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Notes

Sample equations and sums of numbers in the text and tables of this report may not equal totals because of rounding.

Preface

This CBO background paper explains and documents the effective tax rate calculations presented in the October 2005 CBO paper *Taxing Capital Income: Effective Rates and Approaches to Reform.* It begins by presenting the formulas used to compute effective tax rates and then describes the data used to implement the formulas. An appendix provides a user's guide to an Excel workbook that can be used to compute the effective tax rates in *Taxing Capital Income.*

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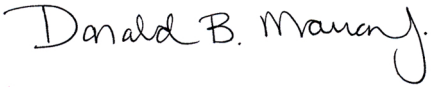

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Introduction

In its October 2005 paper, *Taxing Capital Income: Effective Rates and Approaches to Reform,* the Congressional Budget Office (CBO) used the framework of effective tax rates to determine how heavily and uniformly the federal government taxes capital income and how that taxation would be affected under several scenarios for reform. The effective tax rates computed in that paper were built on methods developed for earlier studies; this background paper documents CBO's application of those methods.[1] The first section presents the methodology used to compute effective tax rates; the second section describes the data used to implement the methodology. The appendix is a user's guide to an Excel workbook of spreadsheets for computing the effective tax rates in the paper.[2]

Methodology for Computing Effective Tax Rates

Although the concept of effective tax rates is straightforward, tax law makes their actual computation complicated. After explaining the concept, this section lays out the basic formulas and then develops several refinements. It ends by describing how effective tax rates for different assets were combined and compared in *Taxing Capital Income*.

Defining Effective Tax Rates

An effective tax rate on capital income measures the bite that taxes take out of the return earned by an investment. For example, if an investment in a new factory earned a 6 percent return and taxes took 2 percentage points of that return, 4 percentage points would be left for the savers who provided the capital. The 2 percentage points taken in taxes is called the *tax wedge*; the *tax rate* is the ratio of the wedge to the before-tax return—in this case, one-third.[3]

An effective tax rate and a statutory tax rate differ in several ways. An effective tax rate applies to the economic income earned over the life of an investment, so it accounts

1. Don Fullerton and Yolanda Kodrzycki Henderson, "Incentive Effects of Taxes on Income from Capital: Alternative Policies in the 1980s," in Charles R. Hulten and Isabel V. Sawhill, eds., *The Legacy of Reaganomics* (Washington, D.C.: Urban Institute Press, 1984), pp. 45–89; Don Fullerton, Robert Gillette, and James Mackie, "Investment Incentives Under the Tax Reform Act of 1986," in *Compendium of Tax Research 1987* (Department of the Treasury, Office of Tax Analysis), pp. 131–172; Jane G. Gravelle, *The Economic Effects of Taxing Capital Income* (Cambridge, Mass.: MIT Press, 1994); Mervyn A. King and Don Fullerton, *The Taxation of Capital Income* (Chicago: University of Chicago Press, 1984); James B. Mackie III, "Unfinished Business of the Tax Reform Act of 1986: An Effective Tax Rate Analysis of Current Issues in the Taxation of Capital Income," *National Tax Journal,* vol. 55, no. 2 (June 2002), pp. 293–338.

2. The workbook is posted along with this background paper at www.cbo.gov. The original workbook is labeled "effective tax rates.xls." Also available is the revised workbook, "corrected ETRs.xls," which corrects minor errors described in footnotes 22, 36, and 49 of this background paper.

3. More specifically, the ratio of the tax wedge to the before-tax return is the rate measured on a tax-inclusive basis.

for several factors beyond a single statutory tax rate: inflation, differences between tax depreciation allowances and economic depreciation, differences in taxation of returns on investment financed by debt or equity, and differences in taxation arising from how individuals hold their savings (in a bank account or pension fund, for example). An effective tax rate is a constant rate that, if applied to the return on an investment over its lifetime, would yield the same after-tax rate of return that would be yielded by application of statutory rates to all forms of taxable income in every year of the investment's life.

Effective tax rates apply to a prospective investment that is assumed to just break even. That is, the cost of the investment would equal the present value of the return the business would have to pay to marginal purchasers of debt and equity after taxes were paid on the profits. Such tax rates are an important consideration in a business's decision to invest because businesses tend to invest in the most profitable project first and to continue their investment in others in declining order of profitability until they reach the break-even or marginal project. Projects after that would not be undertaken. Therefore, changes in effective tax rates can change how many projects are undertaken.

Just as the business investments considered here are those that are marginal, so too are the sources of saving new or marginal. The tax rates savers pay on marginal savings can differ from those paid on existing savings. Consider an individual who has saved up to the limit in an individual retirement account (IRA). The investment earnings of the account are not taxable, but if the person saved one dollar more, it could not be deposited into the account, and the investment returns on that dollar would be taxed.

Effective tax rates are computed by specifying two rates of return on an investment. One is the real (inflation-adjusted) rate of return that a marginal investment must earn before taxes to recover its investment, to pay savers their return, and to pay taxes on the business. The other is a real rate of return savers expect to receive after taxes on the marginal savings provided to a business. The difference between those two rates of return is the tax wedge; the ratio of the tax wedge to the before-tax rate of return is the effective tax rate, *ETR,* expressed algebraically as

$$ETR = \frac{before - after}{before} \tag{1}$$

where *before* and *after* are the before- and after-tax returns on investing.

Basic Formulas

Marginal investments made in corporations, noncorporate businesses, and owner-occupied housing are assumed to satisfy similar break-even conditions. Because the ways taxes are levied on the investment returns are substantially different, however, the expressions for the before- and after-tax returns developed for corporations must

be modified to illustrate the case for noncorporate businesses and for owner-occupied housing. The corporate case is given first.

Corporate Before-Tax Rate of Return. The before-tax return required for a marginal investment by a corporation can be expressed as follows: [4]

$$before = \rho_c = \frac{(r_c - \pi + \delta)}{1-u}(1 - uz_c) + w - \delta \qquad (2)$$

where

ρ is the real before-tax return a corporation requires on the marginal investment,

r is the nominal discount rate of the corporation,

π is the rate of inflation,

δ is the rate of economic depreciation of the investment,

u is the statutory corporate tax rate on the marginal investment,

z is the present value of tax depreciation allowances per dollar of investment, and

w is the property tax rate.

The subscript c distinguishes the parameter values that apply to corporations from those that will be applied to noncorporate businesses, n, and owner-occupied housing, h.

The present value of tax depreciation allowances per dollar of investment, z, is derived from expressions of the following form:

$$z_c = \int_0^Y z(y)e^{-r_c y}dy \qquad (3)$$

where

Y is the number of years over which the asset can be depreciated for tax purposes,

y is time in years, and

4. See, for example, Fullerton and Henderson, "Incentive Effects of Taxes," pp. 84–85. Their parameters a and k, which represent the investment tax credit, have been omitted from equation (2) because the tax laws and proposals considered in *Taxing Capital Income* omit the investment tax credit. Similar specifications are used by the other studies cited in footnote 1.

$z(y)$ is the tax depreciation schedule (specified later in the section "Refinement of the Basic Formulas"), and

e is the mathematical constant.

The nominal discount rate of the corporation, r_c, is the cost of funds to the firm. If the firm obtains its funds as equity—whether from retained earnings or from new share issues—the firm must pay a real rate of return, E_c, that is comparable to what savers could earn on equity investments in other corporations. If the firm obtains its funds by issuing bonds or through borrowing, it must pay savers the nominal market interest rate, i. However, the firm can deduct its interest payments, leaving a net cost of $i(1-u)$. In the general case in which the firm finances its investments with a mix of debt and equity, the weighted-average nominal discount rate is

$$r_c = f_c[i(1-u)] + (1-f_c)(E_c + \pi) \tag{4}$$

where f_c is the fraction of the investment financed by debt. The real discount rate, $r_c - \pi$, which appears in equation (2), becomes

$$r_c - \pi = f_c[i(1-u) - \pi] + (1-f_c)E_c \tag{5}$$

The value of f_c can vary from zero, which represents all-equity financing, to one, which represents all-debt financing. Varying the value of f_c directly affects the value of r_c in equation (4), and it indirectly affects the value of z_c in equation (3); both flow through to affect the value of ρ_c in equation (2).

Corporate After-Tax Rate of Return. Sometimes an after-tax rate of return is specified as the return the corporation pays out after its tax. Combining that return with the before-tax rate of return generates the effective corporate income tax rate, *ETR.* Other times, an after-tax rate of return is specified as the return savers realize after they pay their personal income taxes. Using such an after-tax rate of return generates a combined corporate and individual effective tax rate—the effective total tax rate, *ETTR.* Although only the *ETTR* is reported in *Taxing Capital Income,* researchers use both, and the Excel spreadsheets that accompany this background paper compute both. This paper uses *ETTR* to refer only to the combined tax on corporate investments; *ETR* refers to single layers of tax or taxes on all types of investment, as in equation (1).

After-Corporate-Tax Return and Effective Corporate Tax Rate. The real after-tax return paid by the corporation, $r_c' - \pi$, is $i - \pi$ on debt-financed investments and E_c on equity-financed investments. As a result.

$$after = r'_c - \pi = f_c(i - \pi) + (1-f_c)E_c \tag{6}$$

where the prime distinguishes the after-tax return from the discount rate. The effective corporate tax rate can then be expressed as

$$ETR = \frac{\rho_c - (r'_c - \pi)}{\rho_c} \quad (7)$$

Important features of the corporate *ETR* can be illustrated with equations (2), (5), (6), and (7), and because those features concern the corporate tax, the property tax rate is ignored.

First, suppose an investment is financed entirely with equity, such that $f_c = 0$, and the real after-tax return, $r_c' - \pi$, and the corporation's real discount rate, $r_c - \pi$, equal E_c. Then, if tax depreciation allowances equal economic depreciation—as specified later by equation (40)—the *ETR* equals *u,* the statutory corporate tax rate. Essentially, taxable income from equity-financed investments is the same as economic income, so the statutory rate equals the effective rate. That equality is a condition of a pure corporate income tax. In contrast, if the equity-financed investment is expensed so that $z_c = 1$, the *ETR* becomes zero even though the statutory rate remains at *u.* That is a condition of a pure consumption tax. The effective tax rate is zero because the value of expensing at the time of the investment equals the present value of the taxes paid on the taxable income over the life of the investment.

Second, suppose an investment is financed entirely with debt, such that $f_c = 1$, and the real after-tax return is greater than the real discount rate by the amount of the firm's interest deduction. Then, if inflation is absent and tax depreciation allowances equal economic depreciation, $ETR = 0$. That is another condition of a pure income tax. If inflation is positive, however, the *ETR* becomes negative. The firm would benefit from being able to deduct the inflation premium in the interest rate, and it would increase investment until its before-tax return was less than its after-tax return. Accelerating tax depreciation relative to economic depreciation would encourage the firm to increase investment further, pushing the *ETR* further below zero. The *ETR* reaches a maximum negative value when investment is fully expensed. If the interest deduction is repealed, however, the *ETR* for debt-financed investments can be kept at zero when the investment is expensed. That is the reason proposals to allow full expensing typically are combined with proposals to repeal the deduction for interest expenses. Consumption tax proposals, for example, combine expensing and repeal of the interest deduction.

In an early paper on effective tax rates, Alan Auerbach set the after-tax return equal to the corporation's discount rate, $r_c - \pi$, even when debt finance was included.[5] Computing the *ETR* with that specification does not allow the corporation's deduction of interest to affect its effective tax rate, and therefore the *ETR* is positive.

5. Alan Auerbach, "Corporate Taxation in the United States," *Brookings Papers on Economic Activity,* no. 2 (1983), pp. 462–464. The method also was discussed by Mackie in "Unfinished Business," pp. 295–296.

Individual After-Tax Return and Effective Total Tax Rate. The calculation of the *ETTR* on corporate investment uses the after-tax return received by individuals rather than the return paid by corporations. In modeling individual taxes, CBO assumes that the marginal dollar of saving comes from three types of accounts that differ in the way their investment returns are taxed: fully taxable accounts, such as directly held corporate stocks and bonds, or savings accounts; temporarily deferred accounts, such as annuities and whole-life insurance policies; and nontaxable accounts, such as pension funds.[6] The distribution of marginal saving among them is described in the next section. Mervyn King and Don Fullerton used similar categories of accounts; some other analysts either omit temporarily deferred accounts or use only fully taxable accounts for their computations.[7]

Consider first marginal saving that is invested in debt instruments either directly (for example, in corporate bonds), or indirectly (as a deposit in a savings account, for example). To the extent that marginal saving comes from fully taxable accounts, the individual's real after-tax return is $i(1 - t_{int}) - \pi$, where t_{int} is the tax rate on interest received by marginal savers. To the extent that marginal saving comes from nontaxable accounts, the real after-tax return equals the real return paid by corporations, $i - \pi$. Finally, to the extent that marginal saving comes from temporarily deferred accounts, the saver's real after-tax return, $s_{c,d,td}$, is higher than it is on a fully taxable account, although it is lower than that on a nontaxable account (see the specification in "Refinement of the Basic Formulas"). Equation (8) is the result of combining the three types of accounts for the real after-tax rate of return of savers on corporate debt, $s_{c,d}$

$$s_{c,d} = \alpha_{c,d,ft} \times [i(1 - t_{int}) - \pi] + \alpha_{c,d,td} \times s_{c,d,td} + \alpha_{c,d,nt} \times (i - \pi) \quad (8)$$

where

$\alpha_{c,d,ft}$ is the share of marginal saving coming from fully taxable accounts,

$\alpha_{c,d,td}$ is the share of marginal saving coming from temporarily deferred accounts, and

$\alpha_{c,d,nt}$ is the share of marginal saving coming from nontaxable accounts.

6. The taxation of pension benefits upon withdrawal offsets the forgone taxes associated with deducting the amount originally contributed. It does not offset forgone taxes associated with the exemption for investment income, so the investment income can be characterized as nontaxable.

7. King and Fullerton, *The Taxation of Capital Income,* pp. 220–234, focus more on the unique taxation of life insurance companies than on the benefits of deferral for policyholders. For an example in which effective tax rates reflect only taxable accounts or only taxable and untaxed accounts, see Jane G. Gravelle, *Capital Income Tax Revisions and Effective Tax Rates,* CRS Report for Congress RL32099 (Congressional Research Service, January 5, 2005), pp. 5–11.

The after-tax return on equity is complicated by two additional considerations. First, savers receive returns from investing in corporate equities as dividends or as capital gains, the taxation of which differs. Second, it is not clear how much taxes on dividends or on capital gains contribute to the marginal tax burden on savers—there are two views on the subject. The "old view" is that because taxes on all dividends reduce after-tax returns, the contribution of the tax on dividends to the overall tax on equity is proportional to the amount of dividends paid. The "new view" is that only the taxes paid on dividends from new share issues reduce marginal returns to savers. Investment funded through reinvestment of earnings, in this view, has its return reduced only by the capital gains tax because that is the only additional tax paid if profits are reinvested rather than paid out as they are earned. In keeping with the assumptions in *Taxing Capital Income,* the development of the effective tax rate on equity here relies on the old view of dividends.[8]

As with the return on debt, return on equity can accrue in fully taxable accounts, in temporarily deferred accounts, and in nontaxable accounts. The after-tax return received on fully taxable stocks, $s_{c,e,ft}$, is expressed as follows:

$$s_{c,e,ft} = (1-m)E_c(1-t_{div}) + g \tag{9}$$

where

m is the share of the real equity return retained by the firm and reinvested,

$(1 - m)E_c$ is the real equity return paid as dividends,

t_{div} is the tax rate on dividends of marginal equity investors, and

g is the real return on retained earnings after the capital gains tax is paid by the marginal investor.

The after-tax return on retained earnings, g, reflects several factors that are unique to capital gains in fully taxable accounts: the deferral of tax on real and inflationary capital gains until the underlying asset is sold, the different statutory tax rates for short- and long-term gains, and the forgiveness of tax on gains held until death (see the specification in "Refinement of the Basic Formulas").

The after-tax return on stocks held in temporarily deferred accounts, $s_{c,e,td}$, is similar to that for debt and is also specified in "Refinement of the Basic Formulas." The after-tax return on equity held in nontaxable accounts equals E_c. Thus, $s_{c,e}$, the after-tax return to savers from corporate equity, can be evaluated as follows:

8. Congressional Budget Office, *Taxing Capital Income,* Appendix B, provides a more detailed description of the old and new views and quantitatively compares those views under selected scenarios.

$$s_{c,e} = \alpha_{c,e,ft} \times s_{c,e,ft} + \alpha_{c,e,td} \times s_{c,e,td} + \alpha_{c,e,nt} \times E_c \quad (10)$$

where

$\alpha_{c,e,ft}$ is the share of marginal saving that comes from fully taxable accounts,

$\alpha_{c,e,td}$ is the share of marginal saving from temporarily deferred accounts, and

$\alpha_{c,e,nt}$ is the share of marginal saving from nontaxable accounts.

Combining the after-tax returns on debt and equity from equations (8) and (10) yields s_c, the overall after-tax return to savers on corporate investment:

$$s_c = f_c s_{c,d} + (1 - f_c) s_{c,e} \quad (11)$$

Finally, the effective total tax rate for an investment in the corporate sector is computed as follows:

$$ETTR = \frac{\rho_c - s_c}{\rho_c} \quad (12)$$

Noncorporate Sector. In *Taxing Capital Income,* CBO calls businesses that are not subject to the corporate income tax "noncorporate businesses." That designation includes sole proprietorships, partnerships (except to the extent that the partners are themselves subject to the corporate income tax), and, despite the "noncorporate" moniker, S corporations. Noncorporate businesses are typically smaller than are publicly traded C corporations, and their suppliers of equity savings, the business owners, typically manage the businesses. The profits of noncorporate businesses are passed back to the owners where they are subject to the individual income tax.

Even though taxes on the profits of noncorporate businesses are paid through the individual income tax, the tax code computes them similarly to taxes under the corporate income tax. Their impact, therefore, on the decision of business managers to invest in equipment and structures is similar to the impact of corporate income taxes. For that reason, the literature on effective tax rates models taxes on noncorporate businesses similarly to those on C corporations. In particular, the before-tax return that noncorporate businesses must earn on a marginal investment is expressed as follows:[9]

9. See, for example, Fullerton and Henderson, "Incentive Effects of Taxes," pp. 84–85. In equation (13), as in equation (2), CBO sets Fullerton's and Henderson's parameter k to zero and their a to unity to remove the investment tax credit.

$$\rho_n = \frac{(r_n - \pi + \delta)}{1 - t_n}(1 - t_n z_n) + w - \delta \qquad (13)$$

Equation (13) is similar to equation (2)—the before-tax return for corporations—except that t_n, the tax rate on profits of noncorporate businesses, replaces u, the corporate tax rate. Tax depreciation allowances are based on the same schedule used for the corporate sector, but z_n, the present value of those allowances, is computed with r_n, the nominal discount rate of the noncorporate firm, and therefore differs from z_c, the present value of corporate allowances.

The real discount rate of the noncorporate firm under mixed debt and equity funding is as follows:

$$r_n - \pi = f_n[i(1 - t_n) - \pi] + (1 - f_n)E_n \qquad (14)$$

The terms in equation (14) parallel those used in equation (5) to describe the corporate discount rate. In CBO's computations, f_n, the share of the marginal investment financed by debt, differs from that in the corporate sector, as does E_n, the return paid on equity.

Because there is no second level of tax on the profits of a noncorporate business, the after-tax return on equity to savers, $s_{n,e}$, equals E_n, the return paid by the firm after it pays its tax.[10] (In this case, the savers generally are the business managers.) Furthermore, those amounts are assumed to equal $s_{c,e}$, the after-tax return to savers on corporate equity, because noncorporate business owners would shift their equity between their business and corporate equities until the marginal returns were equalized.

The after-tax return on noncorporate debt, $s_{n,d}$, is computed similarly to the after-tax return in equation (8) for corporate debt:

$$s_{n,d} = \alpha_{n,d,ft} \times [i(1 - t_{int}) - \pi] + \alpha_{n,d,td} \times s_{c,d,td} + \alpha_{n,d,nt} \times (i - \pi) \qquad (15)$$

The only difference is that $\alpha_{n,d,ft}$, $\alpha_{n,d,td}$, and $\alpha_{n,d,nt}$—the shares coming from fully taxable, temporarily deferred, and nontaxable accounts—differ from those in Equation (8). Previous analyses have not allowed those shares to differ among sectors.

