plan or DC plan can have opportunities to negotiate minimized administrative expenses. A DC plan involves costs that do not exist in a DB plan, such as the

costs of individual recordkeeping, individual transactions, and investment education to help employees make good decisions. However, DB plans, unlike DC plans, bear the administrative costs of making regular monthly payments after retirement.

But fees are only part of the story; differences in the way retirement assets are managed in DB and DC plans play a substantial role. As previously discussed, investment decisions in DB plans are made by professional investment managers, whose activities are overseen by trustees and other fiduciaries.

DB plans have broadly diversified portfolios and managers who follow a long-term investment strategy. Additionally, the average individual in DC plans, despite their best efforts, often falls short when it comes to making sound investment decisions.

Furthermore, studies show that over the long term, individual investor level returns significantly lag behind the returns of any individual asset class or benchmark—largely due to inappropriate investment decisions.[29] For example, during the 2008 financial crisis, individual participants generally failed to re-balance their asset allocation, and those who did shift assets incurred significant losses by fleeing from equities near the bottom of the market.[30] In 2012 and 2013, investors pulled funds out of asset classes before they experienced price increases, and into asset classes that were about to experience price drops.[31]

The analysis assumes no net disadvantage on the basis of fees or investor skill for the ideal DC plan compared to the DB plan. This is a generous assumption given real life experience with TDF use and with DC investor behavior in general.

Investor "behavioral drag" is assumed to be 69 basis points before retirement and 168 basis points post-retirement. For information on other levels of disparity, please see the Technical Appendix of the 2014 report.

The "behavioral drag" on individually directed DC plan returns – which is greatest post-retirement once funds leave employer-sponsored plans – compounds over time to create a significant cost disadvantage. In particular, the analysis finds that the amount which must be set aside for each individual at retirement age now climbs to almost $880,000 (compared to the roughly $520,000 required in the DB plan). **Thus, after accounting for differences in net returns due to investment expertise and fees—in addition to the longevity risk and asset allocation factors described above—the level of required contributions climbs again for the individually directed DC plan, this time to 32.3 percent of payroll, compared to 16.5 percent under the DB plan** (an increase of 96 percent).

Taken together, the economies that stem from investment pooling and longevity risk pooling can result in significant cost savings to employees and employers/taxpayers. **In this model, required contributions to fund a given level of retirement benefit are 49 percent lower in the DB plan compared with the individually directed DC plan, and 27 percent lower compared to the ideal DC plan.**

V. SUMMARY OF RESULTS: DB PLANS REDUCE COSTS BY NEARLY HALF

The analysis clearly demonstrates that DB plans are far more cost-effective than DC plans. To achieve roughly the same target retirement benefit that will replace 54 percent of final salary, the DB plan will require contributions equal to 16.5 percent of payroll. In contrast, the individually directed DC plan will require contributions to be almost twice as high as the DB plan—32.3 percent of payroll. Even the "ideal" DC plan, generously modeled with the same fees and investor skill as the DB plan—provides benefits at a substantially higher cost of 22.6 percent of payroll.

This study finds that due to the effects of longevity risk pooling, maintenance of portfolio diversification, and greater investment returns over the lifecycle, a DB plan can provide the same level of retirement benefits at about 27 percent lower cost than an ideal DC plan and about 49 percent lower cost than an individually directed DC plan.

Table 1 breaks down the cost savings realized by the DB plan relative to the individually directed DC plan. First, the longevity risk pooling that occurs in the DB plan accounts for 7 percent cost savings. Second, the DB plan's ability to maintain a more diversified portfolio drives another 12 percent cost savings. Third, superior net investment returns across the lifecycle generate an additional 30 percent reduction in cost compared to an individually directed DC plan—bringing the total cost savings to 49 percent.

Table 1: Tallying DB Plan Cost Savings Compared to Individually Directed DC Plan

Source	Savings
1. Longevity Risk Pooling	7%
2. Maintenance of Portfolio Diversification (staying invested in equities)	12%
3. Lower Fees and Professional Management	30%
All-In Cost Savings in DB Plan	49%

