

# A BETTER BANG *for New York City's* BUCK



## AN EFFICIENCY COMPARISON OF DEFINED BENEFIT PENSION PLANS AND DEFINED CONTRIBUTION RETIREMENT SAVINGS PLANS



NEW YORK CITY COMPTROLLER  
JOHN C. LIU



NATIONAL INSTITUTE ON  
Retirement Security

OCTOBER 2011

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by  
William B. Fornia, FSA

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## About the New York City Comptroller's Office

The New York City Comptroller, an independently elected official, is the Chief Financial Officer of the City of New York. The mission of the office is to ensure the financial health of New York City by advising the Mayor, the City Council, and the public of the City's financial condition. The Comptroller also makes recommendations on City programs and operations, fiscal policies, and financial transactions. In addition, the Comptroller manages the assets of the five New York City Pension Funds, performs budgetary analysis, keeps the City's accounts, audits City agencies, and registers proposed contracts. His office employs a workforce of more than 700 professional staff members. These employees include accountants, attorneys, computer analysts, economists, engineers, budget, financial and investment analysts, claim specialists, and researchers in addition to clerical and administrative support staff.

## About the National Institute on Retirement Security

NIRS, based in Washington, D.C., is a not-for-profit organization established to contribute to informed policymaking by fostering a deep understanding of the value of retirement security to employees, employers, and the economy through national research and education programs. NIRS seeks to encourage the development of public policies that enhance retirement security in America.

## About Retirement Security NYC

Retirement Security NYC is a major initiative launched by Comptroller John C. Liu to protect the retirement security of public employees while ensuring the City's financial health. Retirement Security NYC is partnering with two leading institutions – the National Institute on Retirement Security and the New School's Schwartz Center for Economic Policy Analysis – to analyze the current state of public pensions and retirement preparedness among all New Yorkers and offer sensible reforms.

## About William B. Fornia, FSA

The founder and president of Pension Trustee Advisors, William Fornia is a Fellow of the Society of Actuaries with more than 30 years of experience in pension and retirement-related areas. He has worked with 22 state retirement systems, as well as IBM, US West and Ford Motor Company. In 2008, Fornia co-authored a study with Beth Almeida that compared the economic efficiency of defined benefit and defined contribution retirement plans in the United States. That study, which was issued by the National Institute on Retirement Security, served as the basis for this report.

## INTRODUCTION

Worries about retirement security abound. Governments are concerned about delivering on the promises that they have made to their citizens and to their employees as tax revenues shrink amid a weakening economy. In this environment, some have proposed replacing traditional defined benefit (DB) pensions with 401(k)-type defined contribution (DC) retirement savings plans in an effort to save money.

DB plans, particularly public employee pension plans, have been under fire in recent years largely due to the volatility of contributions. During periods of economic downturn, reduced asset values necessitate increased contributions that are generally borne by governments and their taxpayers. This creates legitimate concerns, which are balanced by two important considerations. The first is that entities such as governments are more naturally suited to absorb this risk because of their long-term nature, particularly when compared to individuals. The second is that as a result of the ability to take these risks, DB plans have enormous economic efficiencies over DC plans. The latter is the major finding of this analysis.

The value of traditional DB pensions to employees is generally recognized: they provide a secure, predictable retirement income that cannot be outlived. But less well known is the value of a DB pension to an employer. Due to their group nature, DB plans possess “built-in” savings, which make them highly efficient retirement income vehicles, capable of delivering retirement benefits at a lower cost to the employer and employee. These savings derive from three principal sources:

First, DB plans manage longevity risk more economically than DC plans. By pooling the longevity risks of large numbers of individuals, DB plans allow plan sponsors to make contributions based on average life expectancy of their members. The money thus accumulated enables a DB plan to provide their members with a guaranteed retirement income for life no matter how long they live. In order to achieve the same level of life-time security, an individual in a DC plan must make contributions to cover his or her maximum life expectancy, a considerably more expensive proposition. And, if an individual lives longer than expected and has not contributed adequately, he or she is in danger of running out of money. Consequently, DB plans are able to do more with less.

Second, because DB plans, unlike the individuals in them, do not age, they are able to take advantage of the enhanced investment returns that come from a balanced portfolio throughout an individual’s lifetime. Participants in DC plans generally sacrifice anticipated investment returns for safety as they age.

Third, DB plans, which are professionally managed, achieve greater investment returns as compared with DC plans that are made up of individual accounts managed by individual employees. A retirement system that achieves higher investment returns can deliver a given level of benefit at a lower cost.

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Because of these three factors, we find that a DB pension plan can offer the same retirement benefit at a steep discount to a DC retirement savings plan. Specifically, our analysis indicates that for workers in the five New York City DB plans that were studied, the cost to deliver the same level of retirement income ranges from 36 percent to 38 percent lower than the cost of a DC plan. (Put another way, this analysis finds that it would be 57 percent to 61 percent more expensive for DC plans to deliver the same level of retirement incomes as the five New York City DB plans that were studied.) This is an important factor for policy makers to consider, especially with respect to public sector workforces, where tax dollars are an important source of funds for retirement benefits. DB plans are a more efficient use of taxpayer funds when offering retirement benefits to state and local government employees.

More specifically, this study finds that ...

- Longevity risk pooling in the City's DB plans saves from 10 percent to 13 percent;
- Maintenance of portfolio diversification in the City's DB plans saves from 4 percent to 5 percent; and,
- The City's DB plans' superior investment returns save from 21 percent to 22 percent.

... as compared to typical DC plans that provide equivalent benefits.

**TABLE 1: TALLYING DB PLAN COST SAVINGS**

	1. Longevity risk pooling saves:	2. Maintenance of portfolio diversification saves:	3. Superior investment returns save:	All-in costs savings in DB plans over equivalent DC Plans:
Teacher	10%	4%	22%	36%
Case Worker	13%	4%	21%	38%
Sanitation Worker	13%	4%	21%	38%
Police Officer	10%	5%	22%	37%
Fire Fighter	10%	5%	22%	37%

## TWO APPROACHES TO RETIREMENT – DB AND DC PLANS

Retirement plans are a form of deferred compensation, whereby employers – and in some cases, employees – set aside a portion of current wages in order to provide the employees with funds to live on after retirement. Employers who offer retirement plans can consider two basic approaches: a traditional defined benefit pension plan and a defined contribution retirement savings plan.<sup>1</sup> Each type of plan has certain distinguishing characteristics that influence their cost to employers and employees.<sup>2</sup>

<sup>1</sup> The most common type of DC plan in the private sector is the 401(k) plan. But there are others. Public sector employees often save for retirement in 403(b) plans or through 457 plans. These nomenclatures reflect the sections of the Federal tax code that spells out the rules governing these plans.

<sup>2</sup> Both types of plans also share some common features. For instance, they both are employment-based plans that make preparing for retirement easier than if employees had to tackle the job completely on their own. Both DB and DC plans benefit from tax incentives designed to encourage retirement preparedness. And both types of plans are governed by laws designed to protect employees and their benefits.



## DB Plans

DB plans provide workers with a predictable monthly benefit in retirement.<sup>3</sup> 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 toward the end of his or her career.<sup>4</sup> For example, for a civilian employee, the New York City Employees' Retirement System provides a benefit in the amount of 2 percent of final average salary for each year worked if the employee completes at least 20 years of service and is 57 years old. Thus, a Child Protective Case Worker who retires at age 61, whose final average salary is \$71,817, and who had devoted 25 years to the job, would earn a lifetime monthly benefit of \$2,992 (\$35,909 per year) with adjustments for Cost of Living Allowance (COLA) increases as prescribed by law. Such a plan design is attractive to employers because the security it provides employees aids recruitment and retention, especially of government workers who are generally lower-paid than their private sector counterparts.<sup>5</sup> Employees know in advance of accepting a position that they will have a steady, predictable income to maintain a certain standard of living in retirement.

Participation in DB plans is generally mandatory, which prevents situations where employees do not join a retirement plan due to either ignorance or inertia and end up having inadequate retirement benefits.

Benefits in DB plans are pre-funded. That is, employers (and, in the case of the New York City pension plans, employees) make contributions to a common pension trust fund over the course of a worker's career. Pre-funding provides an advantage to a DB plan because investment earnings compound over decades and can do much of the work of paying benefits. Between 1984 and 2010, 61 percent of the New York City pension fund receipts were from investment returns.<sup>6</sup> The pension funds are invested by professional asset managers whose activities are overseen by trustees and other fiduciaries. The earnings that build up in the fund, along with the dollars contributed, pay for the benefits a worker receives when he retires.

When calculating the amount needed to pay for benefits, an actuary anticipates earnings that are expected to build up in the fund over time by assuming a reasonable future investment return rate based on the fund's investment portfolio, which is usually diversified among stocks, bonds, and other investments. However, it is expected that year-to-year investment returns will vary from the assumed investment return. In years after periods when the fund's earnings fall short of the assumed investment return, employers must make additional contributions to cover short-term losses. Conversely, employer contributions drop after periods of short-term gains. Although

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***Because pension obligations are paid over decades and because of the long-term nature of governments, government plans can spread investment risk and contribution volatility over many years.***

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<sup>3</sup> See table on page 35 of the Technical Appendix for NYC employee contributions to each pension fund.

<sup>4</sup> 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.

<sup>5</sup> Braconi, Frank. 2011. "Municipal Compensation in New York City." New York, N.Y.: New York City Comptroller's Office.

<sup>6</sup> Individual pension system Comprehensive Annual Financial Reports (CAFRs) and National Institute on Retirement Security calculations.



actuaries use smoothing techniques to dampen this year-to-year volatility of employer contributions, decades with significant shortfalls in investment income may lead to sharp increases in required future contributions, while decades with significant excess investment income may decrease required contributions. This volatility of contributions is the greatest drawback of DB plans. Governments have an inherent advantage over private employers in managing this DB risk. Because pension obligations are paid over decades and because of the long-term nature of governments, government plans can spread this investment risk and contribution volatility over many years. Sound policy is for governments to understand this risk, manage it effectively, and respond prudently in both good times and bad.

### DC Plans

DC plans function very differently from DB plans. First, there is no implicit or explicit guarantee of retirement income in a DC plan. Rather, employers and employees contribute to the plan over the course of a worker's career. Whether the funds in the account will ultimately be sufficient to meet retirement income needs will depend 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.

***In DC plans it is typically left to the retiree to decide how to spend one's retirement savings. Research suggests that many individuals struggle with this task.***

Participation in DC plans is generally voluntary, which means workers can delay joining or opt-out entirely with the obvious impact on their retirement savings. Moreover, even if the employee participates, retirement savings could be hurt if the employee does not contribute adequate recommended amounts.

While DC plan assets are also held in a pension 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 at retirement, how to withdraw the funds. 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-returning 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.

This high degree of participant direction makes DC plans very flexible in accommodating individual desires, decisions, and control. Employees, however, do not always follow expert advice when it comes to saving and



investing for retirement.<sup>7</sup> Too many workers fail to contribute sufficient amounts to the plans, and 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 class, such as stocks, bonds, or cash. For example, one study found that more than half of all DC plan participants had either no funds invested in stocks – which exposes them to very low investment returns – or had almost all their assets allocated to stocks, making for a much more volatile portfolio.<sup>8</sup>

Another important difference between DC and DB plans becomes apparent at retirement. Unlike in DB plans, where workers are entitled to receive regular, monthly pension payments, in DC plans it is typically left to the retiree to decide how to spend one's 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 having a lower standard of living as a result.<sup>9</sup> Annuity payout options, which would allow DC participants to get a guaranteed monthly income in retirement akin to that of DB recipients, are rarely provided by employers. A retiree may purchase an individual annuity from other sources but they are expensive and not often utilized.<sup>10</sup>

Private sector employers have increasingly converted to DC plans over the last several decades for several reasons, including government regulation of DB plans and the shifting of some of the risk of DB plans away from employers.