Combining the after-tax returns on debt and equity yields s_n, the overall after-tax return on noncorporate investment:

10. Owners cannot hold their equity in accounts that would avoid or defer the business tax on profits, whose tax rate is t_n. Owners who sell business assets or the entire business may owe capital gains taxes, but those taxes are omitted from the effective tax rate calculation because of their complexity and uncertainty. Instead, investments are assumed to be held indefinitely.

$$\rho_n = f_n \rho_{n,d} + (1 - f_n)\rho_{n,e} \tag{16}$$

Combining the before- and after-tax returns for noncorporate equity gives the effective tax rate, which is also the effective total tax rate, because there is only one layer of taxation. The term ETR_n is used to indicate one layer of taxation:

$$ETR_n = \frac{\rho_n - s_n}{\rho_n} \tag{17}$$

Owner-Occupied-Housing Sector. The return on equity invested in owner-occupied homes is exempt from income tax. Mortgage interest and property taxes paid on first and second homes are deductible for owners who itemize, although homeowners cannot deduct depreciation.[11]

Those differences lead to differences (from those for businesses) in the equation for the before-tax return on investment in owner-occupied housing. The lack of taxation on the equity return causes the tax rate in equation (2) to be set to zero, and the disallowance of depreciation deductions sets the present value of those deductions to zero. The limitation on the deductibility of property taxes to those who itemize requires that a new term be added. The resulting equation for the before-tax return on the marginal investment in owner-occupied housing is as follows:[12]

$$\rho_h = r_h - \pi + w(1 - \lambda_h t_h) \tag{18}$$

where

t_h is the tax rate faced by marginal investors in owner-occupied housing and

λ_h is the fraction of property taxes those investors deduct.

The real homeowner discount rate, $r_h - \pi$, is specified using a similar expression to that used for businesses:

$$r_h - \pi = f_h[i(1 - \lambda_h t_h) - \pi] + (1 - f_h)E_h \tag{19}$$

The fraction of funding from debt, f_h, need not be the same as those for the corporate or noncorporate sectors. For convenience, the fraction of mortgage interest that is deductible is assumed to equal λ_h, the fraction of property taxes that is deductible.

11. The amount of interest that can be deducted is limited to that on $1.1 million of debt undertaken to buy, build, or improve a primary residence and a second home.

12. Fullerton and Henderson, "Incentive Effects of Taxes," pp. 84–85.

Because there is no tax on the equity return, the amount owners receive after taxes, $s_{h,e}$, equals E_h, the amount they earn on their investment. Furthermore, because homeowners could shift equity between home and corporate equity (or, when possible, to a noncorporate business), it is assumed that the return on the marginal dollar of equity invested in a home equals the after-tax return on equity invested in corporate stocks or in a noncorporate business, $s_{h,e} = s_{c,e} = s_{n,e}$. Home equity generally is not subject to the capital gains tax, and no such tax is included in the computation of the effective tax rate.

In contrast to the homeowner who pays no tax on the return on equity, the saver who lends mortgage financing might pay tax on the associated interest, depending on the type of account from which the loan is made. The after-tax return on homeowner debt, $s_{h,d}$, is calculated using an expression similar to that for the corporate and noncorporate sectors. The difference is that the shares of marginal saving coming from fully taxable ($\alpha_{h,d,ft}$), temporarily deferred ($\alpha_{h,d,td}$), and nontaxable ($\alpha_{h,d,nt}$) accounts are unique to those who lend to homeowners.

$$s_{h,d} = \alpha_{h,d,ft} \times [i(1-t_{int}) - \pi] + \alpha_{h,d,td} \times s_{c,d,td} + \alpha_{h,d,nt} \times (i - \pi) \tag{20}$$

Combining after-tax returns on equity and debt invested in owner-occupied homes gives s_h, the overall after-tax return:

$$s_h = f_h s_{h,d} + (1 - f_h)\, s_{h,e} \tag{21}$$

From the before- and after-tax returns on the marginal investment in owner-occupied housing, the effective tax rate is calculated as follows:

$$ETR_h = \frac{\rho_h - s_h}{\rho_h} \tag{22}$$

Refinement of the Basic Formulas

Several terms in the above formulas require further development. The analysis focuses on federal taxes so other taxes are removed from the formulas where they are unnecessary. Furthermore, the present values of tax depreciation allowances, the after-tax return from capital gains, and the after-tax return from temporarily deferred accounts are specified. Finally, the basic equations for before-tax returns need to be modified to accommodate inventories and land.

Focus on Federal Taxes. The effective tax rates computed in *Taxing Capital Income* are for federal taxes. In equations (2), (13), and (18), therefore, payments of property taxes to local governments were removed by subtracting w, the property tax rate, from the expressions for the before-tax rate of return on investments by corporations, noncorporate businesses, and homeowners. For corporate and noncorporate businesses alike, that operation completely removes property taxes from the expressions. For

homeowners, the term $-w\lambda_h t_h$ represents the amount by which federal individual income tax rates are reduced by itemized deductions of property taxes.[13] The equations are revised as follows:

$$\rho_c = \frac{(r_c - \pi + \delta)}{1-u}(1 - uz_c) - \delta \tag{23}$$

$$\rho_n = \frac{(r_n - \pi + \delta)}{1-t_n}(1 - t_n z_n) - \delta \tag{24}$$

$$\rho_h = r_h - \pi - w\lambda_h t_h \tag{25}$$

In other studies, calculations of income tax rates often include federal and state tax rates.[14] The corporate tax rate, for example, would consist of the following:

$$u = u_{federal}(1 - u_{state}) + u_{state} \tag{26}$$

Equation (26) accounts for the deductibility of state and local corporate taxes from federal tax income. Here, as in *Taxing Capital Income,* tax rates are limited to federal taxes, so u should always be interpreted as $u_{federal}$.[15]

Like property taxes, state corporate and individual income taxes do not affect the federal tax rate on the marginal business investment. Businesses must earn enough on that investment to pay the state income tax, then deduct that payment before determining federal taxable income. Unlike property taxes, state income taxes do not affect the federal income tax on the marginal investment in owner-occupied housing. The difference between state income taxes and state and local property taxes arises because the marginal investment in owner-occupied housing generates no additional state income tax, although it does generate additional property tax.

13. Businesses also can deduct property taxes, but for the marginal investment they must pass those taxes on to customers, thereby increasing the business's taxable income and offsetting the tax deduction. Owner–occupants cannot pass along the cost of the property tax, so the deduction is not offset by additional taxable income.
14. See, for example, King and Fullerton, *The Taxation of Capital Income*; Fullerton and Henderson, "Incentive Effects of Taxes"; and Fullerton, Gillette, and Mackie, "Investment Incentives."
15. The omission of state taxes allows the focus of the analysis to remain on incentives that can be affected by the federal government. However, it produces lower effective tax rates than prospective investors would actually face. Use of an average state rate would give an estimate of how much state taxes add overall, but it would not necessarily reflect the effective tax rates faced by any particular investment because of the variation in rates by state.

Present Values of Tax Depreciation Allowances. Because the tax code specifies two basic methods of depreciation, CBO uses two formulas to compute the present value of tax depreciation allowances: one for straight-line depreciation and the other for declining-balance depreciation with a switch to straight line. The second is used for the 200 percent and 150 percent declining-balance variations permitted by the tax code.

CBO uses three additional formulas to compute present values of depreciation allowances that would be permitted under proposed changes in the tax law: depreciation at a constant rate, economic depreciation, and expensing. In principle, expensing can be applied to the full investment, but between 2001 and 2004 it was permitted for a fraction of investment in some assets.

CBO's formulas for current law are continuous-time analogues to the depreciation schedules provided by the Internal Revenue Service (IRS).[16] The advantage of their use for calculation of effective tax rates is that they match the earnings streams from the continuous-time formulations of the before- and after-tax returns on investments specified above. The work cited in footnote 1 used continuous-time analogues for the same reason; CBO's analogues most closely follow Jane Gravelle's.

Straight-Line Depreciation. This method allows a constant-dollar amount to be claimed annually that will exhaust the purchase price of an asset over an allowed recovery period. Consider an asset purchased for $1 and allowed a five-year recovery period. Depreciation under the straight-line method would be 20 cents per year, and the undepreciated value of the asset would decline in a straight line from $1 to zero over five years (as shown in Figure 1). Of course, the market value of that asset could be more or less than its value for tax depreciation purposes.

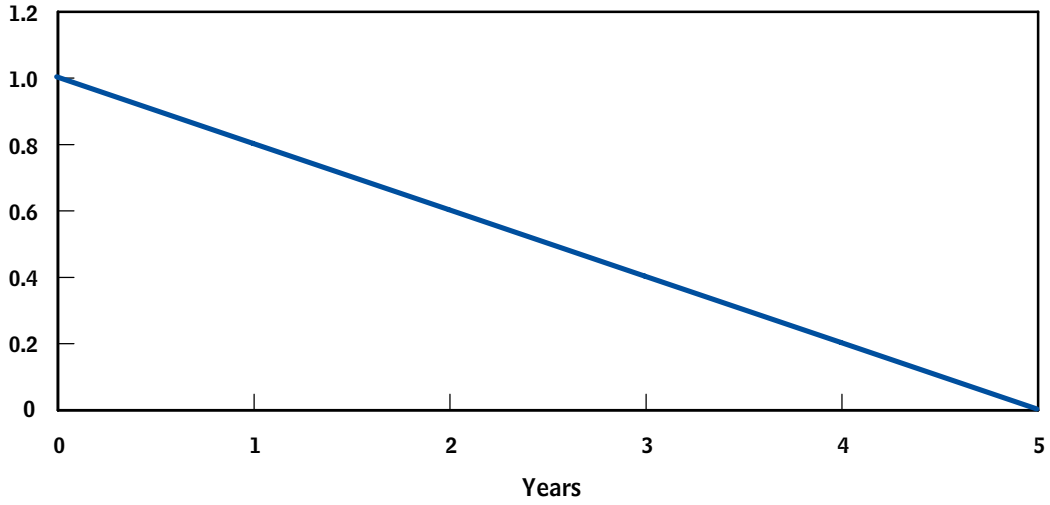
More generally, the recovery period can be labeled Y years. The depreciated value of the asset declines in a straight line from $1 to zero between the date of purchase and Y. Depreciation is a constant amount per period $1/Y$, which is the negative of the slope of the straight line. The present value of straight-line depreciation, z_{sl}, is obtained by discounting those depreciation amounts at the nominal discount rate, r, of the firm making the investment. The present value can be written as shown in equation (27):

16. Department of the Treasury, Internal Revenue Service, *Publication 946, How to Depreciate Property, For Use in Preparing 2004 Returns,* pp. 71–96.

Figure 1.

Remaining Value for $1 Invested in an Asset with Five-Year Recovery Under Straight-Line Depreciation

(Dollars)



Source: Congressional Budget Office.

$$z_{sl} = \int_0^y \frac{1}{Y} e^{-rY} dy \tag{27}$$

where y indexes the change in time from 0 to Y. Integrating the equation converts it to the formula used to compute present values:

$$z_{sl} = \frac{1 - e^{-rY}}{rY} \tag{28}$$

From equation (28), one can verify that the present value of straight-line depreciation is lower when the recovery period is longer and when the discount rate is higher.

Declining-Balance Depreciation with a Switch to Straight-Line Depreciation. The combination of the declining-balance and straight-line methods creates additional complexity. The declining-balance method is actually a constant-percentage rate of depreciation, so the dollar amount of depreciation declines in each successive period. In the example of straight-line depreciation, $1 invested in an asset with a five-year recovery period can claim depreciation at the rate of 1/5, or 20 cents per year (see Table 1 for this and the examples that follow). The 200 percent declining-balance rate is 2/5, or 40 percent. So, for tax purposes, an investment of $1 would depreciate by 40 cents in the first year. In the second year, depreciation would be 40 percent of the remaining value (60 cents), or 24 cents. At the end of the second year, the asset's tax

Table 1.

Tax Depreciation Schedules for $1 Invested in an Asset with Five-Year Recovery

(Dollars)

	Straight Line		200 Percent Declining Balance		200 Percent Declining Balance with Switch to Straight Line	
Year	Depreciation	Remaining Value	Depreciation	Remaining Value	Depreciation	Remaining Value
1	0.2	0.8	0.400	0.600	0.400	0.600
2	0.2	0.6	0.240	0.360	0.240	0.360
3	0.2	0.4	0.144	0.216	0.144	0.216
4	0.2	0.2	0.086	0.130	0.108	0.108
5	0.2	0	0.052	0.078	0.108	0

Source: Congressional Budget Office.

value would be 36 cents. In the third year, its depreciation would be 40 percent of the 36 cents of remaining value, or 14.4 cents. The declining amounts of depreciation under this method do not exhaust the value of the asset after five years: Just under 8 cents of the initial $1 investment is unclaimed. In fact, the declining-balance method cannot completely depreciate the value to zero.

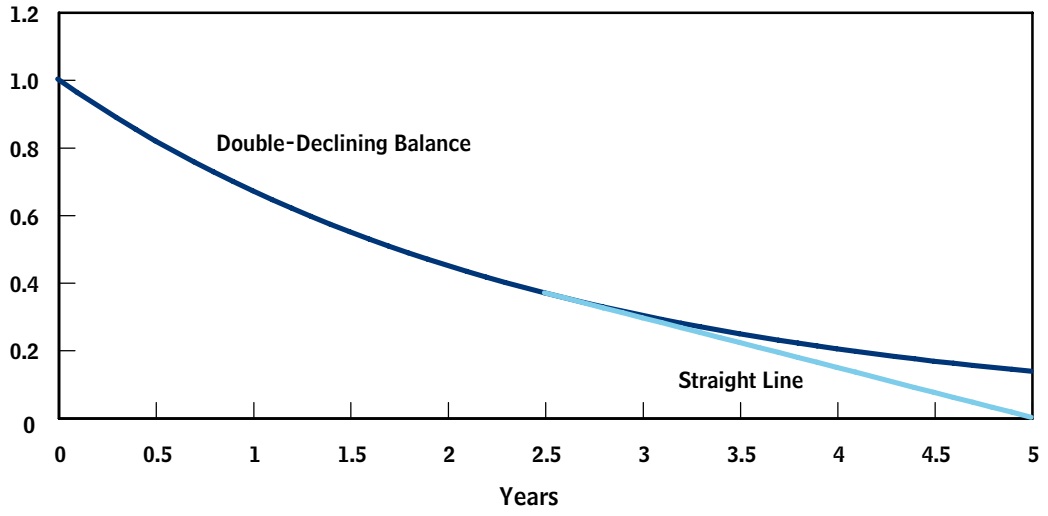
To allow taxpayers to fully recover investments when declining-balance depreciation is used, depreciation schedules switch to the straight-line method before the recovery period ends. The time chosen is the year in which straight-line depreciation on the remaining balance would give the same or a larger depreciation allowance. In the discrete time example described here, the switch would occur for the fourth year. At the end of the third year, the remaining depreciable value is 21.6 cents. The double-declining-balance method would allow about 8.6 cents of depreciation for the fourth year, but the straight-line method would allow 10.8 cents (half the remaining balance because the taxpayer has two more years to claim the 21.6 cents).

The continuous-time analogue is represented in Figure 2. The declining-balance method is shown by the curved line that starts at a value of $1 on the vertical axis at time 0. After five years, the undepreciated value is still positive. In the continuous-time analogue, the optimal time to switch to straight-line depreciation is at 2.5 years. From then through year five, the asset's undepreciated value declines along a straight line to zero.

Figure 2.

Remaining Value for $1 Invested in an Asset with Five-Year Recovery Under the Double-Declining-Balance Method with and without a Switch to Straight-Line Depreciation

(Dollars)



Source: Congressional Budget Office.

Under the declining-balance method, the undepreciated value, *V,* of the asset at any time, *y,* is given by

$$V(y) = e^{-\beta y} \tag{29}$$

where β, the rate of decline in value, is set by the acceleration of the straight-line rate of depreciation. That is, if acceleration is *b* times the straight-line rate, then $\beta = b/Y$. For a 200 percent declining balance over five years, β = 2/5, or 40 percent.

The slope, σ_{db}, at time *y* implied by equation (29) is

$$\sigma_{db} = \frac{dV}{dy} = -\beta e^{-\beta y} \tag{30}$$

and the slope converted to a positive amount is the depreciation allowance implied by the declining-balance method.

The point at which switching to straight-line depreciation will give the larger deduction can be determined by equating the depreciation rate in equation (30) to the slope of the straight line running from $V(y)$ at that time to the value of zero at time *Y,* as shown in Figure 2. The slope, σ_{sl}, of that straight line is shown in equation (31):

$$\sigma_{sl} = \frac{e^{-\beta Y^*}}{Y^* - Y} \tag{31}$$

where Y^* is the optimal switching time. It can be shown that

$$Y^* = Y\left(1 - \frac{1}{b}\right) \tag{32}$$

When the degree of acceleration is double the straight-line rate, the switching point is halfway through the recovery period, $Y/2$. When the degree of acceleration is 1.5, the switching point is one-third of the way through the recovery period, $Y/3$. Under the continuous-time analogue, the optimal switching time for double-declining-balance recovery over five years is 2.5 years, not three years as is the case for annual depreciation cited above.

The present value of depreciation deductions taken by the declining-balance method with a switch to straight-line depreciation at point Y^* is given by

$$z_{dbsl} = \int_0^{Y^*} \beta e^{-(\beta+r)y} dy + \int_{Y^*}^{Y} \frac{e^{-\beta Y^*}}{Y - Y^*} e^{-ry} dy \tag{33}$$

Integrating simplifies equation (33) to the formula CBO uses to compute present values:

$$z_{dbsl} = \frac{\beta}{\beta + r}\left[1 - e^{-(\beta+r)Y^*}\right] + \frac{e^{-\beta Y^*}}{(Y - Y^*)r}\left[e^{-rY^*} - e^{-rY}\right] \tag{34}$$

Equations (28) and (34) make it possible to compute the present value of tax depreciation for the range of assets identified in the data set. For each asset, IRS *Publication 946* guides the taxpayer's selection of a depreciation method, the degree of acceleration (if the method permits the declining-balance method), and the recovery period. Additional details are provided in the section on implementation.

Declining-Balance Depreciation. The President's Advisory Panel on Federal Tax Reform proposed grouping all equipment and structures of a business into four categories and depreciating the remaining value of each category at a constant rate.[17] That method is equivalent to the declining-balance method but without the switch to straight-line depreciation. The parameter β gives the constant rate of depreciation, but β is not necessarily determined by a particular recovery period and by a degree of

17. President's Advisory Panel on Federal Tax Reform, *Simple, Fair, and Pro-Growth: Proposals to Fix America's Tax System* (November 2005), pp. 131–132. The depreciation proposal was to be part of a simplified income tax.

acceleration over straight-line depreciation. As with the declining-balance method, the rate is applied to the remainder of the original purchase price of the asset. Thus, the depreciation allowance at time *y* and per dollar of initial investment is given by equation (30). Although the balance of assets never reaches zero, the value many years into the future is small enough that a present value of depreciation allowances for an asset can be computed as follows:

$$z_{db} = \int_0^{\infty} \beta e^{-\beta y} e^{-ry} dy \tag{35}$$

which integrates to

$$z_{db} = \frac{\beta}{\beta + r} \tag{36}$$

Economic Depreciation. Economists have suggested setting tax depreciation equal to economic depreciation as a part of making taxable income equal to economic income. Economic depreciation—used in equations (23) and (24) to calibrate the before-tax rates of return—is assumed to occur at the constant rate δ. Examinations of actual depreciation rates show that many assets depreciate at an approximately constant rate.[18] Thus, setting tax depreciation to economic depreciation in the framework developed above requires setting the parameter β in the declining-balance method to δ. However, an additional adjustment is required. Economic depreciation applies to the replacement value of the asset, which accounts for the effects of inflation on the asset's value. The inflation-adjusted value at time *y* of $1 invested in an asset at time zero is expressed as

$$V(y) = e^{(\pi - \delta)y} \tag{37}$$

and economic depreciation at that time is

$$z(y)_{econ} = \delta e^{(\pi - \delta)y} \tag{38}$$

The present value of economic depreciation is given by

$$z_{econ} = \int_0^{\infty} \delta e^{(\pi - \delta)y} e^{-ry} dy \tag{39}$$

or

18. Charles R. Hulten and Frank C. Wycoff, "The Measurement of Economic Depreciation," in Hulten, ed., *Depreciation, Inflation, and the Taxation of Income from Capital* (Washington, D.C.: Urban Institute Press), pp. 81–125.

$$z_{econ} = \frac{\delta}{\delta + r - \pi} \tag{40}$$

If the expression on the right-hand side of equation (40) is substituted into equation (23) for the before-tax rate of return on corporate investment, the expression for the corporate *ETR* under equity finance simplifies to *u.* Thus, setting tax depreciation allowances to economic depreciation causes the effective tax rate to equal the statutory corporate tax rate, as discussed in the section on the corporate *ETR.* Setting tax depreciation equal to economic depreciation also causes the effective tax rate on equity-financed investment by noncorporate businesses to equal t_n, the statutory tax rate on noncorporate business.