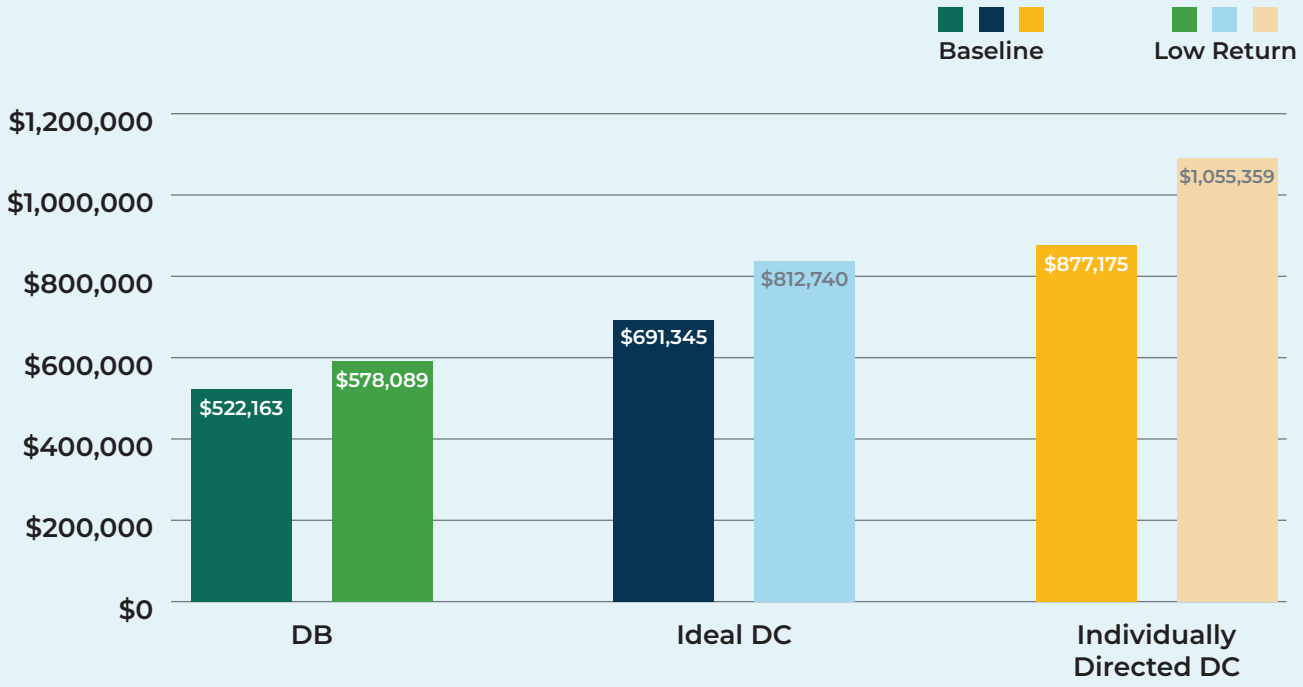
The results also indicate that DB plans can do more with less. That is, DB plans can ensure that all individuals in the plan (even those with very long lives) are able to enjoy an adequate retirement benefit that lasts a lifetime, at the same time that they require less money to be contributed to a retirement plan and fewer assets to accumulate in the plan. The study calculates the amount of money that would be required to be set aside for each retiree in each type of plan, to provide a modest retirement benefit of about $2,700 per month.

Figure 7A illustrates the comparison between the baseline investment scenario and the low-return environment. It shows that at retirement age, the DB plan requires just over $520,000 to be set aside for each individual. However, in the persistent low-return environment, the cost jumps about $60,000 to around $580,000. The ideal DC plan requires nearly $700,000 in the baseline scenario, and the low return scenario increases that cost by almost $122,000 (to $810,000). Meanwhile, the individually directed DC plan requires $877,000 in the baseline scenario, with the low return environment driving up costs to over $1 million.

The difference in resources needed at retirement between the DB plan and the two DC plans illustrates that the efficiencies embedded in DB plans can yield large dollar savings for employers, employees, and taxpayers. The low return scenarios widen the efficiency gap both in terms of the dollar increase and the percentage increase in costs--with the target level of resources needed for the DB plan increasing 11 percent, while the individually directed DC target increases by 20 percent.[32]

As discussed in the next section, the target level of resources needed to produce the same income levels for the three types of plans enables us to look at the share of overall inefficiencies that are experienced post-retirement compared to during the working years.

Figure 7A: Per Employee Amount Required at Age 62, DB Plan vs. DC Plan, Baseline Scenario and Low Interest Rate Scenario



This report also looks at how the efficiency of the same three plans is impacted when workers are hired mid-career (at age 45). **Figure 7B shows the resources needed at retirement for the target benefit under each plan, with the partial career benefit being 57 percent of the full career benefit (working 17 years instead of a full 30)**. The differences among the three plans in Figure 7B represent the cost differential for the three plans during post-retirement years stemming from longevity pooling and higher/lower returns. The post-retirement efficiency gap is unaffected by the mid-career start, as the post-retirement experience is the same (see **Table 2** below).

