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CBO's Model for Estimating the Effect That Federal Taxes Have on Capital Income From New Investment

Paul Burnham
Congressional Budget Office
Paul.Burnham@cbo.gov

Dorian Carloni
Congressional Budget Office
Dorian.Carloni@cbo.gov

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Supplemental data and a link to the code for CBO's CapTax model on [GitHub](#) are posted along with this paper on CBO's website.

Abstract

The Congressional Budget Office has developed a model to estimate the effect that federal taxes have on capital income from new investment; it uses that model to help estimate how changes in tax law would affect the economy. The model follows a well-established analytical framework that involves calculating the difference between the before-tax rate of return required to justify an investment and the after-tax rate of return demanded by savers (that is, individuals purchasing the equity and debt issued by businesses). The calculation of the before-tax rate of return is based on the Hall-Jorgensen formula for the user cost of capital and incorporates marginal tax rates on profits, deductions for interest and cost recovery, and investment tax credits. The formula for after-tax rates of return accounts for the taxation of interest, dividends, and capital gains at the individual level, as well as for the opportunity to shelter such income from taxation in retirement accounts. Calculations in the model are performed at a level of disaggregation that reflects differences in tax treatment among different industries, types of assets, legal forms of organization, and sources of financing. The disaggregated measures are weighted to more aggregated levels on the basis of asset values in such a way that the results reflect both the differences in tax treatment and differences in the distribution of assets among the various groups. An alternative approach to aggregation that isolates the differences in tax treatment is presented in an appendix.

Keywords: Computational techniques, simulation modeling, capital taxation

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Framework for Estimating the Effect That Federal Taxes Have on Capital Income

The Congressional Budget Office has published multiple reports that have quantified the effect that federal taxes have on capital income generated by investment in nonfinancial assets (that is, equipment, structures, intellectual property products, inventories, and land).¹ To measure that effect—which is often referred to as the tax burden—CBO developed a model to estimate effective marginal tax rates on such capital income. That model, called CapTax, has been improved and expanded over the years. In addition to being used in the analysis underlying those earlier reports, the model has been used to help estimate the impact of changes in tax law on investment and saving. Although the particular model is unique to CBO, it operates within a framework that many other analysts have adopted. This paper, which accompanies the public release of the model, outlines the general analytical framework and explains how CBO’s model fits within it.

Measuring the Effect of Taxes on Capital Income

Taxes on capital income reduce the rate of return that a prospective investment is expected to generate. Measures of the tax burden are computed using two rates of return on a marginal investment—an investment that, if it earned any less, would not be made. One of those rates is the *required before-tax rate of return*, which is the real rate of return (that is, the rate after the effects of inflation have been removed) that a marginal investment must earn before taxes to recover its initial outlay, pay investors a return, and pay taxes on the resulting income. It is sometimes referred to as a *hurdle rate* because it represents a hurdle that must be cleared to justify an investment. The second rate is the *required after-tax rate of return to savers*, which is the real rate of return that savers expect to receive after taxes on the marginal savings provided to a business.

For example, if savers expected a real after-tax rate of return of 4 percent and taxes reduced the real rate of return by 2 percentage points, the hurdle rate would be 6 percent. If an investment was not expected to yield a return of at least 6 percent, it would not be made. The 2 percentage-point reduction in the real rate of return is a measure of the tax burden called the *tax wedge*. Another measure of the tax burden is the *effective marginal tax rate* (EMTR), which is the ratio of the tax wedge to the hurdle rate—in this case, 33.3 percent $[(6 - 4)/6]$.

An effective tax rate differs from a statutory tax rate in several ways. An EMTR is a constant rate that if applied to the average annual before-tax return on an investment over its lifetime, would yield the same after-tax rate of return as applying statutory rates to the taxable income

¹ Congressional Budget Office, *How Taxes Affect the Incentive to Invest in New Intangible Assets* (November 2018), www.cbo.gov/publication/54648, *Taxing Capital Income: Effective Marginal Tax Rates Under 2014 Law and Selected Policy Options* (December 2014), www.cbo.gov/publication/49817, and *Taxing Capital Income: Effective Rates and Approaches to Reform* (October 2005), www.cbo.gov/publication/17393.

generated by the investment (both at the entity level and individual level) in every year of the investment's life. To accomplish that, an EMTR accounts for several factors that cause taxable income to differ from the true economic return on an investment. Those factors include the following:

- Differences in the taxation of returns on investments undertaken by investors adopting different legal forms of organization, such as C corporations (the profits of which are subject to the corporate income tax), pass-through entities (the profits of which are taxed only under the individual income tax), and owner-occupied housing (the profit-equivalent income of which is not taxed at all);
- Differences in the taxation of returns on investments financed by debt or equity;
- Differences between cost-recovery allowances and economic depreciation (that is, the reduction in an asset's value due to wear and tear or obsolescence), which vary among asset types and, occasionally, among industries;
- Differences in taxation arising from where individuals hold their savings (in a bank account or pension fund, for example); and
- Inflation.

Effective tax rates are an important consideration in a business's decision to invest. Businesses tend to invest in the most profitable project first and to continue their investment in other projects in declining order of profitability until they reach the break-even or marginal project. Projects with less than a break-even rate of return would not be undertaken. Changes in effective tax rates move the hurdle rate up or down and therefore can be used to evaluate the effect of tax changes on investment decisions.

Basic Concepts

To estimate the tax burden, the required before- and after-tax rates of return must first be calculated.

Required Before-Tax Rate of Return. Underlying the required before-tax rate of return (ρ) for most types of assets is the Hall-Jorgenson formula for the user cost of capital.² That cost has three components—the investor's return, the economic depreciation of the asset, and taxes. The before-tax rate of return subtracts economic depreciation from the user cost of capital (in brackets) as follows:

$$\rho = [(r + \delta) * T] - \delta$$

² Robert E. Hall and Dale W. Jorgenson, "Tax Policy and Investment Behavior," *American Economic Review*, vol. 57, no. 3 (June 1967), pp. 391–414, www.jstor.org/stable/1808970. The Hall-Jorgenson formula does not apply to inventories or owner-occupied housing, which are treated as special cases below.

where r is the real discount rate of the investing business (that is, the investor's required return), which varies by source of financing and accounts for the deductibility of interest payments by the investing business;

δ is the rate of economic depreciation of the asset; and

T is a factor that grosses up the other two components (that is, it is used to calculate the gross, or before-tax, amount of those components) and adjusts for cost-recovery allowances in the tax code.

The value of ρ can vary by the industry of the investing business, by the type of asset being acquired, by the legal form of organization making the investment, and by the source of the investment's financing. Further explanation of how CBO constructed r , δ , and T is provided below.

Required After-Tax Rate of Return. In theory, there is a single after-tax rate of return—one that does not vary by industry, asset type, legal form of organization, or source of financing—that every prospective investment must realize to justify the investment. That rate would be the return available through an index fund of equity and debt instruments—an ever-present alternative to investing in nonfinancial assets. Because savers will generally seek the highest rate of return, firms, regardless of their characteristics, cannot offer a lower rate of return if they want to attract savers. Therefore, the model framework treats the after-tax rate of return as fixed, either implicitly or explicitly.

Choosing the appropriate rate for the model, however, introduces some nuances. At the decisionmaking level for C corporations, the investor (the entity purchasing assets) requires a different after-tax rate of return than the saver (the individual providing such an entity with funds to invest) receives. That is because the savers holding corporate stock or debt instruments are taxed on the income those instruments generate—a tax that does not affect the investors. That extra level of taxation reduces the after-tax rate of return to savers (even within an index fund) and ultimately increases the tax burden. CBO analyses typically measure the tax burden on the basis of the after-tax rate of return to the saver.³

Determining the appropriate after-tax rates of return also depends on the analytical question. If one is interested strictly in analyzing the uniformity of the tax code (referred to hereafter as the *tax-uniformity perspective*), explicitly enforcing the single after-tax rate of return is critical. If, however, one is using the framework as a tool to analyze the economy as a whole (referred to hereafter as the *comprehensive perspective*), empirical evidence that rates of return differ on the

³ In previous reports, CBO has used the abbreviation ETR for the measure calculated with the after-tax rate of return to investors and the abbreviation ETTR (effective total tax rate) for the measure calculated using the after-tax rate of return to savers. In this report, EMTR always refers to the measure calculated with the after-tax rate of return to savers.

basis of other factors—say, between equity and debt—can be taken into account. Doing so does not contradict the fixed-rate assumption; it merely recognizes that factors, such as risk, that are not explicitly incorporated into this framework, play an implicit role in realizing that fixed rate.⁴ CBO can adopt either perspective in its analyses, depending on the question being addressed. This paper, however, generally adopts the comprehensive perspective. Implementation of the tax-uniformity perspective is described in Appendix B.

Under the comprehensive perspective, the nominal after-tax rates of return demanded by investors differ by source of financing and are designated i_{equity} and i_{debt} . Those values are observable for C corporations and are projected by CBO. Real after-tax rates of return required by investors are calculated by subtracting inflation (π). Real after-tax rates of return demanded by savers, which may incorporate additional factors, are designated as s_{equity} and s_{debt} . (For a summary of how the various rates of return relate to one another, see Table 1.)

From the saver’s viewpoint, however, the tax system does not treat equity from C corporations, pass-through entities, and owner-occupied housing the same: Equity returns from C corporations are subject to two levels of tax, those from pass-through entities are subject to one level of tax, and those from owner-occupied housing are not taxed at all. Thus, the value of i_{equity} for each legal form should, in theory, reflect that difference. In the absence of data on rates of return for non-C corporations, however, CBO explicitly equalizes the values of s_{equity} among the three legal forms. The model treats C corporations as the anchor and adjusts the values of s_{equity} for pass-through entities and owner-occupied housing to match that for C corporations. That implies a lower value of i_{equity} for pass-through entities and owner-occupied housing relative to C corporations under the comprehensive perspective. No similar adjustment is made for s_{debt} because the tax treatment for the three legal forms of organization is similar.

Measures of the Tax Burden. The formula for the tax wedge is as follows:

$$Tax\ wedge = \rho - s$$

The tax wedge can be converted to an effective marginal tax rate with the following formula:

$$EMTR = \frac{\rho - s}{\rho}$$

The EMTR calculation generates a rate that is analogous to a statutory rate and, in most cases, is easy to interpret. However, as the value of ρ approaches zero or even goes negative—a condition that can apply to asset types with especially favorable tax treatment—the EMTR can take on extremely high or negative values and the analogy to a statutory rate breaks down. The tax

⁴ Empirical evidence suggests that there are other effects, such as clientele effects and home bias, that can result in differing rates even after accounting for risk. Like risk, those effects are not part of this framework.

wedge, in contrast, has a consistent interpretation at all values of ρ and is better suited for some quantitative analyses.