Expensing. The President's panel and many economists have proposed allowing businesses to expense the full value of investments when they are made.[19] When full expensing is allowed, the present value of the deduction is simply the cost of the investment, so $z = 1$. As discussed in the section on the corporate *ETR,* expensing, combined with the deductibility of business interest expenses, reduces the effective tax rate on debt-financed investments to below zero. Consequently, expensing is generally proposed as part of broader proposals for a consumed-income tax, which sets to zero the effective tax rate on the marginal investment of corporate and noncorporate businesses. Those proposals also include repeal of the deduction for interest expenses. *Taxing Capital Income* develops those points further.

In the Job Creation and Worker Assistance Act of 2002, partial expensing was allowed for some assets purchased and installed between 2001 and 2003. Businesses could expense 30 percent of a qualified investment and depreciate the remaining 70 percent under normal rules. The Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) raised expensing to 50 percent and extended the period through 2004. If x is the fraction expensed, the present value of depreciation for an asset under partial expensing, z_{pxp}, is given by equation (41):

$$z_{pxp} = x + (1 - x) \times z \tag{41}$$

where z is the present value of depreciation for the asset under normal tax rules, as defined above.

Capital Gains Taxes. Computation of effective tax rates in this paper follows the common practice of assuming that corporations pay out some profit as dividends and retain the rest for investment in new assets. This paper does not consider the use of profits to repurchase shares or the realization of capital gains taxes by noncorporate businesses and homeowners.

19. President's Advisory Panel on Federal Tax Reform, *Simple, Fair, and Pro-Growth,* pp. 163–164.

Corporations that reinvest profits in marginal investments should raise the value of their shares by the amount invested. Over time, more earnings are reinvested and the value of the shares continues to rise. When shareholders sell the stock, they realize the accumulated return. At that time (and assuming the investment is taxable), the capital gains tax is levied on the nominal increase in the share price since the time the shareholder purchased it. The shareholder keeps the residual as the nominal after-tax return. That return is not suitable for inclusion as the term g in equation (9), however. To be included, it must be converted to a real annualized rate of return.

To make that conversion, consider the case of a saver who purchases one share of stock in a corporation at time 0 and holds it until time Y. The firm earns a real rate of return, E. It reinvests the fraction m and pays out the rest as dividends. The reinvested earnings raise the value of the company's stock by the amount reinvested. In addition, the value of the stock is raised by the inflation rate, π. Assuming time is measured continuously, the value of the stock at the time it is sold can be expressed as

$$V(Y) = V(0)e^{(\pi+mE)Y} \tag{42}$$

The capital gain on the stock is the difference, $V(Y) - V(0)$, and it is taxed at the statutory rate on capital gains of t_{cg}. The amount the saver has after payment of the tax, $V(Y)'$, is

$$V(Y)' = V(Y) - t_{cg}[V(Y) - V(0)] \tag{43}$$

Substituting the right-hand side of equation (42) for $V(Y)$ in the right-hand side of equation (43) gives

$$V(Y)' = V(0)\left[(1 - t_{cg})e^{(\pi+mE)Y} + t_{cg}\right] \tag{44}$$

That after-tax return can be converted into an equivalent real annualized rate of return by solving for the term g in equation (45):

$$V(Y)' = V(0)e^{(\pi+g)Y} \tag{45}$$

To solve for g, set the right-hand side of equation (45) equal to the right-hand side of equation (44), take the natural logarithm of both sides, and rearrange. The resulting expression for g is shown in equation (46) for short-term gains—those held for less than one year and taxed at the saver's ordinary income tax rate, t_{scg}.

$$g_{scg} = \frac{1}{Y_{scg}} \times \ln\left[(1 - t_{scg})e^{(\pi+mE)Y_{scg}} + t_{scg}\right] - \pi \tag{46}$$

For holding periods of more than one year, the realized capital gain is subject to tax at a reduced rate, t_{lcg}, as shown in equation (47).

$$g_{lcg} = \frac{1}{Y_{lcg}} \times \ln\left[\left(1 - t_{lcg}\right) e^{(\pi + mE) Y_{lcg}} + t_{lcg}\right] - \pi \tag{47}$$

Furthermore, if the stock is held until the owner dies, the gain accrued at that time is exempt from income tax, so the annualized return is simply the real accruing gain, *mE*.

The three annualized after-tax rates of return must be combined into a weighted average rate *g*, which is used in equation (9). The weights represent the share of the marginal dollar of saving in taxable stock investments that is held for less than one year, ω_{scg}; the share held for more than one year but not until the owner's death, ω_{lcg}; and the share held until the owner's death, ω_{xcg}. The expression is

$$g = \omega_{scg} \times g_{scg} + \omega_{lcg} \times g_{lcg} + \omega_{xcg} \times mE \tag{48}$$

In *Taxing Capital Income,* CBO computed effective tax rates for the President's proposal in 2003 to integrate corporate and individual income taxes. In addition to eliminating the tax on some dividends, the proposal would have altered the way owners of corporate stocks compute the capital gain when they sell their stock. The portion of retained earnings attributable to those stocks would be added to the initial purchase price, and that sum would be subtracted from the sale price to arrive at the taxable capital gain. That computation would lower the taxable gain and thus the tax, thereby raising the after-tax return on retained earnings relative to that in equation (47). The gain remaining to be taxed on the initial stock purchase and on the amounts reinvested would be attributable to inflation.

To reflect the proposal in the expressions above, the initial purchase price, $V(0)$, in equation (43) would be supplemented by the amount of earnings retained from year 0 to year *Y*. That sum would be subtracted from the sale price, $V(Y)$. Cumulative retained earnings, κ, can be expressed as

$$\kappa = \frac{mEV(0)}{\pi + mE}\left[e^{(\pi + mE)Y} - 1\right] \tag{49}$$

When κ is incorporated into equation (43), and subsequent equations are adjusted to reflect that change, the expression for *g* in equation (47) is modified by replacing t_{lcg} with t'_{lcg}, which is given by equation (50):

$$t'_{lcg} = \frac{\pi}{\pi + m} t_{lcg} \tag{50}$$

In essence, allowing retained earnings to be added to the purchase price in measuring taxable capital gains is equivalent to reducing the statutory tax rate on gains by the

fraction $\pi/(\pi + m)$ when computing the real after-tax return. A parallel adjustment is made in equation (46) for short-term capital gains.

Taxation of Annuities and Whole-Life Insurance. Savers use annuities to convert current payments into a future income stream (generally before the owner's death). The amounts savers pay, called considerations, are invested and earn returns until paid out, and the returns are not taxed until that time. Taxes that normally would be paid as returns are earned, therefore, are instead deferred. That treatment is similar to the taxation of capital gains, which are not taxed until they are realized from the sale of an asset. Because of the similarity, the real annual rate of accrual from an investment in an annuity is given by an expression similar to that in equation (47). One difference between investing in an annuity and investing in a stock is that taxation of the entire return of the annuity is deferred until the payout. Stock dividends, in contrast, are taxed as they are earned. Another difference is that the annuity payout is taxed at ordinary rates instead of at the lower rates that apply to long-term capital gains and dividends.

Many annuities promise a fixed payout, which implies a fixed return over a period of years, and they tend to be invested in corporate bonds or in mortgages of noncorporate businesses. These annuities are assumed to earn the market interest rate, i. When an investment is held in such an annuity for Y_{td} years and then paid out, the real annual rate of return is given by the following variant of equation (47):

$$s'_{c,d,td} = \frac{1}{Y_{td}} \ln \left[(1 - t_{td})\, e^{iY_{td}} + t_{td} \right] - \pi \qquad (51)$$

Here $s'_{c,d,td}$ is the real after-tax return for temporarily deferred saving either in corporate bonds or in debt obligations of noncorporate businesses. Like interest income, the portion of the payout from an annuity that represents return of investment income is taxed as ordinary income. However, the tax rate that applies to annuity distributions, t_{td}, can differ from the tax rate that applies to interest income, t_{int}, because the recipients of annuities can be in different tax brackets than are recipients of interest.

Whole-life insurance also is subject to deferred taxation. The initial premiums are larger than would be necessary to pay death benefits for people of the policyholder's age, the excess is invested, and the earnings accumulate. The earnings then can be used to keep premiums from rising as the policyholder ages or for savings the policyholder can tap. As long as those earnings are used to pay premiums or death benefits, they are not taxed. In that case, the full return, i, is untaxed, and the real after-tax return is $i - \pi$. Whole-life insurance assets are largely invested in debt obligations. Thus, the return from investing in tax-deferred debt instruments is an average of the return on annuities and the return on the untaxed part of saving through whole-life insurance. That return, $s_{c,d,td}$, is computed as follows:

$$s_{c,d,td} = \gamma(i - \pi) + (1 - \gamma)\, s'_{c,d,td} \tag{52}$$

where γ is the fraction paid out as untaxed insurance premiums or death benefits.

Some annuities are invested in corporate stocks rather than in debt obligations. The real after-tax return to savers using these annuities also is expressed by a variant of equation (47), but the real return is E rather than $i - \pi$. Like annuities invested in debt instruments, the eventual payout is taxed as ordinary income. CBO assumes that tax rate is the same as the rate on payouts from annuities invested in debt obligations. The real after-tax return from annuities invested in stocks, $s_{c,e,td}$, is given by

$$s_{c,e,td} = \frac{1}{Y_{td}} \ln\left[(1 - t_{td})e^{(\pi+E)Y_{td}} + t_{td}\right] - \pi \tag{53}$$

The small amount of equity investment in whole-life insurance is ignored.

Inventories. Inventories can be inputs purchased for use in manufacturing, such as steel purchased by an automaker. Inventories also can be finished products held by the firm until they are sold, such as automobiles held by dealerships. In either case, the inventories are considered capital for the businesses that hold them. Inventories typically are held for much shorter periods than are other forms of capital, such as equipment and structures, that businesses purchase. Inventories are assumed not to depreciate in value, nor are their holders allowed to take depreciation allowances for determining taxable income. When inventories or the products made from them are sold, the cost of purchasing the inputs is deductible against the revenue from the sale.

The marginal investment in inventories by the profit-maximizing firm is assumed to cover the amount the firm must pay to savers whose funds are tied up in inventories and the taxes it must pay on the value of sales attributable to the inventories. More specifically, the corporation's marginal investment of $1 held for Y_v years must appreciate by enough to earn the amount needed to pay taxes on the increase in value and still leave enough to cover the firm's cost of funds, r. When the cost of inventories for tax purposes is based on their cost at the time of purchase (called first-in, first-out or FIFO accounting), the following condition should hold:

$$e^{rY_V} = e^{(\rho+\pi)Y_V} - u\left(e^{(\rho+\pi)Y_V} - 1\right) \tag{54}$$

When FIFO accounting is used, the growth rate for inventories' value is the sum $\rho + \pi$, where ρ is the growth rate exclusive of inflation (or the real growth rate) and π is the rate of inflation. The real growth rate is analogous to the real before-tax return in equation (2) for corporations. The expression can be solved for ρ for use in computing the effective tax rate on investment in inventories:

$$\rho_{FIFO} = \frac{1}{Y_v} \ln\left[\frac{e^{rY_v} - u}{1-u}\right] - \pi \tag{55}$$

Tax law also allows firms to use the price of inventories at the time of sale through last-in, first-out (LIFO) accounting. In that case, the marginal investment in inventories should meet the following condition, which is a modification of equation (54):

$$e^{rY_v} = e^{(\rho+\pi)Y_v} - u\left(e^{(\rho+\pi)Y_v} - e^{\pi Y_v}\right) \tag{56}$$

The real before-tax return becomes

$$\rho_{LIFO} = \frac{1}{Y_v} \ln\left[\frac{e^{(r-\pi)Y_v} - u}{1-u}\right] \tag{57}$$

A weighted-average real before-tax return for a marginal dollar invested in inventories can be computed as follows:

$$\rho = \phi\rho_{FIFO} + (1-\phi)\rho_{LIFO} \tag{58}$$

where ϕ is the proportion of the marginal dollar invested in inventories that follow FIFO accounting.

The corporate *ETTR* is computed by combining this ρ with the real after-tax return of savers, as in equation (12). Real before-tax returns for noncorporate firms are computed with formulas analogous to those in equations (54) through (58), with only the tax rates and discount rates changed. Of course, the effective tax rates on inventories for noncorporate businesses are computed using the after-tax return on saving supplied to noncorporate businesses, as in equation (17).

Land. Effective tax rates for investments in land were computed in largely the same way as were rates for investments in equipment and structures. However, in the land computations, the economic depreciation rate was set to zero and no tax depreciation was included.

Gravelle recommends that land be omitted from effective tax rates for the entire economy because land is in fixed supply for the U.S. economy, and no marginal investment could increase the quantity of land. For individual firms, industries, or even the corporate sector, she recommends land be included because each portion of the economy could expand its quantity of land by buying it from the remaining sectors. Others who compute effective tax rates include land for the entire economy as well as for

its components, and *Taxing Capital Income* follows that practice.[20] One rationale for including land in computations for the entire economy is that it can be improved to become more useful through irrigation, drainage, grading, and so on.

Measuring the Uniformity of Effective Tax Rates

In *Taxing Capital Income,* CBO compared effective tax rates for the corporate and noncorporate sectors, for debt and equity financing, and for tenant-occupied and owner-occupied housing. To make those comparisons, CBO aggregated effective tax rates over several asset types and sources of saving. It also measured the uniformity of effective tax rates among different asset types, using an interquartile range.

Comparing Aggregate Effective Tax Rates. Most measures of uniformity that CBO used were based on weighted-average tax rates computed for six aggregations of possible investments. CBO also computed effective tax rates for aggregations of all business investments and all business and homeowner investments. Those reflected the overall level of capital taxation rather than the relative levels indicated by the six narrower aggregations. The aggregations and their components are listed in Table 2.

The aggregate tax rates were constructed by separately averaging before-tax returns and then after-tax returns for each aggregation and then constructing an aggregate effective tax rate from those averages using the definition of effective tax rates in equation (1). For example, consider the aggregate *ETTR* for marginal investment in the corporate sector. The average before-tax return, represented by $\rho_{c,all}$, is computed as

$$\rho_{c,all} = \frac{\sum_{l=1}^{49} B_l q_{c,l} \rho_{c,l}}{\sum_{l=1}^{49} B_l q_{c,l}} \tag{59}$$

where

B_l is the capital stock of one of the 49 types of assets,

$q_{c,l}$ is the share of the stock of that asset type in the corporate sector, and

$\rho_{c,l}$ is the before-tax return computed from equation (23) for that asset type.

20. Gravelle's recommendations were delivered to CBO through personal communication. Others also include Fullerton and Henderson, "Incentive Effects of Taxes," p. 51; Fullerton, Gillette, and Mackie, "Investment Incentives," pp. 145–147; and Mackie, "Unfinished Business," pp. 309–310.

Table 2.

Aggregations of Effective Tax Rates

	Components			
Aggregation	**Sectors**	**Financing Mix**	**Asset Types**	**Sources of Saving[a]**
Corporate	n.a.	41 percent debt, 59 percent equity	49 asset types	3 sources of saving for corporate sector
Corporate equity	n.a.	100 percent equity	49 asset types	3 sources of saving for corporate sector
Corporate debt	n.a.	100 percent debt	49 asset types	3 sources of saving for corporate sector
Noncorporate	n.a.	32 percent debt, 68 percent equity	49 asset types	3 sources of saving for noncorporate sector
Tenant-occupied housing	2 sectors (corporate, noncorporate)	Financing by debt and equity shares for each sector as above	2 asset types (residential structures and land)	3 sources of saving for each sector
Owner-occupied housing	n.a.	43 percent debt, 57 percent equity	2 asset types	3 sources of saving for homeowner sector
Business	2 sectors (corporate, noncorporate)	Financing by debt and equity shares for each sector as above	49 asset types	3 sources of saving for each sector
Overall	3 sectors	Financing by debt and equity shares for each sector as above	49 asset types	3 sources of saving for each sector

Source: Congressional Budget Office.

Note: n.a. = not applicable.

a. Fully taxable, temporarily deferred, and nontaxable accounts.

The companion average after-tax return is s_c, computed in equation (11), which averages over sources of saving and sources of finance as shown by that equation. The aggregate $ETTR_{c,all}$ is computed as

$$ETTR_{c,all} = \frac{\rho_{c,all} - s_c}{\rho_{c,all}} \tag{60}$$

The aggregate *ETTR* for a debt-financed corporate investment is computed the same way, except that the share of finance from debt, f_c, is set to 1 in equations (5) and (11). For equity-financed corporate investment, f_c is set to zero.

The aggregate effective tax rate for the noncorporate sector is derived through computations that are completely parallel to those for the corporate *ETTR.* Computation of an effective tax rate for tenant-occupied housing deviates from the two preceding aggregations in that it averages only two asset types, structures and land. It also differs by averaging shares of those assets and shares of saving for the corporate and noncorporate sectors, because both sectors invest in rental housing. The aggregate effective tax rate for homeowners is computed similarly to those for corporate and noncorporate sectors, but only for residential structures and land.

The overall effective tax rate for all investments is computed from averages of the before- and after-tax returns for each sector. The average before-tax return, ρ_{all}, is computed as

$$\rho_{all} = q_c\rho_{c,all} + q_n\rho_{n,all} + q_h\rho_{h,all} \tag{61}$$

where q_c, q_n, and q_h are the shares of the total capital stock in the corporate, noncorporate, and homeowner sectors, respectively. The average after-tax return on saving, *s,* is given by a similar expression:

$$s = q_c s_c + q_n s_n + q_h s_h \tag{62}$$

Finally, the overall effective tax rate is computed by substituting ρ_{all} and *s* into equation (1). An overall rate for businesses is computed from similar equations as the overall rate, except that owner-occupied housing is omitted and shares represent shares of the two sectors.

Interquartile Range of Effective Tax Rates Among Asset Types. CBO summarized differences in tax rates among its 49 asset types with the interquartile range of effective total tax rates. The 49 *ETTR*s computed for investments by corporations with the typical mix of financing were ranked from highest to lowest and weighted by shares of the capital stock. The interquartile range is the difference between the *ETTR* at the 75th percentile and that at the 25th percentile. Half of all assets have tax rates within that range—one-quarter have higher rates and one-quarter have lower rates. The

range gives a single measure of how much effective total tax rates differ over a large number of categories. A change in the tax law would alter the interquartile range if it systematically widened or narrowed differences in the relative *ETTR*s of the 49 asset types. Changes that affect tax rates for only a few asset types at the extremes of the distribution would have no effect on the interquartile range, nor would changes that affect tax rates for a minority of asset types clustered near the median tax rate.

The standard deviation is a more common measure of variation, but CBO decided against using it because it gives the greatest weight to the most extreme values. Effective tax rates are ratios of the tax wedge and before-tax returns, so small values for before-tax returns can cause extreme values for effective tax rates and inflate the standard deviation.[21]

Differences in effective tax rates among asset types are caused primarily by differences in the balance between economic depreciation and tax depreciation allowances. Those differences are substantially the same, regardless of sector or source of financing. For that reason, CBO computed the interquartile range for one sector and financing mix.

Implementation of Effective Tax Rate Calculations

To solve the equations presented in this paper, values must be assigned to the variables. First, the distribution of marginal business investments among asset types, sources of financing, and tax treatments must be identified, along with the tax rates that would apply to the return on those investments. Next, the distribution of marginal individual saving by type of account must be identified, along with the tax rates that would apply to the return on that saving. Depreciation schedules also must be defined and assets must be assigned to the appropriate schedules. Finally, the rates of return that apply to each type of investment must be specified.

Identifying and Taxing Marginal Investments

Prospective investors must decide which asset types to invest in, how to finance their investments, and under which legal forms their enterprises should be organized (which, in turn, determines how investments are taxed, see Box 1). CBO classified potential investments according to a matrix defined by 49 asset types, two sources of financing (debt, equity), and three tax treatments (corporate, noncorporate business, owner-occupied housing). It then calculated *ETR*s and *ETTR*s for most of the cells in the matrix.