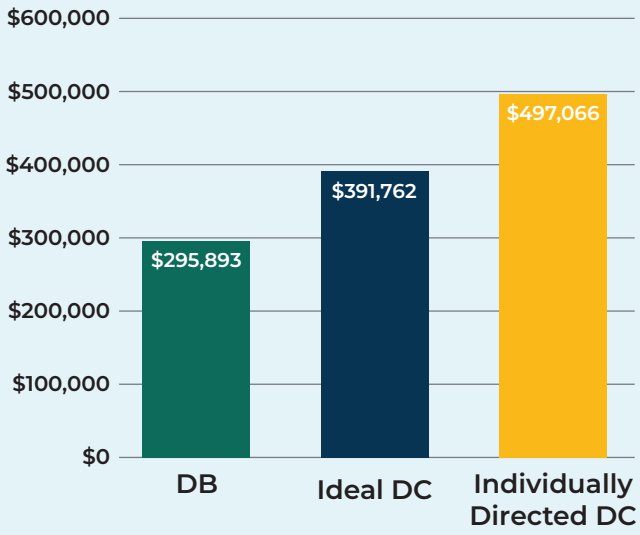
Figure 1C lays out the cost of accruing the resources in each plan to fund the mid-career hire target benefit. The percent of payroll needed to fund the target benefit amount increases under all three plans because the contributions start at a later age, allowing less time for investment returns to accrue and subsidize benefit costs. Even with a smaller targeted benefit, a higher contribution rate is required as a result of fewer years of investment earnings. For the DB plan, the rate increases by 29 percent to fund the target benefit for the mid-career hire, while the individually directed DC plan rate increases by 22 percent.

It is important to remember that, if a DC plan were to calculate a contribution rate needed to reach a targeted level of resources, any such figure would be applicable only to an individual—not the entire workforce. However, normal costs in pension systems are blended, or averaged over all participants. Therefore, comparing a DB plan's blended normal cost to a benefit example for an individual young person hired in a DB plan is not an apples-to-apples comparison.

One takeaway is that any benefit analysis comparing costs and benefit outcomes under DB and DC plans should include a range of ages at hire, so the benefit impacts for those hired at younger and older ages are well understood. This is particularly true given that DB accruals (as dollars of annual income earned for a year of service) increase gradually throughout one's career, while early dollars are much more effective at generating retirement income in a DC plan.[33]

The findings indicate that DB plans provide a better bang for the buck when it comes to providing retirement income, which is illustrated in the baseline scenario, the low return scenario, and when looking at workers hired mid-career. The analysis finds that an individually directed DC plan costs nearly twice as much to provide the same level of retirement income as a DB plan. Even compared to an ideal DC plan with generous assumptions about fees and investor skill, a DB plan delivers the same benefit for 19 percent less cost.

Figure 7B: Per Employee Amount Required at Age 62, DC Plan, Mid-Career Hire Scenario



Hence, DB plans should remain a centerpiece of retirement income policy and practice, given the persistent advantages in economic efficiency.

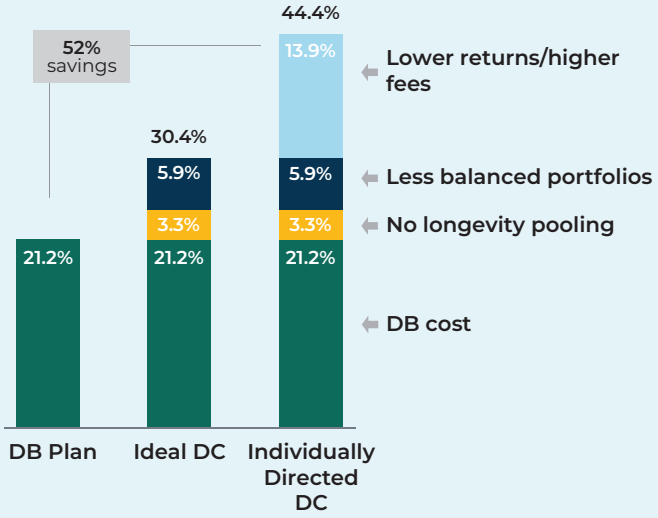
The Cost Impact of Incorporating Today's Low Interest Rate Environment

In addition to the baseline scenario, this study analyzes how all three plans would be impacted by a set of assumptions that includes today's low interest rate.

Figure 1B shows the costs of equivalent benefits in the three plans, where market returns are below historical levels. All three plans experience higher costs as a result of lower expected investment returns, which means a higher share of these costs come from contributions (and less from returns) compared to the baseline scenario. DB plan costs increase from 16.5 percent of payroll to 21.2 percent due to lower returns--an increase of 28 percent. Similarly, the ideal DC cost increases by 35 percent to 30.4 percent of payroll. And the individually directed DC costs increase by 37 percent, leaving a contribution of 44.4 percent of payroll to fund the same benefits.

It is worth noting that the assumption set for this scenario includes near-term pessimism that investors currently hold on equity returns over the next decade, since equity prices have run up significantly during the pandemic. This scenario also considers the current low interest rate environment. The baseline scenario backs out this near-term equity pessimism and low interest rates. This may be reasonable, given that these projections (for a 30-year-old hired today) span the next seven decades.