NIRS looked at this trend in "Who Killed the Private Sector DB Plan?"<sup>11</sup> and found that it has occurred for several reasons, the most prominent being increased federal regulation of private sector DB plans. Three federal agencies regulate

private sector DB plans to make sure the increasingly complex pension and tax laws are followed. The most recent change in pension law was the Pension Protection Act of 2006, which imposed more stringent funding requirements on DB plans, and had the unintended consequence of impacting employers' cash flow and spiking the volatility of plan funding. Federal pension funding rules do not apply to public DB plans, which have been able to moderate the volatility of contributions by spreading out the risk over longer periods of

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**DC plans, in their present forms, are comparatively recent creations...Until a substantial number of individuals derive significant retirement income from DC plans, their success will remain unproven.**

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7 Benartzi, S. & R.H. Thaler. 2007. "Heuristics and Biases in Retirement Savings Behavior." *Journal of Economic Perspectives*. Vol. 21 No. 3. 81-104; Mitchell, O. and S. Utkus. 2004. *Pension Design and Structure: New Lessons from Behavioral Finance*. New York: Oxford University Press; Munnell, A. H. and A. Sunden. 2004. *Coming Up Short: The Challenge of 401(k) Plans*. Washington, DC: Brookings Institution Press.

8 Holden, S. and J. VanDerhei. 2001. "401(k) Plan Asset Allocation, Account Balances, and Loan Activity in 2000." EBRI *Issue Brief* 239. Washington, DC: Employee Benefit Research Institute.

9 Copeland, C. 2007. "How Are New Retirees Doing Financially in Retirement?" EBRI *Issue Brief*. No. 302. Washington DC: Employee Benefit Research Institute; Love, D., P.A. Smith, and L. McNair. 2007. "Do Households Have Enough Wealth for Retirement?" *Finance and Economics Discussion Series*. 2007-17. Washington DC.: Federal Reserve Board

10 Perun, P. 2007. "Putting Annuities Back into Savings Plans." In Ghilarducci and Weller, eds. *Employee Pensions: Policies, Problems, and Possibilities*. Champaign IL: Labor and Employment Relations Association; Gentry, W. and C. Rothschild. 2010. "Enhancing Retirement Security Through the Tax Code: The Efficacy of Tax-Based Subsidies in Life Annuity Markets." *Journal of Pension Economics and Finance*, April 2010, Vol. 9, No. 2, pp.185-218. See literature review discussion regarding fees and take-up rates.

11 Boivie, I. 2011. "Who Killed the Private Sector DB Plan?" Washington DC: National Institute on Retirement Security.



time. Also, in the recent recessions, as many employers have been forced to cut costs, private DB plans have found that federal tax law makes it difficult for employees to share in the cost of their DB plans as public employees almost always do.

DC plans are also associated with the modern economy, which is increasingly “high-tech” and service-oriented, where employees may not stay with the same employer long-term. Thus, the portability of DC benefits allows them to retain retirement savings as they move from job to job.

Finally, it should be pointed out that many believe that the most popular type of DC plans – 401(k) plans – really have not yet “stood the test of time.” DC plans, in their present forms, are comparatively recent creations. In fact, relatively few individuals as yet have gone through a full career covered under a DC plan and lived a full retirement thereafter based primarily on their DC plan and Social Security income. A host of DC plans began in the 1980s and 1990s, particularly when high investment returns made the DC model seem attractive to workers who saw double-digit investment returns for long periods. The experience during the first decade of the 21st century has been different and comparatively discouraging. However, the true long-term picture has not yet emerged. Until a substantial number of individuals derive significant retirement income from DC plans, their success will remain unproven.

### **BOTH DB AND DC PLANS ARE IMPORTANT TO RETIREMENT SECURITY**

Because individuals do not have perfect knowledge as to whether they will remain in a given job (and therefore in a given DB plan) until retirement, taking advantage of the opportunity to save in a supplemental DC plan can provide employees with useful diversification of retirement income sources. DC plans also are flexible vehicles that can accommodate individual retirement income needs that can vary. For example, two otherwise identical workers might have different family situations, health needs, or simply different preferences and expectations about their retirement income needs. DC plans give workers the opportunity to save for retirement in a manner that reflects their individual situations.

This is why most retirement experts today liken the ideal design of retirement income sources to a “three-legged stool,” consisting of Social Security, a DB plan, and a supplemental DC savings plan. Indeed, researchers have found that workers who have access to all three sources of retirement income are in the best position to achieve a secure retirement.<sup>12</sup>

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***Most retirement experts today liken the ideal design of retirement income sources to a “three-legged stool,” consisting of Social Security, a DB plan, and a supplemental DC savings plan.***

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<sup>12</sup> Munnell, A. H., M. Soto, A. Webb, F. Golub-Sass, and D. Muldoon. 2008. “Health Care Costs Drive Up the National Retirement Risk Index.” Center for Retirement Research *Issue in Brief*, No. 8-3. Boston College; Munnell, A.H., A. Webb, and F. Golub-Sass. 2007 “Is there Really a Retirement Savings Crisis? An NRRI Analysis.” Center for Retirement Research *Issue in Brief*, No. 7-11. Boston College; Love, D. et al., Op. Cit. 2007.





However, to the extent that retirement benefits for private sector employees constitute a cost to employers, and since benefits for public employees are supported by taxpayer contributions, designing retirement benefits in a fiscally responsible fashion is an important public policy goal. To that end, it is important for policymakers to recognize that DB plans – which are highly attractive to employees because they provide predictable, lifetime, monthly retirement benefits – also provide significant savings for employers and taxpayers.

### DB PLANS ARE MORE COST EFFECTIVE

The cost of either a DB or DC plan depends primarily, but not only, on the generosity of the benefits that it provides. Economists have found that DB plans are typically more generous than DC plans, and obviously, more generous benefits are more expensive.<sup>13</sup> However, **for any given level of benefit, a DB plan will cost less than a DC plan.**<sup>14</sup> This makes DB plans, in the language of economists, **more efficient** since they stretch taxpayer, employer, or employee dollars further in achieving any given level of retirement income.

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

1. Because DB plans pool the longevity risks of large numbers of individuals, they avoid the “over-saving” dilemma inherent in DC plans. DB plans need only accumulate enough funds to provide benefits for the average life expectancy of the group. In contrast, individuals in DC plans will need to set aside enough funds to last for the “maximum” life expectancy if they want to avoid the risk of running out of money in retirement. Since the maximum life expectancy can be substantially greater than the average life expectancy, a DC plan will have to set aside a lot more money than a DB plan to achieve the same level of monthly retirement income.
2. Because DB plans do not age, unlike the individuals in them, they are able to take advantage of the enhanced investment returns that come from a balanced portfolio over long periods of time. For instance, ongoing DB plans generally include individuals with a range of ages. As older workers retire and die, younger workers enter the plan. As a result, the average age of all participants in a mature DB plan does not change much. This means DB plans can ride out bear markets and take advantage of the buying opportunities they present without having to worry about converting all of their money into cash for benefits in the near future. By contrast, individuals in DC plans must gradually shift to a more conservative asset allocation as they age, in order to protect against financial market shocks later in life. This process can sacrifice investment returns because people may have to sell assets when they are worth too little due to market fluctuations coinciding with retirement timing. Moreover, they are not able to take advantage of higher expected returns associated with a balanced portfolio.

**For any given level of benefit, a DB plan will cost less than a DC plan. This makes DB plans, in the language of economists, more efficient.**

<sup>13</sup> Ghilarducci, T. and W. Sun. 2006. “How Defined Contribution Plans and 401(k)s Affect Employer Pension Costs.” *Journal of Pension Economics and Finance*, 5(2), 175-96; Blake, D. 2000. “Does It Matter What Type of Pension Scheme You Have?” *The Economic Journal*, 110(461), F46-F81.

<sup>14</sup> Fuerst, D. and A. Rappaport. 2004. “Defined Benefit Plans: Still a Good Idea?” *AARP Global Report on Aging*. Washington DC: AARP International. [http://www.aarpinternational.org/gr\\_sub/gr\\_sub\\_show.htm?doc\\_id=562911](http://www.aarpinternational.org/gr_sub/gr_sub_show.htm?doc_id=562911)



3. DB plans achieve greater investment returns as compared to the individual account DC plans. Because of professional management of assets, DB plans achieve superior investment performance as compared to the average individual DC plan investor. Also, superior returns in DB plans can be attributed partly to lower fees that stem from economies of scale.

### METHODOLOGY

We compare the relative costs of DB and DC plans by constructing a model that first calculates the cost of achieving a target retirement benefit in a typical DB plan. We express this cost as a level percent of payroll over a career. We then calculate the cost of providing the same retirement benefit under a DC plan. This study does not distinguish between employee contributions toward this cost and employer contributions toward this cost. Additional details on our methodology can be found in the Technical Appendix which begins on page 27.

Our model is based on a group of 1,000 newly-hired employees as shown below in each of New York City's following plans:

- The "Teachers' 55/27" plan applicable to teachers under the Teachers' Retirement System.
- The "57/5" plan applicable to civilian workers under the New York City Employees' Retirement System (NYCERS) and the Board of Education Retirement System. Our hypothetical NYCERS employee is a female Child Protective Case Worker.
- The "Sanitation 20 Year (SA20)" plan applicable to Sanitation workers under NYCERS.
- The "Police Tier 3" plan applicable to police officers.
- The "Fire Tier 3" plan applicable to fire fighters.

For the purposes of simplicity, we give the individuals in each group a common set of features, according to the average data associated with each different plan and assume that all of them retired for service after working for a specified number of years.

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***DB plans achieve superior investment performance as compared to the average individual DC plan investor.***

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**TABLE 2: DB MODEL–NYC PENSION PLANS**

Worker	Age when Hired	Age at Retirement	Years of Service	Gender
Teacher	34	62	28	Female
Case Worker	36	61	25	Female
Sanitation Worker	30	53	23	Male
Police Officer	26	51	25	Male
Fire Fighter	27	52	25	Male

Next, we calculate the DB benefits provided based on information from the various plans.<sup>15</sup>

Worker	Final Average Pay	Pension Multiplier	Years of Service	Annual Pension
Teacher	\$96,267	2.00%	28	\$53,910
Case Worker	\$71,817	2.00%	25	\$35,909
Sanitation Worker	\$83,876	2.5%/1.5%	23	\$45,538
Police Officer	\$87,030	2.00%	25	\$43,515*
Fire Fighter	\$88,943	2.00%	25	\$44,472*

\*Does not include “Variable Supplements Fund” annual payments, as described in the Technical Appendix, page 33.

As discussed in the Technical Appendix, we define certain parameters for life expectancy and investment returns. Then, on the basis of all these inputs, we calculate the contribution that will be required to fund our target retirement benefit through the DB plan over the course of a career. We perform the same exercise for the DC plan. The following pages will review various findings for these five hypothetical workers.

<sup>15</sup> For more complete details about the features of each of the plans, please see page 35 of the Technical Appendix.



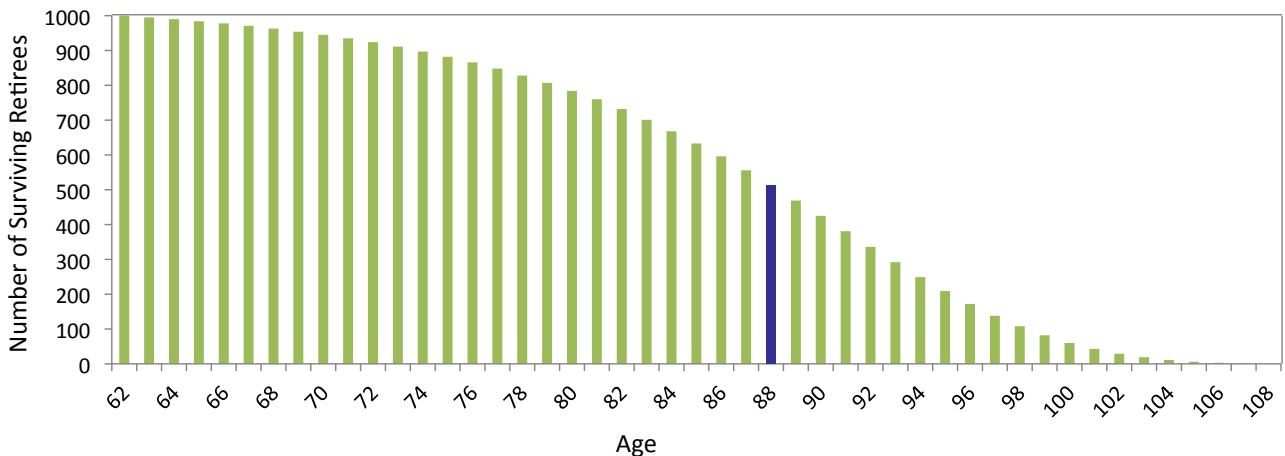
## FINDINGS: DB PLANS ARE MORE COST-EFFECTIVE

To explain the development of the cost comparisons between DB and DC, the Teachers' group is used as an example.<sup>16</sup> DB plans were found to be more efficient than DC plans in providing the same level of benefit for three reasons: longevity risk pooling, diversification, and superior investment returns.