Aggregation. CBO’s CapTax model accounts for four characteristics by which the required-before tax rate of return can vary—the industry of the investing business, the type of asset being acquired, the legal form of the business organization, and the financing source. Specifically, the model incorporates 60 industries, 78 asset types, two legal forms of business organization (C corporations and pass-through entities), and two sources of financing (equity and debt), resulting in 18,720 cells for which the various measures of the tax burden on capital income from business investment are calculated.⁵ Each cell represents a unique combination of the four characteristics. In addition, the tax burden is calculated for debt- and equity-financed investments in owner-occupied residential structures and the associated land, which are treated as a third legal form of organization.

That level of disaggregation facilitates some precision in identifying the tax burden on a particular investment. Some questions relevant to policymakers, however, can best be addressed by more aggregate measures of the tax burden. Because EMTRs are a ratio, it is necessary to aggregate the components (the before- and after-tax rates of return) separately and then use them to calculate the aggregated EMTR.⁶ Aggregating the components is a matter of applying a

⁵ The tax law also treats investments differently on the basis of characteristics other than the four identified here. Because those other characteristics are not fully accounted for in the CapTax model, there can be significant variation in the tax burden among investments even in the most disaggregated cell in the model.

An example of one of the characteristics not incorporated in the model is the individual income tax bracket into which owners of pass-through entities and recipients of interest, dividends, and capital gains fall. The model uses average marginal tax rates that account for the fact that recipients of interest income typically fall into lower tax brackets than do recipients of dividends and capital gains, but it does not calculate separate EMTRs for savers in each tax bracket.

Another such characteristic is the amount of investment, which is typically a function of firm size. Some provisions, such as section 179 expensing, differentiate tax treatment based on the amount of the investment. Because pass-through entities typically invest less than C corporations, CBO has built that distinction into the legal form dimension. Thus, the term *pass-through entities* should be interpreted as averaged-sized (relatively small) pass-through entities, and *C corporations* should be understood as average-sized (relatively large) C corporations. Relatively large pass-through entities and relatively small C corporations are not represented in the model’s results.

⁶ Tax wedges can be aggregated directly. In practice, however, the CapTax model calculates the aggregated tax wedge using aggregated before- and after-tax rates of return., It then divides the aggregated tax wedge by the aggregated before-tax rate of return to get the aggregated EMTR.

weight to the value in each cell and adding them up. Under the comprehensive perspective, the CapTax model uses the percentage of total assets in each cell as the weight.⁷

The result is that aggregated values for different categories may differ from each other not just because of the tax code but because of their mix of assets or financing sources. For example, the EMTR on pass-through entities under the comprehensive perspective is higher than that on C corporations because the assets of pass-through entities, especially those in the real estate industry, are less likely to be eligible for bonus depreciation—a feature of the tax code that lowers the tax burden. Accounting for such differences is appropriate when estimating changes in saving or investment. But when evaluating the uniformity of the tax system, a different weighting scheme is used. That system is explained in [Appendix B](#).

Uses and Limitations of the General Framework and the CapTax Model

The general framework for analyzing the tax burden on capital can be used in a variety of ways. Typically, it is used to measure the overall tax burden on capital income, but it has also been used to illustrate how the tax law creates inefficiencies in the economy by taxing different activities differently.⁸ CBO’s application of its model has largely mirrored those uses. But the model is just one of many tools that CBO uses to evaluate the tax system. The CapTax model focuses entirely on one component of the tax system, namely the tax burden on capital income. CBO uses other tools to evaluate such things as international taxation, the tax burden on labor income, and the distribution of the tax burden among income groups. A thorough analysis of the tax system would require that all those tools be brought to bear on the subject. Furthermore, even as a tool for evaluating the tax burden on capital income, the general framework—as well as CBO’s implementation of it—has limitations that should be taken into account.

How CBO Uses Measures of the Capital Tax Burden. CBO uses measures of the tax burden on capital in three distinct ways, all of which relate to estimating how changes in the tax law

⁷ The value of equipment, structures, and intellectual property products by type and industry were taken from the fixed asset tables published by the Bureau of Economic Analysis. CBO further disaggregated data on three asset types—mining structures, own-account software, and research and development—by using techniques described in Congressional Budget Office, *How Taxes Affect the Incentive to Invest in New Intangible Assets* (November 2018), Appendix A, www.cbo.gov/publication/54648. The values of inventories and land by industry were based on the table “Detailed Capital Measures” in the multifactor productivity series published by Bureau of Labor Statistics. CBO used industry-level data from the Statistics of Income (SOI) Division of the Internal Revenue Service to disaggregate business assets by organizational form. CBO used data from Federal Reserve Board, “Financial Accounts of the United States” (June 11, 2020), www.federalreserve.gov/releases/z1/release-dates.htm, to estimate shares of sources of financing for each legal form and then introduced industry variation on the basis of net worth and long-term debt reported on tax return balance sheets by corporations and partnerships.

⁸ See, for example, Huaqun Li and Kyle Pomerleau, *Measuring Marginal Effective Tax Rates on Capital Income Under Current Law*, Fiscal Fact 687 (Tax Foundation, January 2020), <https://tinyurl.com/mdv4e3cf>; Joseph Rosenberg and Donald Marron, *Tax Policy and Investment by Startups and Innovative Firms* (Tax Policy Center, February 2015), <https://tinyurl.com/5arpfbb5>; and James B Mackie III, “Unfinished Business of the 1986 Tax Reform Act: An Effective Tax Rate Analysis of Current Issues in the Taxation of Capital Income,” *National Tax Journal*, vol. 55, no. 2 (June 2002), pp. 293–337, <https://doi.org/10.17310/ntj.2002.2.06>.

would affect the economy. First, CBO uses the change in the economywide EMTR to help estimate the change in saving that would be induced by a change in the tax law. Second, CBO uses the change in the user cost of capital (disaggregated by asset type and legal form of organization) to help estimate the change in investment that would be induced by a change in the tax law. The theory underlying both of those applications holds that a higher tax burden discourages saving and investment.⁹ Both of those uses of measures of the tax burden on capital reflect the comprehensive analytical perspective. Furthermore, those measures exclude land because its acquisition does not constitute new investment.

For its third use of such measures, CBO adopts the tax-uniformity perspective. The agency generates an estimate of the change in the uniformity of the tax burden (disaggregated by type of asset, legal form of the organization, and source of financing) to estimate, independently of the larger saving and investment effects, how the change in tax uniformity would affect gross domestic product (GDP). The underlying theory of that analysis is that when the tax burden is not uniform, investment will be diverted away from its most efficient use to minimize tax burdens.¹⁰ Land is included in the tax-uniformity analysis because taxing it differently from new investment contributes to the economic distortions that would affect GDP.

Limitations of the Framework. The analytical framework described above treats the United States as the sole tax jurisdiction. Thus, the resulting measures of the capital tax burden apply only to domestic investment by U.S. citizens. Over time, such investment has accounted for a decreasing share of total investment either in the United States or by U.S. citizens. However, those investments still represent a substantial majority of total investment and therefore the model's results remain highly relevant. Even so, the model may overstate the effects on saving of changes in the taxation of domestic investors and the effects on domestic investment of changes in the taxation of domestic savers.

Because the hurdle rate applies to marginal investments, the framework is less relevant for analyzing the effect of taxes on investments with expected returns in excess of the hurdle rate. Other measures, such as the *effective average tax rate*, have been developed to analyze the effect

⁹ Both uses are described in Congressional Budget Office, *The Budget and Economic Outlook: 2018 to 2028* (April 2018), pp. 106–107, www.cbo.gov/publication/53651.

¹⁰ The specific measure of the tax burden used in that analysis is the weighted-average coefficient of variation (that is, the standard deviation divided by the mean) of tax wedges. CBO links tax uniformity to GDP by calibrating its results to those reported in several published analyses of that relationship. See U.S. Department of the Treasury, *Integration of the Individual and Corporate Tax Systems: Taxing Business Income Once* (January 1992), pp. 129–135, <https://go.usa.gov/xFhjr> (PDF, 25.5 MB); and Diane Lim Rogers, “Assessing the Effects of Fundamental Tax Reform With the Fullerton-Rogers General Equilibrium Model,” in *Joint Committee on Taxation Tax Modeling Project and 1997 Symposium Papers* (Joint Committee on Taxation, November 1997), pp. 49–82, www.jct.gov/publications/1997/jcs-21-97.

of taxes on such investments.¹¹ Those tools generally take the decision to invest for granted and focus on locational decisions (that is, investing in the jurisdiction with the lowest tax burden). However, because the framework on which CBO based its CapTax model recognizes only one tax jurisdiction, the model necessarily focuses solely on the decision to invest or not invest.

The tax burden measures are forward-looking—that is, they measure the future tax burden on prospective investments that might be undertaken in a specified year. Therefore, the framework is not useful for analyzing the tax burden on past investments. Those investments were made in many different years and the tax burden each has faced depends on what the tax law has been since the investment was made.

Although the analytical framework itself is forward-looking, it treats investors and savers as completely myopic when it comes to the tax system. In other words, investors make their decisions based on the tax features that apply in the year the investment is made as if those features would remain in place for the life of the investment. Thus, the tax burden on income from investments made in 2021 would not account for the individual income tax rate increases scheduled for 2026. However, the belief that the tax system will not change as scheduled is not uncommon, and it probably influences the decisions of many investors and savers.

The analytical framework treats investments as if they remained the property of the original investor for their entire useful lives. Rapid asset turnover would tend to increase the EMTR on debt-financed investments because the investor might not be able to take full advantage of the interest deduction. In some cases, such as intellectual property, assets that have changed ownership are taxed differently from assets held by their original owner. Data on asset turnover, however, is very limited, and accounting for it would require a different (and more complex) set of equations than those presented below.

Although the framework could, in theory, cover other taxes, the CapTax model covers only federal income taxes (both individual and corporate) and, to the extent that they apply to capital income, Self-Employed Contributions Act (SECA) taxes. The model does not estimate the effects of federal estate taxes, additional taxes on early withdrawals from retirement accounts, or unrelated business income taxes on nonprofit organizations. Furthermore, it does not cover state and local income, sales, or property taxes.

¹¹ See Michael P. Devereux and Rachel Griffith, “Evaluating Tax Policy for Location Decisions,” *International Tax and Public Finance*, vol. 10 (2003), pp. 107–126, <https://doi.org/10.1023/A:1023364421914>.