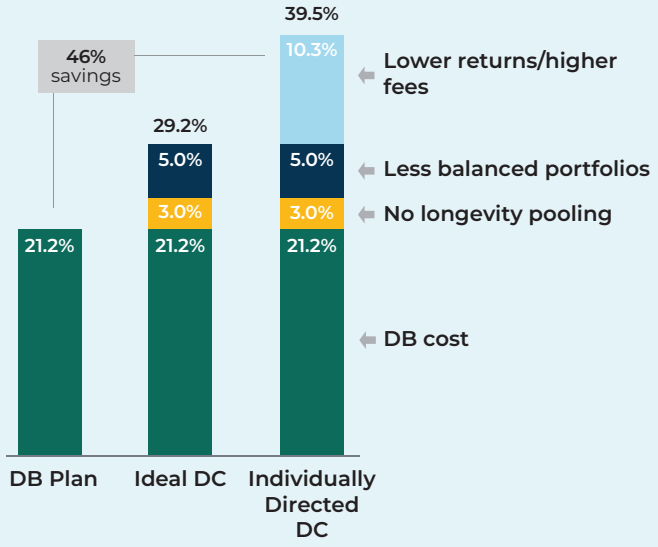
Figure 1B: Cost of DB and DC Plan as Percentage of Payroll, Low Return Scenario



The Cost Impact for Mid-Career Hires

In addition to the baseline scenario, this study analyzes the economic efficiency for an employee who was hired mid-career (age 45). The overall economic efficiency advantage of DB plans is consistent with the baseline findings, although reduced slightly due to the shorter accumulation period.

Figure 1C: Cost of DB and DC Plan as Percentage of Payroll, Mid-Career Hire



Post-Retirement DC Experience Drives Four-Fifths of Efficiency Gap

Another new aspect to this update is the addition of an analysis of how much of the DC inefficiency gap occurs before and after retirement.

Much of the challenge with DC plans, in terms of delivering value, occurs after one retires. This becomes clear when considering the returns at different ages, as shown on Figures 6A and 6B. For instance, returns at all ages are 6.80 percent for the DB plan in the baseline scenario. The individually directed DC plan only lags by 38 basis points at age 35, and the ideal DC plan actually has higher returns. Because the amount of assets accrued at this age is relatively low compared to later ages, these higher returns do not have much impact over a full lifetime.

But, when looking toward the post-retirement years, the differences in annual investment returns increase to 131 basis points for the ideal DC and 299 basis points for the individually directed DC at age 75. Given that account balances are expected to be largest at retirement, the 242 basis point difference between the DB plan and the individually directed DC returns at age 62 is a significant cost-driver, as are all years after retirement when DC participants are typically advised to be more risk-adverse.

Across the three scenarios, about four-fifths of the inefficiencies in the individually directed DC plan (relative to the pension plan) occur after retirement. In the baseline scenario, the pension benefit was 49 percent less expensive. Put another way, the individually directed DC plan was 49 percent more economically inefficient. However, even if there were no difference before retirement, the DB plan still would reduce costs by 40 percent over the individually directed DC plan due to inefficiency throughout the post-retirement years. The post-retirement inefficiency was the same for mid-career hires (with the same return assumptions), but with fewer working years the pre-retirement inefficiencies were slightly lower. The market assumptions used for the persistent low interest rate environment increased the efficiency gap overall, but also moved a small portion of the difference from the working years to the post-retirement years. It is notable that the efficiency gap during the post-retirement experience of the low interest rate scenario is 45 percent alone.

The DC industry is focused on the post-retirement experience, and has been a topic of legislative proposals. Retirees typically withdraw their funds at retirement and manage their money outside of a workplace plan that offers fiduciary protections. DC plans have been successful at lowering investment fees. The move from a workplace plan to managing funds on one's own is a move from a wholesale to a retail experience—with associated higher fees. Retail investment recommendations face a lower legal standard protecting retirees. As some 401(k) providers seek to keep retirees in workplace plans by providing viable lifetime income options, there is room for improvement. DC plans would achieve greater economies if fees reduce further.

Using private annuities to generate life income in DC plans would not close the efficiency gap with DB plans. This was explored extensively in the 2014 report. Private annuities are expensive due to factors such as the cost of inflation protection, inherent costs faced by insurance companies; the current low interest rate environment increasing annuity costs; and insurance company statutory capital

Table 2: DC Plan Efficiency Gap

	Baseline Scenario	Mid-Career Hire	Low Return Environment
Post-Retirement Inefficiency	40%	40%	45%
Pre-Retirement Inefficiency	9%	6%	7%
Total Inefficiency	49%	46%	52%

requirements which DB plans do not face. The expense of private annuities is a factor in the low utilization by retirees. Building an annuity into a workplace DC plan could perhaps reduce some of these costs and deliver greater value to retirees, but doing so efficiently is challenging when the risk pool is composed of only retirees and no younger workers.

