



How CBO Uses Discount Rates to Estimate the Present Value of Future Costs or Savings



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At a Glance

Many activities of the federal government have budgetary and other effects that can last far into the future. To produce estimates of those budgetary effects—and to help lawmakers compare different policies—the Congressional Budget Office often has to translate a flow of future income or payments into an equivalent lump-sum value today. This report describes such present-value estimates, particularly how CBO selects and uses discount rates to calculate the value of future cash flows in its analyses.

- **Discount Rates and Present Values.** The present value of future cash flows depends on the rate used to convert those flows into a single equivalent value at a specific time, generally the present. Discount rates account for the time value of money: the fact that an amount received or paid today is more valuable than the same amount received or paid in the future. Discount rates can also incorporate factors such as risk, inflation, and other considerations that can affect the value of an asset to a person or business.
- **Types of Estimates That Use Present Values.** CBO uses discount rates for a wide variety of estimates. They include estimates of the budgetary cost of federal programs that make or guarantee loans, the financial position of the Social Security trust funds, and the long-term effects of spending for infrastructure or children’s health on federal spending and revenues. CBO also uses discount rates to estimate household wealth, the value of future retirement benefits, the lifetime costs of weapon systems, the likelihood that people will invest in energy-saving technologies, and the cost of future damage from flooding, among other topics.
- **CBO’s Methods and Data for Choosing Discount Rates.** The choice of discount rates can have large effects on estimates, especially for cash flows far in the future. To estimate discount rates that are consistent with market prices and rates of return, CBO uses data from an array of sources, including financial markets, the Bureau of Economic Analysis, the Federal Reserve, and academic studies. CBO’s discount rates may differ from those used by the Administration for various reasons, such as differences in economic assumptions, assessments of risk, and decisions about what factors discount rates should reflect.

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Notes About This Report

Unless this report indicates otherwise, the years referred to are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end.

Numbers in the text and figures may not add up to totals because of rounding.

How CBO Uses Discount Rates to Estimate the Present Value of Future Costs or Savings

Summary

Many government policies have effects on the federal budget and other outcomes that continue over long periods. A useful way to estimate and compare long-term effects is to calculate a *present value*, which can summarize a series of projected values in the future as a single value in the present. Such a summary is especially helpful for comparing the impact on federal debt of programs that affect spending and revenues at different times in the future, such as the government's direct loans and loan guarantees. Present values can also help lawmakers weigh alternative policies by making it easier to compare the net costs of proposals despite differences in the timing of their cash flows. (Cost is just one of the factors that lawmakers may consider when comparing policies.)

To estimate a present value, the Congressional Budget Office follows the standard practice of applying a discount rate—a rate that captures the difference in value between a cash flow in the future and the same cash flow today. The chosen discount rate can have a sizable effect on an estimate, especially when discounting cash flows that are projected to occur far in the future.

When Does CBO Use Discount Rates?

CBO prepares its baseline budget projections and its cost estimates for proposed legislation following rules set in law and scorekeeping guidelines developed with the House and Senate Committees on the Budget and the Administration's Office of Management and Budget (OMB). For most federal programs, those rules require the use of *cash-based estimates*, which record spending and revenues in the years when they occur. In certain cases, however, those rules require the use of present-value estimates, also called *accrual estimates*.¹

In particular, the Federal Credit Reform Act of 1990 (FCRA) requires that the cost of federal programs that make or guarantee loans—such as the Department of Education's student loans and the Federal Housing Administration's mortgage guarantees—be measured as the present value of cash flows over the life of a loan, discounted to the year the loan is disbursed, using interest rates on Treasury securities as the discount rates.² CBO has also been required by law or directed by the Budget Committees to use present-value estimates for several other federal activities, such as the financial support that the government offered to households, financial markets, and businesses in response to the coronavirus pandemic.

In addition to producing baseline budget projections and cost estimates, CBO analyzes many aspects of the budget, the economy, and related issues at Congressional request. The agency uses present-value estimates in many of those analyses. One example is for federal insurance programs, such as flood insurance and pension insurance. Although such programs carry many of the same risks as loan or loan guarantee programs, by law their costs are measured on a cash basis rather than an accrual basis in baseline projections and cost estimates. To provide a fuller picture of long-term costs, CBO uses discount rates to produce present-value estimates for federal insurance programs in its analytical reports and as supplemental information in cost estimates for legislation that would alter those programs.

CBO also discounts future cash flows in its analyses of some government activities that have long-term budgetary effects, including the Social Security program, spending on human and physical capital (such as education and infrastructure), pensions for federal employees, the acquisition of military weapon systems, and programs

1. Congressional Budget Office, *Cash and Accrual Measures in Federal Budgeting* (January 2018), www.cbo.gov/publication/53461.

2. Public Law 101-508 (codified at 2 U.S.C. § 661a(5)(E) (2018)).

that are likely to be affected by a changing climate (such as programs aimed at reducing future flood damage).³

In some cases, CBO adjusts its discount rates to incorporate market risk (the element of financial risk that is associated with the overall performance of the economy rather than with the performance of a specific investment). A measure of present value that accounts for market risk is known as a *fair-value estimate*. The present-value estimates that FCRA requires for federal credit programs incorporate the projected average costs of future defaults on federal direct or guaranteed loans. As supplemental information, CBO routinely publishes fair-value estimates for federal credit programs that account for the programs' exposure to market risk, such as the greater tendency of people to repay their loans when the economy is doing well than when it is doing poorly. In CBO's view, fair-value estimates are a more comprehensive measure than FCRA estimates and thus help lawmakers better understand the advantages and drawbacks of various policies. However, FCRA estimates provide more accurate estimates of average budgetary effects than fair-value estimates do.

Fair-value estimates are especially helpful for comparing government activities that involve different amounts of market risk. The Congress has required the use of fair-value estimates in several instances, such as for the obligations of the International Monetary Fund and of the Troubled Asset Relief Program (which was created to stabilize financial markets during the 2007–2009 financial crisis).⁴

How Does CBO Choose Discount Rates?

CBO chooses discount rates in various ways depending on the purpose of its estimates. To select some discount rates, CBO uses its projections of interest rates on Treasury securities as well as data from financial markets, the Federal Reserve, and the Bureau of Economic

Analysis. To estimate the discounting that people might do when deciding whether to invest in products that produce long-term savings, CBO sometimes consults academic studies about how people have made similar decisions in the past.

To incorporate market risk in fair-value estimates, CBO estimates the premium (or additional return) that investors would require for taking on the same risk and adds that premium to its projections of interest rates on Treasury securities, which are generally considered risk-free.⁵ CBO measures the market risk of federal credit and insurance programs on the basis of premiums for exposure to comparable risks in private markets. CBO measures the market risk associated with people's future earnings and the economy's future gross domestic product (GDP) using methods from the growing academic research on the measurement of economywide risks.

The discount rates that CBO uses in its present-value estimates may differ from those used by OMB or actuaries for the Social Security program. Reasons for such discrepancies include different projections of Treasury interest rates and market risk premiums and different assessments of the financial risks associated with federal activities.

The Role of Discount Rates in Calculating Present Values

In converting a stream of future income and payments, or future costs and savings, into a present value, discount rates incorporate the time value of money—that is, people's tendency to place a higher value on a dollar today than on a dollar in the future, reflecting the fact that the money can earn a financial return in the interim. The discount rate reflects that potential rate of return. For example, if a dollar today could earn a 5 percent return over the next year, \$100 invested today would be worth \$105 in a year. By extension, a payment of \$105 to be received one year from now would be worth \$100 today.⁶ In a present-value estimate, the discount rate (5 percent

3. Government spending on human and physical capital affects the federal budget in part through its effects on the economy. CBO refers to the budgetary effects of changes in the economy as macroeconomic feedback. (Those effects are sometimes also called dynamic effects, and their inclusion in budget estimates is referred to as dynamic analysis.) Macroeconomic feedback can be included in either a cash-based estimate or a present-value estimate. Whether to include macroeconomic feedback is a separate issue from which type of estimate to use.

4. Congressional Budget Office, *Measuring the Cost of Government Activities That Involve Financial Risk* (March 2021), www.cbo.gov/publication/56778.

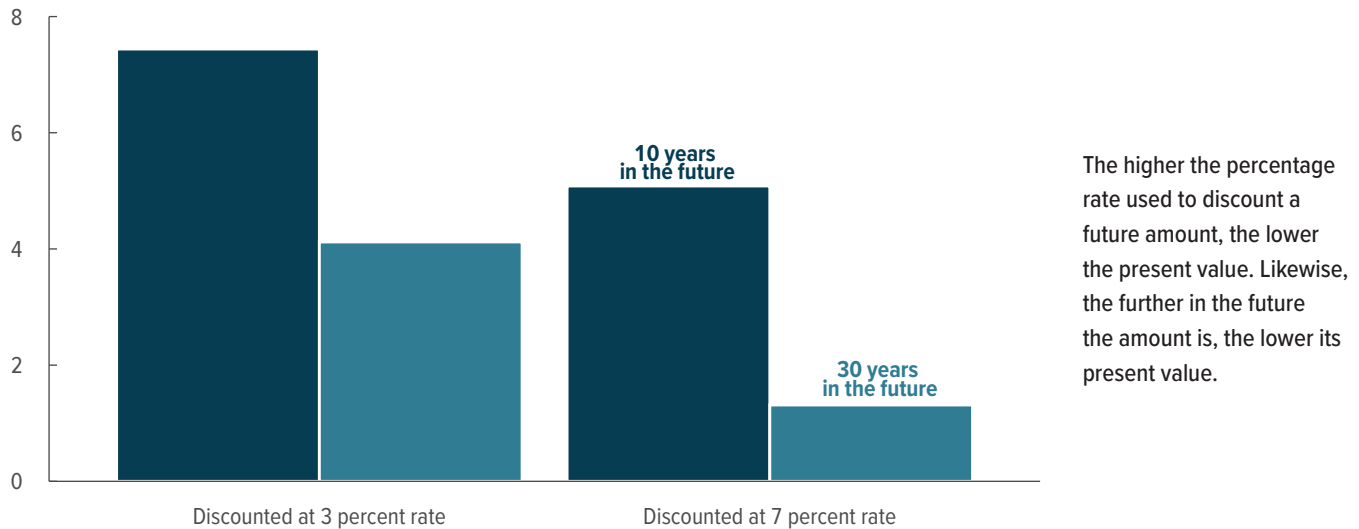
5. A Treasury security is generally seen as free of credit risk (the risk that the federal government will default). But it is subject to interest rate risk (the risk that results from changes in prevailing interest rates) when the holder sells the security before its maturity date.

