

Congressional Budget Office
Washington, D.C.

**Including Market Risk in Estimates of the
Budgetary Effects of Changing the
Federal Retirement System for
Civilian Workers: Supplemental Material for *Options for
Changing the Retirement System for Federal Civilian
Workers***

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In this document, the Congressional Budget Office provides fair value estimates of the accrual costs of options that would change the federal retirement system, where the cost is based on an estimate of the market value of the government's obligation. In the report *Options for Changing the Retirement System for Federal Civilian Workers*, CBO estimates accrual costs under current law and under the options as present-value estimates discounted using the 20-year Treasury rate.¹ This supplement adjusts that discount rate to calculate fair-value estimates that incorporate market risk of the accrual costs under current law and under the options. It compares them to the estimates presented in the report, which did not incorporate market risk.

¹ See Congressional Budget Office, *Options for Changing the Retirement System for Federal Civilian Workers* (August 2017), www.cbo.gov/publication/53003.

In an August 2017 report, *Options for Changing the Retirement System for Federal Civilian Workers*, the Congressional Budget Office reported the costs on an accrual basis of options that would change the system for the cohort of federal employees that would be hired in 2018.² That basis approximates the percentage of workers' salaries that the government would need to set aside each year to pay for those workers' retirement benefits. Because such an approach treats current and deferred forms of compensation equally, it avoids budgetary effects resulting from the timing of compensation and facilitates the comparison of the government's compensation costs for a pension with those for a defined contribution plan.

For its estimates on an accrual basis, CBO calculated the present value of two future streams of payment: net cash outflows for retirement benefits and salaries. The present value of each depends on the rate of interest—the discount rate—used to translate those future streams into current dollars. Specifically, the agency calculated lifetime net cash outflows as the sum of the discounted present values of the projected annual outlays for defined benefit pension payments (to the retired workers and their spouses and children, if eligible), minus employees' contributions to the pension, plus the government's contributions to the Thrift Savings Plan (TSP). CBO also calculated lifetime salaries as the sum of the discounted present values of the projected annual salaries of the examined group of workers. The accrual cost—the percentage of a worker's salary that needs to be set aside today to pay his or her retirement costs in the future—is the ratio of lifetime net cash outflows to lifetime salaries.

In its August report, CBO used a discount rate equal to CBO's long-term projection of the nominal rate of return on 20-year Treasury securities. That rate is projected to be 2.7 percent in 2017 and to increase to 5.0 percent in 2046. If the federal government set aside a percentage of workers' salaries each year, invested those salaries in Treasury securities, and paid pensions from the resulting funds, then the set-aside amounts would be sufficient to pay the pension benefits, on average.

In this document, the agency presents fair-value estimates of the amount of money that would need to be set aside. Those estimates were calculated using a discount rate that incorporates the price of market risk, which is 1.5 percentage points higher than the Treasury rate. The adjustment reflects the price a private-sector firm would charge to take on uncertainty about the future earnings of federal employees, if it provided pension benefits to those workers. The private firm could invest contributions in a mix of assets that matches the risk of the obligation. That mix of assets—which would be expected to earn a higher return than the rate of return on 20-year Treasury securities—would be sufficient to pay the pension benefits, on average, under the higher discount rate.

The result of using a higher discount rate is to lower the cost of pensions on an accrual basis. The reason is that the present value of the pension payments is reduced more than the present value of lifetime salaries because the pension payments occur farther in the future. Thus, fair-value estimates of the costs of options to increase pension payments tend to be lower than estimates using Treasury rates, and the savings from options to decrease pension payments tend to be smaller as well. This document provides comparisons of estimated budgetary effects on accrual basis for the five options presented in the August report, using the two discount rates.

² See Congressional Budget Office, *Options for Changing the Retirement System for Federal Civilian Workers* (August 2017), www.cbo.gov/publication/53003.

What Are Fair-Value Estimates?

The government bears market risk in the Federal Employees Retirement System (FERS) because its pension benefits are indexed to the future earnings of federal employees. Market risk is the component of risk that remains even after a portfolio has been diversified as much as possible. The fair-value approach, by incorporating the cost of market risk for the government when providing pension benefits, provides a more comprehensive measure of cost, in CBO's view. Future earnings by federal employees are uncertain. Because those earnings are used to determine pension payments to future retirees, the cost of those benefits to the federal government is also uncertain.