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21. Some previous studies have stabilized their measures of the standard deviation by computing them either for before-tax rates of return or for tax-exclusive effective tax rates (defined as tax wedges divided by after-tax returns). See, for example, Fullerton, Gillette, and Mackie, "Investment Incentives," pp. 147–150. CBO decided against these approaches because CBO presented no other information on before-tax returns or tax-exclusive effective tax rates that would help readers judge the importance of the changes in the standard deviations.

Box 1.

What Is "Corporate"? What Is "Noncorporate"?

The category labels "corporate" and "noncorporate" are used to describe both a legal form of organization and an organization's tax treatment. However, their meanings are not the same in both contexts. In this background paper, unless stated otherwise, the Congressional Budget Office uses the terms "corporate" and "noncorporate" as they apply to the tax treatment of businesses, as shown below.

Entity	Legal Form of Organization	Tax Treatment
C Corporation	Corporate	Corporate
S Corporation	Corporate	Noncorporate
Partnership	Noncorporate	n.a.
Share of partnership income attributable to corporate partners	n.a.	Corporate
Share of partnership income attributable to individual partners	n.a.	Noncorporate
Sole Proprietorship	Noncorporate	Noncorporate

Source: Congressional Budget Office.

Note: n.a. = not applicable

Performing the aggregations listed in Table 2, however, requires assumptions concerning how marginal investments would be distributed among the cells; that is, values of *B, q, f,* and α must be specified. Given those assumptions, appropriate data must be located and procedures for operationalizing the assumptions must be implemented.

Assumptions. In general, CBO assumed that marginal investments would be distributed among the matrix cells in proportion to the value of the existing capital stock. Underlying that explicit assumption is the implicit assumption that the same market conditions that determined the distribution of investment in the past would apply in the future.

That assumption has its limitations. Technology, for example, is changing. Current marginal investments are much more likely to be in computers and peripheral equipment than in, say, agricultural machinery. The existing capital stock does not fully reflect that because it includes farm equipment that will not be replaced when it wears out. Ideally, one would want to know the economy's profit-maximizing production function and weight the asset classes accordingly, but that information is not known.

Using actual investment from a recent year would be more distorting than using the existing stock of capital. To the extent that technological change causes one asset type to be replaced eventually by another asset type with a similar working life, actual investment more accurately approximates the distribution of marginal investment.

However, using actual investment substantially overweights short-lived assets at the expense of longer-lived assets, even in the absence of any technological change. The resulting distortion is much more severe than is that caused by the delay in recognizing technological change that results from using the value of existing capital stock. Therefore, the value of the capital stock was deemed to be the best option for distributing marginal investment among asset types.

Using the value of existing capital stock to distribute marginal investment among the corporate, noncorporate, and homeowner sectors and between debt and equity financing also fails to consider changes in the regulatory environment and in tax law. For example, one might assume that the Sarbanes-Oxley Act of 2002 would alter the corporate sector's share of marginal investment, either reducing it because of the compliance costs imposed on publicly traded corporations, or increasing it because of greater confidence in the accuracy of corporate reporting. Similarly, one might assume that JGTRRA would shift corporate investment toward equity financing because of its reduced tax rates on dividends and capital gains. The magnitude, and in some cases even the direction, of those shifts is highly uncertain, however. Therefore, CBO made no attempt to adjust for those changes.

Sources of Data. The primary source of data on the value of the existing capital stock was the Bureau of Economic Analysis (BEA), an agency within the Department of Commerce. Its Web site offers two types of tables: Detailed Fixed Asset Tables are disaggregated by asset type and industry (www.bea.gov/bea/dn/FA2004/Details/Index.html), and Standard Fixed Asset Tables are less disaggregated, but still offer information on legal forms of organization (www.bea.gov/bea/dn/FA2004/SelectTable.asp).

Nonresidential Assets. The 2002 value of nonresidential assets by industry and asset type was taken from Detailed Fixed Asset Table 2.1 (detailnonres_stk1.xls). All asset types in the spreadsheet were retained. Although CBO did not calculate effective tax rates by industry, the industry detail in the spreadsheet was, with a few exceptions, also retained (see Box 2). The preservation of that structure facilitated a more precise matching of depreciation methods with the appropriate assets than would have been possible had CBO used more aggregated data.

Aggregate values for nonresidential equipment and structures by legal form of organization (corporate, partnership, sole proprietorship, nonprofit) were available from

Box 2.

Aggregated Industries Used in Spreadsheet Calculations

To arrive at its calculations, the Congressional Budget Office (CBO) used four aggregated industries created from those included in the Bureau of Economic Analysis (BEA) spreadsheet Detailed Fixed Asset Table 2.1 for nonresidential detailed estimates (go to www.bea.gov/bea/dn/FA2004/Details/Index.html, then detailnonres_stk1.xls):

- Manufacturing of transportation equipment, consisting of (1) motor vehicle, body, trailer, and parts manufacturing and (2) other transportation equipment manufacturing;
- Air, water, and rail transportation (three separate industries in the BEA table);
- Professional and technical services, consisting of (1) legal services, (2) computer systems design and related services, and (3) other professional and technical services; and
- Health care and social assistance, consisting of (1) hospitals and (2) nursing homes and residential care facilities.

CBO included all of the finance industry. Some analysts omit all or part of that industry, presumably because the industry can be viewed as part of the process by which individual saving is allocated to investments of nonfinancial firms. In that approach, taxes born by the finance industry should be reflected in the effective total tax rates of nonfinancial firms. Instead, CBO's analysis included the fixed assets of the finance industry in the same manner as investments in other industries because they are indistinguishable from the assets of any other business. The "part of the process" argument has more relevance to calculating shares of debt and equity financing, which is discussed in the main text.

Standard Fixed Asset Table 4.1. Those figures were used as control totals in removing the assets of nonprofits and in distributing nonresidential assets by tax treatment (see below).

Residential Assets. The 2002 value of residential assets by tenure was taken from BEA's Detailed Fixed Asset Table 1 (detailresidential.xls), although not all of the detail contained in the spreadsheet was retained. The spreadsheet breaks the figures down by legal form of organization (household, corporation, sole proprietorship, nonprofit),

tenure (owner- or tenant-occupied), size (1–4 units, 5+ units), and type of asset (new structure, additions and alterations to structure, major replacement, manufactured home, equipment). All nonprofit data were omitted; their treatment is discussed later. The remaining figures for equipment and structures were aggregated separately for tenure and legal form of organization.[22] (The form-of-organization split is used below in determining the distribution by tax treatment.)

Land. The value of land was derived from data on capital inputs that were assembled by the Bureau of Labor Statistics (BLS) in 2005.[23] Those data provide the stock of wealth in land, structures (nonresidential, residential), equipment, and inventories for three major sectors of the economy: manufacturing, agriculture, and the rest of private business—the nonmanufacturing and nonfarm sectors. The wealth data were in 2000 dollars, and the price indexes provided by BLS allowed CBO to convert the values to 2002 dollars.

BLS obtained most of its land values by imputation. The exception is values of agricultural land, which were collected by the Department of Agriculture. For all other land, BLS multiplied values of structures by ratios of the value of land to the value of the structures. Those ratios were based on unpublished estimates by the Bureau of the Census.[24] CBO reconstructed the ratios from the BLS wealth data for 2002 and applied the ratios to the value of structures in the BEA data identified above. CBO did not take the land values directly from BLS because its data on structures differ from those used by BEA.

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22. CBO mistakenly included $86 billion worth of owner-occupied structures on farms operated by sole proprietors in the total of tenant-occupied noncorporate structures. Those structures should have been included with other owner-occupied structures. That mistake raised the total of tenant-occupied structures owned by noncorporate businesses by 3.6 percent and lowered the amount of owner-occupied structures by 0.8 percent. It also raised the effective tax rate on all tenant-occupied housing from 18.1 percent to 18.2 percent in Table 1 of *Taxing Capital Income*; no other change was large enough to distort the rates reported in that paper.

23. The data CBO downloaded are dated February 1, 2005. Newer data, dated March 23, 2006, are available. The new data differ somewhat from those used by CBO, reflecting North American Industrial Classification System instead of Standard Industrial Classification system classifications and updated information on land and other capital stocks. Go to www.bls.gov, select "Productivity," then "Multifactor Productivity," then "Get Detailed MFP Statistics," then "Download comprehensive tables of multifactor productivity and related capital data for private business, private nonfarm business and manufacturing," then "1987–2004 Capital Detail Data by Asset Type for Major Sectors."

24. U.S. Department of Labor, Bureau of Labor Statistics, *BLS Handbook of Methods, Bulletin 2490* (1997), p. 92.

CBO combined the data for nonresidential and residential structures from BEA's Standard Fixed Asset Tables 4.1 and 5.1 to get structures for the three sectors BLS used: farm, manufacturing, and the remainder of private business. From the data provided in the two BEA tables, the structures given for each sector were divided into corporate and noncorporate businesses—in this case, "corporate" includes C and S corporations. CBO then applied the ratios from the BLS data to compute the amount of land in each sector by form of business organization. The total amount of land held by corporations and by other businesses was obtained by adding the amounts each type of business held in the farm, manufacturing, and other sectors.

Finally, the BLS data omitted the value of land in owner-occupied housing. That value was obtained by subtracting the value of owner-occupied structures (from the BEA's Standard Fixed Asset Table 5.1 noted above) from the total value of owner-occupied real estate (from the *Flow of Funds* data).[25] The result was an aggregate value of land in 2002 of $7,518 billion.

Inventories. BEA's Table 5.7.5.B of the National Income and Product Accounts (NIPAs) provides values of private inventories by quarter (www.bea.gov/bea/dn/nipaweb/SelectTable.asp). CBO used those data as revised on April 28, 2005. Because the nation's economy in 2002 was in the early recovery phase from a recession and because inventories fluctuate over business cycles, CBO averaged data from 1996 through 2003 to arrive at a "normal" amount for inventories to accompany the rest of the capital stocks valued in that year. CBO computed the ratio of private inventories from BEA's NIPA Table 5.7.5.B to the value of private fixed assets listed in BEA's Detailed Fixed Asset Table 2.1 on capital stocks. The ratios were computed with fourth-quarter inventories to match end-of-year values for the capital stocks. In the years of strong growth, 1996–2000, inventories dropped from 7.7 percent to 7.2 percent of fixed assets; in 2001–2003, the years of recession and slow recovery, inventories fell from 6.5 percent to 6.3 percent of fixed assets. The average ratio was 7.0 percent; applying that ratio to the value of fixed assets of $23,530 billion in 2002 yielded inventories of $1,653 billion.

Other Data. The BEA data are not sufficiently detailed to use for identification of the assets of nonprofits or to allocate assets by tax treatment. However, most of the necessary detail can be extracted from tax data compiled in publications of the IRS Statistics of Income (SOI) division. The rest of the detail can be extracted from the Census of Agriculture (COA).

Three sources of tax data were consulted (see Box 3) and used to extract fields that covered the value of depreciable assets, accumulated depreciation, inventories, and land by industry and form of organization. The 2002 Census of Agriculture was used

25. Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), Table B.100, "Real Estate of Household for 2002" ($13,701.4 billion).

Box 3.

Sources of Tax Data Used to Supplement Bureau of Economic Analysis Data

In its analysis, the Congressional Budget Office used corporate, partnership, and sole proprietorship tax data in its analysis from the following sources. The list identifies the source table for each variable referenced in the text.

- Internal Revenue Service, *Statistics of Income—2001 Corporate Income Tax Returns* (2004).

  Table 6 (All active corporations)
  - Depreciable assets by minor industry
  - Accumulated depreciation by minor industry
  - Land
  - End-of-year inventories
  - Interest paid
  - Capital stock
  - Additional paid-in capital
  - Retained earnings (appropriated and unappropriated)
  - Cost of treasury stock

  Table 14 (S corporations)
  - Depreciable assets by minor industry
  - Accumulated depreciation by minor industry
  - Land
  - End-of-year inventories
  - Interest paid
  - Capital stock
  - Additional paid-in capital
  - Retained earnings (appropriated and unappropriated)
  - Cost of treasury stock

  The tables are available at www.irs.gov/taxstats/bustaxstats/article/0,,id=112834,00.html.

because the SOI division does not report data for farms that are sole proprietorships. The value of land and buildings, the value of machinery and equipment, and acreage owned by legal form of organization were extracted from COA Table 58.[26]

26. U.S. Department of Agriculture, National Agricultural Statistics Service, "United States Summary and State Data," *2002 Census of Agriculture,* Vol. 1, Part 51 (June 2004). Table 58 is available at www.nass.usda.gov/census/census02/volume1/us/st99_1_058_058.pdf.

Box 3.

Continued

- Tim Wheeler and Maureen Parsons, "Partnership Returns, 2002," *Statistics of Income Bulletin* (Fall 2004), pp. 46–125, available online: www.irs.gov/pub/irs-soi/02partnr.pdf.

  Table 1
  - Depreciation deductions by minor industry
  - Beginning-of-year inventories

  Table 3
  - Depreciable assets by major and minor industry
    - All partnerships
    - Partnerships with net income
  - Accumulated depreciation by major and minor industry
    - All partnerships
    - Partnerships with net income
  - Land

  Table 5
  - Net income or loss by type of partner and major industry

  Note that "Minor industries" are those listed in Table 1, and "major industries" are those listed in Table 5, except that four categories of lessors of buildings and property are aggregated.

- Kevin Pierce and Michael Parisi, "Sole Proprietorship Returns, 2002," *Statistics of Income Bulletin* (Summer 2004), pp. 6–64, available at www.irs.gov/pub/irs-soi/02solp.pdf.

  Table 2
  - Depreciation deductions by minor industry
  - Beginning-of-year inventories

Removing Nonprofits from the BEA Data. The BEA figures by asset type and industry include the assets of nonprofit organizations. Nontaxable entities incur no tax burdens on their investments, so it is not necessary to calculate effective tax rates on their assets. Retaining those assets in the data would overweight the effective tax rates on asset types that are most commonly owned by nonprofits. The most straightforward step was to delete religious buildings from the BEA data. Otherwise, the nonprofits' assets were identified as follows, then subtracted from the reported BEA amounts.

1. Depreciable assets, minus accumulated tax depreciation by industry, were tabulated from SOI data and compared with the corresponding BEA values.[27] The SOI tabulations necessarily exclude nonprofits, which do not file tax returns.[28] Therefore, a large difference between the BEA amount for an industry and the corresponding SOI amount implies a large nonprofit presence in that industry. Each of the following industries, which have the lowest ratios of SOI assets to BEA assets, was identified as having a significant nonprofit component:

   - Educational services,
   - Health care and social assistance—offices of health practitioners and outpatient care centers,
   - Health care and social assistance—hospitals, nursing homes, and residential care facilities,
   - Arts, entertainment, and recreation—other arts and entertainment (such as museums and performing arts organizations), and
   - Other services (including religious, grantmaking, civic, and professional organizations).

2. For each identified industry, the ratio of SOI assets to BEA assets was normalized to the average for industries without a significant nonprofit component (excluding banking and real estate). To estimate the value of assets held by nonprofit organizations, one minus the normalized ratio was applied to the BEA value of all types of assets.

3. Equipment and structures in identified industries were each multiplied by a separate adjustment factor to align with BEA control totals for equipment and structures owned by nonprofits (see BEA's Standard Fixed Asset Table 4.1).

Allocating Assets Between Corporate and Noncorporate Tax Treatments. Assets subject to corporate tax treatment are those owned by C corporations and the share of those owned by partnerships that can be attributed to corporate partners. Assets subject to noncorporate tax treatment are those owned by S corporations, sole proprietors, and the portion of those owned by partnerships that can be attributed to individual partners. CBO used the following steps in identifying the amounts presented, by minor industry (see Table 3):

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27. For sources of the depreciable assets of corporations and partnerships, see Box 3. Depreciable assets of sole proprietorships were imputed, as described below.

28. Although nonprofits do not file their own tax returns, they may be partners in a partnership that files a Form 1065. Assets attributable to such partners are removed in a later step.

1. Allocate corporate assets between C and S corporations.

2. Allocate partnership assets between corporate and individual partners.

3. Impute the value of assets to nonfarm sole proprietorships.

4. Impute the value of assets to farm sole proprietorships and calibrate other farm assets.

After those amounts were identified for each industry, the overall share of marginal investment subject to the corporate tax was calculated for each industry. Those values were converted into corporate shares by type of asset by weighting industry-specific shares according to the industry distribution of each asset type (see the appendix).[29]

Allocating Corporate Assets. An estimate of the value of existing capital stock (specifically, depreciable assets minus accumulated depreciation) was calculated from SOI data (see Box 3) for all active corporations and S corporations, by minor industry. The figures were then adjusted to align with BEA control totals for 2002. Separate control totals were available for farms, manufacturing, and all other industries. The resulting adjustment factors, also applied to the S corporation data, were as follows: farms, 1.74; manufacturing, 1.32; other, 2.48. The adjusted S corporation amounts were assigned to the noncorporate tax treatment; the difference between all corporations and S corporations was attributed to C corporations and assigned to the corporate tax treatment (see Table 4 on page 42).

Corporate tax data also were used to allocate land and inventories between C and S corporations.[30] No control totals were available, however, so the unadjusted amounts were assigned to a tax treatment in the same manner as other capital stock.

Allocating Partnership Assets. CBO used SOI data (see Box 3) to calculate the current value of depreciable assets by major industry for all partnerships and for partnerships with net income. The current value of depreciable assets for partnerships with a net loss was calculated as the difference between those two values. That permitted calculation of two ratios for each major industry: for profitable partnerships, the current value of depreciable assets to net income; for unprofitable partnerships, current value of depreciable assets to net loss.

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29. For corporate-owned, tenant-occupied housing, the corporate share was based on the C-to-S corporation split for the real estate industry. All other tenant-occupied housing was assigned a corporate share of zero. The corporate share of residential equipment was calculated directly from BEA data, assuming that none of it was held by S corporations.

30. To maintain compatibility between corporate tax data (from 2001) and noncorporate tax data (from 2002), end-of-year inventories were used for corporations and beginning-of-year inventories were used for noncorporate businesses.

Table 3.

Allocation of Assets Among Forms of Organization and Tax Treatment Categories, by Minor Industry

(Percent)

Industry	Form of Organization		Tax Treatment	
	Corporation	Partnership or Sole Proprietorship	Corporate	Noncorporate
	Equipment and Structures			
Agriculture, Forestry, Fishing, Hunting				
Farm structures	8.1	91.9	7.4	92.6
Farm equipment	17.5	82.5	13.6	86.4
Support activities, forestry, fishing, hunting	82.9	17.1	40.8	59.2
Mining	90.2	9.8	92.3	7.7
Utilities	98.2	1.8	99.6	0.4
Construction				
Building construction	83.8	16.2	43.6	56.4
Heavy construction, land subdivision	81.3	18.7	51.6	48.4
Specialty trade contractors	97.9	2.1	52.9	47.1
Manufacturing				
Food, beverage, tobacco	95.8	4.2	89.6	10.4
Textiles, textile products	96.9	3.1	86.6	13.4
Apparel, leather, allied products	97.4	2.6	74.1	25.9
Wood products	95.3	4.7	77.1	22.9
Paper	98.5	1.5	95.0	5.0
Printing, related activities	96.9	3.1	70.7	29.3
Petroleum, coal products	94.0	6.0	99.2	0.8
Chemicals	94.7	5.3	98.1	1.9
Plastics, rubber products	95.9	4.1	81.3	18.7
Nonmetallic mineral products	97.0	3.0	88.9	11.1
Primary metals	95.9	4.1	91.5	8.5
Fabricated metal products	96.3	3.7	74.4	25.6
Machinery	97.7	2.3	91.6	8.4
Computers, electronic products	98.7	1.3	98.3	1.7
Electrical equipment, appliances, components	99.5	0.5	96.3	3.7
Transportation equipment	99.4	0.6	98.2	1.8
Furniture, related products	97.2	2.8	79.2	20.8
Miscellaneous manufacturing	96.1	3.9	83.8	16.2

Continued

Those ratios were applied to the net income or loss of corporate partners, individual partners, and nonprofit partners in the industry as appropriate—the former if the amount was positive and the latter if the amount was negative. That technique misses most of the variation between profitable and unprofitable partnerships, but at least it renders positive values of assets for all types of partners in all industries. The corporate, individual, and nonprofit shares of the capital stock were then calculated by major industry.