6. That amount is calculated by dividing the payment by 1.05. A mathematically equivalent calculation is to multiply the payment by the inverse of 1.05 (1 divided by 1.05), which is known as the discount factor.

Figure 1.

Present Value of \$10 Million in the Future, by Discount Rate and Time Frame

Millions of dollars



Data source: Congressional Budget Office. See www.cbo.gov/publication/60284#data.

in this example) reduces the value of future cash flows to express their value today.

The discount rate and the present value have an inverse relationship: For a given future amount, using a higher discount rate results in a lower present value. For instance, \$10 million 10 years from now would have a present value of \$5.1 million if discounted by 7 percent a year or \$7.4 million if discounted by 3 percent a year (see Figure 1). In addition, the choice of a discount rate has a greater effect on the present value for amounts further in the future. The same \$10 million 30 years from now would have a present value of \$1.3 million with a 7 percent discount rate or \$4.1 million with a 3 percent discount rate.

In addition to reflecting the time value of money, present-value estimates can incorporate other factors—such as inflation, market risk, or taxes—depending on what is being measured as a present value and how the series of future values is calculated. For example, if CBO estimates future cash flows in real terms (that is, with adjustments to remove the effects of inflation), it also adjusts the discount rate to remove the effects of inflation, such as by using a Treasury interest rate minus the expected inflation rate (see Table 1). When CBO produces a fair-value estimate of a set of future cash flows, it incorporates market risk either in the discount

rate or in the projected cash flows.⁷ The impact of future flood damage on property values could be measured by incorporating the tax effects of flood damage into projected cash flows and using an after-tax rate of return for discounting, or by excluding those tax effects and using a before-tax rate of return for discounting, as CBO does.⁸

Federal budgetary rules that require present-value estimates generally specify that Treasury interest rates be used to discount future cash flows. However, CBO sometimes publishes fair-value estimates—whose discount rates account for the risk some federal programs face from the overall performance of the economy—either because the Congress directed CBO to produce such estimates by request or through statute, or because

7. Michael Falkenheim, *Fair-Value Cost Estimation and Government Cash Flows*, Working Paper 2021-05 (Congressional Budget Office, April 2021), www.cbo.gov/publication/57062.

8. The tax effects occur because when property owners calculate the amount of income tax they owe, they can deduct the cost of repairing flood damage as an expense from the income they receive from rents. An alternative approach to estimating the impact of future flood damage on property values would be to discount cash flows from rents, net of the value of that tax deduction, using an after-tax rate of return.

Table 1.

Comparable Methods to Incorporate Inflation, Market Risk, and Taxes in Present-Value Estimates

Factor	How to incorporate the factor in the discount rate	How to incorporate the factor in projected cash flows
Inflation	Discount nominal cash flows using a nominal interest rate on Treasury securities	Discount real cash flows using a real interest rate ^a
Market risk	Discount average cash flows using Treasury rates plus a premium for market risk	Discount cash flows that incorporate market risk using Treasury rates ^b
Taxes	Discount before-tax cash flows using a before-tax rate of return	Discount after-tax cash flows using an after-tax rate of return

Data source: Congressional Budget Office.

a. Real values are nominal values that have been adjusted to remove the effects of inflation.

b. Cash flows that incorporate market risk go by many names in academic studies on finance: certainty-equivalent cash flows, risk-neutral cash flows, and risk-adjusted cash flows. For a discussion of cash flows that incorporate market risk, see Michael Falkenheim, *Fair-Value Cost Estimation and Government Cash Flows*, Working Paper 2021-05 (Congressional Budget Office, April 2021), www.cbo.gov/publication/57062.

CBO concludes that fair-value estimates would provide a useful perspective on costs.⁹

Fair-value estimates account for the fact that people prefer to receive a certain return on their investment rather than an uncertain one, particularly when that return varies with the state of the economy. If an asset pays more when the economy is performing well and less when the economy is performing poorly, investors tend to discount future cash flows from that asset more. The market values of financial assets reflect their market risk.¹⁰ When the government creates programs that are subject to market risk, such as credit programs, it passes that risk on to its stakeholders: taxpayers and program beneficiaries.

Incorporating market risk into budget estimates has advantages and disadvantages depending on the circumstances and purpose of the estimates. Discounting with

Treasury rates produces estimates that reflect the likely effect of a policy on projected federal debt. Discounting with rates that include a premium for market risk produces estimates that are more useful for comparing different forms of government assistance because they provide a more comprehensive measure of costs.

Purposes of Present-Value Estimates

CBO decides whether to include market risk and other factors in its present-value estimates largely according to the purpose of the estimates. In general, CBO calculates present values for three purposes: to summarize budget projections; to estimate the market value of assets, liabilities, and cash flows; and to predict how people and businesses make decisions about investments.

Summarizing Budget Projections

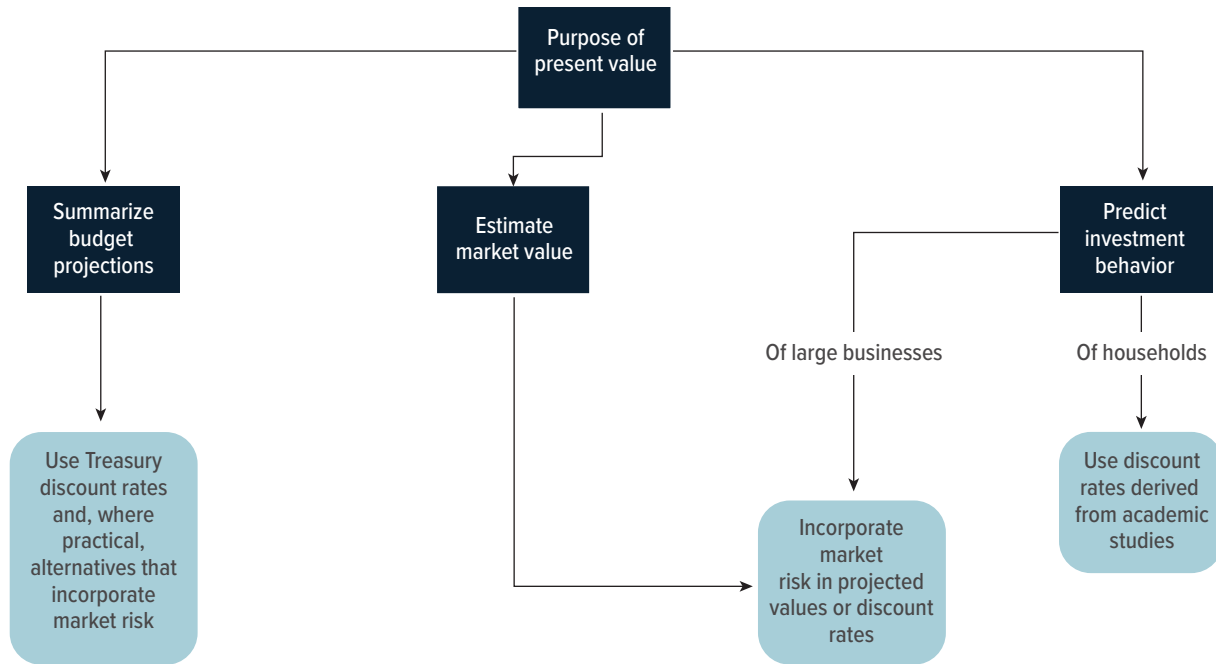
CBO calculates present values to summarize some projections of federal spending and revenues that occur over a long period of time. When measuring the cost of the government's loans and loan guarantees or the long-term budgetary impact of federal spending on human or physical capital, CBO uses present values mainly to measure average budgetary effects. Similarly, when the costs of an activity occur over many years, CBO may calculate present values to compare alternatives using a single measure of budgetary cost. For all of those budget estimates, CBO uses Treasury interest rates for discounting; it sometimes also uses rates that incorporate premiums for market risk (see Figure 2).

9. Michael Falkenheim, *Fair-Value Budgeting: Practical Issues*, Working Paper 2021-08 (Congressional Budget Office, July 2021), www.cbo.gov/publication/57264.