Attention to improving options for spending down DC assets is well-deserved. However, the gap will not be reduced significantly without the benefits of risk-pooling and risk premiums that come with investments in equities – particularly in light of today's historically low interest rate environment.

CONCLUSION

Despite notable changes in the retirement benefit landscape since 2008, including some improvement in DC performance and fees, DB pensions retain their cost advantage as a means of providing retirement benefits to workers. This study compares the cost of providing equivalent benefits through a typical large public sector DB plan, an ideal DC plan, and an individually directed DC plan. The study also examines the impacts of both a mid-career start to saving and a persistent low interest rate environment on the efficiency of these three plan types.

Due to the advantages of longevity risk pooling and the maintenance of portfolio diversification, the DB plan costs less than a DC plan, even compared to the ideal DC plan with no disadvantage in terms of fees and investor skill. And when examining the individually directed DC plan with more realistic assumptions regarding fees and investor skill, the cost of the DC plan doubles compared to the DB plan because the DB plan realizes a hefty additional cost advantage due to its low expenses and professional management of assets.

The sources of cost savings in DB plans reflect, at a very basic level, the differences in how DB and DC plans operate. Group-based DB plans provide lifetime benefits and feature pooled, cost-efficient, professionally managed assets invested over a long time horizon. These features drive significant cost savings that benefit employers, employees, and taxpayers. While well-designed DC plans can theoretically mimic some of these advantages—for instance, employers may select low-fee TDFs as a default investment option for their workers—DB plans would still retain their advantages of longevity risk pooling and long-term portfolio diversification. Using private annuities to convert DC account balances at retirement into a lifetime income stream does not close this gap because such annuities are expensive, especially when they include the kind of inflation protection offered by public DB plans. In fact, the analysis reveals that four-fifths of the inefficiency of DC plans occurs post-retirement.

When considering the results, it is important to keep in mind that in an effort to construct an "apples to apples" comparison, the analysis made a number of simplifying assumptions that do not account for other disadvantages of DC plans. For instance, this analysis did not model any asset leakage from either the ideal or individually directed DC plan before retirement through loans or early withdrawals. The analysis also assumes that individuals followed a sensible "goldilocks-like" withdrawal pattern in retirement—not too fast, not too slow, but just right. This study used conservative estimates of the difference in actual investment returns between DB and DC plans. And, the analysis uses 75th percentile life expectancy to project required accumulations in the DC plans, which means 25 percent of individuals will either outlive their savings or have to reduce drawdowns (income) in their later years.

Thus, if anything, the analysis underestimates the cost of providing benefits in a DC plan and thereby understates the cost advantages of DB plans.

Due to the built-in economic efficiencies of DB plans, employers and policy makers should continue to carefully evaluate claims that "DC plans will save money." As discussed, benefit generosity is a separate question from the economic efficiency of a retirement plan. While either type of plan can offer more or less generous benefits, DB plans have a clear cost advantage for any given level of retirement benefit. Consequently, shifting from a DB plan to

a DC plan and maintaining the same contribution rate will generate significant cuts in retirement income. Considering the magnitude of the DB cost advantage, the consequences of a decision to switch to a DC plan could be dramatic for employees, employers, and taxpayers.

Finally, policymakers should focus on how to best encourage life income options in DC plans. This is a significant technical challenge, but improved post-retirement options would make retirement in a DC plan more effective. However, it must be done in a manner that presents good value to retirees, as much opinion research indicates retirees are very interested in life income options--but currently few retirees purchase annuity products. Improving offerings may result in closing the gap between the desire of retirees to simplify their finances and their actual behavior. In addition, policymakers should consider proposals that can strengthen existing DB plans and promote the adoption of new ones. When viewed against the backdrop of workers' increasing insecurities about their retirement prospects and the economic and fiscal challenges facing employers and taxpayers, now more than ever, policy makers ought to focus their attention and energy on this important goal. Many features that make DB plans attractive to employees drive cost savings for employers and taxpayers. In this way, DB plans represent a rare "win-win" approach to achieving economic security in retirement that should be recognized and replicated.

TECHNICAL APPENDIX

Methodology

This report calculates the cost, expressed as a level percent of payroll over a career, of achieving a target benefit in a typical DB plan and compares that with the cost of providing the same target benefit in a typical DC plan.

The analysis begins by constructing a cohort of 1,000 newly-hired employees. This cohort is given a common set of features. All are female teachers age 30 on the start of their employment. They work for three years and then take a two-year break from their careers to have and raise children. They return to work at age 35 and continue working until age 62. Thus, the length of the career is 30 years. By their final year of work, their salary has reached $60,000, having grown by 3.31 percent each year.