Table 3.

Continued

(Percent)

Industry	Form of Organization		Tax Treatment	
	Corporation	Partnership or Sole Proprietorship	Corporate	Noncorporate
	Equipment and Structures (Continued)			
Wholesale Trade				
Durable goods	99.2	0.8	81.4	18.6
Nondurable goods	98.6	1.4	87.2	12.8
Retail Trade				
Motor vehicles, parts	96.4	3.6	50.9	49.1
Furniture, home furnishings	96.8	3.2	59.8	40.2
Electronics, appliances	94.8	5.2	78.8	21.2
Building materials, garden supplies	98.5	1.5	85.9	14.1
Food, beverage	97.9	2.1	86.3	13.7
Health, personal care	98.3	1.7	89.0	11.0
Gasoline	92.0	8.0	47.6	52.4
Clothing, accessories	98.7	1.3	92.8	7.2
Sporting goods, hobby items, books, music	97.3	2.7	82.6	17.4
General merchandise	99.4	0.6	98.7	1.3
Miscellaneous stores	91.6	8.4	68.7	31.3
Nonstore retailers	89.3	10.7	66.0	34.0
Transportation, Warehousing				
Air, rail, water	99.5	0.5	96.4	3.6
Truck	93.9	6.1	63.1	36.9
Transit, ground passenger transportation	97.0	3.0	73.2	26.8
Pipeline	46.3	53.7	68.5	31.5
Other transportation, support activities	96.7	3.3	88.1	11.9
Warehousing, storage	87.1	12.9	60.7	39.3
Information				
Publishing	98.4	1.6	92.9	7.1
Motion pictures, sound recording	93.8	6.2	91.4	8.6
Broadcasting, telecommunications	96.7	3.3	99.3	0.7
Information, data processing	98.7	1.3	97.7	2.3
Finance, Insurance				
Credit intermediation	98.7	1.3	94.4	5.6
Securities, commodity contracts, other financial investments	91.7	8.3	89.7	10.3
Insurance	99.6	0.4	97.6	2.4
Other financial vehicles	99.8	0.2	99.9	0.1

Continued

Table 3.

Continued

(Percent)

Industry	Form of Organization		Tax Treatment	
	Corporation	Partnership or Sole Proprietorship	Corporate	Noncorporate
	Equipment and Structures (Continued)			
Real Estate, Rental, Leasing				
Real estate	30.9	69.1	23.2	76.8
Rental, leasing (including nonfnancial intangible assets)	89.5	10.5	79.1	20.9
Professional, Scientific, Technical Services	80.5	19.5	66.5	33.5
Management of Companies	97.9	2.1	95.4	4.6
Administrative, Support, Waste Management, Remediation Services				
Administrative, support services	91.4	8.6	67.3	32.7
Waste management, remediation	95.1	4.9	84.1	15.9
Educational Services	82.0	18.0	57.1	42.9
Health Care, Social Assistance				
Health practitioners' offices, outpatient care centers	86.8	13.2	60.7	39.3
Miscellaneous health care, social assistance	80.8	19.2	69.5	30.5
Hospitals, nursing homes, residential care facilities	89.5	10.5	78.1	21.9
Arts, Entertainment, Recreation				
Amusement, gambling, recreation services	86.9	13.1	63.1	36.9
Other arts, entertainment	83.6	16.4	55.5	44.5
Accommodations, Food Services				
Accommodations	82.9	17.1	70.1	29.9
Food, beverage	94.2	5.8	66.5	33.5
Other Services				
Repair, maintenance	84.2	15.8	38.6	61.4
Personal, laundry services	88.8	11.2	48.2	51.8
	Land (Except owner-occupied housing)			
All Industries	51.1	48.9	46.8	53.2
	Inventories			
All Industries	85.7	14.3	72.0	28.0

Source: Congressional Budget Office calculations based on the 2002 Census of Agriculture and the following Internal Revenue Service Statistics of Income data: 2001 corporate income tax returns, 2002 partnership returns, and 2002 nonfarm sole proprietorship returns.

Next, the current value of depreciable assets was estimated for all partnerships by minor industry. The resulting estimates were adjusted by a factor of 0.43 to align with BEA control totals for partnership assets, then allocated among corporate, individual, and nonprofit partners on the basis of the shares associated with the major industry under which the minor industry falls.[31] The corporate share was assigned to the corporate tax treatment and the individual share was assigned to the noncorporate tax treatment (see Table 5 on page 45). The nonprofit share was dropped from the analysis.

Land in each major industry was allocated among corporate, individual, and nonprofit partners using the same distribution as for depreciable assets. The results were then aggregated over all industries. Inventories were allocated among the three types of partners using shares calculated for depreciable capital over all partnerships. No control totals were available for land or inventories, however, so the unadjusted amounts were assigned directly to the appropriate tax treatment.

Imputing Assets to Nonfarm Sole Proprietorships. Most assets of sole proprietorships are not reported by the SOI. They therefore were imputed, in keeping with the assumption that sole proprietors deploy assets similarly to partnerships in the same industry. Using partnership data, two ratios were calculated by minor industry: current-year depreciation deductions to the current value of depreciable assets (see Table 4), and the value of land to the current value of depreciable assets (see Box 3).[32]

The first set of ratios was applied to depreciation deductions of nonfarm sole proprietorships in the same minor industry. The resulting estimates of the current value of depreciable assets were adjusted by a factor of 0.47 to align with BEA control totals for nonfarm sole proprietorship assets and then assigned the noncorporate tax treatment.

Next, to estimate the value of land, the second set of ratios was applied to the imputed current value of depreciable assets by minor industry. Those results were aggregated over all industries, and—in the absence of a control total—assigned directly to the noncorporate tax treatment without adjustment.

Inventories for nonfarm sole proprietorships are reported by the SOI. Therefore, no imputation was necessary.

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31. See Tim Wheeler and Maureen Parsons, "Partnership Returns, 2002," *Statistics of Income Bulletin* (Fall 2004), Table 5, available at www.irs.gov/pub/irs-soi/02partnr.pdf. Partners that are themselves partnerships and partners who are nominees are also broken out in the data. Those partnerships were ignored under the assumption that their assets ultimately would be distributed among tax treatments in proportion to the three categories that were retained.

32. Basing the imputation on S corporations rather than on partnerships does not result in a substantially different distribution of sole proprietorship assets across industries.

Table 4.

Allocation of Assets Among Tax Treatments for Corporations and Sole Proprietorships, by Minor Industry

Industry	Corporations: Assets Owned by C Corporations (Percent)	Corporations: Assets Owned by S Corporations (Percent)	Sole Proprietorship Assets/ Partnership Assets
	Equipment and Structures		
Agriculture, Forestry, Fishing, Hunting			
Agricultural production	55.1	44.9	4.43
Forestry, logging	55.9	44.1	5.65
Support activities, fishing, hunting, trapping	42.5	57.5	2.73
Mining	94.0	6.0	0.11
Utilities	99.8	0.2	0.10
Construction			
Building, developing, general contracting	50.8	49.2	4.50
Heavy construction	61.5	38.5	1.36
Special trade contractors	53.5	46.5	7.29
Manufacturing			
Food	86.7	13.3	0.15
Beverages, tobacco products	95.1	4.9	0
Textiles, textile products	87.1	12.9	0.35
Apparel	76.0	24.0	0.80
Leather, allied products	68.2	31.8	2.10
Wood products	78.1	21.9	0.62
Paper	95.0	5.0	0
Printing, related activities	71.7	28.3	1.15
Petroleum, coal products	99.4	0.6	0
Chemicals	98.3	1.7	0.01
Plastics, rubber products	81.2	18.8	0.12
Nonmetallic mineral products	89.4	10.6	0.27
Primary metals	91.5	8.5	0.03
Fabricated metal products	75.1	24.9	0.60
Machinery	92.3	7.7	0.48
Computers, electronic products	98.3	1.7	0.01
Electrical equipment, appliances, components	96.4	3.6	0.08
Transportation equipment	98.3	1.7	0.11
Furniture, related products	80.5	19.5	1.70
Miscellaneous manufacturing	84.0	16.0	0.18
Wholesale Trade			
Durable goods	81.7	18.3	0.48
Nondurable goods	87.7	12.3	0.43

Continued

Table 4.

Continued

Industry	Corporations: Assets Owned by C Corporations (Percent)	Corporations: Assets Owned by S Corporations (Percent)	Sole Proprietorship Assets/ Partnership Assets
	Equipment and Structures (Continued)		
Retail Trade			
Motor vehicles, parts	51.7	48.3	0.89
Furniture, home furnishings	61.1	38.9	1.52
Electronics, appliances	81.0	19.0	0.36
Building materials, garden supplies	87.1	12.9	3.01
Food, beverage	87.3	12.7	0.40
Health, personal care	90.3	9.7	1.84
Gasoline	48.8	51.2	0.55
Clothing, accessories	93.8	6.2	1.04
Sporting goods, hobby items, books, music	84.3	15.7	1.54
General merchandise	99.1	0.9	0.63
Miscellaneous stores	74.1	25.9	4.52
Nonstore retailers	71.2	28.8	1.30
Transportation, Warehousing			
Air, rail, water	96.8	3.2	0.35
Truck	66.9	33.1	8.57
Transit, ground passenger transportation	75.3	24.7	5.73
Pipeline	97.6	2.4	0
Other transportation, support activities	90.8	9.2	2.30
Warehousing, storage	63.7	36.3	0.70
Information			
Publishing	93.1	6.9	0.20
Motion picture, sound recording	91.9	8.1	0.14
Broadcasting, telecommunications	99.3	0.7	0
Information, data processing	97.7	2.3	0.30
Finance, Insurance			
Credit intermediation	95.0	5.0	0.17
Securities, commodity contracts, other financial investments	93.2	6.8	0.09
Insurance	97.9	2.1	5.89
Other financial vehicles	99.9	0.1	0

Continued

Imputing the Value of Assets to Farm Sole Proprietorships and Calibrating Other Farm Assets. The 2002 COA reports the value of farmland and structures, R, and the value of equipment, Q, for farms owned by corporations, c, partnerships, p, and sole proprietors, s. Instead of using tax data, CBO used the COA as its benchmark for farm assets because only the COA includes sole proprietorships. To be useful for the allocation of assets to the corporate or noncorporate tax treatments, however, the COA figures must be rearranged to conform to the way asset data are reported for tax purposes: It is necessary to isolate the value of land, L, while combining the values of structures and equipment, K, such that $L + K = R + Q$.

Table 4.

Continued

Industry	Corporations: Assets Owned by C Corporations (Percent)	Corporations: Assets Owned by S Corporations (Percent)	Sole Proprietorship Assets/ Partnership Assets
		Equipment and Structures (Continued)	
Real Estate, Rental, Leasing			
Real estate	48.9	51.1	0.40
Rental, leasing	82.6	17.4	0.26
Lessors of nonfinancial intangible assets	88.9	11.1	0
Professional, Scientific, Technical Services	75.2	24.8	1.00
Management of Companies	96.2	3.8	0
Administrative, Support, Waste Management, Remediation Services			
Administrative, support services	72.2	27.8	2.38
Waste management, remediation	86.4	13.6	0.37
Educational Services	67.5	32.5	2.03
Health Care, Social Assistance			
Health practitioners' offices, outpatient care care centers	67.9	32.1	1.57
Miscellaneous health care, social assistance	79.4	20.6	0.42
Hospitals, nursing homes, residential care facilities	83.3	16.7	0.08
Arts, Entertainment, Recreation			
Amusement, gambling, recreation services	66.5	33.5	0.19
Other arts, entertainment	59.7	40.3	0.41
Accommodations, Food Services			
Accommodations	72.5	27.5	0.12
Food, beverage	68.0	32.0	0.51
Other Services			
Repair, maintenance	45.7	54.3	8.38
Personal, laundry services	54.1	45.9	4.39
		Land	
All Industries	76.5	23.5	0.78
		Inventories	
All Industries	78.2	21.8	n.a.

Source: Congressional Budget Office calculations based on the 2002 Census of Agriculture and the following Internal Revenue Service Statitistics of Income data: 2001 corporate income tax returns, 2002 partnership returns, and 2002 nonfarm sole proprietorship returns.

Note: n.a. = not applicable.

For partnerships, proxy values of L and K (from SOI data, see Box 3) can be used to estimate corresponding values that are consistent with the COA. First, $L'/(L' + K')$ was calculated. The result, 53.3 percent, was applied to the COA value of $R_p + Q_p$ to arrive at an estimate for L_p. The value of K_p was then calculated as $R_p + Q_p - L_p$.

No proxies for L and K were available from SOI data for sole proprietorships. Therefore, it was assumed that the distribution of the value of farmland between partnerships and sole proprietorships was proportional to the distribution of acreage, A, as

Table 5.

Allocation of Assets Among Tax Treatments for Partnerships, by Major Industry

Industry	Percentage Ownership	
	Corporate Partners	Individual Partners
	Equipment and Structures	
Agriculture, Forestry, Fishing, Hunting	24.1	74.2
Mining	83.9	14.7
Utilities	87.1	11.9
Construction	39.0	61.0
Manufacturing	95.3	4.4
Wholesale Trade	76.6	23.3
Retail Trade	54.1	44.1
Transportation, Warehousing	40.8	53.5
Information	98.0	1.6
Finance, Insurance		
Credit intermediation	66.0	33.7
Securities, commodity contracts, other financial investments	45.1	33.0
Insurance	66.0	33.7
Other financial vehicles	48.0	0.9
Real Estate, Rental, Leasing		
Lessors of real estate	19.5	76.0
Other real estate	30.6	56.7
Rental, leasing	55.9	40.4
Professional, Scientific, Technical Services	20.6	78.9
Management of Companies	54.2	41.9
Administrative, Support, Waste Management, Remediation Services	56.2	43.8
Education Services	30.6	67.9
Health Care, Social Assistance	35.5	61.0
Arts, Entertainment, Recreation	48.4	51.0
Accommodations, Food Services	65.4	33.4
Other Services	6.8	92.7
	Land	
All Industries	a	a
	Inventories	
All Industries	39.1	59.8

Source: Congressional Budget Office calculations based on the 2002 Census of Agriculture and 2002 partnership returns from Internal Revenue Service Statitstics of Income data.

Note: Rows do not add to 100 percent. Assets owned by nonprofit partners account for the remainder.

b. Allocation of land is the same as allocations for equipment and structures, by industry.

reported in the COA. The value of farmland owned by sole proprietorships was estimated as follows:

$$L_s = L_p \times A_s \div A_p \tag{63}$$

The value of K_s was then calculated as $R_s + Q_s - L_s$.

Values of L_c and K_c were estimated in the same manner as for partnerships. The value of K_c was calibrated to the BEA control total for farm assets owned by corporations. The sum of K_s and K_p was similarly calibrated to the BEA control total for farm assets owned by noncorporate businesses. Finally, K_c was apportioned between the corporate and noncorporate tax treatments on the basis of the S corporation percentage calculated earlier for the agricultural production industry. K_p was similarly apportioned on the basis of the percentage attributable to corporate partners calculated earlier for the entire agriculture industry.

Allocating Assets Between Debt and Equity Financing. Data on type of financing are available by form of business organization, but not by asset type. Therefore, marginal investments, regardless of asset type, were assumed to be financed in proportion to existing financing arrangements by form of organization. In general, the data were taken from the Federal Reserve's March 10, 2005, release of the *Flow of Funds.*[33] The tables used, and the data extracted from each, were as follows:

- B.100: Value of owner-occupied houses;
- L.102: Liabilities of nonfarm nonfinancial corporations, by type of instrument;
- L.103: Liabilities of nonfarm noncorporate business, by type of instrument;
- L.104: Liabilities of farm businesses, by type of instrument;
- L.208: Commercial paper outstanding (financial corporations);
- L.210: Agency- and GSE- (government-sponsored enterprise) backed securities outstanding (financial corporations);
- L.212: Corporate bonds outstanding (financial corporations);
- L.213: Corporate equity outstanding, by sector (nonfinancial, financial);
- L.215: Bank loans (n.e.c., not elsewhere classified) outstanding (financial corporations);

33. Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), available at www.federalreserve.gov/releases/z1/20050310/. The most recent data are available at www.federalreserve.gov/releases/z1/Current/.

- L.216: Other loans and advances outstanding (financial corporations);
- L.217: Total mortgages (financial corporations);
- L.218: Home mortgages (households); and
- L.228: Proprietors' equity in noncorporate business, by sector (farm, nonfarm).

Corporations. The *Flow of Funds* report generally distinguishes between financial and nonfinancial corporations. The mix of liabilities differs greatly for those two, as does the propensity to invest in equipment and structures. The differences imply that simply combining the debt and equity of financial corporations with that of nonfinancial corporations might not accurately reflect the mix of financing that would be associated with marginal investment in equipment and structures. Debt and equity were therefore extracted separately from the *Flow of Funds* report for financial and nonfinancial corporations. Corporate equity was $7,907.1 billion for nonfinancial corporations and $2,618.8 billion for financial corporations. Nonfinancial corporation debt was $4,785.1 billion; financial corporation debt was $6,979.6 billion.

SOI data for corporations in 2001 were used to identify the portion of debt and equity attributable to S corporations (see Box 3). Debt was assigned in proportion to interest deductions: 1.0 percent for financial corporations and 5.8 percent for nonfinancial corporations. Equity was assigned in proportion to the sum of capital stock, additional paid-in capital, and retained earnings minus treasury stock: 0.3 percent for financial corporations and 6.4 percent for nonfinancial corporations. The resulting S corporation amounts were subtracted from corporate totals (leaving the amount for C corporations) and added to noncorporate businesses, as described below.

The data indicate that financial C corporations finance 72.6 percent of their investments with debt; for nonfinancial C corporations, the figure is 37.9 percent. According to the BEA data, 9.86 percent of corporate equipment and structures were held in the financial services industry. The weighted-average percentage of marginal C corporation investments financed by debt, f_c, was calculated as follows:

Financial		**Nonfinancial**		**Weighted**	(64)
(72.6×0.0986)	+	(37.9×0.9014)	=	41.3	

Noncorporate Business. The *Flow of Funds* report presents data separately for noncorporate farms and nonfarm businesses.[34] Nonfarm noncorporate debt was $2,107.8 billion, and farm debt was $199.8 billion. Noncorporate equity was $4,057.9 billion for nonfarm businesses and $1,076.9 billion for farms. Figuring in the amounts attributable to S corporations from above, noncorporate investment financed by debt, f_n, was estimated at 32.3 percent.

34. The data for farms actually include some corporations. For this exercise, however, all farms were assigned to the noncorporate sector.

Owner-Occupied Housing. For purposes of an analysis of effective tax rates, homeowner debt consists entirely of home mortgages—$5,909.5 billion, according to the *Flow of Funds* report. The total value of owner-occupied housing was $13,701.4 billion, and the average share financed by debt was 43.1 percent. As with the corporate and noncorporate sectors, CBO assumed that the marginal investment in owner-occupied housing, f_h, is funded with the same share of debt.

Of course, individual homeowners typically have their highest debt share at the time of purchase. The share of debt is gradually reduced as the mortgage is paid off and as the home appreciates in value. Refinancing interrupts the process, but the trend is still toward a lower share of debt over time. The methodology of effective tax rates, however, is concerned with the debt share over the life of an investment, not with the variation within those years. From that perspective, the average share of debt among all homeowners is a better guide to the debt share of a marginal investment than is the debt share at the time a home is purchased.

Identifying the Marginal Tax Rate for Business Entities. Marginal tax rates must be estimated for application in each sector.

Corporate Profits. The average marginal rate at which corporate profits are taxed, u, was assumed to be 35 percent—the highest statutory rate on the corporate tax schedule. Use of that rate assumes that the marginal investment is made by a profitable corporation in the top tax bracket. Businesses in lower corporate tax brackets—a group that holds barely 2 percent of the assets of profitable corporations—generally have assets of less than $5 million. The CBO analysis omitted the recently enacted deduction for productive activity because it had not analyzed how broadly the deduction would apply to corporate income.[35] That credit will be completely phased in by 2010, and by that time it would reduce the statutory tax rate on qualifying income by as much as 9 percent.