Because wages tend to reflect the strength or weakness of the economy, the government's total cost of FERS benefits is likely to be relatively high if the economy performs well, and relatively low if the economy underperforms. CBO expects federal wages to roughly follow overall wage rates. Federal employees receive an annual salary increase that by law is tied to the employment cost index, a measure of average wage growth in the economy. Average wage growth is systematically linked to the economy's overall performance.

In the private sector, uncertain cash flows that grow and shrink with the economy are less valuable, and discounted at a higher rate, than cash flows that are certain. For example, one portfolio of direct loans with an unknown default rate that includes loans that are more likely to be repaid when the economy is strong and more likely to go into default when the economy is weak is less valuable than a second portfolio that is otherwise similar but that has a known default rate equal to the projected average default rate of the first portfolio.³ Fair-value estimates of a portfolio that is more likely to go into default when the economy is weak would use a higher discount rate than the Treasury rate to reflect that systematic risk. Those fair-value estimates would be lower than present-value estimates made by discounting at the Treasury rate.

Although the FERS program represents an obligation rather than an asset, the principle remains the same. Because FERS pension payments would be larger under better-than-expected economic performance and lower in the opposite case, an upward adjustment to the discount rate is appropriate. That upward adjustment to the discount rate would lower the present value of the FERS pension obligation.

Adjusting for risk in this case reduces the fair-value estimate, which may seem surprising given that in credit programs, for which the fair-value and conventional estimates are most commonly reported, the reverse occurs. In general, but not always, fair-value cost estimates in credit programs exceed conventional estimates. Many government obligations, like loan guarantees, grow when the economy is weak and shrink when it is strong. The FERS pension obligation moves in the opposite direction, growing and shrinking in tandem with the government's capacity to make payments.

³ See Congressional Budget Office, *Fair-Value Estimates of the Cost of Selected Federal Credit Programs for 2015 to 2024* (May 2014), www.cbo.gov/publication/45383.

How Did CBO Determine the Risk Premium for Its Fair-Value Estimates?

To develop an adjustment to the discount rate for the FERS obligation, CBO applied methods from academic studies that estimate the financial value of payments based on future wages.⁴ Those studies measured the risk associated with future wages by relating uncertainty in wages to uncertainty in the stock market. Although they can diverge in the short term, over long periods wages and stock prices tend to follow similar paths. Stocks earn an excess return—known as the equity premium—over Treasury bonds because of their systematic relationship to the economy.

The strong long-term relationship between stock prices and wages implies that some fraction of the equity premium should apply to the discount rate for FERS benefits. CBO estimates that fraction to be three-eighths.⁵ That fraction yields an adjustment of 1.5 percentage points when it is applied to an equity premium of 4 percent.

How Do Fair-Value Estimates Affect the Cost of Options to Change the Federal Retirement System Compared With Estimates Using Treasury Rates?

The net accrual cost of federal retirement benefits under current law and under several options depends on the discount rate that is used to estimate the present value of costs that will be paid in the future. CBO compared the accrual cost estimates reported in CBO's August 2017 report using the interest rate projected for 20-year Treasury securities as the discount rate with estimates using a discount rate that is 1.5 percentage points higher. That higher discount rate, used in the fair-value estimate of the net accrual cost under current law and the options, reflects the return on a mix of assets that best matches the government's pension obligation.

Under current law and under the options that change but do not eliminate the pension plan, the fair-value estimate of net accrual costs for retirement benefits would be lower than the net accrual costs calculated using a discount rate equal to the rate of return of 20-year Treasury securities, CBO projects. For example, for the cohort of employees starting federal service in 2018, the cost to the government of retirement benefits would be 14.2 percent of the salaries of those workers when a discount rate equal to

⁴ See Mark Huggett and Greg Kaplan, "How Large Is the Stock Component of Human Capital?" *Review of Economic Dynamics*, vol. 22 (2016), pp. 21–51, <https://doi.org/10.1016/j.red.2016.06.002>; John Geanakoplos and Stephen P. Zeldes, "Market Valuation of Accrued Social Security Benefits," in Deborah Lucas, ed., *Measuring and Managing Federal Financial Risk*, (University of Chicago Press, 2010), pp. 213–233, <http://papers.nber.org/books/luca07-1>; Luca Benzoni, Pierre Collin-Dufresne, and Robert S. Goldstein, "Portfolio Choice Over the Life-Cycle When the Stock and Labor Markets Are Cointegrated," *The Journal of Finance*, vol. 62, no. 5 (October 2007), pp. 2123–2167, <https://doi.org/10.1111/j.1540-6261.2007.01271.x>; and Deborah Lucas and Stephen P. Zeldes, "Valuing and Hedging Defined Benefit Pension Obligations—The Role of Stocks Revisited" (preliminary draft, September 2006), <http://tinyurl.com/ybqdx8rq>.