10. Congressional Budget Office, *Measuring the Cost of Government Activities That Involve Financial Risk* (March 2021), www.cbo.gov/publication/56778. Market risk is distinct from the expected cost of default, which CBO accounts for in projected cash flows rather than in the discount rate. Other analysts estimate the value of credit instruments such as loans by projecting their promised cash flows—what the borrower is obligated to pay—and discounting those cash flows using a rate that incorporates the possibility that the borrower will not pay.

Figure 2.

CBO’s Process for Choosing Discount Rates



Data source: Congressional Budget Office.

Estimating the Market Value of Assets, Liabilities, and Cash Flows

To estimate the value of assets (or other cash flows) to their owners or the effect of policies on that value, CBO typically incorporates a premium for market risk. The value of assets such as stocks and bonds is based on how much investors are willing to pay for them. Investors require a return on their investment that compensates for all costs, including market risk; thus, the asset’s value is discounted by investors at a rate that includes the cost of market risk. To estimate the value of cash flows from the government (such as Social Security benefits) that are comparable with those other assets, CBO also incorporates market risk in the discount rate.

Predicting Investment Behavior

When estimating how businesses will respond to policies that affect their decisions about long-term investments, CBO also includes a premium for market risk in the discount rate. In the case of investments by households, CBO generally relies on academic studies that estimate the discount rates people typically apply when making investment decisions. Those discount rates implicitly reflect anything important to a household’s decision,

including market risk, the affordability of the investment, and whether (as with energy-efficient appliances) people believe that the projected savings will materialize.

Examples of Estimates for Which CBO Uses Discount Rates

CBO uses discount rates for various types of estimates (see Table 2). They include long-term projections for Social Security and Medicare, for federal credit and insurance programs, and for the effects of federal spending for human and physical capital (such as education and infrastructure). CBO also uses discount rates to model the investment decisions of people and companies, to measure the value of payments to retirees, to estimate the lifetime costs of weapon systems, and to estimate the cost of future damage from floods. In addition, if CBO was asked to measure the long-term budgetary effects of preventive medical services, it would use discount rates in such analyses (see Box 1).

Long-Term Budget Projections

CBO and others use a concept called the actuarial balance to summarize the financial position of the trust funds for Social Security and for Medicare’s Hospital



Table 2.

Selected CBO Publications With Present-Value Estimates

Purpose of present-value estimate	Example publications	Factors included in discount rates	
		Market risk	Other
Actuarial balance of federal trust funds	The Long-Term Budget Outlook: 2024 to 2054 CBO’s 2024 Long-Term Projections for Social Security	No	
Budgetary effects of programs or policy changes	Estimates of the Cost of Federal Credit Programs in 2025	Yes, in alternative estimates	
Budgetary effects of spending on human and physical capital	Exploring the Effects of Medicaid During Childhood on the Economy and the Budget Effects of Physical Infrastructure Spending on the Economy and the Budget Under Two Illustrative Scenarios	Sometimes, in alternative estimates	
Value of investments by businesses and households	Modeling the Demand for Electric Vehicles and the Supply of Charging Stations in the United States CBO’s Simulation Model of New Drug Development	Yes	For households, discount rates implicitly include anything important to investment decisions
Value of payments to retirees	Trends in the Distribution of Family Wealth, 1989 to 2022 Comparing the Compensation of Federal and Private-Sector Employees in 2022 Options for Changing the Retirement System for Federal Civilian Workers Approaches to Changing Military Compensation	Sometimes	
Life-cycle costs of weapon systems	Life-Cycle Costs of Selected Navy Ships Usage Patterns and Costs of Unmanned Aerial Systems	No	
Cost of future flood damage	Flood Damage and Federally Backed Mortgages in a Changing Climate Federal Spending for Flood Adaptations Flood Damage Avoided by Potential Spending on Property-Level Adaptations	Yes	Discount rates are based on before-tax returns on capital

Data source: Congressional Budget Office.

Insurance (HI) program over periods such as 25 years or 75 years. The actuarial balance summarizes a trust fund’s current balance and future annual streams of revenues and outlays as a single number. It equals the sum of the present value of the fund’s projected income over a given period and the fund’s current balance, minus the sum of the present value of its projected outlays and a year’s worth of benefits at the end of the period.¹¹

11. The calculation includes benefits for a year at the end of the projection period “to be an adequate reserve for unforeseen contingencies.” See Social Security Administration, *The 2024 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds* (May 2024), Appendix I, “Glossary,” p. 253, www.ssa.gov/oact/TR/2024.

Actuarial Balance of the Social Security Trust Funds.

The Old-Age and Survivors Insurance Trust Fund and the Disability Insurance Trust Fund finance the benefits paid by the Social Security program. The trust funds receive revenues from two sources: a payroll tax (12.4 percent, split equally between employer and employee) on workers’ earnings up to an annual cap (\$168,600 in 2024) and income taxes on some recipients’ Social Security benefits.

In its annual report on the long-term outlook for Social Security, CBO summarizes the finances of the two trust funds over 75 years as a single present-value number, expressed as a percentage of the nation’s gross domestic product. In CBO’s most recent projections, the Social



Box 1.

Discounting the Long-Term Effects of Policies to Improve Health

Medical services that prevent the onset of diseases or that focus on early detection and treatment can improve people's health and affect health care spending over the long run.¹ Those preventive services can reduce the health care spending of patients, governments, and others by averting illnesses or by slowing or stopping their progression, thereby avoiding complications and more-expensive treatments at later stages of an illness.

In some cases, the spending reductions and health improvements that result from such preventive services can accrue for years or even decades after treatment. For example, serious complications from untreated hepatitis C can develop as long as two or three decades after the initial infection with hepatitis C virus (HCV).² As a result, underdiagnosis is common until later stages, when more serious symptoms, such as liver damage, can occur.³ Treatments are effective in clearing the infection and preventing the disease from reaching later stages. But factors such as high treatment costs, lack of awareness of the disease, and challenges in reaching populations at high risk of HCV infection result in low rates of timely treatment.⁴

Present-value estimates could be used to summarize the long-term effects of federal policies related to preventive medical services, showing what share of the up-front federal costs of such policies might be offset by federal savings from improved health over the long run. For instance, policies aimed at increasing treatment rates for HCV would incur initial costs. But they would probably reduce health care spending for decades once the treatments succeeded in preventing the onset of

other medical conditions, such as cirrhosis or liver cancer, that require more expensive treatments, including liver transplants. (Depending on the progression of the disease in people who were treated, those cost reductions might not occur within the Congressional Budget Office's standard 10-year period of analysis.)⁵

Early intervention for HCV could affect the federal budget in other ways as well, such as by decreasing costs for Social Security disability and Supplemental Security Income benefits and by increasing costs for Social Security retirement benefits and Medicare. Early intervention might also increase other types of federal costs that tend to rise when people receiving treatment live longer, such as spending for federal employees' pensions.

To estimate the present value of such costs or savings, CBO would discount the net change in federal spending using interest rates on Treasury securities—and perhaps using an alternative discounting approach that incorporated market risk, in accordance with approaches used widely by academics and policy researchers. For example, the Second Panel on Cost-Effectiveness in Health and Medicine, convened by the Department of Health and Human Services, recommended in 2016 that the monetary effects of health interventions be discounted using a rate based on past Treasury rates and that sensitivity analyses be conducted using a range of discount rates to account for uncertainty.⁶

As in other applications of present value, the long-term effects of different policies on federal spending and revenues are not the only factors lawmakers might want to consider in determining how much to spend on preventive medical services. The fact that such services can improve people's quality of life is also an important consideration.

1. Congressional Budget Office, *How CBO Analyzes Approaches to Improve Health Through Disease Prevention* (June 2020), www.cbo.gov/publication/56345.
2. World Health Organization, "Hepatitis C" (April 9, 2024), <https://tinyurl.com/35pcar2e>.
3. Karthik Gnanapandithan and Maged P. Ghali, "Self-Awareness of Hepatitis C Infection in the United States: A Cross-Sectional Study Based on the National Health Nutrition and Examination Survey," *PLoS One*, vol. 18, no. 10 (October 2023), www.ncbi.nlm.nih.gov/pmc/articles/PMC10597475.
4. William W. Thompson and others, "Vital Signs: Hepatitis C Treatment Among Insured Adults—United States, 2019–2020," *Morbidity and Mortality Weekly Report*, vol. 71, no. 32 (August 12, 2022), pp. 1011–1017, www.cdc.gov/mmwr/volumes/71/wr/mm7132e1.htm.

5. Congressional Budget Office, *Budgetary Effects of Policies That Would Increase Hepatitis C Treatment* (June 2024), www.cbo.gov/publication/60237.
6. Gillian D. Sanders and others, "Recommendations for Conduct, Methodological Practices, and Reporting of Cost-Effectiveness Analyses: Second Panel on Cost-Effectiveness in Health and Medicine," *Journal of the American Medical Association*, vol. 316, no. 10 (September 2016), pp. 1093–1103, <https://doi.org/10.1001/jama.2016.12195>.

Security program is estimated to have an actuarial deficit (a negative actuarial balance) over 75 years equal to 1.5 percent of GDP.¹²

The discount rates that CBO uses to calculate the actuarial deficit of the combined trust funds are the average rates on all bonds projected to be held by the trust funds until their balances are exhausted. The interest rates on the special-issue bonds held by the trust funds are set equal to the average yield on marketable federal securities with current maturities of more than 4 years. The weighted average interest rate on those securities approximately equals the interest rate on 10-year Treasury notes.