Noncorporate Business Income. The average marginal rate at which noncorporate business income is taxed, t_n, was assumed to be 26.7 percent.[36] CBO estimated that rate using its individual income tax model, limiting the analysis to tax returns with positive taxable income and positive noncorporate business income (defined, in terms of schedules of Form 1040, as the sum of positive Schedule C income, positive Schedule F income, and positive values of four items from Schedule E—real estate rental income, partnership income, S corporation income, and farm rental income). Unlike

35. The deduction relating to income attributable to production activities in the United States was enacted in section 102 of the American Jobs Creation Act of 2004. For a description of the provision, see United States Congress, Joint Committee on Taxation, *General Explanation of Tax Legislation Enacted in the 108th Congress* (May 2005), p. 170.

36. A computational error in combining the different sources of noncorporate business income rendered the tax rate slightly higher than it should have been. The correct value would be 26.4 percent.

the corporate tax rate, the noncorporate tax rate explicitly accounts for businesses in tax brackets other than the highest one—a much more common phenomenon among noncorporate businesses than among corporations.

Owner-Occupied Housing. The marginal rate at which the implicit rent on owner-occupied housing is taxed is, by law, zero. Nevertheless, because interest and property tax payments are deductible, it was necessary to include an average marginal rate for those deductions, t_h.[37] That rate was estimated, using the CBO individual income tax model, at 19.4 percent. Unlike the other rates, that rate was not applied to all interest paid; taxpayers who do not itemize their deductions derive no benefit from the deductibility of interest. Mortgage interest actually deducted on tax returns in 2002 was 94 percent of mortgage interest payments reported by BEA.[38] Therefore, the tax rate was applied, through λ_h, to 94 percent of interest paid.

Identifying and Taxing Marginal Saving

The income earned by marginal investments flows through to individuals, where it registers as a return on marginal saving. There, it can accrue in one of three types of accounts, each taxed differently:

- Nontaxable: interest, dividends, and capital gains accruing in IRAs and qualified employment-based retirement plans;[39]
- Temporarily deferred: interest, dividends, and capital gains accruing in whole-life insurance policies and nonqualified annuities, and capital gains accruing outside tax-favored accounts; and
- Fully taxable: interest and dividends accruing outside tax-favored accounts.

37. The amount of the property tax deduction was estimated using an average national rate of 1.17 percent. That rate was calculated as the unit-weighted average tax paid per $1,000 of value. See Bureau of the Census, *American Housing Survey of the United States: 2003* (2004), Table 1A-7; available at www.census.gov/hhes/www/housing/ahs/ahs03/tab1a7.htm.

38. Nearly $337 billion in mortgage interest was reported on tax returns in 2002. See Internal Revenue Service, *Statistics of Income—2002 Individual Income Tax Returns* (2004), Table 2.1, available at www.irs.gov/taxstats/indtaxstats/article/0,,id=134951,00.html. CBO estimated that $5 billion of that total was disallowed by the limitation on itemized deductions, leaving almost $332 billion that was ultimately deducted. BEA reports homeowners paid $351 billion in mortgage interest in 2002. See Department of Commerce, Bureau of Economic Analysis, "National Income and Product Account Tables," *Survey of Current Business,* vol. 64, no.161 (August 2004), Table 7.11; available at http://bea.gov/bea/ARTICLES/2004/08August/0804NIPA_TABLES.pdf.

39. Omitted are health savings accounts (HSAs), which are even more tax favored, allowing pretax contributions and tax-free withdrawals (as long as they are applied to medical expenses). However, in 2002—the year for which CBO collected most of its data—HSAs had not yet been introduced and no data were available for their much smaller predecessors, the Archer Medical Savings Accounts, which were replaced when HSAs became available in 2004.

The procedures outlined below treat all income from directly held corporate stocks as fully taxable but make a special adjustment to account for deferral when the marginal tax rate is applied to capital gains.

Noncorporate business owners and homeowners provide equity investments through their own saving. Consequently, the returns do not flow through to other savers whose tax status would have to be determined. The effective tax rate on those equity returns is captured by the computation of the before-tax return in equation (24) for noncorporate businesses and in equation (25) for owner-occupied housing.[40] Thus, the taxation of those equity returns is not discussed further in this section.

Assumptions. The first task is to classify all household assets according to three criteria: the source of financing of the underlying investment, the business-entity-level tax treatment of the underlying investment, and the individual-level tax treatment of saving. By classifying assets on the basis of characteristics of the underlying investment, the CBO analysis departs from the usual practice of performing a single allocation of all household assets among individual-level tax treatments (frequently ignoring the "temporarily deferred" category). The desirability of abandoning that practice can be illustrated by examining how businesses with different organizational forms borrow. The biggest source of corporate borrowing is in bonds. Noncorporate businesses, in contrast, use primarily mortgages and bank loans. It is common for nontaxable accounts to hold corporate bonds, but it is less common for them to hold business mortgages or bank deposits. Thus, interest on corporate debt held by households is ultimately taxed at a lower average rate than is interest on noncorporate business debt.

Assets were allocated among the three categories of individual-level tax treatments in proportion to the distribution of assets in 2002. In general, marginal saving was distributed among those categories in proportion to assets. The exception was for assets in nontaxable accounts held by individuals who were constrained by a statutory contribution limit. For example, an IRA owner who contributes $5,000 annually cannot direct any marginal saving to that IRA because the statutory contribution limit is already met. Thus, it was necessary to divide the nontaxable category into groups designated as constrained and unconstrained. Plans in the constrained group have contribution limits that are binding on a significant percentage of participants. IRAs and 401(k)-type retirement plans normally would make up this group, but the nature of the data makes it necessary to include all defined-contribution plans. Unconstrained plans have explicit or implicit contribution limits that only rarely are binding on participants. For purposes of this exercise, they are the defined-benefit plans.

Merely identifying total assets in each household tax treatment category is not sufficient, however. In the nontaxable–constrained category, contribution limits are

40. Equation (24) accounts for the fact that the equity return from noncorporate businesses is fully taxable. Equation (25) accounts for the fact that the equity return from owner-occupied housing is not taxed although mortgage interest and property taxes are deductible for people who do itemize.

binding on some participants but not on others. To distribute marginal saving in the manner proposed, it was necessary to estimate the percentage of assets held by those for whom the limits are binding. CBO assumed that the marginal saving that would have been allocated to actually constrained accounts under a strictly proportional system was redirected to the fully taxable and temporarily deferred categories. The nontaxable–unconstrained category was not affected by the reallocation, because saving in defined-benefit plans is determined largely by employers and so is usually beyond the discretion of the taxpayer. To simulate alternative laws, CBO reestimated the percentage of assets held in nontaxable–constrained accounts by those for whom contribution limits are binding. Those assets were redirected to the fully taxable and temporarily deferred categories.

Identifying Household and Nonprofit Assets as Debt or Equity. Debt and equity instruments are not distributed the same way among the categories of accounts. Because different proposals affect debt and equity differently, it is important to be able to reflect those differences in the calculation of effective tax rates. Under current law, debt and equity are taxed differently when they fall into the "fully taxable" category.

The source of financing underlying household assets is straightforward in some cases but difficult to ascertain in others. The simplest to identify are the assets held directly by households, but assets also can be held indirectly in nontaxable, pass-through entities, such as mutual funds. Sometimes, the assets must be traced to identify the underlying source of financing. For example, some households hold part of their assets in private defined-contribution plans. Those plans, in turn, hold some assets in mutual funds. Finally, the mutual funds hold corporate equities and various credit market instruments. The debt–equity split for the mutual fund must be assigned back to the household.

Equity. Corporate equities held directly by households and nonprofits in 2002 were reported as $5,047.8 billion on line 16 of *Flow of Funds* Table L.100.a (see Table 6). Corporate equities held indirectly by households and nonprofits in 2002 were reported as $5,003.5 billion on line 8 of Table B.100.e. The vehicles in which equities are held indirectly include bank personal trusts and estates (Table B.100.e, line 9), life insurance companies (line 10), private defined-benefit pension funds (line 12), private defined-contribution pension funds (line 13), state and local government retirement funds (line 14), federal government retirement funds (line 15), and mutual funds (line 16).

Noncorporate equities in 2002 were reported as $5,139.7 billion on line 22 of *Flow of Funds* Table L.100. All were held directly. Equity in owner-occupied housing in 2002 was reported at $7,791.9 billion on line 50 of Table B.100. Like noncorporate business equity, all was held directly by households.

Table 6.

Corporate Equity Held by Households and Nonprofits, 2002

	Billions of Dollars of Equity
Directly Held	5,047.8
Indirectly Held	
Bank personal trusts	385.0
Life insurance companies	692.5
Private defined-benefit plans	535.3
Private defined-contribution plans	1,076.0
State and local retirement plans	869.8
Federal retirement plans	45.9
Mutual funds	1,399.0
Total	**10,051.3**

Source: Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), Tables B.100.e. and L.100.a, available at www.federalreserve.gov/releases/z1/20050310.

Debt. The *Flow of Funds* report does not include a table that summarizes debt held both directly and indirectly by households. Instead, CBO compiled that information from various *Flow of Funds* tables (see Table 7).

Debt held directly by households is reported on line 7 of Table L.100.a as "credit market instruments." It is divided into open market paper (line 8), treasury securities (line 9), agency- and GSE-backed securities (line 12), municipal securities (line 13), corporate and foreign bonds (line 14), and mortgages (line 15). Treasury securities are excluded from the analysis because they are never issued by a taxable entity.

Debt held indirectly by households is more difficult to identify. Some is held directly by sectors whose liabilities are all assets of households. Those assets can simply be passed through to households. The sectors for which this is permissible, and the *Flow of Funds* table on which their credit market instrument holdings are reported, are bank personal trusts (Table L.116), private defined-benefit plans (Table L.119.b), private defined-contribution plans (Table L.119.c), state and local government retirement funds (Table L.120), and federal government retirement funds (Table L.121).

Other debt held indirectly by households is held directly by sectors whose liabilities are only partly assets of households. Those sectors, and the *Flow of Funds* tables on which their credit market instrument holdings are reported, are life insurance companies (Table L.117), money market funds (Table L.122), mutual funds (Table L.123), agency- and GSE-backed mortgage pools (Table L.126), commercial banks (Table L.109), savings institutions (Table L.113), and credit unions (Table L.115).

Before attributing the credit market instruments held by those sectors to households, the appropriate share was identified. That was a straightforward exercise for several sectors:

- Table L.117 in the *Flow of Funds* report indicated that 87.7 percent of life insurance liabilities were either pension fund reserves or life insurance reserves, both of which are considered assets solely of households and nonprofits.

- All money market fund liabilities are money market fund shares. According to Table L.206, 48.8 percent of those shares were held by households or nonprofits. Therefore, 48.8 percent of each credit market instrument held by money market funds was attributed to the household and nonprofit sector.

- All mutual fund liabilities are mutual fund shares. Because Table L.214 shows that 63.9 percent of those shares were held by households or nonprofits, 63.9 percent of each credit market instrument held by mutual funds was attributed to the household and nonprofit sector.

- All agency- and GSE-backed mortgage pool liabilities are agency- and GSE-backed securities. According to Table L.210, 3.6 percent of those shares were held by households and nonprofits. Therefore, 3.6 percent of each credit market instrument held by agency- and GSE-backed mortgage pools was attributed to the household and nonprofit sector.

Deposits in commercial banks, savings institutions, and credit unions present another challenge in that they are not the only liability of depository institutions. Thus, only a portion of the debt held by depository institutions (67.1 percent) was passed through to other entities; the remainder was assumed to affect the value of corporate equities. Furthermore, according to Table L.205, sectors other than households and nonprofits held 37.0 percent of the passed-through deposits. Therefore, the share of each debt instrument held by depository institutions passed through to households and nonprofits was approximately 42.3 percent.

Finally, it was necessary to identify credit market instruments held indirectly by households and nonprofits through more than one level of pass-through entity. In addition to holding credit market instruments, several sectors also hold money market funds, mutual funds, agency- and GSE-backed securities, and deposits in financial institutions: life insurance companies, private defined-benefit plans, private defined-contribution plans, state and local retirement plans, federal retirement plans, and bank and personal trusts.

Table 7.

Credit Instruments Held by Households and Nonprofits, 2002

(Billions of dollars)

	Open Market Paper	Agency- and GSE-Backed Securities	Municipal Securities	Corporate and Foreign Bonds	Bank Loans, n.e.c.	Other Loans and Advances	Home Mortgages	Other Mortgages
Directly Held[a]	98.9	200.5	585.6	706.8	0	0	103.6	34.0
Indirectly Held (One pass-through entity)								
Depository institutions[b]	2.3	776.5	82.9	286.6	718.8	33.1	1,311.9	642.7
Money market funds[c]	289.7	158.1	137.9	83.3	0	0	0	0
Agency-, GSE-backed mortgage pools[d]	0	0	0	0	0	0	128.2	4.0
Bank personal trusts[e]	11.4	34.2	100.9	35.6	0	0	2.3	0
Life insurance companies[f]	64.9	290.3	17.5	1,271.6	0	92.2	4.1	215.2
Private defined-benefit plans[g]	16.3	181.5	0	231.5	0	0	1.2	3.4
Private defined-contribution plans[h]	23.6	39.0	0	75.8	0	0	1.6	4.2
State, local retirement plans[i]	45.5	151.8	0.5	334.5	0	0	6.8	14.5
Federal retirement plans[j]	0	5.5	0	2.8	0	0	0	0
Mutual funds[k]	40.3	269.8	177.3	301.1	0	0	0	0
Indirectly Held (Two pass-through entities)								
Bank personal trusts[l]								
Depository institutions	0	2.2	0.2	0.8	2.0	0.1	3.7	1.8
Money market funds	14.5	7.9	0.2	0.8	0	0	0	0
Agency-, GSE-backed mortgage pools	0	0	0	0	0	0	21.9	0.7
Mutual funds	5.9	39.3	25.8	43.9	0	0	0	0
Life insurance companies[m]								
Depository institutions	0	6.1	0.6	2.3	5.7	0.3	10.4	5.1
Money market funds	37.5	20.5	17.8	10.8	0	0	0	0
Agency-, GSE-backed mortgage pools	0	0	0	0	0	0	185.6	5.8
Mutual funds	0.2	1.6	1.1	1.7	0	0	0	0
Private defined-benefit plans[n]								
Depository institutions	0.1	26.7	2.8	9.9	24.7	1.1	45.1	22.1
Agency-, GSE-backed mortgage pools	0	0	0	0	0	0	116.1	3.6
Mutual funds	2.3	15.2	10.0	16.9	0	0	0	0
Private defined-contribution plans:[o]								
Depository institutions	0	4.7	0.5	1.7	4.4	0.2	8.0	3.9
Money market funds	22.1	12.1	10.5	6.4	0	0	0	0
Agency-, GSE-backed mortgage pools	0	0	0	0	0	0	24.9	0.8
Mutual funds	8.1	53.9	35.4	60.2	0	0	0	0

Continued

Table 7.

Continued

(Billions of dollars)

	Open Market Paper	Agency- and GSE-Backed Securities	Municipal Securities	Corporate and Foreign Bonds	Bank Loans, n.e.c.	Other Loans and Advances	Home Mortgages	Other Mortgages
Indirectly Held (Two pass-through entities), continued								
State, local retirement plans[p]								
Depository institutions	0	1.7	0.2	0.6	1.5	0.1	2.8	1.4
Agency, GSE-backed mortgage pools	0	0	0	0	0	0	97.1	3.0
Federal retirement plans and								
Agency, GSE-backed mortgage pools[q]	0	0	0	0	0	0	3.5	0.1
Total	**683.4**	**2,299.0**	**1,214.5**	**3,488.9**	**757.1**	**127.1**	**2,078.9**	**966.2**

Source: Congressional Budget Office based on Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), available at www.federalreserve.gov/releases/z1/20050310. The individual tables used are listed below.

Note: GSE = government-sponsored enterprise; n.e.c. = not elsewhere classified.

a. Table L.100.

b. Tables L.109, L.113, L.115, and L.205.

c. Tables L.122 and L.206.

d. Tables L.126 and L.210.

e. Table L.116.

f. Table L.117.

g. Table L.119.b.

h. Table L.119.c.

i. Table L.120.

j. Table L.121.

k. Tables L.123 and L.214.

l. Tables L.116, B.100.e, L.109, L.113, L.115, L.122, L.126, and L.123.

m. Tables L.117, B.100.e, L.109, L.113, L.115, L.122, L.126, and L.123.

n. Tables L.119.b, B.100.e, L.109, L.113, L.115, L.122, L.126, and L.123.

o. Tables L.119.c, B.100.e, L.109, L.113, L.115, L.122, L.126, and L.123.

p. Tables L.120, L.109, L.113, L.115, and L.126.

q. Tables L.121 and L.126.

Table 8.

Nonprofit Share of Assets and Liabilities, 2000

(Percent)

Assets of Nonprofits as a Percentage of Assets of Households and Nonprofits	
Time Deposits, Savings Deposits	0.4
Money Market Fund Shares	7.0
Open Market Paper	100.0
Agency-, GSE-Backed Securities	18.4
Municipal Securities	0.3
Corporate and Foreign Bonds	25.2
Mortgages	8.4
Corporate Equities	9.1
Mutual Fund Shares	1.4
Life Insurance Reserves	0
Pension Reserves	0
Investments in Bank Personal Trusts	0
Liabilities of Nonprofits as a Percentage of Liabilities of All Issuers	
Municipal Securities	9.7
Bank Loans, n.e.c.	2.8
Other Mortgages	7.5

Source: Congressional Budget Office calculations based on Congressional Budget Office based on Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), Tables L.100 and L.100a, available at www.federalreserve.gov/releases/z1/20050310.

Note: GSE = government-sponsored enterprise; n.e.c. = not elsewhere classified.

The example of corporate bonds held by mutual funds that, in turn, are held by bank personal trusts illustrates how those amounts were estimated:

$339.1 billion	Mutual fund holdings of bank personal trusts (Table L.116, line 14)
− $203.9 billion	Equity portion of mutual fund holdings of bank personal trusts[41]
$135.2 billion	Nonequity portion of mutual fund holdings of bank personal trusts
× 0.325	Corporate bond share of nonequity portion of all mutual funds[42]
$43.9 billion	Corporate bond portion of mutual fund holdings of bank personal trusts.

41. Derived as follows: $385.0 billion in corporate equity held indirectly by households through bank personal trusts (Table L.117, line 15), minus $181.0 billion in corporate equity held directly by bank personal trusts (Table B.100.e, line 9), equals $203.9 billion in corporate equity held indirectly (in mutual funds) by bank personal trusts.

42. Derived as follows: $470.9 billion in corporate bond holdings of mutual funds (Table L.123, line 8), divided by $1,450.4 billion in nonequity holdings of mutual funds (Table L.123, line 11 minus line 9), equals 0.325 as the corporate bond share of nonequity holdings of mutual funds.

Table 9.

Nonprofit Assets and Household Assets Distributed by Entity-Level Tax Treatment

(Billions of dollars)

	Households					
	Total[a]	Corporate	Non-corporate	Owner-Occupied Housing	Nonprofits	Total, Households Nonprofits
Debt						
Commercial paper	563.7	497.4	7.5	0	119.7	683.4
Agency-, GSE-backed securities	2,233.9	938.9	9.5	0	65.1	2,299.0
Municipal securities	1,201.0	103.2	6.4	0	13.5	1,214.5
Corporate bonds	3,297.3	2,968.7	102.5	0	191.6	3,488.9
Bank loans, n.e.c.	744.8	392.4	284.1	0	12.3	757.1
Other loans and advances	126.5	94.6	17.0	0	0.6	127.1
Home mortgages	2,024.1	0	0	2,024.1	54.8	2,078.9
Other mortgages	951.5	218.4	672.5	0	14.7	966.2
Total	**11,142.7**	**5,213.5**	**1,099.4**	**2,024.1**	**472.3**	**11,615.1**
Equity						
Corporate equities	9,543.3	9,084.3	459.0	0	508.0	10,051.3

Source: Congressional Budget Office calculations based on Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), available at www.federalreserve.gov/releases/z1/20050310; and Internal Revenue Service Statistics of Income data.

Note: GSE = government-sponsored enterprise; n.e.c. = not elsewhere classified.

a. Includes debt issued by governments, nonprofits, foreign entities, pass-through entities, and households (except for home mortgages).

Analogous calculations were performed for all credit market instruments held by the sectors in question. The amounts passing through life insurance companies were reduced to reflect the fact that only 87.7 percent of life insurance company liabilities are assets of households and nonprofits.