### Longevity Risk Pooling

Longevity risk describes the uncertainty an individual faces with respect to their exact lifespan. While actuaries can tell us that, on average, for example, our pool of female teachers who retire at age 62 will live to be 88, they can also predict that some will live only a short time, and some will live to be more than 100. The chart below illustrates the longevity patterns among our 1,000 teachers. With each passing year, fewer retirees are still living. Age 88 corresponds to the year when roughly half of retirees are still alive.

**FIGURE 1: LONGEVITY OF 1,000 RETIRED FEMALE TEACHERS**



**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.**

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 plan for 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 the case of the Teachers' group, to age 88. Based on our target benefit level, the DB plan needs to have accumulated \$607,946 for each teacher in the plan by the time they turn 62. This amount will ensure that every individual in the plan will receive a regular monthly pension payment that lasts as long as they live. The total employer and employee contribution required to fund this benefit, smoothed over a career, comes to

<sup>16</sup> The cost comparisons for the other groups were developed similarly and can be found on page 23.



13.6 percent of payroll. The costs are conceptually similar but technically different from what the plan actuary calculates as the “Entry Age Normal Cost.” This difference is discussed further in the Technical Appendix. As also discussed in the Technical Appendix, a 13.6 percent total annual employee/employer contribution during the teacher’s active work-life would grow with investment income to \$607,946 when the teacher retires at age 62. For our group of 1,000 teachers, the \$607,946 thus accumulated for each one would continue to grow with investment income, and be drawn down over the retirees’ lifetimes.

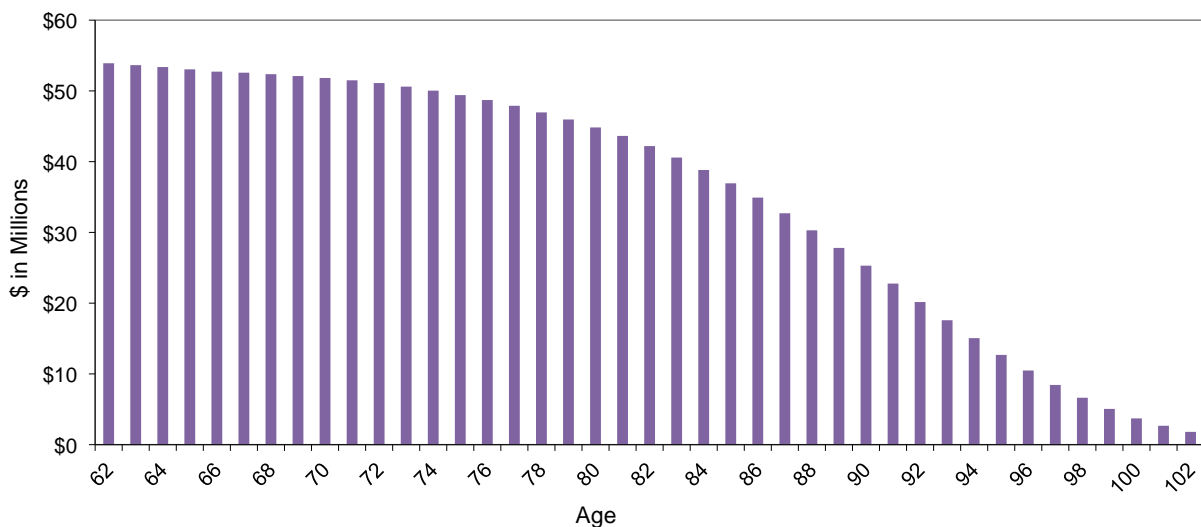
The corresponding information for the DB plans for all five employee groups analyzed in our study is as follows:

**TABLE 3: DB PLAN COST COMPARISONS OF PAYROLL FOR EMPLOYEE GROUPS**

Worker	Amount needed at age of retirement	Annual Cost Percentage	Average life expectancy at retirement
Teacher	\$607,946	13.6%	88 at age 62
Case Worker	\$391,031	13.0%	85 at age 61
Sanitation Worker	\$496,365	16.2%	79 at age 53
Police Officer	\$769,299	21.8%	82 at age 51
Fire Fighter	\$779,526	21.4%	82 at age 52

Total annual DB payments to the Teachers’ group is shown in the chart below. (Total annual DB payments to the Child Protective Case Workers and Sanitation workers will have a similar pattern as seen in this chart. The pattern of payments to the Police and Fire groups differs slightly and is discussed in the Technical Appendix.) The amount of benefits paid out will decrease steadily as individuals gradually die off. The cost of living increase is small: 1.3 percent of \$18,000, or \$234, in our examples. In the DB plan, every retiree receives a steady monthly income that lasts until his or her death.

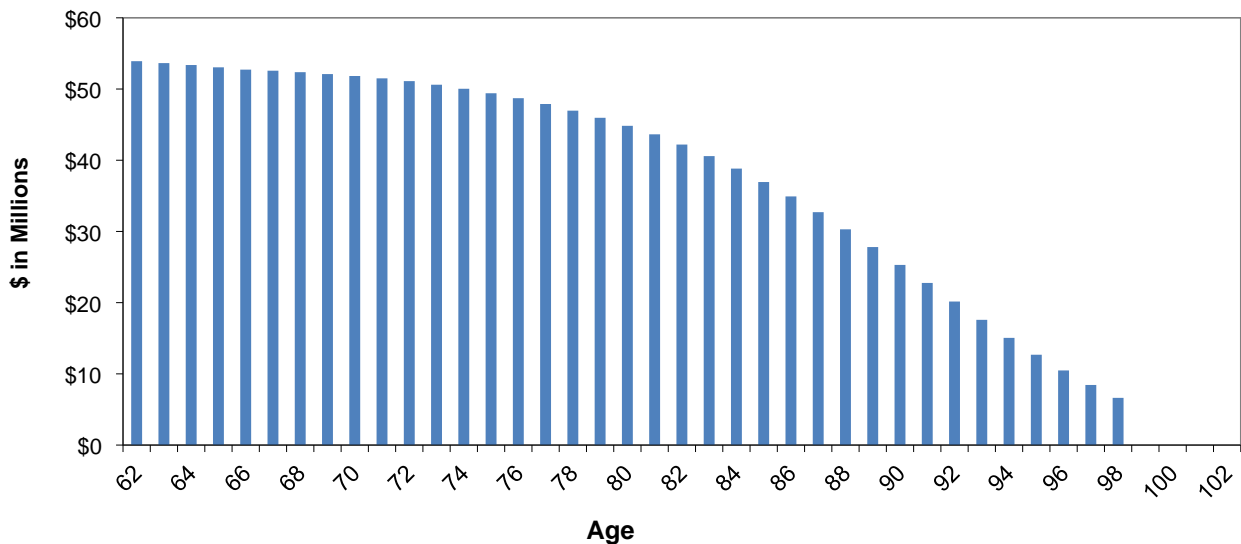
**FIGURE 2: TOTAL PAYMENTS UNDER THE DEFINED BENEFIT PLAN**



We contrast this situation with that of a DC plan. Because DC plans rarely offer annuity options, individuals must self-insure longevity risks. This can be an expensive proposition. A teacher in a DC plan does not know exactly how long she will live so she will probably not be satisfied with saving an amount sufficient to last for the **average** life span, because if she lives past age 88, she will have depleted her retirement savings. For this reason, an individual will probably want to be sure that she has enough money saved to last for the **maximum** life span (or something close to it).

From mortality tables currently used by the NYC Office of the Actuary (NYCOA), we determined the Teachers' "maximum life expectancy" to be 98 years. We define the "maximum life expectancy" for the purposes of this study as the age beyond which only 10 percent of individuals survive, and therefore it is not a "true" measure of maximum life expectancy.<sup>17</sup> In fact, our mortality table indicates that one lucky individual out of the 1,000 retired teachers will celebrate her 107th birthday. This simplifying assumption (that most individuals will be satisfied with a 90 percent chance of not outliving their money, rather than a 100 percent chance) is intended to be more realistic, but it will also tend to understate the cost of the DC plan. The chart below illustrates the payout pattern under the DC plan, where individuals withdraw funds on an equivalent basis to the DB plan until age 98 – that is, in a series of regular, inflation-adjusted payments. After age 98, there are no more withdrawals, even though 100 (10 percent of our initial pool of 1,000) teachers are still living. The money has simply run out.

**FIGURE 3: TOTAL BENEFIT PAYMENTS UNDER THE DC PLAN**



Thus, our simplifying assumption of using a 90th percentile life expectancy of 98, rather than the true maximum life expectancy, will reduce the cost of providing the target benefit under the DC plan, but will also mean that individuals with exceptionally long lives will experience a reduced standard of living, compared to what they would experience under a DB plan. Thus, in our example, the DC plan ends up delivering less in total retirement benefits than the DB plan.

<sup>17</sup> Authors' calculations based on mortality tables adopted by the various NYC pensions funds' boards of trustees, based on actual NYC experience.



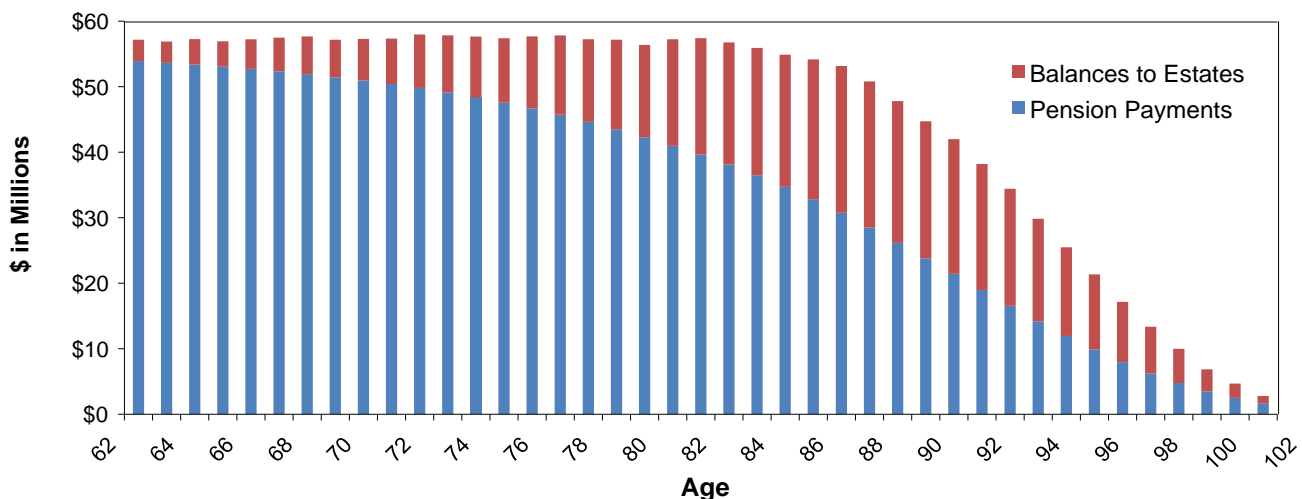
Of course, those 10 percent of individuals who do survive beyond age 98 would want to avoid the possibility of having their retirement income reduced to zero. It is likely that individuals will respond to a long life by gradually reducing their withdrawals from the plan to avoid running out of money.

Annuities offer another potential way to address the problem of exhausting DC savings prematurely. Because DC plans consist of many separate, individual accounts, in order to receive a guaranteed income upon cessation of work, retirees must purchase individual annuities. Because DC plans do not offer the same risk pooling benefits that DB plans impart, however, these individual annuities are much more expensive than the annuitization available under DB plans. Bodie explains that the “private market for life annuities is plagued by the problem of adverse selection: There will be a tendency for people with a higher than average life expectancy to have a high demand for this kind of insurance.”<sup>18</sup> DB plans, on the other hand, “create a group annuities market that reduces the cost of adverse selection.”<sup>19</sup> Furthermore, the annuitization is more expensive than would be available through a DB plan because insurance companies must retain adequate reserves and cannot generally invest in equities to the extent that an ongoing DB plan, particularly a governmental DB plan, can.