Estimating the Required Before-Tax Rate of Return

CBO has expanded the generalized formula for the required before-tax rate of return shown above by attaching subscripts to reflect the full range of variation by industry (j), asset type (a), legal form of organization (o), and source of financing (f) as follows:

$$\rho_{j,a,o,f} = (r_{j,o,f} + \delta_{j,a}) * T_{j,a,o} - \delta_{j,a}$$

The formula can be deconstructed by focusing on the three costs that make up the user cost of capital:

- The firm's discount rate (r), which is the break-even real return demanded by investors,
- The economic depreciation of the asset (δ), and
- A tax effect (T) that applies to both δ and r .

CBO has added some features to the calculation of T that are not explicitly part of the Hall-Jorgenson formula, resulting in the following:

$$T_{j,a,o} = \frac{[1 - t'_{j,a,o} z_{j,a,o} (1 - \psi_{j,a} k_{j,a}) - k_{j,a}^{\dagger}]}{1 - t^*_{j,a,o}}$$

where t' is the entity-level marginal tax rate that applies to deductions (in this case, for cost recovery),

t^* is the entity-level marginal tax rate that applies to profits,

z is the present value of cost-recovery deductions per dollar of investment,¹²

k is the nominal rate of the investment tax credit,

k^{\dagger} is the present value of the investment tax credit per dollar of investment, and

ψ is the share of the investment tax credit's base that cannot also be claimed as a cost recovery deduction.

The denominator of T has the effect of grossing up the discount and economic depreciation rates to account for the average marginal tax rate on profits at the entity level. The numerator mitigates that effect by accounting for cost-recovery allowances, either in the form of deductions or credits (with ψ determining whether any investment can benefit from both). Complete mitigation occurs via cost-recovery deductions when z equals 1.0 (and k equals zero); it occurs

¹² A present value is a single number that expresses a flow of current and projected future income or payments in terms of an equivalent lump sum received or paid at a specified time.

via investment tax credits when k^\dagger equals t^* (and z equals zero). In those cases, T is equal to 1, and ρ is equal to r . For equity-financed investments of pass-through entities, those conditions result in an EMTR of zero.¹³ Lower values of z and k —that is, slower cost recovery—imply higher values of T and higher EMTRs. If the sum of z and k drops too low, the EMTR can exceed the statutory rate.

Because the derivation of z is dependent on the discount rate, further discussion of T is postponed until after the discussions of the discount rate and economic depreciation. Furthermore, certain asset types, such as owner-occupied housing, business land, and inventories, are special cases and require a different formula for ρ than that shown above.

Discount Rate

The discount rate (r) is closely related to the real after-tax rate of return to investors. In fact, for equity investments, there is no difference:¹⁴

$$r_{equity} = i_{equity} - \pi$$

The equation for debt, however, accounts for the deductibility of interest as follows:

$$r_{j,a,o,debt} = i_{debt}(1 - \theta_o t'_{j,a,o}) - \pi$$

where θ represents the deductible share of interest payments, and

t' still represents the entity-level marginal tax rate that applies to deductions (in this case, however, for interest).

Before 2018, θ had a value of 1 for businesses, meaning interest payments were fully deductible. But the 2017 tax act imposed limits on the deductibility of business interest. Businesses can deduct interest expenses in excess of interest income up to 30 percent of their adjusted taxable income.¹⁵ Although those limits are not statutorily different for C corporations and pass-through

¹³ Under the same conditions, EMTRs for other organizational forms and sources of financing would not be zero because of features of the discount rate and the required after-tax rate of return (discussed below) that do not apply to equity-financed investments of pass-through entities. Specifically, the EMTR for debt-financed investment of pass-through entities would be negative because of the deductibility of interest expenses, the EMTR for equity-financed investment of C corporations would be positive because of the individual income tax on dividends and capital gains, and the sign on the EMTR for debt-financed investments of C corporations would depend on whether the individual income tax on interest income was larger or smaller than the corporate income tax savings due to the interest expense deduction.

¹⁴ CBO uses the interest rate of corporate bonds rated Baa for i_{debt} and the interest rate on 10-year Treasury bonds plus an equity premium for i_{equity} . In previous reports, CBO has rendered the term $(i_{equity} - \pi)$ as E .

¹⁵ In 2021, adjusted taxable income excludes the pass-through deduction and deductions for interest, net operating losses carried over from previous years, depreciation, amortization, and depletion. After 2021, deductions for depreciation, amortization, and depletion will be included in adjusted taxable income, which will reduce the value of θ and increase the value of r .

entities, they are more binding on the typical C corporation than they are on the typical pass-through entity. For homeowners, the deduction is limited to itemizers and to interest on mortgages of \$750,000 or less (increasing to \$1,000,000 in 2026).

Economic Depreciation

Economic depreciation (δ) appears twice in the equation defining the required before-tax rate of return. In the first instance, it is combined with r to represent the amount of after-tax return an investor would require before being multiplied by T to get the before-tax amount. In the second instance, δ is subtracted out to ensure that the only difference between the required before- and after-tax rates of return is taxes.

The two instances of δ do not, however, cancel one another out—economic depreciation still has a significant effect on the value of ρ . For example, for equity-financed investments, high values of δ , which represent rapid rates of depreciation, magnify the effect of T when costs are recovered over multiple years ($z < 1$). In those cases, ρ is more sensitive to taxes for asset types that depreciate more rapidly, such as software and equipment. That is not to say that ρ is necessarily higher for those asset types—that depends on the tax law, particularly the cost-recovery parameters z and k . But with equity financing, the incentive to invest in such assets is more dependent on the tax law than is the incentive to invest in longer-lived assets, such as buildings. (Economic depreciation also affects ρ for debt-financed investments, but the relationship is much more complex.)

CBO calculated economic depreciation rates by asset type based on the capital stock and depreciation values in the fixed asset tables published by the Bureau of Economic Analysis (BEA).¹⁶ In its published estimates of economic depreciation, BEA has also identified some asset types for which values varied by industry.¹⁷ For those asset types, CBO also performed industry-specific calculations of δ .

Taxes

The value of T in the above formula relies on three features of the tax code: tax rates, cost-recovery deductions, and investment tax credits. Considerable detail lies behind all three features.

¹⁶ Specifically, CBO divided BEA's values for "Depreciation, current cost" by those for "Net stocks, current cost." See Bureau of Economic Analysis, "Detailed Data for Fixed Assets and Consumer Durable Goods: Nonresidential Detailed Estimates" (August 2021), <https://apps.bea.gov/national/FA2004/Details/Index.htm>.

¹⁷ Bureau of Economic Analysis, "BEA Depreciation Estimates," https://apps.bea.gov/national/pdf/BEA_depreciation_rates.pdf (83 KB).

Tax Rates. Construction of the tax rate parameters starts with the average marginal tax rate (t) that applies to the profits of the business, which varies by legal form of organization.¹⁸ To increase the flexibility of the CapTax model and accommodate new features of the tax law, CBO has added two important types of adjustments to those rates. One type of adjustment can account for direct and indirect rate adjustments that are targeted to specific industries or asset types. (Indirect rate adjustments are statutory deductions that are mathematically equivalent to reductions in the marginal rate.) The other type of adjustment accounts for the timing of realization of income or deductions.

Direct and Indirect Rate Adjustments. On occasion, the Congress has enacted deductions that are a fixed percentage of specific types of income. An example under current law is the deduction for 20 percent of most business income realized by firms organized as pass-through entities.¹⁹ The pass-through deduction is an indirect rate adjustment; it is mathematically equivalent to reducing the marginal tax rate on qualifying income by 20 percent.

Another approach, the direct rate adjustment, is to simply reduce the statutory tax rate on income from certain types of investments. For example, several European countries have introduced “patent boxes,” which reduce the tax rate on income from investments in intellectual property. Such targeted rate adjustments have been proposed for the United States, but none has been enacted.

The CapTax model can accommodate two direct or indirect rate adjustments that vary by industry and one adjustment that varies by asset type. Of those options, current law invokes only the adjustments that vary by industry—namely, the pass-through deduction in the first instance and the renewable energy production credit in the second. For full specification of all three options, see [Appendix A](#).

The adjustment factor (μ) that defines the industry-specific rate adjustment created by the pass-through deduction is calculated as follows:

$$\mu_{j,o} = [1 - \xi \varepsilon_o - (1 - \xi)q_{j,o}\varepsilon_o]$$

where ξ represents the share of qualified business income that falls below a certain taxable income threshold,

¹⁸ The value of t for C corporations is, by law, a flat 21 percent. For pass-through entities, CBO used its microsimulation model of individual income taxes to estimate the value of t (both the individual income tax and SECA tax components).

¹⁹ Another example is the deduction for domestic production activities, which (after a phase-in period) allowed a deduction equal to 9 percent of qualifying income between 2004 and 2017. Qualifying income had to come from the production of goods in the United States, which excluded income from offshore activities and most income from services.

ε represents the statutory percentage of qualified business income that can be deducted (20 percent in all industries for pass-through entities; zero for C corporations), and

q is a nonstatutory parameter that identifies the share of business income that qualifies for the deduction when taxable income exceeds ζ .²⁰

If q equaled 1.0, the value of ζ would be irrelevant and μ would equal 0.8—a factor that, when applied to the tax rate, would reduce it by 20 percent. At income levels where q is less than 1.0, the deduction is disallowed in certain labor-intensive industries and limited by payroll in all other industries (and, in some cases, by assets, too).²¹ That results in a value of μ that is greater than 0.8 and thus reduces the tax rate by less than 20 percent.

Timing Adjustments. The convention in studies using this framework has been to treat investments as being undertaken by established profitable firms that realize the required after-tax rate of return in every year after the investment is made. Although CBO follows that convention, the model contains a parameter (ν) that allows for alternative treatments, such as rates of return that fluctuate over time.

For example, during an economic downturn, an investing firm may not be profitable. In that case, there might be insufficient income to permit all otherwise allowable deductions to be claimed. The excess deductions create a net operating loss (NOL), which can be carried over to future years in which there is sufficient income to fully offset the deductions. The present value of deferred deductions is less than that of immediate deductions. In that case the ν parameter would represent the present value of the deferred deduction divided by the nominal amount of the deduction.

NOLs also have an effect on the taxation of income. In the year that a firm claims a carried over NOL, the deduction effectively reduces the tax on income earned in that year—frequently to zero. When the timing of deductions is accounted for, the timing of the taxation of income must also be accounted for. Therefore, the ν parameter can take on two distinct values that relate to tax

²⁰ Under current law, the taxable income threshold is not a cliff but a phaseout range. The model cannot take explicit account of the dollar thresholds defining that range. Instead, the value of ζ takes account of business income that is within the phaseout range but that has not been phased out. For example, the numerator of ζ should include three-quarters of the qualified business income of taxpayers whose taxable income is one-quarter of the way into the phaseout range. (The denominator of ζ is all qualified business income.) CBO estimated a value for ζ using its microsimulation model of individual income taxes.