Removing Nonprofits from the *Flow of Funds* Data. It also was necessary to remove the assets of nonprofits from those reported in the *Flow of Funds* report's Table L.100 (assets of households and nonprofit organizations). In theory, that is accomplished by subtracting amounts held by nonprofits as reported on Table L.100.a. The March 2005 release of that table, however, included data only through 2000. Therefore, nonprofit percentages for each asset were calculated for 2000 (see the top section of Table 8), then applied to the 2002 figures on Table L.100 (see the "Nonprofits" column of Table 9). The implication for indirectly held assets is that the nonprofit share is deemed to be that of the pass-through entity, not that of the corresponding asset when directly held by households and nonprofits. For example, 25.2 percent of

corporate and foreign bonds held directly by households and nonprofits in 2000 were held by nonprofits. However, nonprofits held just 1.4 percent of mutual fund shares held by households and nonprofits, so only 1.4 percent of the corporate bonds held in mutual funds that were in turn held by households and nonprofits was attributed to nonprofits.

Allocating Assets Held by Households Among Business-Entity-Level Tax Treatments. Assets, regardless of ownership, were distributed among the corporate, noncorporate, and owner-occupied housing categories using largely the same data that were used to allocate marginal investments between debt and equity financing. The instrument-specific tables from the *Flow of Funds* report used in that task to identify the liabilities of financial corporations (along with Table L.211, Municipal Securities) also were used to perform the initial allocation of those instruments among financial corporations, nonfinancial corporations, farms, and nonfarm noncorporate businesses.

Some assets fall into a "nontaxable" category. Debt instruments held directly or indirectly by households might have been issued by governments, nonprofits, foreign entities, pass-through entities, or other households—none of which (except home mortgages) enter into this analysis. The portion issued by nonprofits was estimated using the nonprofit amounts reported for 2000 on Table L.100.a (see the bottom section of Table 8). Otherwise, liabilities of nontaxable entities were taken from the instrument-specific tables listed in the previous section.

Allocation of assets between the corporate and noncorporate tax treatments differed for financial corporations, nonfinancial corporations, noncorporate nonfarm businesses, and farms. As above, 99.0 percent of the debt and 99.7 percent of the equity issued by financial corporations was assigned to the corporate treatment; the rest (attributable to S corporations) was assigned to the noncorporate category. For nonfinancial corporations, 94.2 percent of debt and 93.6 percent of equity was assigned to the corporate treatment. All noncorporate nonfarm business debt and equity was assigned to the noncorporate tax treatment. Farms were split, 6.5 percent corporate and 93.5 percent noncorporate. The resulting allocation is shown in the top section of Table 10; the percentage distribution of each debt instrument is shown in the bottom section of that table.

Those percentages (derived from the way business liabilities are distributed between the corporate and noncorporate tax treatments) were then applied to the portion of debt and equity that was held as assets by households—smaller numbers (see the "Households Total" column of Table 9) than the liabilities from which the percentages were derived because they exclude amounts held as assets by entities that are not subject to the individual income tax (nonprofits, foreign entities, governments). Once each type of instrument had been distributed among entity-level tax treatments, the debt in each was added for all types of instruments (see "Total Households,

Table 10.

Distribution of Credit Market Instruments and Corporate Equities Outstanding, by Entity-Level Tax Treatment, 2002

Asset	Corporate	Non-corporate	Owner-Occupied Housing	Other[a]	Total
			Billions of Dollars		
Commercial Paper	1,209.0	18.3	0	147.4	1,374.7
Treasury Securities	0	0	0	3,609.8	3,609.8
Agency-, GSE-Backed Securities	2,326.9	23.5	0	3,185.9	5,536.3
Industrial Revenue Bonds	151.5	9.3	0	1,602.3	1,763.1
Corporate Bonds	5,383.2	185.8	0	410.1	5,979.1
Bank Loans, n.e.c.	706.2	511.3	0	122.9	1,340.4
Other Loans, Advances	1,103.6	198.0	0	174.3	1,475.9
Home Mortgages	0	0	5,909.5	0.0	5,909.5
Other Mortgages	550.6	1,695.8	0	152.8	2,399.2
Corporate Equities	10,082.0	443.9	0	1,345.1	11,871.0
			Percent		
Commercial Paper	88.2	1.3	0	10.4	100
Treasury Securities	0	0	0	100.0	100
Agency-, GSE-Backed Securities	42.0	0.4	0	57.5	100
Industrial Revenue Bonds	8.6	0.5	0	90.9	100
Corporate Bonds	90.0	3.1	0	6.9	100
Bank Loans, n.e.c.	52.7	38.1	0	9.1	100
Other Loans, Advances	74.8	13.4	0	11.8	100
Home Mortgages	0	0	100	0	100
Other Mortgages	23.0	70.7	0	6.4	100
Corporate Equities	84.9	3.7	0	11.3	100

Source: Congressional Budget Office calculations based on Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), available at www.federalreserve.gov/releases/z1/20050310; and Internal Revenue Service Statistics of Income data.

Note: GSE = government-sponsored enterprise; n.e.c. = not elsewhere classified.

a. Includes debt issued by governments, nonprofits, foreign entities, pass-through entities, and households (except home mortgages).

Nonprofits," Table 9). The resulting amounts were then ready for distribution among individual-level tax treatments.

Allocating Assets Held by Households Among Individual-Level Tax Treatments. For the purpose of identifying marginal saving, household assets characterized as corporate equity, corporate debt, noncorporate debt, or owner-occupied housing debt must be classified as fully taxable, temporarily tax deferred, or nontaxable. The nontaxable category must be further divided on the basis of whether annual contributions to the accounts in question are limited for a significant proportion of participants (see

Table 11). Those identified as having binding contribution limits include IRAs and most defined-contribution retirement plans. Defined-benefit plans were identified as not having binding contribution limits because their implicit limits affect few participants.

In many cases, the assignment was straightforward. Assets passed through private defined-contribution plans were assigned to the nontaxable–constrained category. Assets passed through private defined-benefit plans, state and local pension plans, and federal pension plans were assigned to the nontaxable–unconstrained category. Assets passed through bank personal trusts and agency- and GSE-backed mortgage pools were assigned to the fully taxable category.

Directly held assets and those passing through depository institutions, money market funds, mutual funds, and life insurance companies can all be held in IRAs, which fall into the nontaxable–constrained category. Directly held amounts and the amounts passing through the other entities are reported in the *Flow of Funds* Table L.225.i. Those amounts were subdivided into equity and specific debt instruments in proportion to the holdings of the pass-through entity. For example, because 20 percent of the assets of life insurance companies were equities (after redistributing mutual fund shares), 20 percent of IRA assets held at life insurance companies also were assumed to be equities.

Except for amounts attributed to IRAs, directly held assets and assets that pass through depository institutions, money market funds, and mutual funds were assigned to the fully taxable category. Non-IRA assets passing through life insurance companies cause more complications. Some assets are held in group annuities purchased by qualified plans and therefore are nontaxable. The rest are held in nonqualified annuities and whole-life insurance policies and therefore are temporarily deferred. The *Flow of Funds* report does not distinguish between the two categories. Instead, Table 8.2 of the *Life Insurers Fact Book 2004* provided data for an estimate of the amount held in group annuities.[43] That amount was assigned to the nontaxable–unconstrained category and divided between equity and specific debt instruments in proportion to the overall holdings of life insurance companies. The remaining non-IRA assets were assigned to the temporarily deferred category and similarly divided between equity and specific debt instruments.

Adjusting the Distribution of Assets to Reflect Marginal Saving. The number of families constrained by contribution limits and their share of marginal saving initially was estimated with microdata from the 2001 Survey of Consumer Finances (SCF),[44]

43. American Council of Life Insurers, *Life Insurers Fact Book 2004,* available at www.acli.com/ACLI/About+ACLI+nonmember/Industry+Facts/NM03-01+Fact+Book.htm.

44. The 2001 Survey of Consumer Finances and its accompanying documentation are available at www.federalreserve.gov/pubs/oss/oss2/2001/scf2001.information.html.

Table 11.

Assets Held by Households, by Individual-Level Tax Treatment, 2002

(Billions of dollars)

	Corporate Equity	Corporate Debt	Noncorporate Debt	Owner-Occupied Housing Debt
		Fully Taxable		
Directly Held[a]	3,751.1	533.6	37.4	83.9
Indirectly Held Through				
Depository institutions[a]	0	1,049.6	683.7	1,203.1
Money market funds[a]	0	284.8	5.5	0
Agency-, GSE-backed mortgage pools	0	0.7	2.3	104.6
Bank personal trusts	357.6	152.4	6.7	27.9
Mutual funds[a]	813.5	272.5	7.5	0
Total	4,922.1	2,293.7	743.0	1,419.6
		Temporarily Deferred		
Indirectly Held Through Life Insurance Companies (Nonqualified annuities and whole-life policies)	487.4	1,061.2	152.7	140.7
		Nontaxable–Constrained		
Directly Held[b]	617.8	69.9	4.9	11.0
Indirectly Held Through				
Depository institutions[b]	0	75.2	49.0	86.2
Money market funds[b]	0	95.4	1.8	0
Mutual funds[b]	479.7	156.8	4.3	0
Life insurance companies[b]	60.3	157.5	22.7	20.9
Private defined-contribution plans	1,024.3	231.8	13.9	34.8
Total	2,182.1	786.5	96.6	152.6
		Nontaxable–Unconstrained		
Indirectly Held Through				
Life insurance companies (Group annuities)	111.5	291.1	41.9	38.6
Private defined-benefit plans	509.6	364.5	39.4	162.4
State, local retirement plans	828.0	411.6	25.6	106.7
Federal retirement plans	43.7	4.9	0.2	3.5
Total	1,492.7	1,072.1	107.1	311.2
		All Tax Treatments		
Total	**9,084.3**	**5,213.5**	**1,099.4**	**2,024.1**

Source: Congressional Budget Office calculations and Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), available at www.federalreserve.gov/releases/z1/20050310.

Note: IRA = individual retirement account; GSE = government-sponsored enterprise.

a. Excluding amounts held in IRAs.

b. Held in IRAs. Self-directed IRAs are counted as "directly held."

which covered assets accumulated before the enactment of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA). For this exercise, however, marginal saving was assumed to occur in a tax environment in which EGTRRA was in place and extended indefinitely. The 2004 SCF was not available when the study was conducted; thus, CBO adjusted the 2001 data to reflect EGTRRA, as described below. Furthermore, the 2001 SCF did not include IRA contributions, so they were imputed on the basis of percentages calculated with CBO's individual income tax model. Marginal saving was assumed to be distributed in proportion to the sum of capital income and 401(k) contributions.[45]

According to the SCF, 46 percent of marginal saving was done by families constrained by IRA or 401(k) contribution limits. Their saving was reshuffled so that the amount that ordinarily would have been assigned to the constrained account was redirected to the fully taxable and temporarily deferred groups. The distribution among groups was left unchanged for the 54 percent of marginal saving done by families that were not constrained by a limit.

Consider, for example, saving in corporate equity.[46] Approximately 40 percent of the return on such assets was nontaxable (24 percent in accounts with binding limits, 16 percent in accounts without binding limits), 5 percent was temporarily deferred, and 54 percent was fully taxable (see Table 12, "Assets" column).

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45. An alternative assumption would be that marginal saving is proportional to average saving. Empirical data on average saving, however, are too incomplete to justify the extra effort of their processing. A panel from the 1983 and 1989 Surveys of Consumer Finances (see www.federalreserve.gov/Pubs/oss/oss2/89p/scf89phome.html) is too old to be useful, panels from the Survey of Income and Project Participation (see www.sipp.census.gov/sipp/) are too short-lived, the Panel Study of Income Dynamics (see http://psidonline.isr.umich.edu/data/) is hindered by top-coding, and the Consumer Expenditure Survey (see www.bls.gov/cex/csxmicro.htm) yields implausibly high rates of "dissaving" at the lower end of the income distribution. The two items used to distribute marginal saving are both plausible proxies for the propensity to save—capital income because it implies that saving has occurred in the past, and 401(k) contributions because they imply current saving (unless the contributions represent shifting from taxable accounts, in which case they imply saving in the past). In the absence of more precise data, the two proxies were arbitrarily combined.

46. Similar procedures were followed for corporate debt, noncorporate debt, and owner-occupied-housing debt. The results are shown in Table 12.

Table 12.

Distribution of Assets and Percentage of Marginal Saving Exempted or Deferred

(Percent)

		Marginal Saving	
	Assets[a]	Base Case[b]	Current Law After 2010
Corporate Equity			
Fully taxable	54.2	58.4	64.2
Temporarily tax deferred	5.4	5.8	6.4
Nontaxable	40.4	35.8	29.4
Corporate Debt			
Fully taxable	43.9	45.9	48.7
Temporarily tax deferred	20.4	21.3	22.5
Nontaxable	35.7	32.8	28.8
Noncorporate Debt			
Fully taxable	67.6	69.1	70.9
Temporarily tax deferred	13.9	14.2	14.6
Nontaxable	18.5	16.7	14.5
Homeowner Debt			
Fully taxable	70.0	71.6	73.3
Temporarily tax deferred	7.0	7.1	7.3
Nontaxable	23.0	21.3	19.4

Source: Congressional Budget Office.

a. 2002 shares based on Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States* (March 10, 2005), available at www.federalreserve.gov/releases/z1/20050310.

b. The base case assumes that the tax provisions in place in 2008 under the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003 are permanently extended instead of expiring in 2011.

Equations in Table 13 show how that distribution of assets was used to distribute marginal saving among those groups—for the constrained and unconstrained families separately—then reaggregated. Note that the 24 percent of assets in the nontaxable–binding limits category for unconstrained families was split between "Temporarily Deferred" (2 percent) and "Fully Taxable" (22 percent) for constrained families.

Table 13.

Distribution of Marginal Saving for Families Constrained and Unconstrained by Contribution Limits

	Unconstrained		Constrained		Total
Nontaxable—Binding Limits	(0.54 × 0.24)	+	(0.46 × 0)	=	0.13
Nontaxable—No Binding Limits	(0.54 × 0.16)	+	(0.46 × 0.16)	=	0.16
Nontaxable subtotal, α_{ce1}				=	0.29
Temporarily Tax Deferred, α_{ce2}	(0.54 × 0.05)	+	[0.46 × (0.05 + 0.02)]	=	0.06
Fully Taxable, α_{ce3}	(0.54 × 0.54)	+	[0.46 × (0.54 + 0.22)]	=	0.64

Source: Congressional Budget Office.

The higher contribution limits under EGTRRA had to be incorporated to represent the base case. Implementing the exception to the general rule under such circumstances required estimating how saving would have been distributed under those higher limits. First, unconstrained contributions to 401(k) plans were estimated on the basis of an age-specific percentage of income, then reestimated as though the EGTRRA limits had been in place. Next, IRA contributions in 2002 were estimated on the basis of actual IRA deductions reported in 2002, then extrapolated to represent unconstrained contributions and those under the fully-phased-in EGTRRA limits. Under EGTRRA, the percentage of marginal saving by families constrained by a limit dropped from 46 percent to 29 percent, which was redistributed so that amounts that would otherwise have been saved in constrained accounts were directed to fully taxable or temporarily deferred accounts. That left 17 percent to switch from the constrained to the unconstrained category. It was estimated that the higher limits under EGTRRA would stimulate a 55 percent increase in contributions to nontaxable accounts, so the existing distribution of assets among the groups was adjusted to shift that amount from the fully taxable and temporarily deferred groups into the nontaxable group. The remaining 54 percent of marginal saving was unaffected by EGTRRA, so its distribution among groups did not change.

Identifying the Marginal Tax Rate for Individuals. Although the actual marginal individual income tax rate that would apply to a particular investment depends on the stock- or bondholder's marginal tax bracket, CBO assumed that the average marginal tax rate would apply to all investments. Such rates were estimated for each type of investment income using CBO's individual income tax model. In some cases, additional parameters had to be specified in order to calculate the effect of tax deferral on the effective rate.

Interest. The marginal rate at which interest in taxable accounts was assumed to be taxed, t_{int}, was 22.1 percent. That reflects a weighted average of the regular marginal rates of all taxpayers reporting taxable interest income.

Table 14.

Parameters Affecting the Taxation of Capital Gains

	Percentage of All Gains (ω)	Holding Period (Y)	Marginal Tax Rate (t)
Short Term, *scg*	3.6	4 months	28.0
Long Term, *lcg*	48.2	8 years	14.5
Held Until Death, *xcg*	48.2	n.a.	0

Source: Congressional Budget Office.

Note: n.a. = not applicable.

Dividends. The marginal rate at which dividends in taxable accounts were assumed to be taxed, t_{div}, was 12.1 percent. That rate is substantially lower than the rate on interest, not because the taxpayers receiving dividends were in lower regular tax brackets, but because dividends are subject to a maximum 15 percent rate.

Capital Gains. Three tax rates can be applied to capital gains, depending on the holding period. The short-term rate, t_{scg}, applies to gains on assets held for less than one year. The long-term rate, t_{lcg}, applies to gains on assets held for more than one year but sold before the owner's death. Capital gains on assets held until the owner's death are not taxed, so that rate is zero.

As explained in the section on methodology, deferring the taxation of capital gains from the time gains accrue until a stock is sold causes the effective tax rate on those gains to diverge from the statutory tax rate. Inflation makes the effective tax rate rise, and delay in paying the tax causes the effective tax rate to fall. CBO incorporates those influences by computing effective tax rates on capital gains for average short-term and long-term holding periods. The average holding periods, Y_{scg} and Y_{lcg}, and the corresponding short- and long-term fractions of gains were estimated using the 1998 SOI study of the sale of capital assets.[47] CBO estimated the statutory average marginal tax rates using positive gains reported by returns with positive income (see Table 14).

As with dividends, the lower marginal tax rate on long-term capital gains reflects the 15 percent maximum rate. Short-term capital gains are taxed at regular rates. Equations (46) through (48) show how the capital gains parameters were applied in CBO's analysis.

Annuity Distributions. Distributions from temporarily deferred accounts are reported as pension distributions and taxed at regular rates, even if they reflect deferred dividends or long-term capital gain income. Because there is no way to distinguish such

47. Janette Wilson, "Sales of Capital Assets Reported on Individual Income Tax Returns, 1998 and 1997," *Statistics of Income Bulletin* (Summer 2002), p. 168, available at www.irs.gov/pub/irs-soi/98insoca.pdf.

Table 15.

Economic Depreciation Rates and Tax Depreciation Parameters

Asset	Economic Depreciation Rate	Default Recovery Period (Years)	Default Depreciation Method[a]
		Equipment	
Computers, Peripheral Equipment	0.4633	5	DB (200)
Software	0.4400	3	SL
Communications Equipment	0.1129	7 [b]	DB (200)
Medical Equipment, Instruments	0.1350	7 [b]	DB (200)
Nonmedical Instruments	0.1350	7 [b]	DB (200)
Photocopiers, Related Equipment	0.1800	5 [c]	DB (200)
Office, Accounting Equipment	0.3119	5 [c]	DB (200)
Household Furniture	0.1375	5 [c]	DB (200)
Other Furniture	0.1179	7	DB (200)
Household Appliances	0.1650	5 [c]	DB (200)
Residential Equipment	0.1500	5	DB (200)
Automobiles	0.3333	5	DB (200)
Light Trucks (Including utility vehicles)	0.1725	5	DB (200)
Other Trucks, Buses, Truck Trailers	0.1725	5	DB (200)
Aircraft	0.0859	5 [d]	DB (200)
Ships, Boats	0.0611	10 [c]	DB (200)
Railroad Equipment	0.0589	7	DB (200)
Metal-Working Machinery	0.1225	7 [b]	DB (200)
Special Industrial Machinery	0.1031	7 [b, e]	DB (200)

Continued

distributions from other pension distributions, the average marginal rate on all pension distributions was applied to distributions from temporarily deferred accounts. That rate, t_{td}, was estimated to be 20.9 percent.

By definition, those distributions benefit from tax deferral, and the benefit increases with the holding period. The average holding period, Y_{td}, was assumed to be eight years.

Specifying Economic Depreciation Rates and Tax Depreciation Allowances

For a particular asset type, the before-tax rate of return required by an investment, ρ, depends on the rate at which the asset's economic productivity depreciates, δ, and the present value of the depreciation allowance, z, allowed by the tax code. To calculate before-tax returns for the 49 asset types, therefore, it was necessary to identify rates of economic depreciation and present values of tax depreciation for each type.

Table 15.