### The “Over-Saving Dilemma”

It is important to acknowledge that if a retiree dies before exhausting all of his or her DC retirement savings, the money in the account does not simply evaporate. Rather, it will pass to the estate. Benefits that were intended to be pension benefits become death benefits paid to heirs instead. This is the “over-saving” dilemma that is inherent in DC plans. The chart below illustrates this phenomenon for a teacher. Since her average life expectancy is 88, but DC retirees must prudently save for the 10 percent possibility of reaching age 98, the aggregate amount of money transferred to estates is substantial – totaling 25 percent of all assets accumulated in the plan (although only 16 percent on a present-value basis).

**FIGURE 4: TOTAL BENEFIT + ESTATE PAYMENTS UNDER THE DC PLAN**



<sup>18</sup> Bodie, Z. 1990. “Pensions as Retirement Income Insurance.” *Journal of Economic Literature*, 28(1), 28-49.

<sup>19</sup> McCarthy, D. 2003. “A Lifecycle Analysis of Defined Benefit Pension Plans, Working Paper No. 053.” University of Michigan, Michigan Retirement Research Center.

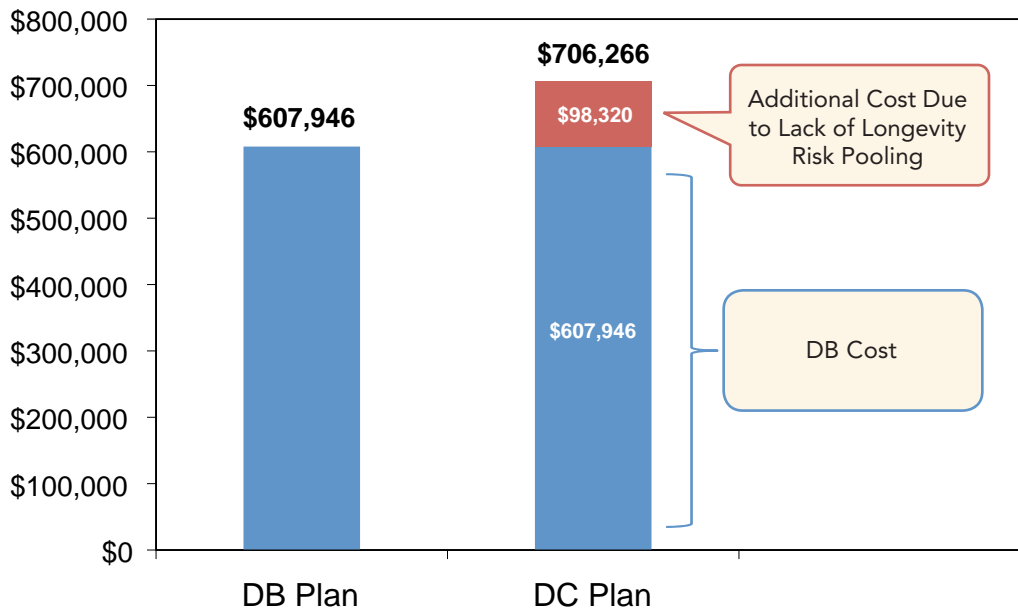


While some individual heirs will benefit from these intergenerational transfers of wealth, they are not economically efficient from a taxpayer or employer perspective. Because heirs did not provide services that the employer/taxpayer benefited from, providing additional benefits to heirs is economically inefficient. Moreover, these additional "death benefits" are not tied in any direct way to an individual employee's productivity during his working years, rather their value is a function of living a shorter life.

DB plans avoid this problem entirely. By pooling longevity risks, DB plans not only ensure that all participants in the plan will have enough money to last a lifetime, they can 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. The Teacher's DB plan needs to accumulate \$607,946 for each participant in the plan by the time she turns 62 in order to fund the target level of benefit. Due to the "over-saving" dilemma, DC plans must accumulate at least \$706,266 per participant, or \$98,320 more, in order to minimize the likelihood of running out of funds. (See chart below.) In order to accumulate those additional amounts to address just the longevity-pooling issue, DC contributions to the plan would climb by 2.1 percentage points to 15.7 percent of pay, from 13.6 percent under the DB plan.

***By pooling longevity risks, DB plans not only ensure that all participants in the plan will have enough money to last a lifetime, they can accomplish this goal with less money than would be required in a DC plan.***

**FIGURE 5: IMPACT OF LONGEVITY RISK POOLING**





## Maintenance of Portfolio Diversification

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.<sup>20</sup> Prior research substantiates DB plans' significant advantage in investment returns, as compared to DC plans.

Part of the reason why DB plans tend to achieve higher investment returns as compared to 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. In this analysis, we assume that the City's well-diversified DB plans will achieve investment returns of 8 percent per year, net of fees. (Had we assumed a lower or higher investment return, the results of the study – which focuses on the difference in costs between DB and DC – would not be significantly different.)

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***Part of the reason why DB plans tend to achieve higher investment returns as compared to 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.***

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The timing of markets does have a role in DB plans in the sense that government budgets are typically strong at just the time when equity returns are also strong, and there is less of a need for robust plan funding. This is one reason why disciplined plan governance is so important at all phases of the investment cycle for DBs.

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 for workers in their 20s are minor, compared to when they are on the eve of retirement. For this reason, individuals are advised to gradually shift away from higher risk/higher return assets as they approach retirement. While this shift offers insurance against the downside risk of a bear market, it also sacrifices expected return since more money will be held in cash or similar assets that offer low 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.

In a DC plan, individuals gradually shift out of higher risk/higher return assets in favor of lower risk/lower return assets. This results in a sacrifice of expected annual return of 2 percent by age 92, as shown in the chart below and discussed further in the Technical Appendix. The development of this gradual decrease in exposure to high risk investments is not based on any rigorous analysis of practice. Because 401(k) plans did not exist until the 1980's, DC plans are too new to have any firm data on individual retiree investment patterns. Those hired under DC plans in the 1980's are only now retiring. The science of post-retirement DC

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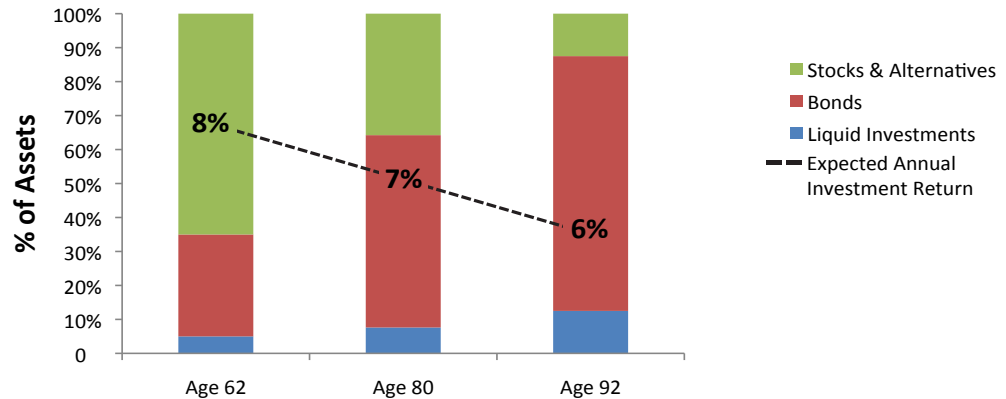
<sup>20</sup> Another factor is particularly important in the discussion of investment – the degree to which contributions and investment earnings remain in the plan until retirement. This is generally not an issue in DB plans, but is a concern in most DC plans, where employees can borrow from their retirement account or take money out before retirement age (with the attendant tax penalties). This problem of "leakage" from DC plans has been well-documented and is receiving more attention by researchers and policy-makers. (See Weller, C. and J. Wenger. 2008. "Robbing Tomorrow to Pay for Today: Economically Squeezed Families are Turning to their 401(k)s to Make Ends Meet." *CAP Economic Policy Report*. Washington, DC: Center for American Progress.)



asset allocation is still evolving.

But financial advisors have long recommended that individuals shift out of risky assets as they age. The New York City Deferred Compensation Plan, for example, offers “Pre-Arranged” portfolios where individuals can do exactly what is anticipated in this section. In those standard portfolios, a 20 percent equity exposure is recommended at age 85, while 60 percent is recommended at age 65. This is reasonably close to the allocations developed for the purposes of this report.

**FIGURE 6: RETURNS BASED ON AGE**



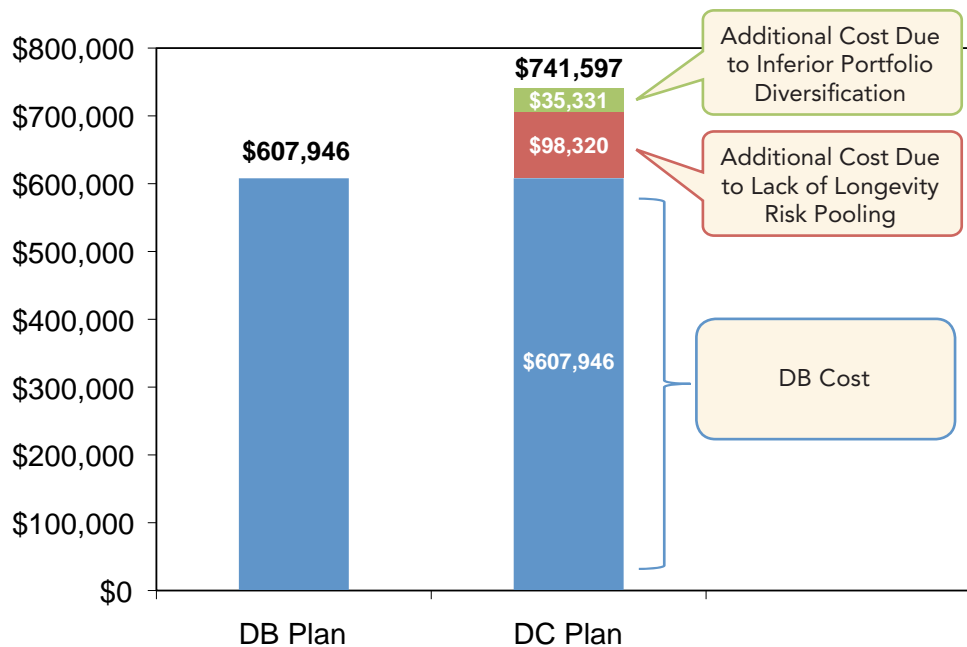
Another concern with respect to portfolio diversification and retirement is the precise timing of DC retirement in terms of the long range bull and bear equity market cycles. The time when an individual retires in the cycle can have an enormous impact in long-term value of the portfolio. It’s one thing for the equity market to decline when a retiree has only 20 percent exposure; it’s quite another for the market to decline immediately after retirement when one still has a substantial equity exposure.

We find that the shift in portfolio allocation has a modest, but nonetheless, significant effect on the cost of DC plans. Specifically, we find that the per- retiree amount that must be accumulated in the Teachers’ DC plan by retirement age now climbs to \$741,597, or \$35,331 more than the total of the DB Plan cost of \$607,946 and the \$98,320 additional DC cost attributed to lack of longevity risk pooling. The contributions to the Teachers’ DC plan required to fund the target benefit level now climb to 16.5 percent of payroll (compared to 13.6 percent of payroll under the DB plan).

***The shift in portfolio allocation has a modest, but nonetheless, significant effect on the cost of DC plans.***



**FIGURE 7: IMPACT OF LONGEVITY RISK POOLING AND PORTFOLIO DIVERSIFICATION**



While an employee in a DC plan cannot take advantage of portfolio diversification as they get closer to or enter into retirement, they are also less likely to have the same portfolio allocation skills that professional investment managers do. DC participants are more likely to buy-high and sell-low than are disciplined professionals. This asset allocation weakness of DC investors is not captured by the calculations above, but rather through the “Superior Returns” section that follows.