²¹ The deduction can be disallowed for businesses involved in “the performance of services in the fields of health, law, accounting, actuarial science, performing arts, consulting, athletics, financial services, investing and investment management, trading, dealing in certain assets or any trade or business where the principal asset is the reputation or skill of one or more of its employees or owners.” See Internal Revenue Service, “Facts About the Qualified Business Income Deduction” (April 2019), <https://go.usa.gov/xMRzR>. The available data do not support the estimation of q at the industry level, so CBO estimated a single value of q by dividing deductions claimed by $\varepsilon(1 - \zeta)$.

rates— v^* to account for the timing of the taxation of income and v' to account for the timing of the realization of deductions.

Because CBO follows the convention of treating investments as realizing the required rate of return in every year, all values of v are set equal to 1. However, if investments were treated as being subject to fluctuating rates of return, values of v' would be higher for pass-through entities than for C corporations (although they would still be less than 1). Losses of pass-through entities can be used to offset other forms of income, including wages. If the model accounted for fluctuating rates of return, the frequency with which deductions must be deferred would be reduced by those offsets, which would in turn mitigate the reduction in the value of v' . By contrast, losses of C corporations cannot be used to offset any other form of income. Accounting for fluctuating rates of return would increase the length of the deferral compared with the same amount of loss from a pass-through entity, which implies a larger reduction in the value of v' for a C corporation than for a pass-through entity.

Combining the Adjustments. The rate and timing adjustments can be combined to create different versions of t that correspond to the two versions of v as follows:

$$t'_{j,a,o} = t_o * v'_o * \mu_{j,a,o}$$

$$t^*_{j,a,o} = t_o * v^*_o * \mu_{j,a,o}$$

where the superscript ' $'$ is used to denote adjustments needed to account for the timing of deductions, and

the superscript ' $*$ ' is used to denote adjustments needed to account for the timing of the realization of income.²²

The first of those two versions of t is used in the numerator of the tax ratio, where it is applied to cost-recovery deductions. The second is used in the denominator to represent the tax on profits.

Cost-Recovery Deductions. In the equation defining the required before-tax rate of return, z represents the present value of cost-recovery deductions divided by the amount of investment. Cost-recovery deductions can take several different forms. One is called *expensing*, which means invested funds are deducted in the same year they are disbursed. If all investments could be expensed, the value of z would be 1 (the implications of which are described above). Investment costs that cannot be expensed are deducted over multiyear periods. The delay in recovering the cost of an investment lowers the value of z below 1.

²² Note that for pass-through entities, $\mu_{j,a,o}$ applies only to the income tax component of t_o , not to the SECA tax component. Furthermore, different values of v can apply to the income and SECA tax components of t_o .

The cost of some asset types, most notably buildings, can be deducted in equal amounts over a fixed number of years—an approach called the *straight-line method* of depreciation. Costs of most other asset types are initially recovered using the *declining-balance method*, in which a predetermined percentage of the undepreciated value is deducted in each year. Finally, the cost of entertainment, literary, and artistic originals (movies, television programs, recordings, and books) are typically recovered using the *income-forecast method*, in which deductions are claimed in proportion to the projected amount of income an investment will generate over a specified period of time.

Expensing. There are numerous sections of the tax code that govern expensing. One of the more complex is section 179. Under that section, firms can expense up to a certain threshold of investment in qualifying asset types (equipment, purchased software, and certain structures). If they invest more than a second threshold, however, the amount they can expense phases down until it reaches zero.

Section 179 does not explicitly differentiate between C corporations and pass-through entities, but the implications of the law are very different for the two forms of organization. The largest businesses—that is, those investing too much to utilize section 179—tend to be C corporations. Pass-through entities tend to be smaller and have more of their investment eligible for section 179 expensing. As a result, pass-through entities, as a whole, expense a much larger share of their qualifying investment under section 179 than do C corporations. CBO has estimated the percentage of investment that can be expensed under section 179 (x_{179}) by industry for the two forms of organization and applies those percentages to all qualifying asset types. Nonqualifying asset types get a value of zero.

Outside of section 179, there are numerous other code sections that govern expensing.²³ The most wide-ranging is section 168(k), which defines what is commonly known as bonus depreciation. Bonus depreciation applies to all the asset types eligible for section 179 expensing, as well as to custom software and movie and television program development. Bonus depreciation covers 100 percent of qualifying investment through 2022, then phases down in increments of 20 percentage points until it reaches zero in 2027. For purposes of the model, all expensing except that governed by section 179 is combined onto one matrix (x_{oth}) that can vary by industry and asset type. For asset types eligible for bonus depreciation, CBO uses the statutory allowable percentage in each year as the parameter value, which applies to all industries except utilities.

²³ For example, section 174 applies to research and development costs, including internally developed software (though such costs can be expensed only through 2021). Sections 167(h), 263I, and 291(b) apply to oil and gas exploration and well development. And sections 616(a), 617(a), and 59I apply to other mineral exploration and mine development.

To prevent expensing more than 100 percent of cost, the two x parameters cannot be added together. Instead, section 179 is applied first, and the other provisions are applied to the remainder to yield the overall value of x . For the full specification, see Appendix A.

Multiyear Depreciation Deductions. All forms of multiyear depreciation deductions are at least partially defined by a recovery period (L)—that is, the useful life of an asset as specified in the tax code. Deductions under straight-line depreciation, are calculated by dividing the acquisition cost by L .²⁴ The declining-balance method also depends on the rate of decay (β)—that is, the percentage of the undepreciated value that can be deducted in a year. (See Figure 1 for an illustrative comparison of cost recovery for an asset under the declining-balance and straight-line methods.) The value of β depends on L and the rate of acceleration (b), both of which vary by asset type and industry:

$$\beta_{j,a} = b_{j,a}/L_{j,a}$$

Values of L range from 3 years for purchased software and special tools used in certain manufacturing industries to 39 years for most nonresidential buildings. Under current law, the acceleration rate for equipment and structures depends on the recovery period. For recovery periods of more than 20 years, b equals 1; for recovery periods of 15 or 20 years, b equals 1.5; for recovery periods of less than 15 years, b equals 2. (When b equals 2, the method is often referred to as double-declining-balance depreciation.) Higher values of b mean that cost-recovery deductions are shifted toward the present, raising the value of z and lowering the tax burden. Higher values of L mean that deductions are spread out over a longer period, lowering the value of z and raising the tax burden. CBO relied on Tables A1 and A2 of IRS Publication 946 when assigning values of b and L to asset types and industries.²⁵

Using only the value of β to determine tax depreciation deductions under the declining-balance method would result in ever smaller deductions indefinitely. Instead, under current law, once the deduction calculated using the declining-balance method is less than the deduction calculated using the straight-line method, the annual deduction switches to the amount based on the straight-line method—that is, the remaining undepreciated amount is deducted in equal amounts

²⁴ The cost of certain intangible assets (specifically purchased software, mineral exploration and development, and research and development) are either expensed or recovered through *amortization*—a process that is mathematically the same as straight-line depreciation. References to straight-line depreciation should be understood to include amortization.

²⁵ See Internal Revenue Service, Publication 946 (March 2021), www.irs.gov/forms-pubs/about-publication-946. As that publication makes clear, investors have some discretion about which depreciation method to use. Because data on which methods they select are not available at the necessary level of disaggregation, CBO generally assigns each industry/asset type cell the most beneficial combination of cost-recovery methods (expensing and multiyear depreciation) available.

over the rest of the asset's useful life.²⁶ That approach ensures that the cost of an investment is fully deducted by year L .²⁷

Calculating z . The formula for calculating z depends on the method used.²⁸ For expensing, the formula is as follows:

$$z_{\text{expensing}} = x$$

For multiyear deductions, a discount rate (r) must be used to calculate the present value of the deductions.²⁹ Because the depreciation basis is not indexed for inflation under current law, that discount rate must be nominal—hence, the addition of π . For straight-line depreciation, the formula is as follows:

$$z_{\text{straight-line}} = \frac{1 - e^{-(r+\pi)L}}{(r + \pi)L}$$

For perpetual declining-balance depreciation, the formula is as follows:

$$z_{\text{declining-balance}} = \frac{\beta}{\beta + r + \pi}$$

The cost-recovery deductions that apply to any given investment may not conform to any of the above formulas. Some asset types can be only partially expensed and those to which the declining-balance method applies switch over to straight-line depreciation at some point. For the full generalized specification of z , see Appendix A.

Investment Tax Credits. The parameter k operates in a manner similar to z in that it represents a means of recovering the cost of an investment, but whereas z represents a deduction, k represents a credit against tax liability. Like z , higher values of k reduce the value of T and the tax burden. Unlike z , however, k does not interact directly with the statutory tax rate.

²⁶ If b equals 1, the straight-line deduction is at least as large as the declining-balance deduction. Hence, straight-line depreciation applies to all asset types with a recovery period of more than 20 years.

²⁷ The income forecast method is a special case that combines economic depreciation with a 10-year recovery period. CBO simulated that by setting b equal to $10 * \delta$, indexing the undepreciated basis for inflation, and switching to straight-line when that is larger than the declining-balance amount.

²⁸ For details on how the equations for calculating z under the different methods are derived, see Congressional Budget Office, *Computing Effective Tax Rates on Capital Income* (December 2006), pp. 13–19, www.cbo.gov/publication/18259.

²⁹ For debt-financed investments, the discount rate (r) is not necessarily identical to the one discussed above, which is affected by the timing adjustments (v') to the tax rate that applies to the interest deduction (t'). The discount rate for debt-financed investments is not affected by those timing adjustments. Instead, those timing adjustments are incorporated into the value of t' by which z is eventually multiplied. However, CBO currently uses a value of 1 for all timing adjustments, so in practice, the two values of r are identical.