For the years after the combined balance of the trust funds is projected to be exhausted (currently estimated to occur in 2034), CBO uses a discount rate based on its projection of the average interest rate on new special-issue Treasury bonds, which equals its projection of the rate on 10-year Treasury notes.¹³

Actuarial Balance of the Medicare Hospital Insurance Trust Fund. The HI trust fund is used to pay hospitals and providers of postacute care under Part A of the Medicare program. The fund's income comes mostly from the Medicare payroll tax (2.9 percent of workers' earnings, split equally between employer and employee). The fund also receives some of the income taxes paid on Social Security benefits by recipients with relatively high income, as well as revenues from Medicare Part A premiums, fines, and penalties.

In its annual *Long-Term Budget Outlook*, CBO summarizes the finances of the HI trust fund over 25 years as an actuarial balance. CBO's most recent estimate for the HI trust fund is an actuarial deficit over 25 years equal to 0.3 percent of GDP.¹⁴ In calculating that measure, CBO uses the same approach to discounting that it does for the Social Security trust funds.

12. Congressional Budget Office, *CBO's 2024 Long-Term Projections for Social Security* (August 2024), www.cbo.gov/publication/60392.

13. For more information about the special-issue securities available to the Social Security trust funds, see Social Security Administration, "Special Issue Securities" (accessed May 9, 2024), www.ssa.gov/oact/progdata/specialissues.html.

14. Congressional Budget Office, *The Long-Term Budget Outlook: 2024 to 2054* (March 2024), p. 20, www.cbo.gov/publication/59711.

Budgetary Effects of Credit and Insurance Programs

The federal government provides credit assistance to people and businesses through direct loans, loan guarantees, and some forms of insurance. Those financial commitments are long-term obligations of the government and can be valued on an accrual basis, in which a single present value summarizes the projected net effects of commitments that last many years. The official budgetary treatment of credit programs, however, differs from that of insurance programs.

Credit Programs. As required by the Federal Credit Reform Act of 1990, the budgetary cost of federal credit programs is recorded on a present-value basis when a direct or guaranteed loan is made. The lifetime cost of a loan or loan guarantee—also known as the subsidy cost—is measured by projecting the cash flows associated with the loan as the average of a set of possible values and then discounting those projected cash flows to the present using the interest rate on Treasury securities with the same maturity as the cash flows.

In addition to FCRA estimates, CBO provides fair-value estimates of subsidy costs for federal credit programs when required by statute or requested by the Congress. Those present-value estimates incorporate market risk. CBO sometimes also provides fair-value estimates as supplemental information—for example, in its annual report *Estimates of the Cost of Federal Credit Programs* or in cost estimates for legislation affecting federal student loans—when such estimates could help lawmakers compare various policies. In 2024, CBO estimated that new loans and loan guarantees issued in 2025 would cost the federal government \$2.4 billion over their lifetime on a FCRA basis. On a fair-value basis, with market risk included, those loans and loan guarantees would have a lifetime cost to the government of \$65.2 billion, CBO estimated.¹⁵

The fair-value approach to calculating present value usually involves discounting future cash flows at rates that include compensation for market risk, consistent

15. Congressional Budget Office, *Estimates of the Cost of Federal Credit Programs in 2025* (August 2024), www.cbo.gov/publication/60517. For CBO's projections of the annual fair-value subsidy rates for student loans, see Congressional Budget Office, "Details About Baseline Projections for Selected Programs: Student Loan Programs," <https://tinyurl.com/mwcttc2j>.

with the way the loans and loan guarantees of a credit program would be priced in a competitive market.¹⁶ Those discount rates equal the interest rates on Treasury securities of corresponding maturities plus a risk premium, which can be estimated from the market prices of similar securities.¹⁷ For example, CBO estimates risk premiums for mortgages guaranteed by the Federal Housing Administration (FHA) and the Department of Veterans Affairs (VA) by using the fees that private mortgage insurers charge borrowers with similar characteristics and down payments. CBO adjusts those fees for the larger losses that FHA and VA are likely to experience on their mortgage guarantees because they tend to serve borrowers who make smaller down payments.

Insurance Programs. Like programs that make or guarantee loans, some federal programs that insure against risks represent long-term obligations of the government. Unlike credit programs, federal insurance programs are required by law to be budgeted for on a cash basis, with cash flows to or from a program recorded when they are received or paid. Examples include programs of the Pension Benefit Guaranty Corporation (PBGC), a federal corporation that insures defined benefit pension plans for private-sector employers. PBGC records cash flows for its pension insurance programs as they occur, although it also reports the present value of those programs' long-term obligations.

CBO's baseline budget projections and estimates for PBGC are made on a cash basis. But CBO also estimates the present value of the liabilities (pension benefits) insured by PBGC—using data reported by individual pension plans and CBO's estimates of a discount rate for pension liabilities—to capture the amount at risk of loss if a pension plan fails. By law, pension plans must meet funding requirements that are determined by the present value of their liabilities.¹⁸ In many cases, however, the

costs to the government are greater than the amount suggested by a plan's valuation.

The choice of a discount rate can significantly affect the outlook for PBGC. Using a higher discount rate reduces the present value of pension liabilities and decreases projections of insurance claims (payments to pension plans and beneficiaries). Conversely, using a lower discount rate increases the present value of pension liabilities and reflects greater certainty about the plans' obligations, increasing projections of insurance claims.

When CBO produces fair-value estimates to capture the market risk of insurance claims from pension plans, it does not add a risk premium to the discount rate. Instead, it incorporates risk in the projected cash flows for a pension plan's assets and liabilities and discounts those cash flows using risk-free Treasury interest rates.¹⁹ Those two methods of adjusting for market risk produce the same result.²⁰

Budgetary Effects of Spending on Human and Physical Capital

Some government spending focuses on human development or physical infrastructure. In addition to the up-front costs, such spending affects the federal budget through its long-term effects on the economy. For example, spending on education and health care for children can lead children to be more productive as adults. Spending on infrastructure, such as broadband networks,

16. In some cases, CBO incorporates market risk in projected cash flows instead of in the discount rate. See Michael Falkenheim, *Fair-Value Cost Estimation and Government Cash Flows*, Working Paper 2021-05 (Congressional Budget Office, April 2021), www.cbo.gov/publication/57062.

17. For more information, see Michael Falkenheim and Wendy Kiska, *How CBO Estimates the Market Risk of Federal Credit Programs*, Working Paper 2021-14 (Congressional Budget Office, November 2021), www.cbo.gov/publication/57581.

18. For additional information about PBGC's pension programs and funding requirements for pension plans, see Wendy Kiska, Jason Levine, and Damien Moore, *Modeling the Costs of the Pension*

Benefit Guaranty Corporation's Multiemployer Program, Working Paper 2017-04 (Congressional Budget Office, June 2017), www.cbo.gov/publication/52749; and Congressional Budget Office, *Options to Improve the Financial Condition of the Pension Benefit Guaranty Corporation's Multiemployer Program* (August 2016), www.cbo.gov/publication/51536, *The Risk Exposure of the Pension Benefit Guaranty Corporation* (September 2005), www.cbo.gov/publication/17160, and *A Guide to Understanding the Pension Benefit Guaranty Corporation* (September 2005), www.cbo.gov/publication/17179.

19. For more details about the procedure CBO uses to estimate cash flows for a pension plan's assets and liabilities, see Wendy Kiska, Jason Levine, and Damien Moore, *Modeling the Costs of the Pension Benefit Guaranty Corporation's Multiemployer Program*, Working Paper 2017-04 (Congressional Budget Office, June 2017), www.cbo.gov/publication/52749.

20. Congressional Budget Office, *Measuring the Cost of Government Activities That Involve Financial Risk* (March 2021), www.cbo.gov/publication/56778; and Michael Falkenheim, *Fair-Value Cost Estimation and Government Cash Flows*, Working Paper 2021-05 (Congressional Budget Office, April 2021), www.cbo.gov/publication/57062.

can make businesses more productive for years to come. In both of those cases, greater productivity can affect the government's revenues and spending, leading to increases in revenues and decreases in spending that can continue for decades.

The changes in the deficit that result from those effects on the economy are known as macroeconomic feedback (or sometimes as dynamic effects). The macroeconomic feedback from increased federal spending on human or physical capital depends on whether the additional spending is offset by changes elsewhere in the budget or is financed through government borrowing. When such spending increases budget deficits and federal debt, it leads to higher interest rates and crowds out private capital, resulting in macroeconomic feedback that adds to the cost of the initial spending. (CBO's cost estimates do not routinely include dynamic effects.)²¹

To estimate the future budgetary effects of spending on human or physical capital, CBO extensively analyzes relevant research. The agency then uses discount rates to convert estimates of future fiscal effects into a present value that can be compared with the up-front costs.

Medicaid Coverage for Children. In a 2023 working paper, CBO analysts examined how additional spending on Medicaid's health insurance benefits for children would affect children's earnings in adulthood and how those changes in earnings would affect the federal budget.²² The authors examined an illustrative policy that would require all states to provide qualifying children with 12 months of continuous Medicaid eligibility. The authors used a dynamic model that projected that increases in Medicaid coverage for children would lead to higher earnings—and thus to increases in federal tax revenues and decreases in federal means-tested transfer payments.²³

The difference between the up-front costs of the policy and those long-term budgetary effects is very sensitive to the choice of discount rates. Providing an additional year of Medicaid coverage for a child would cost an average of about \$1,700 over the following 10 years (discounted to 2022 using Treasury interest rates), the authors estimated. The long-term budgetary gains would offset about half of that up-front cost if they were discounted using fair-value rates that accounted for market risk, or those gains would be roughly twice the up-front cost if they were discounted using Treasury rates (assuming that the initial spending was offset elsewhere in the budget and did not increase the deficit). Market risk applies to such spending because the future fiscal effects would be greater when overall income levels were higher, meaning that the spending would tend to have larger returns in good economic times than in bad times.