### Superior Returns

Two other important reasons why DB plans achieve higher investment returns than DC plans is that assets are pooled and professionally managed. 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 reduce these costs will require fewer contributions. By pooling assets, large DB plans are able to drive down asset management and other fees. For example, researchers at Boston College (Munnell and Soto) find that asset management fees average just 25 basis points for public sector DB plans.<sup>21</sup> By comparison, asset management fees for private sector 401(k) plans range from 60 to 170 basis points.<sup>22</sup> Thus, private DC plans suffer from a 35 to 145 basis point

**By pooling assets, large DB plans are able to drive down asset management and other fees.**

<sup>21</sup> One basis point is equal to 0.01%. Thus 25 basis points is equal to one-quarter of one percent, or 0.25%.

<sup>22</sup> Munnell, A.H. and M. Soto. 2007. “State and Local Pension Plans are Different from Private Plans.” Center for Retirement Research. *State and Local Pensions*, No. 1. Boston College.



cost disadvantage, as compared with public DB plans.<sup>23</sup> 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 fees compounds to a 24 percent reduction in the value of assets available to pay for retirement benefits.<sup>24</sup>

Administrative costs are largely driven by scale. Thus, similarly-sized DB and DC plans can have opportunities to negotiate minimized administrative expenses. But a DC plan involves costs that do not exist in a DB plan, such as the expenses of individual recordkeeping, individual transactions, and investment education to help employees make good decisions. 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. Research has found that DB plans have broadly diversified portfolios and managers who follow a long-term investment strategy.<sup>25</sup> These professional managers follow superior, more disciplined asset allocation strategies than typical individuals. Lay investors, despite their best efforts, often fall short when it comes to making good investment decisions. Thus, it should not be surprising that researchers find a large and persistent gap when comparing investment returns in DB and DC plans. Munnell and Sunden put the difference in annual return at 80 basis points.<sup>26</sup> A 2006 report from the global benchmarking firm, CEM Benchmarking, Inc., concluded that between 1998 and 2005, DB plans showed annual returns 180 basis points higher than DC plans, largely due to differences in asset mix.<sup>27</sup> And Towers Watson found that, between 1995 and 2008, DB plans outperformed DC plans by 103 basis points, on average. Among large plans, the DB advantage was even greater – at 127 basis points.<sup>28</sup>

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**Researchers find a large and persistent gap when comparing investment returns in DB and DC plans.**

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23 This large fee gap may be attributable to several factors. One is plan size. Since most public pension plans tend to be very large compared to many private sector DC plans, their lower fees may be attributable to scale economies. Another factor may be differences in asset mix, which analysts find to be a key driver of asset management fees. However, here the direction of the effect is not entirely predictable. Although DB plans invest in less expensive index funds more often than DC plans, they also are more likely to invest in assets that involve higher expenses (but also higher returns), such as real estate, private equity, or hedge funds. (Flynn, C. 2008. Author's correspondence.)

24 Weller, C. and S. Jenkins. 2007. "Building 401(k) Wealth One Percent at a Time: Fees Chip Away at People's Retirement Nest Eggs." *CAP Economic Policy Report*. Washington, DC: Center for American Progress.

25 Weller, C.E. and J.B. Wenger. 2009. "Prudent Investors: The Asset Allocation of Public Pension Plans." *Journal of Pension Economics and Finance*. Cambridge University Press, Vol. 8(04), pp. 501-525. October.

26 Munnell, A.H. and A. Sunden, Op. Cit. 2004.

27 Flynn, C. and H. Lum. 2006. "DC Plans Underperformed DB Funds." Toronto, ON: CEM Benchmarking, Inc.

28 Towers Watson. 2011. "DB vs. DC Plan Investment Returns: The 2008-2009 Update." *Insider*, 21(4).



### DB and DC Plans: Costs and Expected Returns

In this study's model, we use conservative estimates of the differences in DB and DC plan costs and expected returns. We model a 100 basis point (1 percent) net disadvantage for the DC plan annual investment returns as compared with DB plan returns. While this is slightly higher than the estimate of Munnell and Sunden,<sup>29</sup> it is lower than the more recent estimates of Flynn and Lum from CEM Benchmarking,<sup>30</sup> and Towers Watson.<sup>31</sup> This 100 basis point differential persists into the retirement years and magnifies the effects of the shift in asset allocation discussed previously. However, our model separates these effects to avoid double-counting. We do not isolate the impact of expenses and fees from the impact of superior investment management skill. The Towers Watson study estimated 10 basis points as the impact of DC administrative fees which reduce DC returns. But these DC administrative fees are real costs which are unique to DC plans, so we did not increase the DC returns by 10 basis points. Even if we did, however, as can be seen from Table 4, we would still exceed the 100 basis point assumption.

We have analyzed the rates of return earned by the New York City Retirement Systems between 1995 and 2008 to compare them with the returns analyzed in these two widely published reports.

The two studies use different groups of pension plans for their comparisons and they compared investment performance over different periods. The Towers Watson (TW) study used data from the Department of Labor filings for 97 of the 100 largest publicly-traded U.S. pension sponsors with year-end 2009 fiscal periods. These 97 companies provide both DB and DC plans that were large plans similar to the NYC pensions. The most recent TW study covered the time period from 1995 through 2008. The CEM study, which was done in 2006, covered a wider span of pension and retirement savings plans. It drew from the CEM database that included 1,323 DB plans and 616 DC plans. The study covered the eight-year period between 1998 and 2005. Both studies demonstrated a significant investment advantage for the professionally managed DB plans. The TW study showed an advantage for the DB plans of 127 basis points, and the CEM study showed a greater advantage for the DB plans of 180 basis points.

Given the performance data supplied for the NYC plans on a calendar-year basis, we compared the NYC results to those found in the two studies:

- During 1995-2008, the TW report has average DB returns of 7.37 percent for the largest plans, and 6.10 percent investment return in the DC plans. Over that same period, the NYC pension plans' average return was 8.32 percent. Adjusting the return by 0.20 percent to account for fees lowers the NYC plans' return to 8.12 percent. This return exceeds the DB return for the Towers Watson DB data, as well as exceeding the TW DC plans by 2.02 percent.

<sup>29</sup> Munnell, A.H. and A. Sunden, Op. Cit. 2004.

<sup>30</sup> Flynn, C. and H. Lum, Op. Cit. 2006.

<sup>31</sup> Towers Watson, Op. Cit. 2011.



- For CEM's study of the period 1998-2005, the DB average investment return was 7.5 percent and the corresponding DC return was 5.7 percent. During that same eight-year period the investment return for the NYC pensions was 7.13 percent on a gross basis, which is 6.93 percent after fees. While the investment return for the NYC plan fell below the average return for the DB plans in the CEM database, the NYC investment results still exceed the return for the DC plans in that study by 1.23 percent.

**TABLE 4: COMPARING NEW YORK CITY PLANS' GROSS RETURNS**

PERIOD	1995 - 2008	1998 - 2005
New York City Plans' Average Gross Returns	8.32%	7.13%
New York City Plans' Average Returns Net of Fees	8.12%	6.93%
Towers Watson Average Returns – Large DB	7.37%	6.38%
Towers Watson Average Returns – Large DC	6.10%	5.49%
CEM Benchmarking Average Returns – DB	Not Available	7.50%
CEM Benchmarking Average Returns – DC	Not Available	5.70%
Towers Watson Excess Return – DB over DC	1.27%	0.89%
CEM Benchmarking Excess Return – DB over DC	Not Available	1.80%
<b>New York City Plans' Excess Return over Towers Watson DC</b>	2.02%	1.44%
<b>New York City Plans' Excess Return over CEM Benchmarking DC</b>	Not Available	1.23%

Sources: Individual NYC Pensions System CAFRs, Towers Watson, CEM

In light of the superior returns of the NYC plan over the DB and DC plans in the TW study and the fact that the actual NYC investment performance during the CEM study period, while lower than the CEM DB level, is still more than 100 basis points better than the DC plans in that analysis, we believe using the 100 basis points assumption for the added investment return from a DB plan appears well within a conservative framework.

### DB vs. DC: DB Plans Achieve Superior Returns

As discussed above, this analysis simply incorporated a conservative 1 percent to reflect the superior returns from professionally managed DB plans over individually managed DC plans. To recap, the superior returns would be due to the following factors:

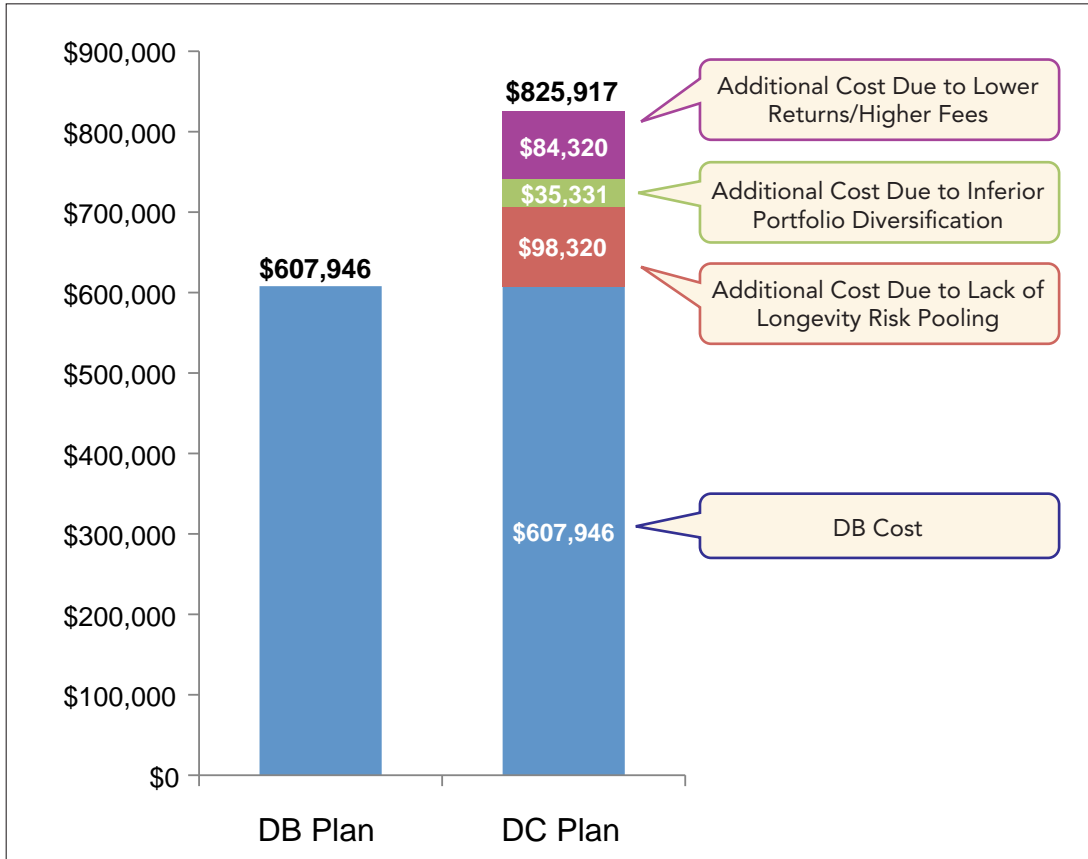
- DB plans do not have the administrative costs inherently related to DC including:
  - o individual account balance recordkeeping
  - o transaction costs for individual investment decisions
  - o individual investor education costs
- DB plans tend to have lower investment management costs due to pooling and stability

**A 1 percent per year disadvantage in DC plan investment returns compounds over time to create a significant cost disadvantage.**



- Professional investors tend to outperform average non-professional investors, due to:
  - More disciplined asset allocation process, avoiding buy-high sell-low phenomenon
  - More disciplined process in choosing active managers
  - Access to and knowledge of alternative investments