A true investment tax credit allows a fixed percentage of an investment to be claimed as a credit against taxes owed. It is analogous to expensing in that it applies in the year the investment is made. Such a credit, at a rate of 10 percent, existed in the United States until 1987.³⁰

The CapTax model uses the k parameter to simulate the credit for increasing research and experimentation (R&E) activities even though it is not a true investment tax credit. The R&E credit does not apply to all qualifying research expenses, only those in excess of a certain base amount. There are two alternative versions of the credit, but in both versions, the base amount is calculated using R&E expenses undertaken over some previous time period. In one of those versions, the base amount is not fixed: Investment in the current year increases the base amount in the next three years, which effectively reduces the value of the credit in the current year. Furthermore, investors must choose between prioritizing the credit or cost-recovery deductions. If they prioritize the credit, the amount they can recover through deductions is reduced by the amount of the credit ($\psi = 1$). If they prioritize cost-recovery deductions, they can deduct the entire investment ($\psi = 0$), but the rate of credit is reduced by 21 percent (or whatever the corporate tax rate happens to be).³¹

Investment tax credits are typically not refundable, meaning that they cannot reduce tax liability below zero. Were rates of return allowed to fluctuate over time so that losses could occur, investment tax credits could not always be claimed in the year the investment was made. Instead, the investor would have to wait until there was positive tax liability to claim the credit. That delay would reduce the value of the credit. An additional v parameter is used to account for the timing of the realization of the credit and a \dagger is used to denote the investment tax credit that has been so adjusted:

$$k_{j,a,o}^{\dagger} = k_{j,a} v_o^{\dagger}$$

Because CBO treats the rate of return as invariant over time, the value of v^{\dagger} is always 1.

Special Cases

Because of differences in tax treatment, such as whether income from an investment is taxed or cost-recovery allowances are made, the standard formula for ρ does not apply to owner-occupied housing (that is, residential structures and the associated land), business land, or inventories. The applicable formulas are set forth here.

³⁰ Under current law, such credits exist but are limited to very specific activities. Because the data for such activities are limited, the CapTax model accounts only for investments in renewable energy property and orphan drug research (that is, research furthering the development of drugs that are used to treat rare medical conditions).

³¹ For both versions of the credit, CBO converted the statutory rate on expenses in excess of the base amount into an effective rate on all qualifying expenses. CBO then estimated k by calculating a weighted average of the two effective rates on the basis of actual utilization of the two versions of the credit.

Owner-Occupied Housing. Owner-occupied housing is unique as a legal form in that it consists entirely of two asset types that are taxed exactly the same under current law. The implicit rent on owner-occupied housing is not taxable, nor can homeowners claim depreciation deductions.³² They can, however, claim deductions for property taxes if they itemize. Thus, the formula for a homeowner's required before-tax rate of return (which varies by source of financing but not by asset type) is as follows:³³

$$\rho_{oh,f} = r_{oh,f} - w\lambda t_{ptx}$$

where $r_{oh,f}$ is the real discount rate for homeowners,

w is the average property tax rate on owner-occupied housing,

λ is the share of residential property taxes deducted by owner-occupants, and

t_{ptx} is the average marginal individual income tax rate that applies to property tax deductions.³⁴

The equations for the homeowner discount rate (r) differ by source of financing in the same manner as for businesses. In fact, the equation for equity-financed investment is the same as for businesses, but the equation for debt-financed investment is as follows:³⁵

$$r_{a,oh,debt} = i_{debt}(1 - \theta_{oh}t_{hmi}) - \pi$$

where θ_{oh} is the deductible share of home mortgage interest paid by owner-occupants, and

t_{hmi} is the average marginal individual income tax rate on home mortgage interest.

³² The exception is when homeowners rent out a portion of their residence. In that case, they are treated as pass-through entities and the standard formula applies.

³³ This is the only instance in which the model accounts for a nonfederal tax and even then, only for the tax's deductibility. If state and local property taxes were included in the tax burden, the formula would be: $\rho_{oh,f} = r_{oh,f} + w(1 - \lambda t_{ptx})$.

³⁴ The average property tax rate (w) was derived from median monthly property taxes paid and median home values in the 2017 American Housing Survey. Note that under current law, λ must exclude the share of property taxes paid by nonitemizers, the share paid by itemizers that is disallowed because it exceeds the \$10,000 cap on the deduction for state and local taxes (through 2025), and the allowable share paid by itemizers but phased out at high income levels (after 2025). Furthermore, the value of t_{ptx} must reflect the average marginal tax rate on all homeowners, not just itemizers. CBO estimated the values of λ and t_{ptx} using its microsimulation model of individual income taxes.

³⁵ Note that under current law in 2021, θ_{oh} must exclude the share of home mortgage interest paid by nonitemizers, the share paid by itemizers that is disallowed because the mortgage amount exceeds \$750,000 (through 2025) or \$1,000,000 (after 2025), and the allowable share paid by itemizers but phased out at high income levels (after 2025). Furthermore, the value of t_{hmi} must reflect the average marginal tax rate on all homeowners, not just itemizers. CBO estimated the values of θ_{oh} and t_{hmi} using its microsimulation model of individual income taxes.

Business Land. The required before-tax rate of return for land can be calculated using the standard formula, but with the unique requirement that δ be set to zero because land does not naturally decline in value after it is purchased.³⁶ By the same token, the tax system allows for no cost recovery for land, so both z and k must also be set to zero. That simplifies the formula to the following:

$$\rho_{j,land,o,f} = r_{j,o,f} / (1 - t_{j,o}^*)$$

Inventories. The formula for the required before-tax rate of return for inventories differs from that for other asset types because inventories are not depreciated. However, their costs are recovered when they are sold, making the holding period a key parameter. Furthermore, the formula depends on which valuation method is used—the first-in-first-out (FIFO) method or the last-in-first-out (LIFO) method. For purposes of the formula, the difference between the two approaches is in how inflation is treated. Under FIFO, inflation increases ρ ; under LIFO, it does not. The overall required before-tax rate of return for inventories accommodates both treatments of inflation, with weights representing the importance of the two valuation methods (see Appendix A for full specification).

Estimating the Required After-Tax Rate of Return to Savers

CBO treats the required after-tax rate of return to savers (s) as being what a saver would receive, after taxes, from an index fund with the same mix of debt and equity as the financing of the proposed investment. To the extent that businesses pay interest or dividends, or their retained earnings increase value that is eventually realized as capital gains, savers may be subject to individual income tax on those amounts, and the corresponding tax rates appear explicitly in the equations where they apply. The taxes on the profits of the investing entity, by contrast, appear only implicitly in the equations for s . The values of i_{debt} and i_{equity} , to which individual income tax rates apply, are projections of observable rates of return that reflect the taxes already levied on the entities making interest or dividend payments.

The individual income tax on capital income depends on both the tax rate and the taxability of the capital income stream generated by the savings—that is, the category of account in which the savings is held. The model simulates the taxability of three categories of accounts:

³⁶ CBO treats characteristics of land, such as soil fertility, extractable mineral content, and contamination, as distinct from the land itself and does not account for them in the model.

- *Nontaxable accounts* (denoted with the subscript *nt*), such as individual retirement accounts and employer-sponsored pensions and 401(k)s, which shield all capital income earned within the accounts from income taxation;³⁷
- *Temporarily deferred accounts* (denoted with the subscript *td*), such as whole life insurance and nonqualified annuities, which defer the taxation of capital income earned within the accounts until it is withdrawn; and
- *Fully taxable accounts* (denoted with the subscript *ft*), which consists of all bank accounts, debt instruments, and corporate stock not held in an account in one of the other two categories.

Nontaxable Accounts

Nontaxable accounts consist of assets held by nonprofit organizations and two subtypes of retirement accounts—traditional accounts, for which contributions are deductible but withdrawals are taxable, and Roth accounts, for which contributions are not deductible but withdrawals are not taxable.³⁸ As long as the tax rate at the time of withdrawal is the same as the tax rate at the time of contribution, the tax on withdrawals from traditional accounts will exactly offset the tax savings associated with the contributions—effectively exempting from taxation the capital income that accrues within the account. For Roth accounts, the exemption of capital income is explicit and not dependent on any tax rate. CBO treats capital income accruing within the two types of accounts identically. The formula for the required after-tax rate of return is therefore as follows:

$$s_{o,f,nt} = i_f - \pi$$

Temporarily Deferred Accounts

Like the formula for nontaxable accounts, the formula for the required after-tax rate of return in temporarily deferred accounts is the same for both debt and equity. Withdrawals from such accounts are taxable to the extent that they exceed after-tax contributions.³⁹ Thus, the required

³⁷ Capital income earned in nontaxable accounts is not, however, shielded from the additional tax on withdrawals from retirement accounts made before the account holder reaches age 59½ or from the unrelated business income tax levied on nonprofit organizations that engage in profit-making activities. CBO does not account for those taxes, but parameters have been provided in the CapTax model to simulate those taxes if so desired. If those parameters are used, a different formula applies; that formula is described in Appendix A.

³⁸ Note that equity in pass-through businesses and owner-occupied housing cannot be held in nontaxable accounts without incurring unrelated business income tax liability. Nevertheless, the CapTax model equalizes values of s_{equity} across all legal forms, which implies a higher value of i_{equity} for pass-through businesses and owner-occupied housing.

³⁹ Death benefits paid by whole life insurance policies are not taxable. CBO shifted a portion of the assets in such policies to the nontaxable category to account for that.

after-tax rate of return depends on the holding period and the tax rate that applies to withdrawals. The full specification can be found in [Appendix A](#).

Fully Taxable Accounts

Unlike the other two account categories, the treatment of capital income that is fully taxable differs by source of financing. Furthermore, the taxation of equity-financed investments made by C corporations differs for the portion financed by new shares and the portion financed by retained earnings.

The equation for the return on fully taxable debt is as follows:

$$S_{o,debt,ft} = i_{debt}(1 - t_{int}) - \pi$$

where t_{int} is the average marginal individual income tax rate on interest income.⁴⁰

For the return on equity investments by pass-through entities and homeowners, the equation is as follows:

$$S_{pt,equity,ft} = S_{oh,equity,ft} = i_{equity} - \pi$$

Note that because break-even investments by those two organizational forms do not generate dividends or capital gains for the owner, no individual income tax rate enters the equation.

The equation for the return on equity investments in C corporations is much more complex. It is the sum of two components—one representing the taxation of dividends and the other representing the taxation of capital gains. The latter, in turn, is the weighted average of returns for three different period classes (n) based on how long savers hold their shares before realizing those capital gains. Those classes are defined by statute—short term (less than one year), long term (one year or more, but realized before death), and until death. A simplified version of the equation is as follows (for the full specification, see [Appendix A](#)):

$$S_{cc,equity,ft} = (1 - m)(i_{equity} - \pi)(1 - t_{div}) + m * \sum_{n=1}^3 (\omega_n * g_n)$$

where m can be interpreted either as the share of the return on equity realized as capital gains or as the share of equity funded out of retained earnings,

⁴⁰ The CapTax model recognizes two different tax rates on interest income—one for interest paid by businesses and one for interest paid by homeowners. The only time those values would be different, however, is if one wanted to simulate the elimination of owner-occupied housing from the tax code entirely, in which case the tax rate on interest paid by homeowners would be zero.

t_{div} is the average marginal individual income tax rate on dividend income,

ω_n is the percentage of accrued gains that are realized during period class n , and

g_n is the after-tax rate of return on stock held for period class n .⁴¹

The value of g differs among the three holding-period classes because each is subject to a different tax rate and because the value of the deferral increases with the length of the holding period.