Infrastructure. In a 2021 report, CBO estimated how increased federal spending on physical infrastructure, such as repairs and construction of highways, would affect economic growth and thus the federal budget over the long term.²⁴ Increases in physical capital would boost productivity and thereby increase economic output, or GDP. Greater GDP would result in more tax revenues. The present value of those additional revenues, discounted using Treasury interest rates, could offset approximately one-third of the initial spending (provided that it did not add to the deficit).

Value of Investments by Businesses and Households

CBO often analyzes how businesses and households might respond to changes in government policies. Those analyses use policy simulation models in which businesses base decisions about whether to invest in capital on the returns they are likely to receive in the future, and households base decisions about whether to invest in things like energy-efficient products on the future savings they are likely to realize. To decide whether to make an investment, businesses and households compare those future amounts with the up-front costs—generally using either discount rates or other rules of thumb that are mathematically comparable with discounting.

Large companies generally follow different approaches to evaluating investments than households do. Large

21. Congressional Budget Office, *CBO Describes Its Cost-Estimating Process* (April 2023), www.cbo.gov/publication/59003.

22. Elizabeth Ash and others, *Exploring the Effects of Medicaid During Childhood on the Economy and the Budget*, Working Paper 2023-07 (Congressional Budget Office, November 2023), www.cbo.gov/publication/59231.

23. Means-tested transfers are cash payments and in-kind services provided through government assistance programs. People's eligibility is determined mainly on the basis of income, which must be below certain thresholds.

24. Congressional Budget Office, *Effects of Physical Infrastructure Spending on the Economy and the Budget Under Two Illustrative Scenarios* (August 2021), www.cbo.gov/publication/57327.

businesses are likely to perform formal financial analyses to determine which investments would provide the best value for their stakeholders. Such analyses apply discount rates that depend on the business's cost of capital and the riskiness of the investments. For example, companies investing in charging stations for electric vehicles discount the future revenues from those stations at a rate that reflects the return their investors expect given the risk of that activity. In general, businesses pursue investments whose projected returns have the highest net present value after accounting for their risk.

Households are more likely to evaluate future benefits using a rule of thumb such as the payback period. For example, a household might invest in an energy-saving appliance if the investment paid for itself in five years or less—in other words, if the undiscounted value of the energy savings over five years was greater than the additional up-front cost to buy the appliance. In such cases, although a typical household is not likely to perform calculations using a discount rate, it is possible to calculate an implicit discount rate that would result in the same decisions.

Electric Vehicle Purchases and Charging Stations.

CBO has analyzed the effects of federal tax credits for buying new electric vehicles and federal subsidies for building public charging stations. Such analyses apply two separate sets of discount rates: one for households that purchase electric vehicles and another for companies that invest in charging stations.²⁵

CBO assesses that households discount future energy savings at a high rate, approximately 10 percent, reflecting households' time preference and their tendency to place a low value on projected future savings from energy-efficient technologies. That low valuation might occur for many reasons. Consumers may be skeptical that the promised savings will materialize, or they may want or need to minimize their up-front costs, even if doing so results in higher future costs.²⁶

25. David Austin, *Modeling the Demand for Electric Vehicles and the Supply of Charging Stations in the United States*, Working Paper 2023-06 (Congressional Budget Office, September 2023), www.cbo.gov/publication/58964.

26. Hunt Allcott and Nathan Wozny, "Gasoline Prices, Fuel Economy, and the Energy Paradox," *Review of Economics and Statistics*, vol. 96, no. 5 (December 2014), pp. 779–795, <https://tinyurl.com/bdaka5ed>; and Gloria Helfand and Ann Wolverton, "Evaluating the Consumer Response to Fuel Economy: A Review

CBO estimates that a company would invest in building a charging station if the future profits from operating the station had a discounted value greater than the up-front costs of construction. To convert those projected future profits into a present value, CBO uses a discount rate of 8 percent, which reflects the weighted average cost of capital for industries whose products and services are used to produce electric vehicle chargers: the automotive, electric utility, electrical equipment, electronics, and engineering and construction industries. That cost of capital reflects the market risk of those activities. The 8 percent discount rate is based on widely used estimates that reflect the prices of corporate stocks and bonds and projections of corporate earnings in those industries.²⁷

Pharmaceutical Research and Development. CBO must sometimes analyze how legislation that would alter revenues in the pharmaceutical industry would affect drug research and development. Prescription drug companies make decisions about which research and development projects to pursue by comparing the present value of a project's costs over all stages of drug development with the present value of the project's expected revenues.²⁸ In analyzing such decision-making, CBO uses discount rates that are based on the weighted average cost of capital for publicly traded pharmaceutical companies, with some adjustments for the additional risk of early-stage research. (That discount rate was approximately 8 percent on the basis of data available in January 2024.)²⁹ As in the approach for electric vehicle chargers, those estimated discount rates reflect the prices of the companies' stocks and bonds and their projected earnings.

Value of Payments to Retirees

The federal government makes regular payments to retirees through the Social Security program and through various retirement programs for federal civilian employees and military personnel. CBO often measures the cost

of the Literature," *International Review of Environmental and Resource Economics*, vol. 5, no. 2 (May 2011), pp. 103–146, <https://tinyurl.com/2p8n5kt5>.

27. Aswath Damodaran, *Equity Risk Premiums (ERP): Determinants, Estimation, and Implications—The 2021 Edition* (March 2021), <https://dx.doi.org/10.2139/ssrn.3825823>.

28. Christopher P. Adams, *CBO's Simulation Model of New Drug Development*, Working Paper 2021-09 (Congressional Budget Office, August 2021), www.cbo.gov/publication/57010.

29. Aswath Damodaran, "Cost of Equity and Capital (U.S.)," (January 2024), <https://tinyurl.com/4ds7aby8>.

of those payments on a present-value basis, using interest rates on Treasury securities as discount rates. CBO sometimes also estimates the market value of retirement benefits to provide a measure that is comparable with other measures of wealth, using discount rates that include a premium for market risk.

Social Security Benefits. In certain long-term projections and in reports on the distribution of household wealth, CBO measures the value of Social Security benefits to program participants over their lifetime on a present-value basis.³⁰ In its long-term projections for Social Security, CBO estimates that value by discounting, to age 65, projected future payments to beneficiaries using the average interest rate on outstanding federal debt.

Social Security represents a large share of retirement income for most U.S. households and thus is a key component of their wealth. Accordingly, CBO incorporates the present value of Social Security benefits in its analyses of the distribution of household wealth. For those analyses, CBO adjusts discount rates for market risk to estimate a value for Social Security wealth that is comparable with the values of financial assets, such as stocks and bonds, held by households. Investors are not willing to pay as much for financial assets that are subject to market risk, if everything else is equal. By using market prices to measure financial wealth, CBO effectively incorporates a typical household's valuation of market risk.

Future Social Security beneficiaries face market risk during their working years because their benefits will be based on their earnings in each year of their career, multiplied by the growth of average wages between that year and their retirement date. The growth of average wages depends on the performance of the economy because it is closely tied to the growth of labor productivity. A Social Security beneficiary's exposure to market risk ends at retirement. After that, Social Security benefits are adjusted annually for inflation rather than for wage growth.

Federal Employees' Retirement Benefits. The federal government operates a number of retirement programs for its civilian employees and military personnel. CBO

sometimes estimates the cost of those retirement benefits on a present-value basis.³¹ For example, in a report analyzing options to reduce the cost of federal retirement programs, CBO used present-value measures of the cost of pension benefits earned by federal employees.³² The main analysis used Treasury rates to discount future retirement benefits. In addition, the report provided supplemental estimates calculated on a fair-value basis, with discount rates that incorporated the effects of market risk.

CBO also calculates the present value of retirement benefits for reports that compare the compensation of federal civilian employees and military personnel with that of private-sector employees.³³ CBO estimates the present value of benefits accrued in federal and private pensions by using Treasury interest rates to discount those benefits. CBO's analysis of compensation for military personnel noted that recruits may discount retirement benefits at a higher rate in their decision-making. That analysis included additional estimates calculated using a "personal discount rate" of 7 percent, a number based on research about how military personnel trade off cash and deferred compensation.³⁴ When deciding whether to change jobs or retire, many federal civilian employees may also discount future benefits at a higher rate than

30. See, for example, Congressional Budget Office, *CBO's 2024 Long-Term Projections for Social Security* (August 2024), www.cbo.gov/publication/60392, and *Trends in the Distribution of Family Wealth, 1989 to 2022* (October 2024), www.cbo.gov/publication/60343.

31. Aside from their use in CBO analyses, present-value estimates play a role in the official budgetary treatment of federal retirement benefits. The government's cash payments for those benefits are reported in the budget as outlays when they are made. However, most federal agencies' budgets are charged for the estimated future cost of some of the retirement benefits their employees accrue each year. Those estimated future costs are present values calculated using discount rates and other assumptions chosen by actuaries at the Office of Personnel Management and the Department of Defense. See Congressional Budget Office, *Accounting for Federal Retirement and Veterans' Benefits: Cash and Accrual Measures* (September 2019), www.cbo.gov/publication/55499.