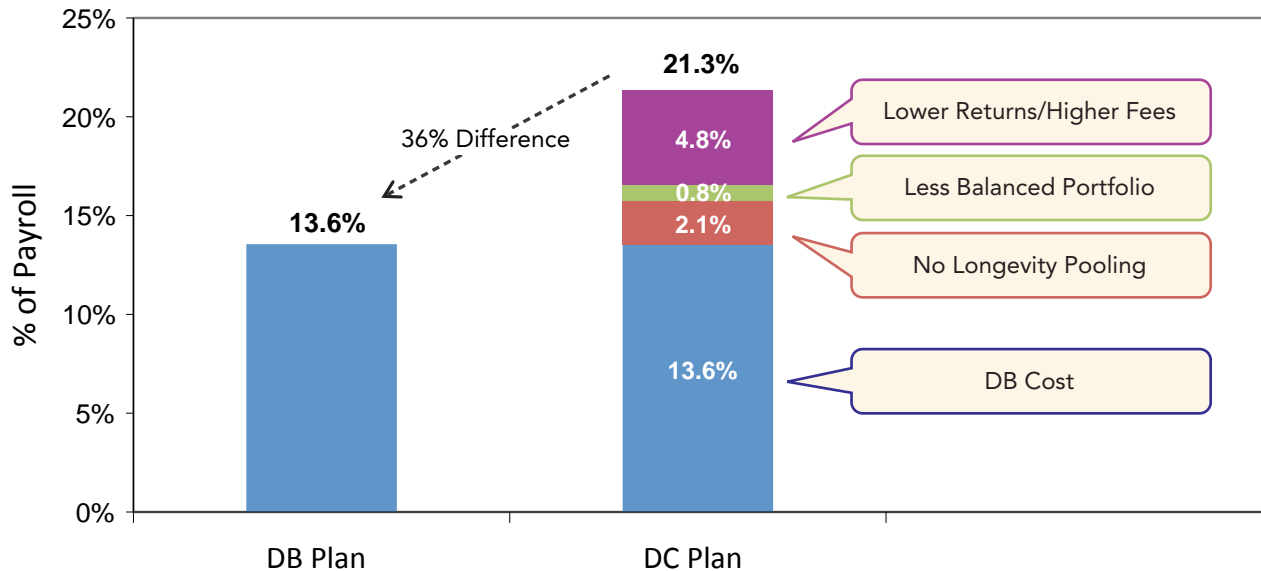
**FIGURE 8: IMPACT OF LONGEVITY POOLING, PORTFOLIO DIVERSIFICATION AND SUPERIOR RETURNS**



We find that a 1 percent per year disadvantage in DC plan investment returns compounds over time to create a significant cost disadvantage. In particular, we find that the amount which must be set aside for each teacher at retirement age now climbs to \$825,917 adding an additional \$84,320 to the previously calculated amount.

The cost to fund the target retirement benefit for the teacher under the Teachers’ Retirement System DB plan comes to 13.6 percent of payroll each year. By comparison, we find that the cost to provide the same target retirement benefit under the DC plan is 21.3 percent of payroll each year. In other words, the DB plan can provide the same benefit to the teacher at a cost that is 36 percent lower than the DC plan, as shown in the chart on the following page.

**FIGURE 9: COST OF DB AND DC PLAN AS A PERCENT OF PAYROLL**



**SUMMARY OF RESULTS – DB PLANS REDUCE COSTS**

The costs of the DB or DC plan are shown below as percentages of annual payroll.

**TABLE 5: DB VS. DC COSTS AS A PERCENT OF PAYROLL**

Worker	DB Cost	DC Cost	Difference
Teacher	13.6%	21.3%	36%
Case Worker	13.0%	21.1%	38%
Sanitation Worker	16.2%	26.1%	38%
Police Officer	21.8%	34.7%	37%
Fire Fighter	21.4%	33.8%	37%

As shown in Table 5, in our model, required contributions range from being 36 percent to 38 percent lower in the five DB plans as compared to the DC plans. Another way to think about this is switching from DB to DC would increase costs by 57 percent to 61 percent to provide the same level of benefits.

Taken together, the economies that stem from longevity risk pooling, maintenance of portfolio diversification, and investment pooling can result in significant cost savings to employees and employers (and in the case of the public sector, taxpayers) that participate in DB plans. The table below shows the breakdown of the incremental cost increases necessary for DC plans to provide the same level of benefits provided by DB plans for the five categories of retirees.





**TABLE 6: TOTAL AMOUNTS REQUIRED AT RETIREMENT**

		For DB Plan	Additional Required for DC			For DC Plan
			Longevity Pooling Impact	Portfolio Diversification Impact	Superior Return Impact*	
Teacher (Age 62)	Accumulation at Retirement	\$607,946	+\$98,320	+\$35,331	+\$84,320	\$825,917
	% of Payroll	13.6%	+2.1%	+0.8%	+4.8%	21.3%
Case Worker (Age 61)	Accumulation at Retirement	\$391,031	+\$83,595	+\$23,423	+\$56,421	\$554,471
	% of Payroll	13.0%	+2.8%	+0.8%	+4.5%	21.1%
Sanitation Worker (Age 53)	Accumulation at Retirement	\$496,365	+\$104,969	+\$33,331	+\$75,941	\$710,606
	% of Payroll	16.2%	+3.4%	+1.1%	+5.4%	26.1%
Police Officer (Age 51)	Accumulation at Retirement	\$769,299	+\$122,083	+\$59,828	+123,633	\$1,074,843
	% of Payroll	21.8%	+3.4%	+1.7%	+7.8%	34.7%
Fire Fighter (Age 52)	Accumulation at Retirement	\$779,526	+\$117,356	+\$58,668	+\$122,429	\$1,077,979
	% of Payroll	21.4%	+3.2%	+1.6%	+7.6%	33.8%

Our analysis clearly demonstrates that DB plans are far more cost-effective than DC plans. We find that to achieve roughly the same target retirement benefit that will replace 50 percent to 56 percent of average salary, the City’s DB plans will require contributions ranging from 13.0 percent to 21.8 percent of payroll, whereas the corresponding DC plan will require contributions that are more than 50 percent higher, ranging from 21.1 percent to 34.7 percent of payroll. We find this increased DC cost is due to the effects of longevity risk pooling, maintenance of portfolio diversification, and greater investment returns over the lifecycle.

\**Accumulation at Retirement* and *Percent of Payroll* in the *Superior Return Impact* column do not have the same relationship to each other as they do in the other columns in this table. The *Superior Return Impact* column displays the impact of the one percent lower investment returns earned for the life of the DC Plan (i.e., from the day of the first contribution into the DC Plan to the day when the final benefit gets paid) due to expenses, lack of pooling, and professional management. The *Percent of Payroll* shown in this column does exactly that. However the dollar figures in the *Accumulation at Retirement* row of this column represent only the additional dollars required for the DC Plan to compensate for the one percent lower investment return earned after retirement (i.e., from the day of retirement to the date of last payment). This is because, given a stream of benefit payments, the required *Accumulation at Retirement* is based solely on what is expected to be earned after retirement.



**TABLE 7: TALLYING DB PLAN COST SAVINGS**

	1. Longevity risk pooling saves	2. Maintenance of portfolio diversification saves	3. Superior investment returns save	All-in costs savings in DB plans over equivalent DC plans:
Teacher	10%	4%	22%	36%
Case Worker	13%	4%	21%	38%
Sanitation Worker	13%	4%	21%	38%
Police Officer	10%	5%	22%	37%
Fire Fighter	10%	5%	22%	37%

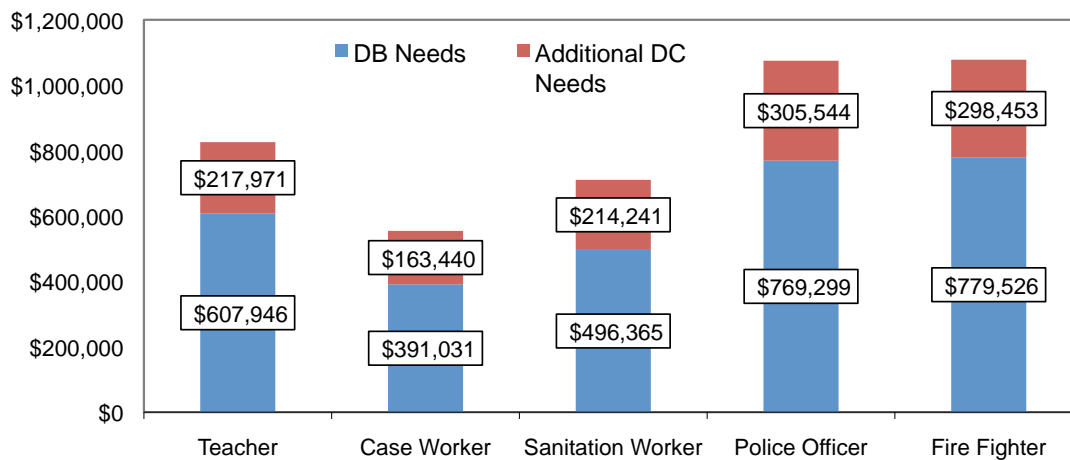
As shown in the table above, the longevity risk pooling that occurs in the five DB plans accounts for 10 percent to 13 percent of the incremental cost savings. The DB plans' ability to maintain a more diversified portfolio drives another 4 percent to 5 percent cost savings, and superior investment returns across the lifecycle generate an additional 21 percent to 22 percent reduction in cost.

Our results also indicate that DB plans can do more with less. That is, they can ensure that all individuals in the plan (even those with very long lives) are able to enjoy their pre-determined retirement benefit for their entire lifetime and, at the same time, require fewer assets to be contributed to a retirement plan and fewer assets to accumulate in the plan. For example, we calculated the amount of money that would be required to be set aside for each retired fire fighter to provide a retirement benefit of \$3,706 per month. As shown in Figure 10, at retirement age, the police and fire fighter DB plans require about \$750,000 to accumulate for each individual, whereas the DC plan requires more than \$1,070,000. The difference – about \$300,000 for each and every police officer and fire fighter – illustrates that the efficiencies embedded in DB plans can yield large dollar savings for taxpayers, private employers, and employees.<sup>32</sup> The DB and DC costs are also compared in Figure 10 for each of the five employees studied.

<sup>32</sup> There is an additional consideration for taxpayers we do not explore. DC plans involve a significant amount of lost revenue to federal and state treasuries, because taxes on contributions and investment earnings are deferred. To illustrate, the exclusion of DB and DC plan contributions and income from Federal tax involved a loss of \$108.6 billion in revenue in 2007. By comparison, the mortgage interest tax deduction cost \$73.7 billion. (See Joint Committee on Taxation. 2007. *Estimates of Federal Tax Expenditures for Fiscal Years 2007- 2011*. Washington, DC: US GPO. September 24.) Since our analysis demonstrates that DC plans require more assets to be accumulated to deliver the same amount of retirement benefits, it is likely that the implicit tax subsidy to deliver \$1 in retirement benefits through a DC plan exceeds that provided to deliver \$1 in benefits through a DB plan. Valuing this impact is beyond the scope of this report, however, and analysis of this issue must be left for future research.



**FIGURE 10: PER EMPLOYEE AMOUNT REQUIRED AT RETIREMENT  
DB PLAN VS. DC PLAN**



So what are the implications of these cost efficiencies? They grant employers a tool to provide attractive compensation packages in order to recruit and retain high-quality and loyal employees. For example, New York City may have the ability to employ municipal workers at lower wages, because the combination of a DB plan – which is a form of deferred wages – makes the City’s compensation package more appealing. However, DB plans do require the City to make up for losses that occur in times of lower investment returns. Under a DC arrangement, the employer has no further risk once contributions are made; retirees will simply have less to live on if the returns don’t meet expectations, absent later involvement through public assistance or other support.

## CONCLUSION

Our findings indicate that DB plans offer a better bang for the buck when it comes to providing retirement income. We find that a DB plan can provide the same level of retirement income at more than one-third less cost than a DC plan. Volatility in the investment markets can lead to shortfalls in DB plan income, requiring increases in sponsor contributions. Many consider this to be the greatest drawback of DB plans. However, the ability of DB plans to absorb this volatility over time, along with the economic efficiencies inherent in DB plans that are described in this report, leads us to conclude that DB plans deserve to remain a centerpiece of retirement income policy and practice. While reducing employee benefits or increasing employee contributions would obviously reduce pension costs, shifting from defined benefit to defined contribution would not generate taxpayer savings.

We find that the biggest driver of the cost advantages in DB plans is the enhanced investment returns that derive from reduced expenses and professional management of assets. The next important factor is the advantages that DB plans have in terms of longevity pooling. The sacrifice of investment returns that results from life-cycle driven shifts in portfolio allocation in DC plans had a smaller, but still significant, effect. 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: these features drive significant cost savings that benefit taxpayers, employees, and private employers.