The interpretation of m depends on the degree to which firms' behavior is consistent with the "old view" or "new view" of dividends. Under the old view, the tax on dividends is a deterrent to saving and $(1 - m)$ represents the share of the equity return that is paid as a dividend. Under the new view, investments funded through reinvested earnings are not deterred by the tax on dividends. If profits are paid as dividends when earned, the dividend tax must be paid immediately. If, instead, profits are reinvested and increase future profits and dividend payments, the dividend tax must be paid in the future when dividends are paid. After accounting for the timing of the dividend payment, the present value of the tax on dividends is the same in both cases. Therefore, under the new view, reinvesting profits does not increase the tax on dividends—only investment funded through new shares does so. The value of $(1 - m)$ thus represents the share of equity investment funded through the issuance of new shares, which is taxed as dividends. In that case, m represents the portion financed out of retained earnings, which is taxed as capital gains.⁴²

Overall

The overall required after-tax rate of return to savers is the weighted average of the values of s in the three account categories, as follows:

$$S_{o,f} = \alpha_{o,f,ft} * S_{o,f,ft} + \alpha_{o,f,td} * S_{o,f,td} + \alpha_{o,f,nt} * S_{o,f,nt}$$

⁴¹ CBO estimated the shares of capital gains assigned to each duration class and the average holding periods within each class using data for 2007 to 2012 from Internal Revenue Service, Statistics of Income Division, "Short-Term and Long-Term Capital Asset Transactions Classified by Asset Type and Length of Time Held," Table 4B (corporate stock only), from "SOI Tax Stats—Sales of Capital Assets Reported on Individual Tax Returns" (accessed January 27, 2022), <https://go.usa.gov/xMnc3>. For the percentage held until death, CBO also used data for 2009 and 2011 from Internal Revenue Service, Statistics of Income Division, "Table 3. Estate Tax Returns Filed for Decedents, Date of Death Values, by Tax Status and Size of Gross Estate" (closely held stock and publicly traded stock only) from "SOI Tax Stats—Estate Tax Year of Death Tables" (accessed January 27, 2022), <https://go.usa.gov/xMnaW>. (Files are listed under Table 2 on website although the table is labeled Table 3 in each of the spreadsheets.).

⁴² For further discussion of the old view and new view, see Congressional Budget Office, *Taxing Capital Income: Effective Rates and Approaches to Reform* (October 2005), Appendix B, www.cbo.gov/publication/17393.

where $\alpha_{o,f,l}$ is the share of saving directed to each category of account l .⁴³

⁴³ CBO estimated values of α using data from Federal Reserve Board, “Financial Accounts of the United States” (June 11, 2020), www.federalreserve.gov/releases/z1/release-dates.htm. Ownership of debt instruments and corporate stock was traced to households, both through direct ownership and indirect ownership via mutual fund shares, money market fund shares, time and savings deposits, agency and GSE-backed securities, life insurance reserves, and pension entitlements. Amounts traced through life insurance companies were deemed “temporarily deferred” (except for the portion attributable to nontaxable death benefits); all other amounts traced through pension funds and a portion of other funds attributable to individual retirement accounts were deemed “nontaxable.” Remaining funds were deemed “fully taxable.”

Appendix A: Full Specification of the Model's Parameters

The main text omitted certain complex equations that underlie the Congressional Budget Office's CapTax model. Among those were the formula for direct and indirect tax rate adjustments beyond the 20 percent deduction for pass-through business income and equations that involve calculating the present value of future income or deductions. Full specification of those equations is provided here.¹

Direct and Indirect Tax Rate Reductions

The main text provided the formula for adjusting the tax rate to account for the deduction for 20 percent of pass-through business income. However, the CapTax model can accommodate three such adjustments simultaneously—two that vary by industry (denoted with a $\hat{\cdot}$) and one that varies by asset type (denoted with a $\tilde{\cdot}$), all three of which also vary by form of organization. Like the pass-through deduction, the other two options are defined by at least two variables. One parameter (q) identifies the share of business income that qualifies for the deduction or the targeted tax rate. The other (ε) represents either the statutory percentage of qualified business income that can be deducted or the percentage by which the targeted tax rate is lower than the regular tax rate.² The first industry-specific adjustment is also defined by an additional parameter (ξ) that represents the share of qualified business income that falls within the eligible taxable income range. Thus, the formula for the first industry-specific adjustment is as follows:

$$\hat{\mu}_{1,j,o} = [1 - \xi \hat{\varepsilon}_{1,j,o} - (1 - \xi) \hat{q}_{1,j,o} \hat{\varepsilon}_{1,j,o}]$$

The other two options are independent of the investor's taxable income. Without that parameter, the equation for the second industry-specific adjustment is as follows:

¹ For purposes of calculating present values of future income or deductions, it is important to recognize that the model's equations incorporate a continuous-time framework rather than a discrete-time framework. In other words, events are always happening rather than happening only at specific points in time. Continuous time works well for simulating economic events, such as the realization of income and wear and tear on assets. However, the tax system is better simulated in discrete time—taxpayers pay their taxes and realize the benefits of deductions at specific times, not continuously. The model, however, must use one framework or the other. The selection of continuous time was driven largely by mathematical convenience—a continuous-time framework facilitates simulation with a single equation, whereas a discrete-time framework would require a separate set of calculations for each time period. Changes to the timing of tax events can still be simulated by changing holding periods (for capital gains, pensions, and inventories) or recovery periods (for depreciation deductions). However, continuous-time calculations tend to result in lower hurdle rates than do discrete time calculations.

² For example, an asset type with a targeted corporate tax rate of 14 percent would require ε to have a value of 0.333 because 14 percent is 33.3 percent lower than the current law rate of 21 percent.

$$\hat{\mu}_{2,j,o} = 1 - \hat{q}_{2,j,o} \hat{\varepsilon}_{2,j,o}$$

and the formula for the adjustment that varies by asset type is as follows:

$$\tilde{\mu}_{a,o} = 1 - \tilde{q}_{a,o} \tilde{\varepsilon}_{a,o}$$

The three adjustments are combined to create an overall adjustment factor (μ) that varies by industry, asset type, and form of organization and that can be applied to the tax rate (t) as follows:

$$\mu_{j,a,o} = \hat{\mu}_{1,j,o} * \hat{\mu}_{2,j,o} * \tilde{\mu}_{a,o}$$

In the CapTax model, the pass-through deduction is handled by the first industry-specific adjustment. Thus, $\hat{\varepsilon}_1$ is zero for C corporations and 0.2 for pass-through entities. In theory, the value of \hat{q}_1 is zero for certain service industries and less than 1.0 for all other industries, reflecting restrictions designed to prevent the $(1 - \zeta)$ share of individuals above the income threshold from deducting what amounts to a portion of labor income. However, the available data do not support industry-specific values of \hat{q}_1 at this time, so CBO set its value at 0.85 for all industries to reflect observed use of the deduction. The other industry-specific adjustment is used for the utility industry to simulate the renewable energy production credit. The adjustment by asset type is not needed under current law.

Cost-Recovery Parameters

As explained in the main text, the model contains separate parameters for expensing under section 179 (x_{179}) and expensing under other provisions (x_{oth}). Expensing under section 179 takes priority, so the formula for combining the two types is as follows:

$$x_{j,a,o} = x_{179,j,a,o} + x_{oth,j,a,o}(1 - x_{179,j,a,o})$$

The x parameter is just one of several that feed into the formula for z —the present value of depreciation deductions as a share of acquisition cost. For multiyear depreciation deductions, the recovery period (L) is a key parameter. In the declining-balance method, the rate of decay (β)—the percentage of the remaining value that can be deducted in a year—is also key. Unless tax depreciation is the same as economic depreciation, the value of β depends on L and the rate of acceleration (b), both of which vary by asset type and industry, as follows:

$$\beta_{j,a} = \begin{cases} \delta_{j,a} & \text{if } p_{j,a} = -1 \\ b_{j,a}/L_{j,a} & \text{otherwise} \end{cases}$$

where $p_{j,a} = -1$ signals the use of economic depreciation as tax depreciation.

Using the declining-balance method in perpetuity would never result in the full cost of an asset being recovered, regardless of the value of b . Therefore, under current law, once the annual deduction calculated using the declining-balance method is smaller than the one calculated using the straight-line method, the deduction switches to the amount based on the straight-line method, and the remaining undepreciated amount is deducted in equal amounts until year L . That approach ensures that costs are fully recovered by year L .

The formula for identifying the year in which tax depreciation switches from the declining-balance method to the straight-line method (L^*) is as follows:

$$L_{j,a}^* = \begin{cases} L_{j,a} * \left(1 - \frac{1}{b_{j,a}}\right) & \text{if } p_{j,a} = 1 \\ 300 & \text{otherwise} \end{cases}$$

where $p_{j,a} = 1$ signals that switching is mandated under the law.

If no switching is to take place (which would be the case if, for example, tax depreciation was to conform to economic depreciation) then the CapTax model cuts the calculation off at 300 years—a point at which over 99 percent of economic depreciation of any asset type would have occurred. Note also that if b is equal to 1, L^* is equal to zero, meaning that the straight-line deduction will exceed the declining-balance deduction in every year.

Another consideration is whether the undepreciated asset value should be indexed for inflation before determining the amount to be deducted. Under current law, indexing is generally not done. It would, however, be required if tax depreciation were equal to economic depreciation. The formula for such an inflation adjustment is as follows:

$$\pi'_{j,a} = \pi * l_{j,a}$$

where $l_{j,a}$ is 1 if tax depreciation is to be adjusted for inflation and 0 otherwise.

Finally, the multiyear portion of the calculation involves calculating the present value of deductions over the entire period (whether L or 300 years). Because the depreciable basis under current law is not indexed for inflation, the applicable discount rate (d) is nominal, in contrast to the real discount rate (r) used to calculate the required before-tax rate of return (ρ):

$$d_{j,a,o,f} = r_{j,a,o,f} + \pi$$

Policies that require indexing would call for a real discount rate. Those are accommodated in the model by subtracting the conditional inflation adjustment parameter (π') from d .