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

33. See, for example, Congressional Budget Office, *Comparing the Compensation of Federal and Private-Sector Employees in 2022* (April 2024), www.cbo.gov/publication/59970, and *Approaches to Changing Military Compensation* (January 2020), www.cbo.gov/publication/55648.

34. Curtis J. Simon, John T. Warner, and Saul Pleeter, "Discounting, Cognition, and Financial Awareness: New Evidence From a Change in the Military Retirement System," *Economic Inquiry*, vol. 53, no. 1 (January 2015), pp. 318–334, <https://doi.org/10.1111/ecin.12146>.

the one used in present-value estimates of the cost of those benefits to the government.³⁵

Life-Cycle Costs of Weapon Systems

In its analyses of the U.S. military, CBO frequently estimates the total costs of current or proposed weapon systems, such as aircraft or ships. Those estimates represent the present value of the expected costs of a system over its service life, discounted using interest rates on Treasury securities.

Unmanned Aerial Systems. In a 2021 analysis, CBO estimated the life-cycle costs of nine present or past U.S. military aircraft capable of performing similar missions: three unmanned aerial systems (drones) and six manned aircraft.³⁶ Life-cycle costs are only one factor policymakers might consider in choosing among those systems, especially when comparing manned and unmanned aircraft. Different aircraft have different capabilities, and manned aircraft have advantages and disadvantages relative to unmanned aircraft. The analysis focused on comparing manned P-8 aircraft and unmanned RQ-4 drones. CBO estimated that those two systems had similar life-cycle costs per flying hour, highlighting the importance of differences in their capabilities.

To measure life-cycle costs for that analysis, CBO used a discount rate of 0.7 percent, which was the agency's projection of the real (inflation-adjusted) Treasury rate when the analysis was conducted. That discount rate was applied to the cost of acquiring different fleets of aircraft and the recurring costs of maintaining and operating those fleets over their lifetimes. The choice of real discount rate affected the relative present-value costs of the systems because, for example, the manned P-8 has a greater proportion of its life-cycle costs in the early years than do unmanned aircraft, which have higher operating costs relative to their up-front costs. Consequently, compared with unmanned aircraft, the P-8 was estimated to be less expensive on a life-cycle basis when the

calculations used lower discount rates than when they used higher rates.

Navy Ships. In a 2010 letter to the Congress, CBO projected life-cycle costs for four classes of Navy ships that could perform missions similar to those of the newly introduced littoral combat ship.³⁷ Those life-cycle estimates included the costs of research and development, procurement, personnel, fuel, disposal, and operations and support. The analysis used a real discount rate of 3 percent, which was widely used at that time as a historical average of inflation-adjusted Treasury rates.

Cost of Future Flood Damage

As part of its efforts to examine the budgetary effects of a changing climate, CBO has analyzed the impact of changes in the risk of flooding for homes financed with federally guaranteed mortgages. CBO has also analyzed the potential reductions in damage associated with spending on flood mitigation by the Federal Emergency Management Agency (FEMA) and the Army Corps of Engineers. In those analyses, CBO estimated the present-value costs to homeowners of future flood damage or the present-value savings from reductions in future flood damage.

Flood Damage and Federally Backed Mortgages.

Properties with federally insured mortgages are projected to sustain \$12.8 billion in flood damage in 2050, given the level of flood risk expected by that year, up from \$9.4 billion in 2020 (both amounts are in 2020 dollars).³⁸ In translating such annual estimates into present values, CBO anticipated that someone purchasing a home would consider the total projected damage over many years, discounted to the present. From the purchaser's viewpoint, future flood damage would require additional investments over time to maintain the value of the property. The buyer would therefore value being able to avoid that projected damage at its present value, discounted by the real rate of return on the property.

For its analysis, CBO used a discount rate of 3 percent. That figure roughly equals the average annual real return on residential assets over the past several decades

35. Congressional Budget Office, *Comparing the Compensation of Federal and Private-Sector Employees in 2022* (April 2024), www.cbo.gov/publication/59970; and Justin Falk and Nadia Karamcheva, *Comparing the Effects of Current Pay and Defined Benefit Pensions on Employee Retention*, Working Paper 2018-06 (Congressional Budget Office, June 2018), www.cbo.gov/publication/54056.

36. Congressional Budget Office, *Usage Patterns and Costs of Unmanned Aerial Systems* (June 2021), www.cbo.gov/publication/57090.

37. Congressional Budget Office, letter to the Honorable Jeff Sessions on the total life-cycle costs of four classes of Navy ships (April 28, 2010), www.cbo.gov/publication/21398.

38. Congressional Budget Office, *Flood Damage and Federally Backed Mortgages in a Changing Climate* (November 2023), www.cbo.gov/publication/59379.

(according to data from the government’s national income and product accounts and the Federal Reserve) and thus matches the rate of return investors have historically required on residential assets given their level of risk.

FEMA’s Property-Level Flood Adaptation Grants.

CBO has estimated the effects of flood mitigation measures that FEMA funds through grants aimed at individual residential properties.³⁹ Those grants fund state and local activities to elevate or buy out homes at high risk of flooding. (In buyouts, the purchased properties are demolished and devoted to open space to prevent future flood damage.) To measure the benefits of flood mitigation, CBO estimated the expected damage avoided through those activities over the next 30 years and discounted that amount to the present using a 3 percent discount rate.

Army Corps of Engineers’ Flood Adaptation Projects.

The Army Corps of Engineers funds infrastructure projects that protect communities from flooding, such as the construction of dams and levees. Such projects can prevent damage not only to residential properties but also to commercial real estate and government properties.

When analyzing those projects, CBO examined the results of benefit-cost analyses that the Corps performed using discount rates required by the Water Resources Development Act of 1974 (Public Law 93-251). That law required the Corps to discount inflation-adjusted benefits and costs by using the average yield on Treasury securities with at least 15 years remaining to maturity, with no adjustment for inflation. CBO compared calculations that used an average of those discount rates (which varied each year and ranged from 2.25 percent to 6.625 percent) with calculations that used the discount rate the Office of Management and Budget specifies in its guidelines for benefit-cost analyses.⁴⁰ OMB’s guidelines, spelled out in Circular A-94, were published in 1992 and updated in 2023. The 2023 version specified a much lower discount rate—3.1 percent instead of the previous 7.0 percent—so CBO provided an illustrative

example of discounting with both the former and current rates specified in that circular.⁴¹

Data and Methods That CBO Uses to Determine Discount Rates

In many cases, laws direct CBO to use certain discount rates for its estimates. In other cases, CBO chooses discount rates depending on the purpose of its estimates (see Figure 2 on page 5). In addition to its projections of interest rates on Treasury securities, CBO uses data from financial markets, the Federal Reserve, and the Bureau of Economic Analysis to select some discount rates.⁴² To determine the discount rates that households might apply in making investment decisions, CBO often relies on academic studies that analyze data about how households have made similar decisions in the past.

Projections of Treasury Rates

Under the Federal Credit Reform Act, the rates used to discount the cash flows of federal credit programs must be based on the interest rates on Treasury securities with a maturity similar to the timing of the cash flows of a given loan or loan guarantee. In practice, that requirement has meant that under FCRA, CBO calculates the present value of projected future cash flows by discounting those flows using interest rates on fixed-rate,

41. Office of Management and Budget, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular A-94 (November 2023), <https://tinyurl.com/huwt4jf5>. The 2023 revisions to Circular A-94 lowered the discount rate as a result of switching from the average before-tax rate of return on a broad category of assets to an after-tax rate of return on the assets of publicly traded companies in selected sectors that are “closest to government investment.” The lower discount rate makes the present value of benefits associated with government spending larger relative to the up-front costs. OMB also made changes in 2023 to Circular A-4, which provides guidance on the discount rates for regulatory analysis. Those changes discontinued the use of a higher discount rate to capture market risk in favor of the use of certainty-equivalent projections (which would incorporate market risk in the projected cash flows) and an approach called “shadow pricing” (which incorporates tax effects in projected costs instead of using a discount rate). See Office of Management and Budget, *Regulatory Analysis*, Circular A-4 (November 2023), <https://tinyurl.com/huwt4jf5>; and Richard G. Newell, William A. Pizer, and Brian C. Prest, *The Shadow Price of Capital: Accounting for Capital Displacement in Benefit-Cost Analysis*, Issue Brief 22-08 (Resources for the Future, November 2022), <https://tinyurl.com/y6zun5rf>.

42. CBO projects Treasury interest rates as part of its process for developing a macroeconomic forecast. See Robert W. Arnold, *How CBO Produces Its 10-Year Economic Forecast*, Working Paper 2018-02 (Congressional Budget Office, February 2018), pp. 18–20, www.cbo.gov/publication/53537.

39. Evan Herrstadt and Jared Jageler, *Flood Damage Avoided by Potential Spending on Property-Level Adaptations*, Working Paper 2024-03 (Congressional Budget Office, May 2024), www.cbo.gov/publication/58168.

40. Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971.

zero-coupon Treasury securities that match the maturity of the cash flows of each credit program.⁴³ In that discounting method—known as the “basket of zeros” approach—the return on a Treasury security maturing in one year would be used to discount cash flows one year after disbursement, the return on a two-year security would be used for cash flows two years after disbursement, and so on.