Modeling DB Plan Benefits and Costs

The DB plan provides a benefit in retirement equal to 1.85 percent of final average salary for each year worked, which represents approximately the median benefit among DB plans covering public employees (hired before the Great Recession) who are also covered by Social Security.[34] Final average salary is calculated on the basis of the final three years of one's career, which in this case is $58,098. Thus, the initial benefit in the DB plan is $32,244 per year or $2,687 per month.

The DB plan provides a cost-of-living adjustment that ensures the benefit maintains its purchasing power during retirement. Inflation is projected at 2.31 percent per year in the baseline scenario and 2.10 percent in the low return scenario. Thus, each individual in the cohort will receive a benefit equal to 54 percent of her final year's salary that adjusts with inflation. This DB plan (in combination with Social Security) would allow an employee to meet generally accepted standards of retirement income adequacy, or roughly 83 percent of pre-retirement income.

DB plans typically offer married participants the ability to receive joint-and-survivor annuity benefits, whereby when the retiree dies, her spouse can continue to receive a monthly benefit that will last the spouse's lifetime. But the retiree often pays the cost of this survivor's benefit. That is, the monthly benefit that would be payable on a single-life basis will be reduced by an actuarially determined factor to account for the fact that payments may continue if the retiree dies before her spouse. Therefore, for simplicity, the study models all benefit payouts on a single-life basis (and does the same for the DC plan), using the Generational RP-2014 Healthy Female Annuitants mortality table with projection under scale MP 2021 (hired in 2021 at age 30).[35]

To model the contributions that are required to fund these benefits, the analysis first establishes expected investment returns based on asset allocation. To construct

the asset allocation and future returns for the DB pension, the analysis draws on the latest available average public pension asset allocation and expected return data from surveys from a number of sources: Aon, Horizon Actuarial Services, Investment Company Institute, Morningstar, Vanguard, and the Public Plan Database.[36] In particular, the Public Plan Database was used to set allocations to broad asset categories, such as public equity, fixed income, private equity, real estate, hedge funds, cash, and other investments. For investment return assumptions by asset class, the analysis drew on proprietary data provided by Aon and the Horizon Actuarial Services' Survey of Capital Markets Assumptions. The results are listed in **Tables A1** and **A2**.

The baseline scenario analysis uses the 2021 Survey of Capital Market Assumptions by asset class over 10 and 20 year periods, conducted by Horizon Actuarial Services. This was adjusted to determine the asset class assumptions for the second 10-year period and the results are shown in the first column of Table A1.[37] Because these projections span over a lifetime of a 30-year old hired in 2021, the longer-term expectation was deemed more appropriate for our analysis. The difference between the Horizon 10-year and 20-year return expectations demonstrates the near-term pessimism that exists as a result of current low interest rates as well as the run up in equity prices during the pandemic.

We made no such adjustment for the second set of capital market assumptions. That analysis used Aon's Investment Consulting Capital Market Expectations as of 2021 Q3 by asset class, as shown in column 1 of Table A2.

Investment consultants and actuaries including Aon use sophisticated techniques including asset class correlation and geometric returns to develop the overall expected rate of return assumption. Such an analysis was beyond the scope of this paper, where a simple weighted average of asset class returns was applied to develop the overall return assumption for the DB plan and the DC plan by age.

Based on this methodology, the DB plan is expected to achieve nominal investment returns of 6.80 percent per year, net of fees, in the base scenario and 5.68 percent in the low interest rate scenario. Readers should exercise caution in comparing this rate of return to expected returns reported by individual public pension funds, because funds tend to use higher inflation assumptions in their forecasting. For the baseline, the analysis used an inflation assumption of 2.31 percent in this study for benefit increases as well as for capital market expectations. For the persistent low interest rate scenario, the study used a 2.10 percent inflation assumption.

On the basis of these inputs, the analysis calculates the contribution that will be required to fund this benefit through the DB plan over the course of a career, and express this as a level percent of payroll. The analysis finds that the cost to fund the target retirement benefit is 16.5 percent of career over a full career. Contributions could be made entirely by the employer or may be split between the employer and employee.

Modeling DC Plan Benefits and Costs

Modeling the cost of the target retirement benefit in the DC plan requires some adjustments based on what is known about how DC plans differ from DB plans. First, because employees are not provided with an annuity benefit at retirement under the DC plan, the analysis determines the size of the lump sum amount that an individual would need to accumulate by their retirement date in order to fund a retirement benefit equivalent to that provided by the DB plan (including inflation adjustments) for a period of 35 years, or to age 97. To make this comparison, the analysis uses a reasonable—though not ideal—spend down strategy of planning for mortality at the 75th percentile life expectancy of female teachers who are now 30 years old can expect when they retire at age 62. This means 25 percent of individuals survive to age 97 and outlive their savings. The other repercussion of this assumption is that 15 percent of the DC value never goes toward producing retirement income. Instead, those who pass away before reaching the age of 97 have their remaining DC asset revert to their estates.