As presented below, the first row of the calculation of z splits the investment amount between the portion that can be expensed (x , for which the discount rate is irrelevant) and the portion that

cannot be expensed. The latter factor $(1 - x)$ applies to both the second and third rows. The second row captures the present value during the period in which the declining-balance method is used (from year 1 to year L^*). The third row captures the present value during the period in which the straight-line method is used (from year L^* to year L). The combination yields the following:

$$Z_{j,a,o,f} = x_{j,a,o} + (1 - x_{j,a,o}) * \left\{ \frac{\beta_{j,a}}{\beta_{j,a} + d_{j,a,o,f} - \pi'_{j,a}} * \left[1 - e^{-(\beta_{j,a} + d_{j,a,o,f} - \pi'_{j,a})L_{j,a}^*} \right] + \frac{e^{-\beta_{j,a}L_{j,a}^*}}{(L_{j,a} - L_{j,a}^*)(d_{j,a,o,f})} * \left[e^{-(d_{j,a,o,f})L_{j,a}^*} - e^{-(d_{j,a,o,f})L_{j,a}} \right] \right\}$$

Inventories

Inventories are not depreciated, but their costs are recovered when they are sold. Thus, the holding period becomes a key parameter. Numerous methods are used to value inventories, and not all of those approaches treat inflation the same way. CBO uses a weighted average of the two extreme methods—the last-in-first-out (LIFO) method, under which the value of inventories is indexed for inflation, and the first-in-first-out (FIFO) method, under which it is not. The treatment of inflation under the other methods falls roughly halfway between that of LIFO and FIFO.³ When the LIFO valuation method is used, the formula is as follows:

$$\rho_{j,lifo,o,f} = \frac{1}{Y_{inv}} \ln \left[\frac{e^{r_{j,o,f}Y_{inv}} - t_{j,o}^*}{1 - t_{j,o}^*} \right]$$

where Y_{inv} is the average holding period of inventories.

When the FIFO valuation method is used, the formula is as follows:

$$\rho_{j,fifo,o,f} = \frac{1}{Y_{inv}} \ln \left[\frac{e^{(r_{j,o,f} + \pi)Y_{inv}} - t_{j,o}^*}{1 - t_{j,o}^*} \right] - \pi$$

³ According to the 2012 Economic Census for Manufacturing, slightly more inventories were valued using LIFO (24 percent) than FIFO (20 percent). The remaining inventories were valued using other methods, including the average-cost and standard-cost methods. See Census Bureau, “Manufacturing: Summary Series: General Summary: Method of Inventory Valuation by Subsector and Industries: 2012,” Table EC1231SG3 (accessed January 27, 2022), <https://go.usa.gov/xMnDT>. Data for nonmanufacturing industries is not available. CBO gives FIFO and LIFO equal weights, which is the equivalent of applying the average-cost or standard-cost method to all inventories.

The formula for overall before-tax rate of return on inventories accommodates both extreme treatments of inflation as well as the half-way treatment of the other valuation methods as follows:

$$\rho_{j,inv,o,f} = \frac{1}{Y_{inv}} \ln \left\{ \frac{e^{[r_{j,o,f} + \phi\pi]Y_{inv}} - t_{j,o}^*}{1 - t_{j,o}^*} \right\} - \phi\pi$$

where ϕ is the share of inventories that is not indexed for inflation.

Required After-Tax Rate of Return to Savers

A significant portion of the after-tax rate of return to savers (s) depends not only on the tax rate that applies to each source of income but also on when that tax rate is applied—the longer the tax is deferred, the less it reduces s . Taxes on interest (which flow from debt instruments) and dividends (which, under the new view, flow from issues of new shares) are applied immediately and reduce s accordingly, as shown in the main text. Taxes on capital gains (which, under the new view, flow from retained earnings) are not applied until the gain is realized, so the holding period matters. The equation for the return on retained earnings by holding-period class (n , which can take on values for short-term, long-term, and until death) is as follows:

$$g_n = \frac{1}{Y_n} * \ln\{(1 - t_n)e^{i_{equity}Y_n} + t_n\} - \pi$$

where Y_n is the average holding period (in years) associated with class n , and

t_n is the average marginal individual income tax rate on capital gains realized during class n .⁴

The rate of return on assets held in temporarily deferred accounts also depends on the holding period and the tax rate. Thus, its equation is very similar to that for capital gains:

$$s_{o,f,td} = \frac{1}{Y_{td}} * \ln\{(1 - t_{td})e^{i_f Y_{td}} + t_{td}\} - \pi$$

To accommodate the possibility of accounting for the additional tax on early withdrawals from retirement accounts and the unrelated business income tax on the profit-making activities of nonprofit organizations, the model uses a formula for assets held in nontaxable accounts that is compatible with those taxes. The additional tax on early withdrawals is deferred until the time of

⁴ In the case of capital gains held until death, the average marginal individual income tax rate is zero. However, by taking into account both the statutory rate of the estate tax and the probability of any given estate falling above the exemption threshold, this parameter could be used to simulate the effects of the estate tax.

withdrawal, so the equation for nontaxable accounts is basically the same as the equation for temporarily deferred accounts:

$$s_{o,f,nt} = \frac{1}{Y_{nt}} * \ln\{(1 - t_{nt})e^{i_f Y_{nt}} + t_{nt}\} - \pi$$

Because CBO does not account for the additional tax on early withdrawals or the unrelated business income tax, the value of t_{nt} has been set to zero, making s_{nt} equal to $i - \pi$.

Appendix B: The Tax-Uniformity Perspective

Throughout the body of the paper, the Congressional Budget Office’s CapTax model is described in terms that are consistent with an analytical perspective referred to as the comprehensive perspective—that is, an analysis of how the tax burden on capital income affects the economy as a whole. CBO adopts such a perspective when it uses results from the model to help estimate changes in saving and investment in response to changes in the tax law. Another analysis CBO performs involves measuring the uniformity of taxation (or the lack thereof) among a number of factors, including the industry of the investing business, the type of asset being acquired, the legal form of organization, and the source of financing. The comprehensive perspective, however, is not well suited for that task.

For purposes of measuring tax uniformity, differences between aggregate measures (say, between C corporations and pass-through entities) should reflect only differences in how those groups are treated by the tax system, holding all else equal. Differences in how assets are deployed or financed within those groups should not be incorporated in the measure of the degree of tax uniformity. Isolating the effects of the tax law requires a different approach to weighting cells, establishing the values of policy parameters, and determining appropriate after-tax rates of return. CBO’s previous reports on effective marginal tax rates (EMTRs) on capital have focused on illustrating how tax treatment varies among asset types, legal forms, and financing sources at a point in time and thus have generally adopted the tax-uniformity perspective. However, the CapTax model has undergone some significant refinements in how the perspective is implemented, and those changes are reflected in the description below.

Weighting Cells

Under the tax-uniformity perspective, the share of total assets in each cell cannot be used as a weight because it will carry factors unrelated to the tax code through to the aggregated result. To understand the weighing method associated with the tax-uniformity perspective and how it differs from that of the comprehensive perspective, consider a stylized example with two asset types (equipment and structures) and two organizational forms (C corporations and pass-through entities). Under the parameters for 2021 law, it is clear that a marginal investment in equipment would be taxed less heavily than an investment in structures, regardless of organizational form (see Table B-1). That is because equipment can be expensed in 2021 and structures generally cannot be.

It is not clear, however, whether a marginal investment undertaken by a C corporation would, on average, be taxed more heavily than one undertaken by a pass-through entity. In the case of

equipment, the EMTR for C corporations (10.0 percent) is higher than the EMTR for pass-through entities (−2.6 percent). That is because of two factors:

- Expensing makes the entity-level component of the EMTR zero for equity-financed investments and negative for debt-financed investments regardless of organizational form, but
- Interest, dividends, and capital gains generated by C corporations are still subject to individual income tax.

In the case of structures, however, the EMTR for pass-through entities is slightly higher than that for C corporations despite the second level of tax. That reflects the fact that the individual income tax rate on pass-through entities' profits is higher than the 21 percent corporate income tax rate.

The answer to whether the overall EMTR is higher for C corporations or pass-through entities can depend on whether the weights are applied using the method associated with the comprehensive perspective or the tax-uniformity perspective. Under both methods, CBO derives its weights from the value of assets in each cell. In this case, the value of C corporations' assets exceeds that of pass-through entities' assets by a factor of three, but the asset mix of the two forms of organization is very different—structures constitute 67 percent of C corporations' assets but 80 percent of pass-through entities' assets (see Table B-2). Under the comprehensive method, structures would get a weight of 67 percent in the C corporation calculation and 80 percent in the pass-through calculation. But when the two forms of organization are considered together, structures constitute 70 percent of asset values. Thus, under the tax-uniformity method, structures would get a weight of 70 percent in both calculations. (Beyond this stylized example, similar averaging occurs along the industry, asset type, and source of financing dimensions.)

As for the required before-tax rate of return (ρ), C corporations give structures (with the higher value of ρ) less weight under the comprehensive method than under the tax-uniformity method, so the overall value of ρ for C corporations is lower under the comprehensive method (see Table B-3). Given only two forms of organization, the opposite is necessarily true for pass-through entities. The values of s differ much less between organizational forms, so the two weighting methods give similar results in that case. Applying the EMTR formula to the weighted-average values of ρ and s derived using the comprehensive method results in an EMTR of 16.7 percent for C corporations and 17.3 percent for pass-through entities. Performing the same exercise with values derived using the tax-uniformity method results in an EMTR of 17.0 percent for C corporations and 15.1 percent for pass-through entities.

On the basis of those results—which, though stylized, are representative of actual results for 2021—we can conclude that a marginal investment that is typical of a pass-through entity faces a higher EMTR than does a marginal investment that is typical of a C corporation. That is because, compared with C corporations, pass-through entities face a higher marginal tax rate on their

profits and have fewer investments in asset types that can be expensed. That conclusion reflects the comprehensive perspective. However, by adopting the tax-uniformity perspective, we can also conclude that a marginal investment in a mix of equipment and structures that is typical of the entire economy would face a higher EMTR if undertaken by a C corporation than if undertaken by a pass-through entity. That is largely because the additional tax at the individual level on capital income generated by C corporations more than offsets the higher marginal tax rate faced by pass-through entities.

Establishing Values for Policy Parameters

Under the comprehensive perspective, values of policy parameters deliberately reflect factors unrelated to how the tax law distinguishes between industries, asset types, legal forms, and sources of financing. The tax-uniformity perspective, by contrast, accounts only for differences attributable to such distinctions made in the tax code. Parameters that must be adjusted to eliminate nontax factors fall into two categories: parameters that vary by some measure of firm size and parameters that vary by the attributes of savers.

Parameters That Vary by Some Measure of Firm Size

Under the tax-uniformity perspective, parameter values limiting interest deductions (θ) are the same for C corporations and pass-through entities. The differences under the comprehensive perspective are driven by a gross receipts test that must be met to avoid the limitations. That test is much more binding on C corporations than on pass-through entities simply because they tend to be larger. The tax-uniformity perspective does not use firm size (as measured by gross receipts) as a differentiator among firms, so it does not reflect those differences.