Data From Financial Markets

For present-value estimates that incorporate market risk (fair-value estimates), CBO determines premiums for market risk by using various financial market data:

- **Returns on corporate bonds.** To calculate the difference between the returns on corporate bonds and on Treasury securities—a key input in measures of market risk for credit programs—CBO uses Bloomberg’s indexes for U.S. corporate bonds from 1996 to the present.⁴⁴ For 2024, CBO estimated market risk premiums that ranged from about 0.5 percent for corporate bonds with a credit rating of AA to about 2.0 percent for corporate bonds with a rating of B or lower.
- **Returns on asset-backed securities.** To estimate the fair value of student loans and other consumer loans, CBO uses the prices of financial securities that are backed by auto loans, credit card receivables (the amount owed on credit cards), private student loans, and other personal loans, as reported by rating agencies. CBO’s estimates of market risk premiums for 2024 varied from about 2.25 percent (for consumer loans with expected loss rates of less than 5 percent) to about 6.5 percent (for consumer loans with loss rates exceeding 20 percent).
- **Stock market values and earnings projections.** To estimate risk premiums on assets of large publicly traded companies, CBO uses publicly available estimates from Aswath Damodaran, a professor of finance at New York University. Damodaran

combines stock prices with earnings projections by stock market analysts to estimate an implicit risk premium for publicly traded corporate assets.⁴⁵ For 2023, Damodaran estimated an implied risk premium on stocks of 4.3 percent.

Data From the Bureau of Economic Analysis and the Federal Reserve

CBO estimates discount rates for property damage associated with flooding by looking at past returns on investment for broad categories of physical capital. To estimate those returns, CBO uses data from the flow-of-funds tables produced by the Federal Reserve and from the national income and product accounts (NIPAs) produced by the Bureau of Economic Analysis (BEA). Those two data sources have been combined into the integrated macroeconomic accounts, which show information about income from the NIPAs and information about outstanding values from the flow-of-funds accounts on a harmonized basis, making it possible to measure returns as the ratio of income to value.⁴⁶

Since 1980, the rate of return on capital in the NIPA data has been less volatile than the weighted average cost of capital of large publicly traded corporations (see Figure 3). The NIPA rate of return has hovered around 7 percent for the past four decades, whereas the weighted average cost of capital has declined over that period. (Both measures were about 6 percent in 2023.) The premium for market risk, as measured by the gap between the weighted average cost of capital and the Treasury rate, has risen during that period, partly offsetting a decline in the real rate on 10-year Treasury notes. Over the 1993–2023 period, the weighted average cost of capital—that is, the risk premium plus the average interest rate on 10-year Treasury notes—has been about 5.5 percent (see Figure 4).

The weighted average cost of capital of large publicly traded companies differs from the average NIPA return on capital—it has generally been less in recent years—primarily because the NIPA measure covers a broader

43. A zero-coupon security is one whose face value is repaid when the security matures. It is typically sold for much less than its face value but earns no interest. Because a zero-coupon security does not make periodic interest payments, its return is simply the difference between the purchase price and the face value paid at maturity.

44. Michael Falkenheim and Wendy Kiska, *How CBO Estimates the Market Risk of Federal Credit Programs*, Working Paper 2021-14 (Congressional Budget Office, November 2021), pp. 14–22, www.cbo.gov/publication/57581.

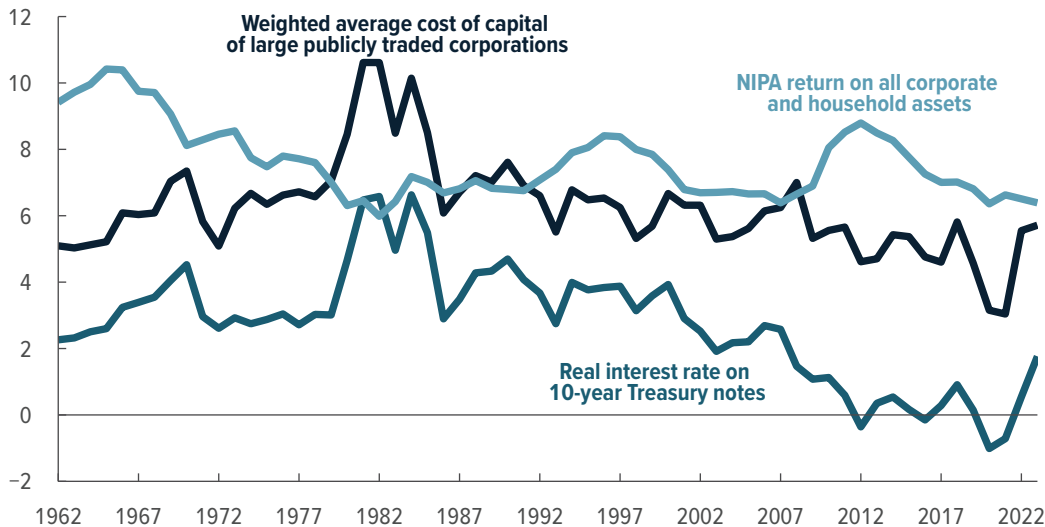
45. Aswath Damodaran, *Equity Risk Premiums (ERP): Determinants, Estimation, and Implications—The 2021 Edition* (March 2021), <https://dx.doi.org/10.2139/ssrn.3825823>.

46. For more information, see Marco Cagetti and others, *The Integrated Macroeconomic Accounts of the United States*, Finance and Economics Discussion Series 2012-81 (Federal Reserve Board, 2012), www.federalreserve.gov/pubs/feds/2012/201281.

Figure 3.

Real Rates of Return Used for Discount Rates

Percent



Since the early 1980s, the rate of return on capital as measured by the NIPAs has been less volatile than interest rates on 10-year Treasury notes or the weighted average cost of capital at large publicly traded corporations. CBO uses the rate of return in the NIPA data to determine discount rates for present-value estimates of property damage from flooding.

Data sources: Congressional Budget Office; Aswath Damodaran, *Equity Risk Premiums (ERP): Determinants, Estimation, and Implications—The 2021 Edition* (March 2021), <https://dx.doi.org/10.2139/ssrn.3825823>; Bureau of Economic Analysis; Federal Reserve; Moody's; ICE Data Indices. See www.cbo.gov/publication/60284#data.

Data are for calendar years.

Real values are nominal values that have been adjusted to remove the effects of inflation.

The risk premium on assets of large publicly traded corporations (a component of the weighted average cost of capital) is estimated from the implied risk premium on companies in the Standard & Poor's 500 index (based on data from Aswath Damodaran) and the interest rate on corporate bonds rated BBB or Baa, with weights determined by the shares of stocks and bonds in the Federal Reserve's flow-of-funds data.

NIPA = national income and product accounts.

set of assets.⁴⁷ The NIPA return includes households, privately held corporations, and smaller publicly traded corporations, in addition to large publicly traded corporations. Including other businesses results in a higher return because large publicly traded companies have a weighted average cost of capital that is well below the average for all businesses. (Including the assets of households in the NIPA measure partly offsets that effect, reducing the return, because households mainly own

residential capital, which typically receives a much lower return; see Figure 5.)

CBO uses the return on capital for large publicly traded corporations when analyzing policies that would primarily affect such companies. The agency uses NIPA returns on capital when analyzing policies that would have broader effects.

Academic Studies

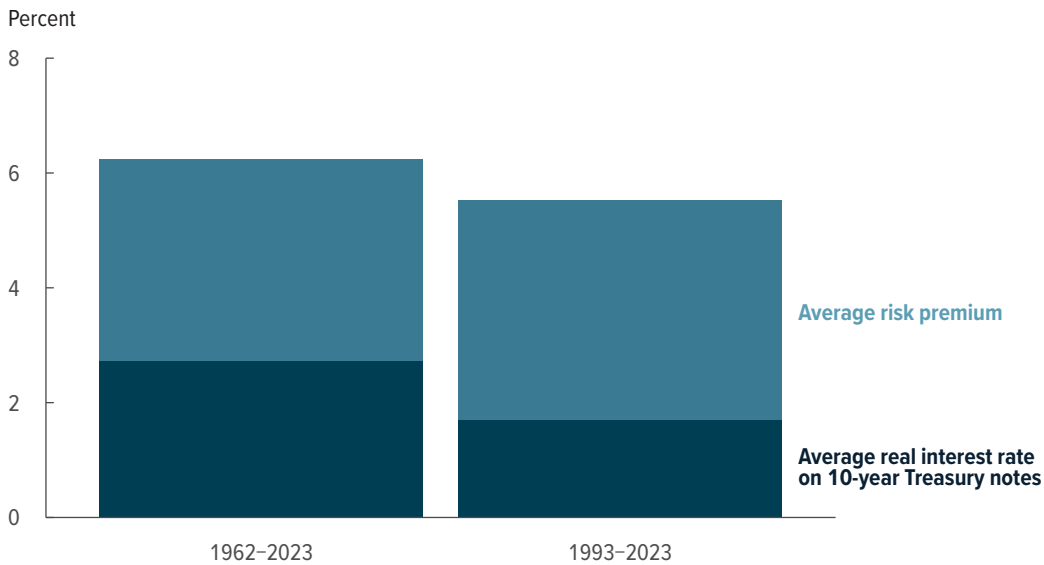
CBO sometimes turns to academic studies for estimates of discount rates when the purpose of discounting is to predict how households might make trade-offs between money now and money in the future. CBO has relied on studies of how people invest in energy-saving technology or how they weigh the relative value of defined benefit pensions and cash compensation.