Thus, the model underestimates the cost of funding retirement benefits through a DC plan: as one in four individuals will experience a reduced standard of living, compared to what they would experience under a DB plan. These individuals may have the foresight to gradually reduce their withdrawals from the plan to avoid the possibility of having their retirement income reduced to zero. However, actual behavior varies greatly.

The analysis assumes that the DC plan would be invested in a TDF, which automatically adjusts asset allocation from stocks to bonds as a worker approaches retirement. The study estimates the equity allocation glide path of TDFs from Vanguard's report, *How America Saves 2021*, from 87 percent equities at age 30 to 43 percent equities at age 71, with five percent assumed to be in cash.[38] This data represents participant-weighted average equity allocation (by age) in Vanguard funds in 2020. See **Table A1** for the asset allocation trajectory.[39]

To model the impact of the shift to a more conservative portfolio allocation beyond age 71, the analysis has individuals begin to shift their portfolio allocation to gradually reduce the share held in equities to zero. The model increases the holdings of cash and liquid investments, treasuries and agency debt, and corporate bonds to 100 percent by age 97. The investment/withdrawal strategy modeled is not the result of an optimization rule; rather, it follows this simple straight-line rule.

Finally, in order to arrive at returns for each plan, the model applies estimates of long-term returns for each asset class from Horizon's capital market assumptions survey for the baseline and Aon's capital market expectations for the lower-return scenario.[40] This gives two possible return environments to study, with the same returns by asset category for both DB and DC plans.

Withdrawals are designed to mimic DB plan payouts, at least in the early years of retirement, declining in later years as retirees adjust to the likelihood of living beyond their original target of age 97. Work by William Sharpe and colleagues suggests that an optimal approach would integrate investment and withdrawal strategies. Specifically, Sharpe finds that a constant withdrawal rate must be paired with a riskless investment strategy to be optimal for an individual.[41] However, a post-retirement asset allocation entirely concentrated in risk-free assets would dramatically drive up the cost of the DC plan. Thus, the model's simple investment and withdrawal strategies would tend to understate the cost advantage of DB plans.

Fees and Behavioral Drag

This study includes estimates of DC plan costs and expected returns based on a review of existing research.

The behavioral drag assumptions are different for pre- and post-retirement years. This is because fees have been reduced significantly in DC plans, and DC plans have continued to move toward target date funds that help reduce behavioral drag. However, those improvements are largely limited to the pre-retirement years, as workers typically pull resources out of the wholesale plan environment at retirement (which provides strong fiduciary protections and competitive fees) and move their money to retail investment strategies that come with far fewer protections.

As a result, the investment behavioral drag impact is larger post-retirement. Before retirement, the behavioral drag in the individually-directed DC plan is assumed to be 69 basis points per year. However, post-retirement fees and behavioral drag totals 168 basis points. These figures are approximated based upon Exhibit 1 in Morningstar's *Mind the Gap 2021* report. The report notes that allocation funds (stocks and bonds and other asset classes) often are used as core holdings for 401(k) accounts. Thus, the 69 basis point gap for allocation funds were used as a proxy to represent the TDFs pre-retirement experience. For post-retirement years, the investment drag for all funds was used—without backing out allocation funds—which was 168 basis points.

The study assumes that in an ideal DC plan, the plan sponsor would retain expenses consistent with those of the DB plan, but also assumes that participants would avoid well-documented mistakes related to asset allocation and market timing decisions such as investing too much or too little in stocks, and reacting emotionally to market fluctuations by selling assets as prices fall and buying back into the market as prices rise.[42] In addition to behavioral finance studies, key studies indicate that individual investor returns lag behind market returns. This is not a significant problem for pension funds because they are managed by professionals who exercise discipline in the face of market fluctuations and regularly rebalance. In contrast, investor-level data shows that individuals earn returns significantly below the returns posted by the funds in which they invest.[43]

Estimates of this gap vary depending on the market cycles captured in the time frame, but most studies that cover a long time-horizon show significant under-performance by individual investors. For instance, Morningstar's *Mind the Gap* study found that, in the 10 years ending on December 31, 2020, investors' actual mutual fund returns lagged by 1.7 percentage points per year, noting the "annual return gap is in line with the gaps measured over the four previous rolling 10-year periods, which ranged from 1.6 to 1.8 percentage points per year."[44] The study also examined net flows in and out of each asset class, and found the "shortfall, or gap, stems from inopportunely timed purchases and sales of fund shares, which cost investors nearly one sixth the return they would have earned if they had simply bought and held."[45]

Despite the persistent gap of 1.6 to 1.8 percentage points per year, the analysis uses allocation funds for working years that better represent TDFs and which Morningstar notes "are often used as core holdings for employer-sponsored retirement plans, such as 401(k)s." Thus, the pre-retirement behavioral drag is assumed to be 69 basis points (the behavioral drag for allocation funds), which is much lower than the overall figures. The 2014 study gave a thorough analysis of the variability of findings based on various amounts of behavioral drag.