When considering our results, it is important to keep in mind our effort to construct an “apples to apples” comparison. We made a number of simplifying assumptions that actually reflected more favorably on DC plans. For instance, we did not model any asset leakage from the DC plan before retirement, through loans or early withdrawals, nor any terminations of employment under either plan. We also assumed that individuals followed a sensible “Goldilocks-like” withdrawal pattern in retirement – not too fast, not too slow, but just right. We used conservative estimates of the difference in actual investment returns between DB and DC plans. And, we used a 90th percentile life expectancy to project required accumulations in the DC plan, rather than “full” life expectancies. Thus, if anything, our analysis likely underestimates the cost of providing benefits in a DC plan and thereby understates the cost advantages of DB plans.

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***A DB plan can provide the same level of retirement income at more than one-third less cost than a DC plan.***

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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.” Here, benefit generosity should not be confused with the economic efficiency of a retirement plan. While either type of plan can offer more or less generous benefits, this study shows that DB plans have a clear cost advantage at any given level of benefit. Bearing in mind the magnitude of the DB cost advantage, the consequences of a decision to switch to a DC plan should be carefully considered in advance to avoid unintended impacts on employees, employers, and taxpayers.

Finally, 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. They should also recognize that DB plans – which are highly attractive to employees because they provide predictable, lifetime, monthly retirement benefits – also provide significant efficiencies for employers and taxpayers over other retirement vehicles. In this way, DB plans represent a rare “win-win” approach to providing economic security in retirement in the most cost-effective manner.



## TECHNICAL APPENDIX





William B. Fornia, FSA | President

October 5, 2011

Mr. John C. Liu  
New York City Comptroller  
One Centre Street  
New York, NY 10007

Subject: Analysis of Defined Benefit Plan Efficiency

Dear Comptroller Liu:

The New York City Office of the Comptroller, together with the National Institute on Retirement Security (NIRS), desires to compare five of the City's defined benefit (DB) pension plans to 401(k)-type defined contribution (DC) retirement savings plans. A research paper in 2008 titled "A Better Bang for the Buck" was authored by Beth Almeida and William B. Fornia for NIRS in which the costs and benefits of a typical DB plan were compared to the costs and benefits of a typical DC plan, based on a hypothetical group of employees.

The Office of the Comptroller and NIRS have asked William B. Fornia and Pension Trustee Advisors, Inc. (PTA) to conduct similar research for New York City using pension formulas and employee profiles to estimate how much it would cost to provide DC plans with benefits that are equivalent to the those provided by the following five current New York City DB pension plans:

1. The "Teachers' 55/27" plan applicable to teachers under the Teachers' Retirement System.
2. The "57/5" plan applicable to civilian workers under the New York City Employees' Retirement System (NYCERS) and the Board of Education Retirement System. Our hypothetical NYCERS employee is a female Child Protective Case Worker.
3. The "Sanitation 20 Year (SA20)" plan applicable to Sanitation workers under the NYCERS.
4. The "Police Tier 3" plan applicable to police officers.
5. The "Fire Tier 3" plan applicable to fire fighters.

The attached report is based on the methodology and approach of "A Better Bang for the Buck," but applying data relevant to the plans named above. In the analysis that follows, we found it cost from 36% to 38% less to provide the same level of retirement benefits through the five New York City defined benefit pension plans than through a DC plan.

The work was conducted by Pension Trustee Advisors under my direction. I am a Member of the American Academy of Actuaries and meet the Qualification Requirements to make such an analysis.

Sincerely,

William B. Fornia, FSA

Cc: Diane Oakley - NIRS

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## Calculating the Cost Savings Embedded in DB Plans

We calculate the cost, expressed as a level percent of payroll over a career, of achieving a target service retirement benefit for five typical New York City government employee Defined Benefit (DB) plans and compare that with the cost of providing the same target benefit in corresponding typical Defined Contribution (DC) plans. The five typical employees, and the pension funds and plans to which they belong, are as follows:

- Teacher (New York City Teachers’ Retirement System—Teachers’ 55/27 Plan);
- Child Protective Case Worker (to represent Civilian Workers in the New York City Employees’ Retirement System and the Board of Education Retirement System—57/5 Plan);
- Sanitation Worker (New York City Employees’ Retirement System—Tier 4 SA20 Plan);
- Police Officer (New York City Police Pension Fund—Tier 3 Plan); and
- Fire Fighter (New York City Fire Pension Fund—Tier 3 Plan).

This study analyzes the total cost of each plan, without addressing who pays, i.e., how the costs are shared between employer and employee. For explanatory purposes, we will primarily reference the Teacher group to illustrate the study methodology discussed herein.

We begin by constructing a cohort of 1,000 newly-hired employees. For the purposes of simplicity, we give this cohort a common set of features and assume that they all retire for service after working for the specified number of years. These common features are based on average data from the five New York City pension funds, as shown in the following table:

	Teacher	Case Worker	Sanitation Worker	Police Officer	Fire Fighter
Age at Hire	34	36	30	26	27
Age at Retirement	62	61	53	51	52
Years of Service	28	25	23	25	25
Salary at Retirement	\$101,000	\$75,000	\$88,000	\$91,000	\$93,000
Averaging Period	3 years	3 years	3 & 5 years*	3 years	3 years
Final Average Salary	\$96,267	\$71,817	\$83,876 / \$80,008	\$87,030	\$88,943
Basic Pension Multiplier	2.00%	2.00%	2.5%/1.5%*	2.00%	2.00%
Annual Pension at Retirement	\$53,910	\$35,909	\$45,538	\$43,515	\$44,472
Monthly Pension	\$4,493	\$2,992	\$3,795	\$3,626	\$3,706
Cost of Living Adjustment	\$234	\$234	\$234	2.5%	2.5%
Social Security Offset	None	None	None	\$18,518	\$18,820
**Variable Supplements Fund	None	None	None	\$12,000	\$12,000

\* Sanitation Worker benefit is 2.5% of 3-year average pay for the first 20 years, plus 1.5% of the 5-year average pay beyond 20 years.

\*\* These Variable Supplements Fund Benefits are paid from certain Variable Supplements Funds and are not considered pension benefits. They are described in this Appendix in the section “Why the Police and Fire DB Benefits are Different.”



For example, all newly hired teachers are age 34 on the starting date of their employment and they are all female. They continue working until age 62 and then retire for service. Thus, the length of the career is 28 years. By their final year of work, their salary has reached \$101,000, having grown by a varying percentage each year based on actuarial assumptions currently used by the New York City Office of the Actuary (NYCOA).

### Modeling DB Plan Benefits and Costs

The Teachers would be eligible to receive a service retirement benefit equal to 2.00 percent of final average salary for each year worked. Final average salary is calculated on the basis of the final three years of one's career, which in this case is \$96,267. Thus, the initial benefit in the DB plan is \$53,910 per year, or \$4,492 per month.

The Teachers' DB plan provides a cost of living allowance (COLA) to help the benefit maintain its purchasing power during retirement somewhat. Inflation is projected at 2.5 percent per year. The Teachers' Retirement System provides a COLA based on one-half the rate of inflation. The increase is limited to 3 percent and further limited to a base benefit of \$18,000. The increase starts after 5 years of retirement if the retiree is at least 62 years of age. The half inflation rate is rounded up to the nearest 0.1 percent. In this example, the COLA is 1.3 percent of \$18,000, or \$234 per year. Thus, each individual retired teacher in our cohort will receive a benefit equal to 56 percent of her final year's salary that adjusts by \$234 each year to help with inflation somewhat, beginning at age 67. This DB plan, in combination with Social Security (which is not addressed in this study), would help an employee to meet the generally accepted standard for retirement income adequacy: roughly 80 percent of pre-retirement income.

(Benefits for Police and Fire are a bit more complicated and hence their payment patterns in the initial years are different. This is explained later in this Appendix under "Why the Police and Fire DB Benefits are Different.")

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 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, we model all benefit payouts on a single-life basis (and do the same for the DC plan), using the various mortality tables currently used by the NYCOA.

In order to model the contributions that are required to fund these benefits, we start by establishing expected investment returns. The DB plan is expected to achieve nominal investment returns of 8.0 percent per year, net of fees. This rate is consistent with the rate used in the national 2008 "Better Bang for the Buck" report.<sup>1</sup> In that report, we calculated a weighted average return, based on assumptions about asset allocation and returns for each asset class.

That DB plan followed a typical asset allocation of 2 percent in cash/liquid assets, 15 percent in treasuries/

<sup>1</sup> Almeida, B., and W. Forna. 2008. "A Better Bang for the Buck: The Economic Efficiency of Defined Benefit Pension Plans." Washington, DC: National Institute on Retirement Security.





agency debt, 13 percent in corporate bonds, and 70 percent in equities and alternative assets. Our expected investment return for each asset class is based on the projections prepared by the Office of the Actuary of the Social Security Administration to support analysis of the impact of private accounts by the President’s Commission to Strengthen Social Security. The Commission’s report described these assumptions as “conservative,” noting that these assumptions are “much lower than that used in many academic and policy studies.”<sup>2</sup> We expect cash/liquid investments to earn a nominal 2.8 percent per year, treasuries and agency debt to earn 5.8 percent, corporate bonds to earn 6.3 percent, and stocks and alternatives to earn 9.3 percent. Asset management fees of 0.25 percent are deducted from these returns, reflecting the average for DB plans in the public sector.

Asset Type	% of Assets	Expected Annual Investment Return
Cash/Liquid Investments	2%	2.8%
Treasuries and Agency Debt	15%	5.8%
Corporate Bonds	13%	6.3%
Stocks and Alternatives	70%	9.3%
	Less Asset Management Fees	-0.25%
	<b>Overall Portfolio</b>	<b>8.0%</b>

Sources: Social Security Administration, Office of the Actuary; National Institute on Retirement Security

On the basis of these inputs, we calculate 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. We find that the cost to fund the various target retirement benefits, smoothed over a career, range from 13.0 percent of payroll for the NYCERS Case Worker to 21.8 percent of payroll for the Police Officer. Mathematically, the contributions could be made entirely by the employer, or, in the public sector, they may be split between the employer and employee. In the five retirement systems considered in this study, both the employers and the employees contribute.

### Comparing DB Costs in this Study with Actuarially Determined Entry Age Normal Rates

It is important to note that the DB costs developed in this study cannot be compared to the Entry Age Normal Rates calculated by the NYCOA for the same plans. The methodologies for determining costs employed in this paper and the NYCOA’s actuarial analysis are completely different. The NYCOA considers a wide assortment of factors including all plan provisions, an array of actuarial assumptions for employee turnover, disability, retirement age and mortality, employee contributions and refund provisions thereof, and uses the Entry Age Normal Actuarial Valuation Method. The approach used in this study considers a single average employee profile for each plan with no pre-service-retirement withdrawal, retirement at the specified age, and much more simplified actuarial assumptions.

<sup>2</sup> President’s Commission to Strengthen Social Security. 2001. “Strengthening Social Security and Creating Personal Wealth for All Americans, Report of the President’s Commission.” Washington DC.



## Modeling DC Plan Benefits and Costs

Modeling the cost of the target retirement benefit in the DC plan requires some adjustments based on what we know about how DC plans differ from DB plans.

First, because employees are not provided with an annuity benefit at retirement under the DC plan, we determine the size of the lump sum amount that a female teacher would need to accumulate by her retirement date in order to fund a retirement benefit equivalent to that provided by the DB plan (including inflation adjustments) for a period of 36 years, or to age 98. This represents our definition of the “maximum life expectancy” for the teacher for the purposes of this study. It corresponds to the age beyond which only 10 percent of the teacher group is expected to survive, and therefore is not a “true” measure of maximum life expectancy. In fact, our mortality table indicates that one individual teacher out of 1,000 will survive to 107. This simplifying assumption is intended to be more realistic (that most individuals will be satisfied with a 90 percent chance of not outliving their money, rather than a 100 percent chance). Using a 90th percentile life expectancy of 98, rather than the true maximum life expectancy will reduce the cost of providing the target benefit under the DC plan, but will also mean that individuals with exceptionally long lives will experience a reduced standard of living, compared to what they would experience under a DB plan.