⁵ The estimate of three-eighths considers the age distribution and status of the cohort entering federal employment in 2018. That estimate is higher than the estimates reported by Lucas and Zeldes in their 2006 analysis. They calculated that roughly 5 percent of the equity premium should be included in the discount rate for a private pension. However, they examined a private pension that differed substantially from FERS: 84 percent of its participants had already retired, and its active participants were older.

the rate of interest on 20-year Treasury securities is used. The corresponding fair-value estimate of those costs would be 11.5 percent of the salaries of those workers (see Figure 1).

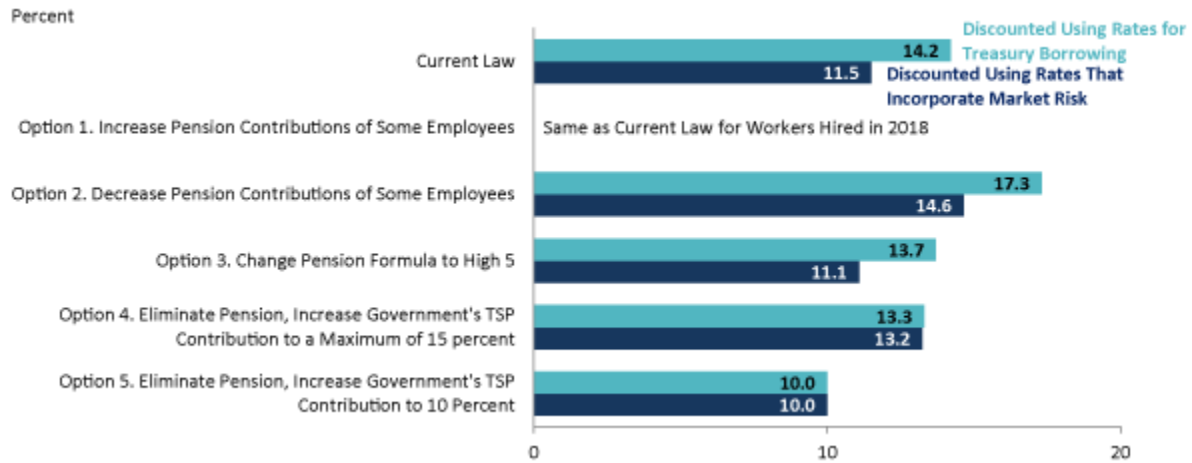
In contrast, under the options that replace the pension plan with larger government contributions to the TSP, the choice of a discount rate has almost no effect on the estimate of the net accrual costs of retirement benefits. There is little influence because the cost to the government of retirement benefits under those options is only the government's matching and automatic contributions to those workers' TSP accounts. Because those benefits are paid out at the same time as those workers' salaries are earned rather than at a point farther in the future, the discount rate has less influence on the estimate of the accrual cost.

Using a discount rate adjusted for market risk also changes the projected costs or savings of the options as compared with outcomes under current law. In its August 2017 report, CBO estimated that under Option 2, retirement costs for new employees would be 22 percent higher on an accrual basis, whereas under Options 3, 4, and 5, retirement costs would be 4 percent, 6 percent, and 29 percent lower, respectively. On a fair-value basis, costs under Option 2 would be 27 percent higher than what they would be under current law, and costs under Option 4 would be 15 percent higher than current law. Costs under Options 3 and 5 would be 4 percent and 13 percent lower than under current law, respectively (see Table 1).

The use of a higher discount rate lowers the estimates of the accrual cost of federal retirement benefits under current law and under Options 2 and 3 in a similar way. Consequently, the percentage changes in accrual cost from implementing Options 2 and 3 are similar to those calculated with a discount rate equal to the rate of return on 20-year Treasury securities. In contrast, the higher discount rate leaves the accrual costs under Options 4 and 5 roughly unchanged. As a result, estimates of the percentage changes in accrual cost from implementing those options are more affected by the use of a higher discount rate.