Similarly, the percentages eligible for expensing under Section 179 (x_{179}) are the same, under the tax-uniformity perspective, for all industries and legal forms (although the ineligibility of certain asset types is retained). The differences under the comprehensive perspective are driven by the investment ceiling and phaseout. Those are structured to favor smaller firms, but do not explicitly target specific industries or legal forms.

Parameters That Vary by the Attributes of Savers

Under the comprehensive perspective, one source of difference between equity financing and debt financing of investments made by C corporations is the taxation of income at the individual level. Interest income (received from debt-financed investment) is taxed, on average, at a lower rate than short-term capital gains (received from equity-financed investments) because interest is commonly paid to taxpayers of all income levels, while short-term capital gains are realized overwhelmingly by high-income individuals. But that is not the result of the tax code's treating equity differently from debt; it is the result of lower-income individuals' having easier access to interest-bearing assets than to equities. The tax-uniformity perspective controls for that difference by using only two nonzero individual income tax rates—one for income sources with

a capped rate (dividends and long-term capital gains) and one for the remaining income sources, which are subject to the normal rate schedule (interest, short-term capital gains, distributions from temporarily deferred accounts, and pass-through business profits). The rates of zero that apply to capital gains held until death and to distributions from nontaxable retirement accounts, however, reflect exemptions in the tax law and remain unchanged under the tax-uniformity perspective.

The account category parameters ($\alpha_{o,f,l}$) are another example. Within the limits imposed by the tax code on contributions to such accounts, savers are free to hold in their retirement accounts debt from any legal form of organization and the equity of C corporations. But in practice, savers are much more likely to hold assets of C corporations in their retirement accounts than they are to hold the debt of pass-through entities or owner-occupied housing. (Equity in those two forms does not remain nontaxable when held in such accounts.) Because that tendency is not the result of the tax code, all asset types that can be held in nontaxable accounts are allocated among taxable, deferred, and nontaxable accounts in the same proportion under the tax-uniformity perspective.

Establishing After-Tax Rates of Return

Under the comprehensive perspective, the after-tax rate of return to investors differs for equity and debt. That difference reflects more than just differences in the tax law; most notably, it reflects differences in the riskiness of the investment. Thus, under the tax-uniformity perspective, the after-tax rates of return to investors must be equalized to ensure that only tax law differences are reflected in the results. CBO uses a weighted-average rate using the overall shares of investment financed by equity and debt as the weights.

To equalize the after-tax rates of return on equity to savers for C corporations and pass-through entities, CBO performs the same adjustment as it does under the comprehensive perspective. However, the anchor rate assigned to C corporations is the weighted average of the rates for equity and debt, not the equity rate alone, as it is under the comprehensive perspective.

To equalize the after-tax rates of return to savers between equity and debt, an additional adjustment is necessary. To illustrate why, consider pass-through entities in a stylized environment in which the weighted average of i_{equity} and i_{debt} applies to all investments, the individual income tax has a flat rate, and no limitations are placed on interest deductibility. In that case, one should expect no difference in the tax burden on equity- and debt-financed investment. The profits from both types of investment would be taxed at the flat rate. A debt-financed investment would benefit from the interest deduction at the entity level, but the taxation of that interest at the saver level—also at the flat rate—would exactly offset the deduction. However, the discount rate that the entity would apply to profits and depreciation deductions is affected by the interest deduction but not by the taxation of the interest income, which is paid by

the saver. That equalizes the after-tax rates of return to investors but does not benefit the saver holding the debt, who receives a lower after-tax rate of return than the firm's owners.

To induce savers to hold their debt, pass-through entities must therefore pay an interest rate that is higher than the rate of return their owners receive on their equity. That is accomplished in the model by making the additional adjustment mentioned above. Doing so equalizes the after-tax rates of return, tax wedges, and EMTRs of equity- and debt-financed investment made by pass-through entities. To attract savers to debt-financed investments of C corporations and owner-occupied houses, those legal forms would have to offer the same interest rate as pass-through entities, and the model adjusts the associated interest rates accordingly.

Tables

Table 1.

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How the Various Rates of Return Relate to One Another

Symbol	Description	Relation to Other Rates
Exogenous Parameters		
π	Inflation	
i	Nominal rate of return on debt or equity	
Rates Calculated Within the Model		
$i - \pi$	Real after-tax rate of return required by investors	
r	Real discount rate of investing firm	Similar to $i - \pi$ but adjusted for deductibility of interest payments
s	Real after-tax rate of return required by savers	Similar to $i - \pi$ but adjusted for individual income taxes due on i
ρ	Real before-tax rate of return required by investors	Built up from r , with adjustments for taxes on the investor's profits and cost-recovery allowances

Data source: Congressional Budget Office.

Calculation of the Disaggregated Effective Tax Rates for the Stylized Example, by Asset Type and Form of Organization

Percent

Asset Type	C Corporations	Pass-Through Entities
	Required Before-tax Rate of Return [ρ]	
Equipment	4.0	3.8
Structures	4.6	4.7
	Required After-tax Rate of Return [s]	
Equipment	3.6	3.9
Structures	3.7	3.7
	Tax Wedge [$\rho - s$] (Percentage points)	
Equipment	0.4	-0.1
Structures	0.9	1.0
	Effective Tax Rate [$(\rho - s)/s$]	
Equipment	10.0	-2.6
Structures	19.6	21.3

Aggregation Weights for the Stylized Example, by Asset Type, Form of Organization, and Weighting Method

Percent

Asset Type	Hypothetical Asset Value (Trillions of dollars)	Weights for Comprehensive Method	Weights for Tax-Uniformity Method
C Corporations			
Equipment	5	33	30
Structures	10	67	70
Pass-Through Entities			
Equipment	1	20	30
Structures	4	80	70
Memorandum: All Forms of Organization			
Equipment	6	30	30
Structures	14	70	70

Calculation of the Weighted-Average Effective Tax Rates for the Stylized Example, by Form of Organization and Weighting Method

Percent

Weighting Method	C Corporations	Pass-Through Entities
	Required Before-Tax Rate of Return [ρ]	
Comprehensive	4.40	4.52
Tax Uniformity	4.42	4.43
	Required After-Tax Rate of Return [s]	
Comprehensive	3.67	3.74
Tax Uniformity	3.67	3.76
	Tax Wedge [$\rho - s$] (Percentage points)	
Comprehensive	0.73	0.78
Tax Uniformity	0.75	0.67
	Effective Tax Rate [$(\rho - s)/s$]	
Comprehensive	16.7	17.3
Tax Uniformity	17.0	15.1

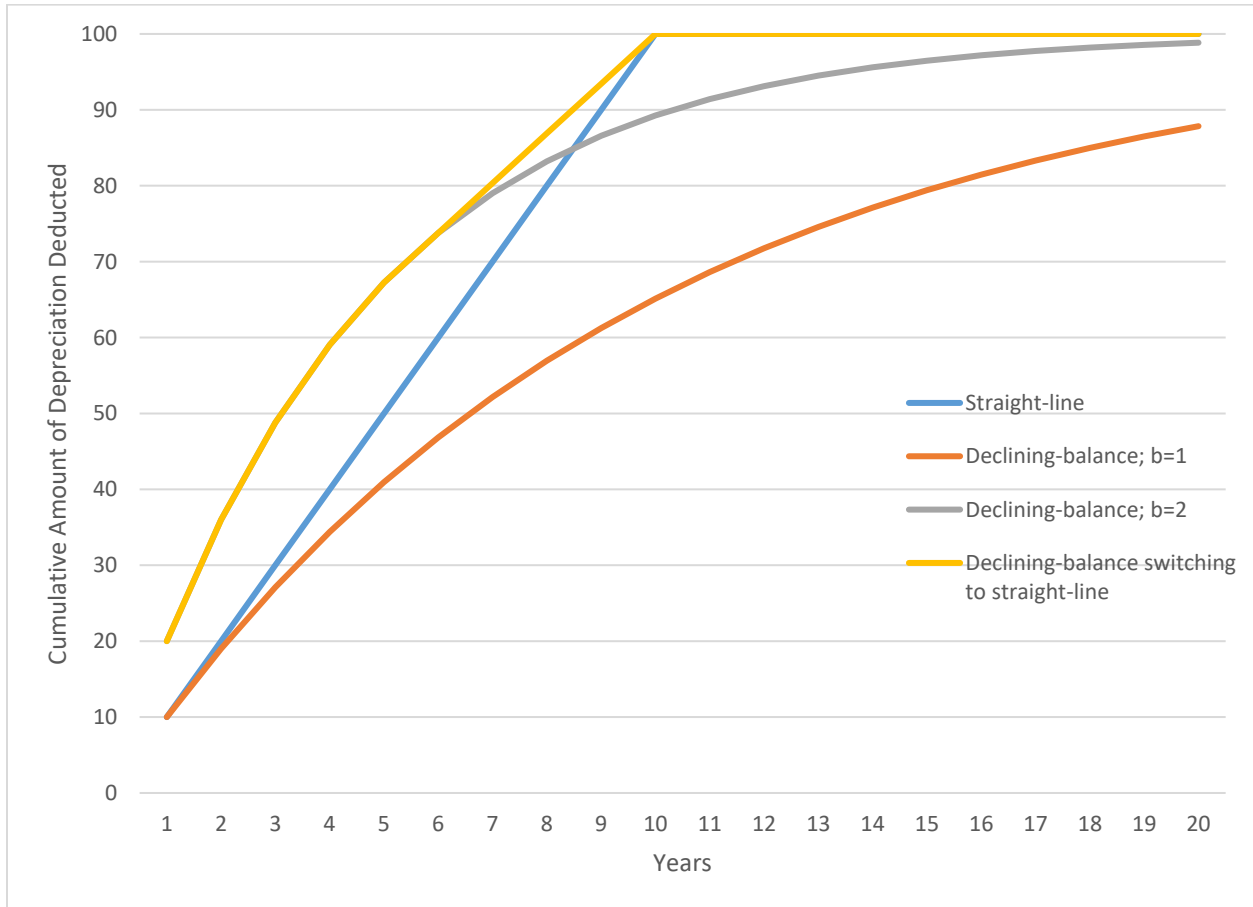
Figure

Figure 1.

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Comparison of Depreciation Methods for a \$100,000 Investment With a 10-Year Recovery Period

Thousands of Dollars



Data source: Congressional Budget Office.

For the declining-balance method of depreciation, b is the rate of acceleration of depreciation. That rate depends on an asset's recovery period—that is, the useful life of the asset as defined in the tax code. For recovery periods of more than 20 years, b equals 1; for recovery periods of less than 15 years, b equals 2. When b equals 2, the method is often referred to as double-declining-balance depreciation.