Below is a table of life expectancies for five sample workers, based on the actuarial mortality tables currently used by the NYCOA:

	Teacher	Case Worker	Sanitation Worker	Police Officer	Fire Fighter
Gender	Female	Female	Male	Male	Male
Age at Retirement	62	61	53	51	52
Average Life Expectancy	88	85	79	82	82
90% Maximum Life Expectancy	98	96	92	94	94

To model the impact of the shift to a more conservative portfolio allocation, starting at retirement age, we have individuals begin to shift their portfolio allocation to gradually reduce the share held in equities and increase the holdings of cash and liquid investments, treasuries and agency debt, and corporate bonds. At retirement, the portfolio holds 65 percent of assets in equities; by age 72 it holds 49 percent; by age 82, it holds 33 percent; by age 92, it holds 16 percent; and so on. This drives the expected return on the baseline portfolio down from 8 percent per year to 6 percent per year in nominal terms.

The investment/withdrawal strategy we model is not the result of an optimization rule, rather it follows ad hoc rules. The investment strategy is modeled as a “glide path,” along which the retiree gradually reduces her exposure to equities. Withdrawals are designed to mimic DB plan payouts, at least in the early years of retirement, declining in later years. Work by William Sharpe and colleagues suggests that an optimal approach would integrate investment and withdrawal strategies. Specifically, they find that a constant withdrawal rate must be paired with a riskless investment strategy in order to be optimal for an individual.<sup>3</sup> However, a post-

<sup>3</sup> Sharpe, W.F., J.S. Scott, and J.G. Watson. 2007. “Efficient Retirement Financial Strategies.” *Pension Research Council Working Paper* PRC WP2007-19. Philadelphia, PA: The Wharton School, University of Pennsylvania.



retirement asset allocation entirely concentrated in risk-free assets would dramatically drive up the cost of the DC plan. Thus, our model's ad hoc investment and withdrawal strategies would tend to understate the cost advantages of DB plans. We also use a conservative and simplifying assumption that individuals do not begin to shift investments until retirement age. Most advisors encourage savers to begin to shift to more conservative investments many years prior to retirement. For example, "target date funds" typically begin to shift to more conservative investing every five or ten years.

We use conservative estimates of the differences in DB and DC plan costs and expected returns. We assume that a large, sophisticated employer will seek to use whatever economies of scale are available to negotiate fees down on both types of plans. To capture the effect of lower DC plan returns over a lifetime, due to fee differentials and superior investment decisions, we model a 100 basis point disadvantage in net return as compared with DB plan returns. While this is slightly higher than the estimates of Munnell and Sunden,<sup>4</sup> it is lower than the more recent estimates of Flynn and Lum<sup>5</sup> and Towers Watson.<sup>6</sup> Thus, we assume individuals achieve a 7 percent nominal rate of return during their working years. This 100 basis point differential persists into the retirement years. So the return disadvantage compounds on top of the shift in portfolio allocation. (We calculate the impact of each effect separately to avoid double counting.) As a result, the expected return on the portfolio gradually declines from 7 percent per year to 5 percent in nominal terms.

On the basis of these inputs, we calculate the contribution that will be required to fund this benefit through the DC plan over the course of a career, and express this as a level percent of payroll. We find that the cost to fund the target retirement benefit through DC plans, smoothed over a career, range from 21.1 percent for the Case Worker and 21.3 percent of payroll for the Teacher to 34.7 percent of payroll for a Police Officer.

### Why the Police and Fire DB Benefits are Different

Benefits for Police and Fire are a bit more complicated than the other three plans. First, their COLA is different from the others and is termed as "Escalation." Escalation is assumed to be 2.5 percent in this study and is calculated on the entire retirement benefit. Second, Police and Fire Tier 3 plans have what is known as a "Social Security Offset." Under this provision, benefits decrease by one-half of the Social Security Primary Insurance Amount upon reaching age 62. For the Police Officer, this decrease amounts to \$1,131 and results in a monthly benefit of \$3,626.97, and for the Fire Fighter, the monthly retirement benefit is reduced by \$1,117 to \$3,627 at age 62.

Third, while they are not considered pension benefits, uniformed Police and Fire members also have the Variable Supplements Fund (VSF) benefits, which provide an additional annual \$12,000 to each service retiree from certain Variable Supplements Funds. This benefit has been included in this study. The VSF benefit begins accruing to active Police and Fire members when they complete 20 years of active service. The accrued amount is paid to the member at retirement in a lump sum, if the member retires for service. Thus, the Police and Fire groups in this study receive a \$60,000 lump sum at retirement, and then continue to receive \$12,000 per year from their VSFs in addition to their regular service retirement benefits.

<sup>4</sup> Munnell, A.H. and A. Sunden, Op. Cit. 2004.

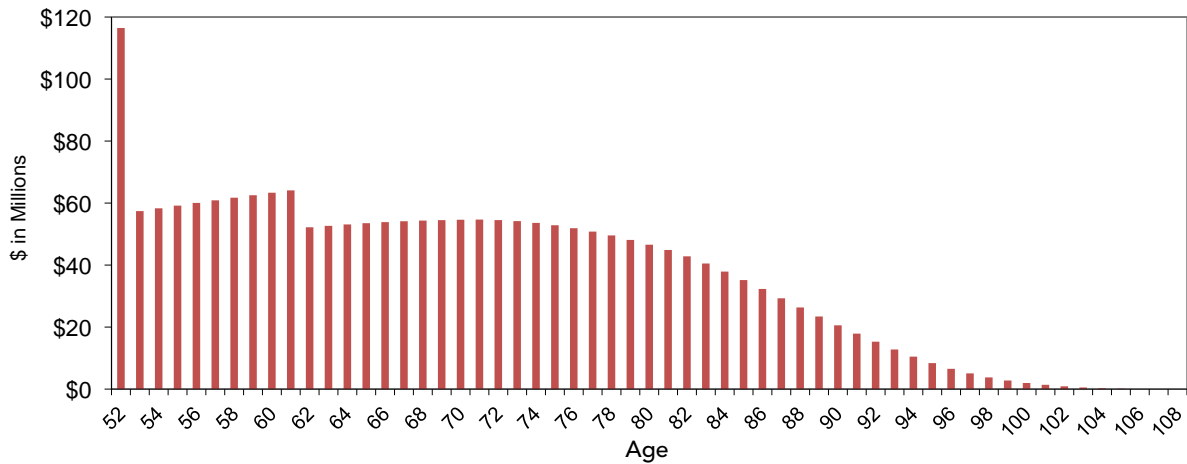
<sup>5</sup> Flynn, C. and H. Lum, Op. Cit. 2006.

<sup>6</sup> Towers Watson, Op. Cit. 2011.



Due to their different COLA (i.e., Escalation), Social Security Offset and the VSF benefits, the pattern of total annual payments for our hypothetical groups of Police Officers and Fire Fighters differs somewhat in the early years from the Teachers' example seen in Figure 2 of the report. Total annual payments from the Police and Fire DB plans will have a unique hump-shaped pattern as seen in the figure below, which depicts the expected payments to the Fire Fighters' group. The amount of benefits paid out is substantial in the year of retirement, as the retiree with 25 years of service is also paid an accrued \$60,000 from his or her VSF in addition to his regular pension and his regular annual VSF payment of \$12,000. In the second year of retirement, the Fire Fighter receives only the annual pension payment, a \$12,000 VSF payment, and an inflation adjustment in accordance with Tier 3 Escalation provisions. The benefits will increase thereafter for a number of years, because the effect of the inflation adjustments is greater than the effect of individuals gradually dying off. At age 62, a Social Security offset kicks in. Then, at age 71, the impact of the number of retiree deaths overtakes the effect of the cost-of-living adjustments and payments decline with each passing year. Both the VSF and Social Security offset are unique to Fire and Police, and do not apply to the other groups in this study.

**TOTAL PAYMENTS UNDER THE DEFINED BENEFIT PLAN:  
NYC FIRE FIGHTERS**



**Areas for Further Study**

Future extensions of our model might incorporate additional differences between DB and DC plans. For example, one could analyze the impact of "leakage" of assets from DC plans through loans or early withdrawals, two features which are rare in DB plans. Pre-retirement death and disability benefits, which are a common feature of DB plans, but not DC plans, could be considered as well. Finally, the model could be extended to capture cyclical and idiosyncratic variances in investment returns. That is, one could 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 our model.



## The Five New York City Pension Plans in this Study

A summary of selected benefit provisions in five New York City pension plans.

Item	NYC Civilian	Sanitation	NYC Police & Fire	NYC Teachers
Normal Retirement Eligibility	Age 57 and 5 years of service	20 years of Allowable Sanitation Service (ASS)	22 years of service	Age 55 and 27 years of service
Service Retirement Benefits	If < 20 years service: 1.66% x FAS-3* x service. If ≥ 20 years service: 2.0% x FAS-3 x service up to 30 years, plus 1.5% x FAS-3 x service > 30 years.	50% x FAS-3 for the first 20 years of ASS, plus 1.5% times FAS-5 for each year of ASS in excess of 20 years plus 1% x FAS-5 for each year of Credited Service other than ASS. Benefit limited to 30 years.	50% x FAS-3. At age 62, benefit is reduced by 50% of Primary Social Security Benefit attributable to all City Service. The dollar amount of reduction stays frozen for future years.	If < 20 years service: 1.66% x FAS-3 x service. If ≥ 20 years credited service: 2.0% x FAS-3 x service up to 30 years, plus 1.5% x FAS-3 x service > 30 years.
Member Contributions	4.85% of compensation for first 10 years, 1.85% of compensation for 10-29 years, 0% of compensation at 30 and future years	3.0% for the first 10 years plus 5.35% for the first 20 years	3.0% of compensation for 25 years	4.85% of compensation for first 27 years, 1.85% of compensation after 27 years
Vesting Eligibility	5 years of credited service	5 years of ASS, payable when member would have completed 20 years	5 years of qualifying service	10 years of credited service
Automatic COLA Eligibility	Service and disability pensioners, and their surviving spouses. COLA applies to (1) pensioners who are at least age 62 and have been retired for at least 5 years; (2) pensioners who are at least age 55 and have been retired for at least 10 years	Service and disability pensioners, and their surviving spouses. COLA applies to (1) pensioners who are at least age 62 and have been retired for at least 5 years; (2) pensioners who are at least age 55 and have been retired for at least 10 years	Service and disability pensioners, and their surviving spouses. COLA applies to (1) pensioners who are at least age 62 and have been retired for at least 5 years; (2) pensioners who are at least age 55 and have been retired for at least 10 years	Service and disability pensioners, and their surviving spouses. COLA applies to (1) pensioners who are at least age 62 and have been retired for at least 5 years; (2) pensioners who are at least age 55 and have been retired for at least 10 years
Automatic COLA Benefit	COLA is 50% of the increase in the CPI-U** based on the year ending March 31, rounded to the next higher .1%, not less than 1.0% nor greater than 3.0%, of the first \$18,000 of maximum retirement allowance.	COLA is 50% of the increase in the CPI-U based on the year ending March 31, rounded to the next higher .1%, not less than 1.0% nor greater than 3.0%, of the first \$18,000 of maximum retirement allowance	COLA is 50% of the increase in the CPI-U based on the year ending March 31, rounded to the next higher .1%, not less than 1.0% nor greater than 3.0%, of the first \$18,000 of maximum retirement allowance. Members receive the greater of the applicable increase from COLA or Escalation	COLA is 50% of the increase in the CPI-U based on the year ending March 31, rounded to the next higher .1%, not less than 1.0% nor greater than 3.0% of the first \$18,000 of maximum retirement allowance.

Annual Escalation

Annual Escalation on "maximum" retirement allowance (1) in full, if retired for service after completing 25 or more years of police or fire service (or elected to defer commencement of benefit to that 25-year date) or on a reduced basis, by 0.0277 for each month that their retirement precedes 25 years or (2) in full, if they have retired for disability or (3) in full, to their beneficiary for accidental death benefits. Escalation begins after retirement on "maximum" pension then on reduced amount after 50% SS offset and is compounded. Escalation is paid in April and is determined from the change in the CPI-U based on the prior year ending December 31, not greater than 3.0%, nor less than -3.0%, in the event of a decrease. Members receive the greater of the applicable increase from COLA or Escalation.

\*FAS = Final Average Salary  
 \*\*CPI-U = Consumer Price Index-All Urban Consumers  
 SS = Social Security





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