CBO has also relied heavily on methods from academic studies to estimate the financial value of payments that

47. The NIPA return is the ratio of income to assets measured on a replacement-value basis, which equals the original cost of an asset minus depreciation. In contrast, the weighted average cost of capital is a ratio of annual returns to market values. The two measures differ by the ratio of the market value of assets to their replacement cost, known in economics as "Tobin's Q." The NIPA return is relatively high when Tobin's Q is low, and vice versa. Tobin's Q has been relatively high in recent decades, accounting for some of the decline in the weighted average cost of capital relative to the NIPA return.

Figure 4.

Components of the Weighted Average Cost of Capital of Large Publicly Traded Corporations



To produce present-value estimates for policies that would mainly affect large publicly traded corporations, CBO uses the average return on capital for such corporations as the discount rate. That return, also called the weighted average cost of capital, has averaged about 6 percent since the 1960s.

Data sources: Congressional Budget Office; Aswath Damodaran, *Equity Risk Premiums (ERP): Determinants, Estimation, and Implications—The 2021 Edition* (March 2021), <https://dx.doi.org/10.2139/ssrn.3825823>; Federal Reserve; Moody's; ICE Data Indices. See www.cbo.gov/publication/60284#data.

Data are for calendar years.

Real values are nominal values that have been adjusted to remove the effects of inflation.

The risk premium on assets of large publicly traded corporations is estimated from the implied risk premium on companies in the Standard & Poor's 500 index (based on data from Aswath Damodaran) and the interest rate on corporate bonds rated BBB or Baa, with weights determined by the shares of stocks and bonds in the Federal Reserve's flow-of-funds data.

are based on future wages.⁴⁸ Those studies measured the risk associated with future wages by relating uncertainty in wages to uncertainty in the stock market, showing that wages and stock prices can diverge in the short term but tend to follow similar paths over long periods. Stocks earn a greater return than Treasury securities do because

stock investments tend to lose money when the economy is performing poorly.

How CBO's Discount Rates Differ From the Administration's

The discount rates CBO uses in its present-value estimates may differ from those used by the Office of Management and Budget, government actuaries, and other groups that produce estimates for federal programs. Those differences can occur for various reasons, including different economic assumptions, different assessments of risk, and different decisions about what to include in discount rates.

OMB issues guidance (through Circulars A-4 and A-94) about the discount rates that most executive branch agencies should use for benefit-cost analyses.⁴⁹ For

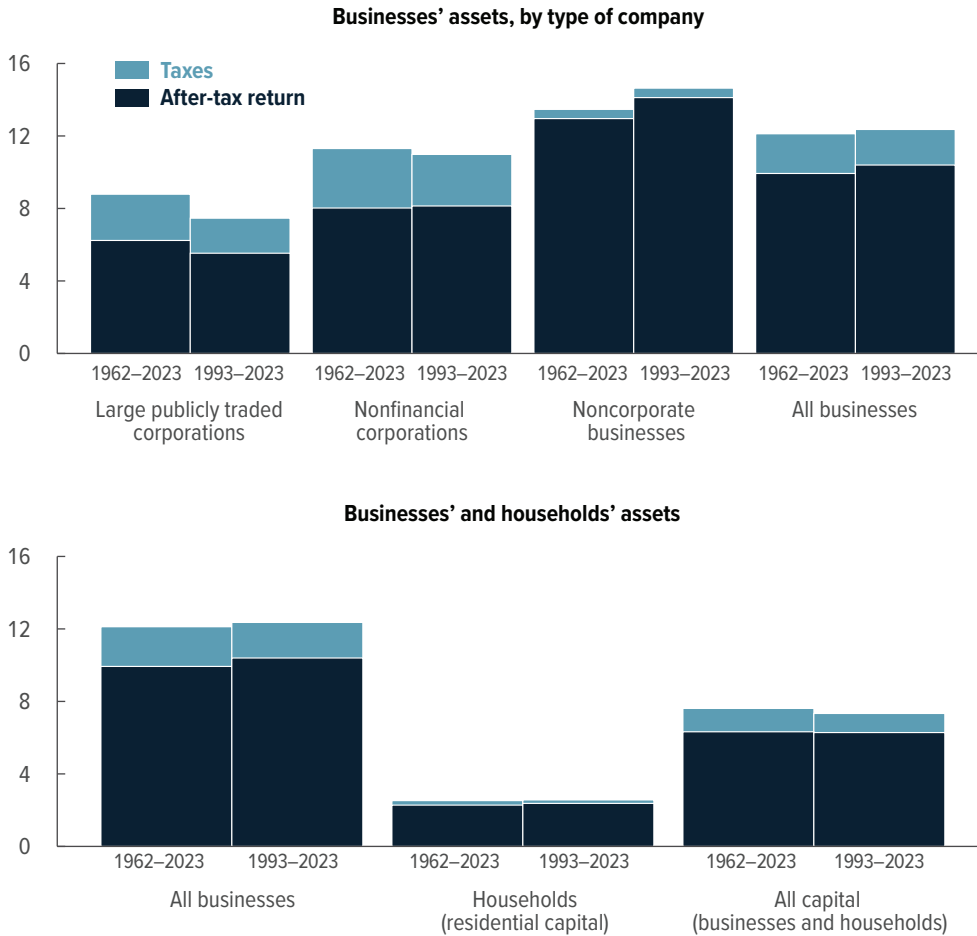
48. See, for example, Mark Huggett and Greg Kaplan, "How Large Is the Stock Component of Human Capital?" *Review of Economic Dynamics*, vol. 22 (October 2016), pp. 21–51, <https://doi.org/10.1016/j.red.2016.06.002>; John Geanakoplos and Stephen P. Zeldes, "Market Valuation of Accrued Social Security Benefits," in Deborah Lucas, ed., *Measuring and Managing Federal Financial Risk* (University of Chicago Press, February 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," *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), <https://tinyurl.com/5c9evsau>.

49. Office of Management and Budget, *Regulatory Analysis*, Circular A-4 (November 2023), and *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular A-94 (November 2023), <https://tinyurl.com/huw74jf5>.

Figure 5.

Average Annual Returns on Different Categories of Assets

Percent



In its present-value estimates for policies, CBO uses returns on different categories of assets as discount rates depending on what parts of the economy a policy would affect. Data on those returns come from the national income and product accounts and financial market sources.

Data sources: Congressional Budget Office; Aswath Damodaran, *Equity Risk Premiums (ERP): Determinants, Estimation, and Implications—The 2021 Edition* (March 2021), <https://dx.doi.org/10.2139/ssrn.3825823>; Bureau of Economic Analysis; Federal Reserve; Moody's; ICE Data Indices. See www.cbo.gov/publication/60284#data.

Data are for calendar years.

estimates of federal credit programs under FCRA, the Administration's projections of interest rates on Treasury securities are used to set discount rates. Some other programs—such as Social Security, Medicare, and the military retirement system—use different rates that are chosen by independent actuaries.

CBO's FCRA estimates may differ from the Administration's because CBO uses discount rates that are based on its own projections of Treasury rates over the period when a program is making or guaranteeing

loans. Different judgments about market risk and about what factors to include in discount rates can also cause CBO's rates to diverge from the Administration's.

For example, although CBO does not perform benefit-cost analyses (the focus of Circulars A-4 and A-94), its discount rates for flood damage have a similar purpose—to estimate the costs of expected annual flood damage in present-value terms. To that end, CBO estimates before-tax returns on capital using data from BEA and the Federal Reserve for a broad category of physical



capital, not just that of publicly traded companies. That broad category covers the range of assets that might be damaged in floods (which is not limited to the assets of publicly traded corporations). Before-tax returns are appropriate for discounting damage that is estimated on a pretax basis. (Damage estimated on an after-tax basis would reflect the reduction in taxes from deducting flood losses as an expense.) The discount rates specified in OMB's Circular A-94, by contrast, are based on after-tax returns of companies in sectors that are comparable with

those of public investment, according to the circular.⁵⁰ (For examples of average returns on the assets of various types of companies, see Figure 5.)

50. Office of Management and Budget, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular A-94 (November 2023), Appendix D, <https://tinyurl.com/huwt4jf5>. Before the 2023 revisions to Circular A-94, OMB's discount rates were based on BEA data. See Council of Economic Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* (January 2017), <https://tinyurl.com/mwbyn6cr>.

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About This Document

This report, which is part of the Congressional Budget Office’s continuing efforts to make its work transparent, describes how CBO selects and uses discount rates to calculate the present value of future cash flows in its analyses. In keeping with CBO’s mandate to provide objective, impartial analysis, the report makes no recommendations.

Michael Falkenheim, Wendy Kiska, and Joyce Bai wrote the report with guidance from Sebastien Gay. Alia Abdelkader, Christopher Adams, David Austin, Nicholas Chase, Xinzhe Cheng, Noelia Duchovny, Justin Falk, Ann E. Futrell, Ron Gecan, Tamara Hayford, Rebecca Heller, Justin Humphrey, Jared Jageler, Nadia Karamcheva, Edward G. Keating, Joseph Kile, Noah Meyerson, David Mosher, Caroline Nielsen, Aditi Sen, Chad Shirley, Delaney Smith, Emily Stern, Julie Topoleski, David Torregrosa, R. Derek Trunkey, and Chapin White offered comments. Mitchell Remy fact-checked the report.

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CBO seeks feedback to make its work as useful as possible. Please send comments to communications@cbo.gov.



Phillip L. Swagel
Director
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