The model does not include important additional differences between DB and DC plans, such as the "leakage" of assets from DC plans through loans or early withdrawals, two features which are rare in DB plans. Neither does the model analyze the effects of ups and downs in financial markets and the impact that these have on investment returns and costs in both DB and DC plans over a career. Also, the fact that in DC plans some individuals will have "better luck" with investing than others means that individuals' retirement prospects will exhibit a wider dispersion than what is predicted by the model. A 2012 Texas TRS plan design study, for instance, estimated that participants in an individually directed DC plan would have a 66 percent chance of having less than 62 percent of the benefit offered by the DB plan with the same contributions.[46]

Table A1: Capital Market Assumptions, Excluding Next 10 Years

Asset Class	Projected Long Term Returns	DB Plan	DC Plan Asset Allocation Glidepath by Age of Worker/Retiree									
			30	35	40	45	50	55	60	65	70	100
Public Equity	7.7%	46.5%	87%	85%	81%	76%	70%	64%	56%	49%	43%	0%
Fixed Income	4.4%	23.2%	8%	10%	14%	19%	25%	31%	39%	46%	52%	95%
Private Equity	10.2%	9.4%										
Real Estate	6.9%	8.9%										
Hedge Funds	6.0%	6.3%										
Cash	2.6%	2.4%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Commodities	4.6%	1.7%										
Misc. Alternatives	7.2%	1.5%										
Other	7.3%	0.1%										
Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Net Return: Ideal DC		**6.80%**	**7.18%**	**7.11%**	**6.98%**	**6.81%**	**6.62%**	**6.42%**	**6.15%**	**5.92%**	**5.73%**	**4.31%**
Net Return: Individually Directed DC			**6.49%**	**6.42%**	**6.29%**	**6.12%**	**5.93%**	**5.73%**	**5.46%**	**4.24%**	**4.05%**	**2.63%**
Inflation Assumption	**2.31%**											

Table A2: Capital Market Assumptions, Including Next 10 Years

Asset Class	Projected Long Term Returns*	DB Plan	DC Plan Asset Allocation Glidepath by Age of Worker/Retiree									
			30	35	40	45	50	55	60	65	70	100
Public Equity	7.0%	46.5%	87%	85%	81%	76%	70%	64%	56%	49%	43%	0%
Fixed Income	2.5%	23.2%	8%	10%	14%	19%	25%	31%	39%	46%	52%	95%
Private Equity	8.7%	9.4%										
Real Estate	5.5%	8.9%										
Hedge Funds	5.2%	6.3%										
Cash	2.0%	2.4%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Commodities	4.4%	1.7%										
Misc. Alternatives	5.7%	1.5%										
Other	5.0%	0.1%										
Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Net Return: Ideal DC		**5.68%**	**6.39%**	**6.30%**	**6.12%**	**5.90%**	**5.63%**	**5.36%**	**5.00%**	**4.68%**	**4.41%**	**2.48%**
Net Return: Individually Directed DC			**5.70%**	**5.61%**	**5.43%**	**5.21%**	**4.94%**	**4.67%**	**4.31%**	**3.00%**	**2.73%**	**0.80%**
Inflation Assumption	**2.10%**											

*Authors estimates based on Aon's assumptions for various asset classes.

Expected returns are using Aon's Q3 2021 Capital Market Assumptions (CMAs) as of 09/30/2021, which are projections about the future returns of asset classes. For asset classes that can be implemented passively, which includes most public assets, alpha and active management fees are not included in the return expectations. For asset classes that can only be implemented actively, such as hedge funds and private assets, we assume alpha and higher active manager fees. Expected returns are geometric (long-term compounded). Expected returns presented are models and do not represent the returns of an actual client account. Actual returns will be reduced by any advisory fees and other expenses a client may incur. Aon's advisory fees are described in Part 2A of Aon's Form ADV. Not a guarantee of future results. Capital market assumptions disclosure pages are available from Aon upon request.

ENDNOTES

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2. The benefit factor could also be a function of a worker's earnings over their entire career (a so-called "career average plan.") Or, the factor could be a flat dollar amount: for example, the plan will pay a monthly benefit equal to $50 per year of service, so that a 30 year employee would have a benefit of $1,500 per month. "Flat dollar" plans are primarily seen among blue-collar workers in the private sector.
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