Figure 1.

Net Accrual Cost to the Government of Retirement Benefits, Measured Using Different Discount Rates, as a Share of Lifetime Salary for Workers Hired in 2018, Under Current Law and Under Several Options



Source: Congressional Budget Office.

Estimates shown are for workers with no prior federal service who are projected to join the federal workforce in 2018, whether or not they receive a pension in retirement.

Under current law, employees hired in 2018 will contribute 4.4 percent of their salary to the FERS pension. The government will make an automatic TSP contribution of 1 percent of salary and match employees' contributions up to an additional 4 percent.

Option 1 would increase the FERS contribution rate to 4.4 percent for current employees (from 0.8 percent for employees hired before 2013 and from 3.1 percent for employees hired in 2013). Option 1 is the same as current law for workers hired in 2018.

Option 2 would decrease the FERS contribution rate to 0.8 percent for all employees (from 4.4 percent for employees hired after 2013 and from 3.1 percent for employees hired in 2013).

Option 3 would decrease FERS pensions by basing the retirement benefit on the five years of highest salary (instead of three years of highest salary).

Option 4 would eliminate the FERS pension, increase the government's automatic TSP contribution to 8 percent of salary, and require the government to match employees' contributions up to an additional 7 percent.

Option 5 would eliminate the FERS pension, increase the government's automatic TSP contribution to 10 percent of salary, and eliminate the government's matching contribution.

These amounts approximate the share of workers' salaries that would need to be set aside each year to fully fund those workers' benefits. Cash flows—regardless of whether they are retirement benefits or lifetime salaries—are discounted using two different rates. One rate is equal to the interest rate projected for 20-year Treasury securities. The other rate incorporates market risk and is 1.5 percentage points higher than the 20-year Treasury rate.

FERS = Federal Employees Retirement System; TSP = Thrift Savings Plan.

Table 1.

Estimated Change in Accrual Costs of Several Options That Would Change the FERS Pension Plan and Contributions to TSP

Option	Percentage Change in Accrual Cost ^a	
	Discounted Using Rate for Treasury Borrowing	Discounted Using Rate That Incorporates Market Risk
<hr/> Options That Would Change the Pension Plan		
1. Increase Pension Contributions of Some Employees	n.a.	n.a.
2. Decrease Pension Contributions of Some Employees	22	27
3. Change Pension Formula to High 5	-4	-4
 Options That Would Replace the Pension Plan With Larger Contributions to TSP for New Employees		
4. Eliminate Pension, Increase Government's TSP Contribution to a Maximum of 15 Percent	-6	15
5. Eliminate Pension, Increase Government's TSP Contribution to 10 Percent	-29	-13

Source: Congressional Budget Office.

Option 1 would increase the FERS contribution rate to 4.4 percent for current employees (from 0.8 percent for employees hired before 2013 and from 3.1 percent for employees hired in 2013). Option 1 is the same as current law for workers hired in 2018.

Option 2 would decrease the FERS contribution rate to 0.8 percent for all employees (from 4.4 percent for employees hired after 2013 and from 3.1 percent for employees hired in 2013).

Option 3 would decrease FERS pensions by basing the retirement benefit on the five years of highest salary (instead of three years of highest salary).

Option 4 would eliminate the FERS pension, increase the government's automatic TSP contribution to 8 percent of salary, and require the government to match employees' contributions up to an additional 7 percent.

Option 5 would eliminate the FERS pension, increase the government's automatic TSP contribution to 10 percent of salary, and eliminate the government's matching contribution.

The accrual cost approximates the share of workers' salaries that would need to be set aside each year to fully fund those workers' benefits. Cash flows—regardless of whether they are retirement benefits or lifetime salaries—are discounted using two different rates. One rate is equal to the interest rate projected for 20-year Treasury securities. The other rate incorporates market risk and is 1.5 percentage points higher than the 20-year Treasury rate.

FERS = Federal Employees Retirement System; TSP = Thrift Savings Plan; n.a. = not applicable.

a. The estimated accrual cost is calculated for workers with no prior federal service who are projected to join the federal workforce in 2018.