Continued

Asset	Economic Depreciation Rate	Default Recovery Period (Years)	Default Depreciation Method[a]
		Equipment (Continued)	
Agricultural Machinery	0.1179	7	DB (200)
Farm Tractors	0.1452	7	DB (200)
Construction Machinery	0.1550	5 [c]	DB (200)
Construction Tractors	0.1633	5 [c]	DB (200)
Mining, Oilfield Machinery	0.1500	7	DB (200)
Service Industry Machinery	0.1528	7 [b]	DB (200)
Fabricated Metal Products	0.0917	7 [b]	DB (200)
General Industrial Equipment	0.1072	7	DB (200)
Steam Engines	0.0516	15 [c,f]	DB (150) [f, g]
Internal Combustion Engines	0.2063	7	DB (200)
Electric Transmission, Distribution Equipment	0.0500	15 [c, h]	DB (150) [g]
Other Electrical Equipment	0.1834	7 [b]	DB (200)
Other Nonresidential Equipment	0.1473	7 [b]	DB (200)
		Structures	
Owner-Occupied Residential Structures	0.0144	n.a.	n.a.
Tenant-Occupied Residential Structures			
Corporate-owned	0.0163	27.5	SL
Noncorporate-owned	0.0167	27.5	SL
Office Buildings, Including Medical	0.0247	39	SL
Commercial Buildings	0.0261	39 [i]	SL[i]
Hospitals, Special Care Facilities	0.0188	39	SL
Manufacturing Buildings	0.0314	39	SL
Educational Buildings	0.0188	39	SL

Continued

Economic Depreciation Rates. CBO used BEA's published economic depreciation rates (see Table 15).[48] BEA does not treat land or inventories as depreciable assets, nor did CBO. For the remaining 47 types of assets, the rates published by BEA are those BEA uses to convert historical acquisition costs into current capital stocks by asset type. Thus, the economic depreciation rates used in CBO's calculations are consistent with the distribution of BEA's capital stock that CBO used to aggregate asset-type-specific, before-tax rates of return, ρ, in equations (59) and (61).

48. Department of Commerce, Bureau of Economic Analysis, *Fixed Assets and Consumer Durable Goods in the United States, 1925–97* (September 2003), Table B, p. M-30; Table C, pp. M-31–M-32; available at www.bea.gov/bea/dn/Fixed_Assets_1925_97.pdf.

Table 15.

Continued

Asset	Economic Depreciation Rate	Default Recovery Period (Years)	Default Depreciation Method[a]
		Structures (Continued)	
Other Buildings	0.0259	39 [c]	SL[g]
Petroleum, Natural Gas	0.0751	5	DB (200)
Mining Structures	0.0450	7	DB (200)
Electric Power Structures	0.0211	20/15 [j]	DB (150)
Other Power Structures	0.0237	20/15 [k]	DB (150)
Communication Structures	0.0237	15	DB (150)
Railroads	0.0213	20	DB (150)
Farm Structures	0.0239	20	DB (150)
Other Nonresidential Structures	0.0225	39	SL

Source: Congressional Budget Office based on Department of Commerce, Bureau of Economic Analysis, *Fixed Assets and Consumer Durable Goods in the United States, 1925–97* (September 2003); and Department of the Treasury, Internal Revenue Service, *Publication 946, How to Depreciate Property, For Use in Preparing 2004 Returns.*

Notes: DB = declining balance; SL = straight line; n.a. = not applicable. In the farm industry, all assets except software use the 150 percent DB method and the recovery period is capped at 20 years.

a. Numbers in parentheses are DB percentages.

b. In the professional, scientific, and technical services industry, the recovery period is five years.

c. In the amusement, gambling, and recreation services industries, the recovery period is seven years.

d. In the air, rail, and water transportation industries; the finance industry; and the non-real-estate rental and leasing industry, the recovery period is seven years.

e. In the plastics, rubber, glass products, and transportation equipment manufacturing industries, the recovery period is three years. In the construction, chemical manufacturing, nonmetallic mineral products manufacturing, and computer and electronic products manufacturing industries, the recovery period is five years. In the textiles and apparel manufacturing industries, the recovery period is evenly weighted between five and seven years. In the petroleum and coal products manufacturing industries, the recovery period is 10 years.

f. In the paper products manufacturing industry, the recovery period is seven years and the 200 percent DB method is used.

g. In the amusement, gambling, and recreation services industry, the 200 percent DB method is used.

h. In the utilities industry, the recovery period is 20 years.

i. In the retail trade industry, 5 percent of assets use the 150 percent DB method; a recovery period of 15 years is used.

j. In all industries, 60 percent of assets have a recovery period of 20 years and 40 percent have a recovery period of 15 years.

k. Except for the pipeline transportation industry, see note j. In pipeline transportation, the recovery period is 15 years.

For 35 of the 47 asset types, BEA reported a single geometric depreciation rate that CBO used directly. For the remaining 12, BEA published more detailed rates, which CBO aggregated by a variety of methods.

Asset Types with Depreciation Rates That Vary by Industry. BEA's depreciation rates varied by industry for five asset types: communications equipment, aircraft, service industry equipment, commercial buildings, and other buildings. Because BEA's capital stocks for each asset type were distributed by industry, CBO used those industry distributions to compute weighted averages of the depreciation rates for each asset type.

Residential Housing. BEA published six depreciation rates by structure size and asset type. Two structure sizes were identified: those with one to four units and those with five units or more. Three asset types were identified: new construction, additions and alterations, and major replacements. BEA also published separate depreciation rates for manufactured homes and residential equipment. BEA publishes capital stocks with the same categories for several forms of ownership that CBO combined into owner-occupied, corporate, and noncorporate ownership. Combining the depreciation rates and capital stocks, CBO computed weighted-average depreciation rates for structures by each form of ownership.[49] The rates varied by type of owner because the distributions of structure types and sizes differed by form of ownership. Residential equipment was retained as a separate type of asset.

Asset Types with Depreciation Rates That Vary by Asset Characteristic. BEA publishes depreciation rates by subcategories of four asset types for which it does not publish corresponding subcategories of capital stocks. Therefore, CBO aggregated the depreciation rates within each asset type, using measures of central tendency as follows:

- Software was aggregated using a simple average of the rates for "packaged software" and "custom and own-account software."
- The asset type "light trucks (including utility vehicles)" and the type "other trucks, buses, and truck trailers" were assigned to the middle of three relevant depreciation rates given by BEA—the one that applies to the trucking industry.
- Railroad structures were aggregated using a simple average of the rates for "rails" and "other structures."

49. CBO's error of including the small amount of owner-occupied farm structures as tenant-occupied, noncorporate structures, noted in footnote 22, caused small errors in average depreciation rates. The average rate for owner-occupied structures should have been 0.0145 instead of 0.0144. Correcting the error does not affect the average for tenant-occupied structures owned by corporations (0.0163), but it reduces the average for tenant-occupied structures owned by noncorporate businesses from 0.0167 to 0.0164.

Automobiles and Computers and Peripherals. BEA has determined that depreciation rates for these two asset categories vary during the lives of the assets. The formulas for before-tax returns, as in equation (23), require a constant rate of depreciation over an asset's life. CBO averaged BEA's rates over the life of an asset to arrive at a single geometric rate.

- A constant geometric depreciation rate of one-third for automobiles was previously estimated by Charles Hulten and Frank Wycoff.[50] Because that rate approximated the varying rates used by BEA, CBO adopted one-third.

- BEA provides time-changing rates for two types of computers and five types of peripherals. CBO observed that the depreciation schedules for the computers were similar and the schedules for the peripherals were similar, so it used one of each: personal computers, to represent the former, and printers, to represent the latter. CBO averaged the yearly depreciation rates for personal computers to arrive at a single geometric rate, and it repeated the averaging for printers. In both cases, BEA's annual depreciation was below average in the first year of use and above average in the last, but otherwise it fluctuated around the average rate. To arrive at a single depreciation rate for the category, CBO averaged the average rates for personal computers and printers, weighting personal computers by two-thirds because of the assumption that spending on computers was about twice that on peripherals.

Present Values of Tax Depreciation Allowances. The formulas for computing present values under current law are shown in equations (28) and (34), and the computed present values for corporate assets are shown in the "Tax Depreciation" column of Table 16. Present values depend on the discount rate of the business or homeowner making the investment and on parameters established by the tax code for each asset type. The parameters from the code are explained in IRS *Publication 946, How to Depreciate Property.*[51] Most depreciable business assets are depreciated according to the modified accelerated cost recovery system, known as MACRS. That system identifies nine property classes and three depreciation methods. The depreciation schedule for an asset is largely determined by the particular combination of a class and a method.

Eight of the property classes applied to the BEA assets. Those were recovery periods of 3, 5, 7, 10, 15, and 20 years; residential rental property (27.5 years); and nonresidential real property (39 years). The three depreciation methods are 200 percent declining balance, 150 percent declining balance, and straight line. The declining-balance methods include a switch to straight-line depreciation in the first year in which the

50. Hulten and Wycoff, "The Measurement of Economic Depreciation," p. 95.

51. CBO used IRS *Publication 946* for tax year 2004.

straight-line method gives a comparable or better depreciation allowance. *Publication 946* provides general guidance and numerous examples to help taxpayers decide which class and method to apply to any particular asset. Thus, CBO's task was to follow that guidance with each of its 47 depreciable asset categories (see Table 15). The tax code does not provide depreciation allowances for land or inventories.

CBO faced considerable ambiguity in assigning classes and methods to some types of assets. Part of the difficulty arose because several BEA asset types do not fit clearly into a single MACRS class. For example, BEA's electric power structures are not divided into nuclear and conventional power plants, but *Publication 946* identifies a 15-year recovery period for nuclear plants and a 20-year recovery period for conventional power plants. Additional difficulty arose because many assets can qualify for different MACRS classes and methods, depending on use. Steam engines, for example, generally appear to qualify for 15-year depreciation under the 150 percent declining-balance method. Steam engines used in the manufacture of pulp and paper, however, qualify for seven-year recovery with the 200 percent declining-balance method.

CBO resolved some ambiguity about asset classes and methods by using BEA's distribution of each asset's capital stock among many industries. It was thus possible to account for some of the differences by activity that are identified in IRS *Publication 946*. In retrospect, greater use could have been made of industry-specific classifications. CBO resolved other ambiguities by following previously published assignments.[52]

When a single BEA asset category had more than one set of depreciation allowances, CBO computed the present value of each and averaged them with weights in proportion to the share of the capital stock of that asset using each method. For some asset types, such as structures used in the generation of electricity, the BEA data were not sufficient to calculate a weight for each component. In those cases, CBO used weights from the earlier publications.

CBO's analysis ignored two temporary modifications of MACRS. Between October 22, 2004, and January 1, 2006, owners of nonresidential buildings could depreciate some improvements for tenants on an accelerated schedule—over 15 years instead of 39 years—and owners of restaurants could depreciate building improvements on the same schedule. CBO ignored those modifications because of the short time they were available and because there was insufficient information from BEA about which improvements would qualify.

Publication 946 explains that the appropriate tax depreciation schedule includes an adjustment to approximately account for the time within a year that an asset is placed in service. CBO's depreciation schedules are continuous-time analogues to the tax depreciation schedules used in practice, and they fully adjust for starting dates within

52. Fullerton, Gillette, and Mackie, "Investment Incentives," pp. 135–140; Gravelle, *The Economic Effects of Taxing Capital Income*, pp. 296–298; Mackie, "Unfinished Business," p. 308.

Table 16.

Present Values of Economic Depreciation and Tax Depreciation of Corporate Assets

(Percentage of acquisition cost)

Asset	Economic Depreciation	Tax Depreciation
	Equipment	
Computers, Peripheral Equipment	89.7	87.0
Software	89.2	90.1
Communications Equipment	68.0	82.6
Medical Equipment, Instruments	71.8	82.5
Nonmedical Instruments	71.8	82.8
Photocopiers, Related Equipment	77.2	87.0
Office, Accounting Equipment	85.5	87.0
Household Furniture	72.1	87.0
Other Furniture	68.9	82.5
Household Appliances	75.7	87.0
Residential Equipment	73.9	87.0
Automobiles	86.3	87.0
Light Trucks (Including utility vehicles)	76.5	87.0
Other Trucks, Buses, Truck Trailers	76.5	87.0
Aircraft	61.8	82.8
Ships, Boats	53.5	76.5
Railroad Equipment	52.6	82.5
Metal-Working Machinery	69.8	82.5
Special Industrial Machinery	66.0	84.4
Agricultural Machinery	68.9	80.9
Farm Tractors	73.2	81.4
Construction Machinery	74.5	87.0
Construction Tractors	75.5	87.0
Mining, Oilfield Machinery	73.9	82.5
Service Industry Machinery	74.2	82.5
Fabricated Metal Products	63.3	82.5

Continued

a calendar year. CBO used continuous-time formulas because they are more consistent with the formulas it used to compute before-tax rates of return.

Specifying Rates of Return

The formulas in the methodology section for computing the before-tax and after-tax returns on investments require values for *i,* the market interest rate, and *E,* the rate of return corporations pay to equity investors. CBO selected values that are observable in capital markets for corporations, and it held them fixed through all alternative tax policies.

Table 16.

Continued

(Percentage of acquisition cost)

Asset	Economic Depreciation	Tax Depreciation
	Equipment (Continued)	
General Industrial Equipment	66.9	82.5
Steam Engines	49.3	64.5
Internal Combustion Engines	79.5	82.5
Electric Transmission, Distribution Equipment	48.5	60.4
Other Electrical Equipment	77.5	82.8
Other Nonresidential Equipment	73.5	82.6
	Structures	
Owner-Occupied Residential Structures	21.3	n.a.
Tenant-Occupied Residential Structures		
Corporate-owned	23.5	43.9
Noncorporate-owned	n.a.	43.9
Office, Including Medical Buildings	31.7	33.8
Commercial Buildings	33.0	34.5
Hospitals, Special Care Facilities	26.1	33.8
Manufacturing Buildings	37.2	33.8
Educational Buildings	26.1	33.8
Other Buildings	32.8	33.8
Petroleum, Natural Gas	58.6	87.0
Mining Structures	45.9	82.5
Electric Power Structures	28.4	59.4
Other Power Structures	30.9	60.1
Communication Structures	30.9	64.0
Railroads	28.6	56.3
Farm Structures	31.0	56.3
Other Nonresidential Structures	29.8	33.9

Source: Congressional Budget Office.

Notes: n.a. = not applicable.

Present values are computed assuming 41 percent debt finance.

The market interest rate CBO selected was the Baa corporate bond rate of 7.2 percent that CBO forecast in January 2005 for the intermediate term.[53] The selected return on corporate equity was the long-term historical real rate of return on corporate equities of about 7 percent, of which about 4 percentage points typically has been paid out in dividends; the other 3 points generally have been retained and reinvested

53. That is an unpublished rate from the forecast used in Congressional Budget Office, *The Budget and Economic Outlook: Fiscal Years 2006 to 2015* (January 2005).

Table 17.

Real Rates of Return and Rate of Inflation

(Percent)

Real Rate of Return	
10-year Treasury bonds	3.7
Baa corporate bonds	5.4
Corporate stocks	7.0
Return paid out as dividends	4.0
Return reinvested	3.0
Rate of Inflation	1.8

Source: Congressional Budget Office based on *The Budget and Economic Outlook: Fiscal Years 2006 to 2015* (January 2005) and Siegel, *Stocks for the Long Run.*

(see Table 17).[54] CBO assumed that distribution pattern for its computations of effective tax rates. The 7.2 percent market interest rate was converted to a 5.4 percent real interest rate by subtracting CBO's intermediate-term inflation rate of 1.8 percent; the real return on equities was converted to a nominal rate by adding that inflation rate. The real return on 10-year Treasury bonds from the same forecast was lower, at 3.7 percent, reflecting their lower risk of default.

The observed rates of return in the corporate sector were extended to the noncorporate and homeowner sectors. Specifically, noncorporate businesses and homebuyers were assumed to borrow for their marginal investments at the same Baa rate that applies to corporations. Savers investing their marginal dollars of equity in their own businesses or homes were assumed to receive the same after-tax return they would receive from investing in corporate equity.

The process by which interest rates and rates of return on corporate equity adjust to changes in tax policies is too complicated to be incorporated into the computation of effective tax rates. For simplicity, CBO decided to fix the interest rate and the return on corporate equity. Nevertheless, interest rates and rates of return on corporate

54. Jeremy J. Siegel, *Stocks for the Long Run* (New York: McGraw-Hill, 1998), pp. 12–13. Siegel's historical 7 percent real rate of return on corporate equities is similar to that implicit in the CBO forecast. His estimated division of the return between dividends and retained earnings, based on dividend price ratios reported by companies, appears to differ from the division reported by BEA in Table 1.12, "National Income by Type of Income," of the national income and product accounts, as revised April 28, 2005. When CBO adjusted the national accounts data to isolate C corporations, about 3/7 of after-tax profits was paid out in dividends; the rest was retained. CBO found no explanation for the discrepancy between the two sources.

equity should be expected to change as the economy adjusts to policy changes.[55] Those adjustments would alter the effective tax rates CBO computes, but they should not change the qualitative implications discussed in *Taxing Capital Income.*

Other assumptions identified earlier also are simplifications to facilitate the computation of effective tax rates, and they are likely to change as the economy adjusts to tax policy changes. Two examples are the assumption that marginal investments are financed by debt and equity in the same proportion as are existing financing arrangements and the assumption that marginal investments are distributed in proportion to the existing mix of capital stock. Many tax policies would be expected to change one or both of those assumptions.

CBO's assumption of fixed interest rates and rates of return on corporate equity has been used in previous studies of effective tax rates. Gravelle, for one, also assumed interest rates and rates of return based on actual returns observed in markets during the years for which she computed effective tax rates.[56] Other researchers have fixed a market interest rate (real or nominal), although not a separate rate for corporate equity.[57] Those researchers typically calculated their effective tax rates a second time, specifying fixed before- or after-tax returns rather than fixed interest rates. (Studies that calculated effective tax rates a second time showed that the main qualitative conclusions were unchanged despite changes in effective tax rates for particular assets, sectors, or types of financing.)

CBO and Gravelle diverge from several other researchers in the use of actual rates of return faced by businesses. Actual returns include premiums to compensate savers for the inherent risks in business investments. Other researchers contend that effective tax

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55. CBO's decision to fix interest rates and the return on corporate equity for all alternative tax policies means that changes in individual income taxes included in those policies do not affect computations of the before-tax returns on investment financed by debt in any sector or by equity in the corporate sector. As can be seen in the equations determining before-tax returns (equations (23)–(25)), individual taxes have no effect except through the rates of return or other variables in the equation. In reality, changes in individual income taxes would affect before-tax returns to the extent that tax changes caused economic changes that in turn caused changes in interest rates, returns on corporate equity, or other parameters.

56. Gravelle, *The Economic Effects of Taxing Capital Income,* pp. 19–21 and 293; Gravelle, *Capital Income Tax Revisions and Effective Tax Rates,* p. 17.

57. King and Fullerton (*The Taxation of Capital Income,* pp. 11–12) computed effective tax rates assuming a fixed real before-tax rate of return as well as a fixed real market interest rate. Fullerton and Henderson ("Incentive Effects of Taxes," pp. 86–88) assumed a fixed real after-tax return as well as a fixed market interest rate, as did Fullerton, Gillette, and Mackie ("Investment Incentives," pp. 132–134). In contrast, Mackie ("Unfinished Business," p. 307) picked one rate of return—that received by savers after taxes. When analysts specify before- or after-tax rates of return, they must rearrange their versions of the equations in the first section to solve for interest rates and returns on corporate equity.

rates cannot adequately portray how taxes affect risky returns.[58] Those researchers specified rates of return derived from relatively risk-free assets such as government bonds. CBO chose returns that incorporate risk premiums with the assumption that doing so would produce tax rates closer to the rates businesses pay.

To test the sensitivity of CBO's effective tax rates to assumptions about the rate of return, CBO substituted the rate of return on 10-year Treasury bonds for debt and equity returns of corporate investments. Treasury bonds are less risky than are corporate bonds, which, in turn, are less risky than corporate equities. The substitution caused little change in the effective tax rates, except that it led to larger differences in tax rates between investments financed by equity and those financed by debt.

58. See, for example, Mackie, "Unfinished Business," pp. 299–300.

Appendix: User's Guide to the Effective Tax Rates Workbook

The Excel workbook, "effective tax rates.xls," which accompanies this background paper, is posted at www.cbo.gov along with this background paper and a revised Excel workbook, "corrected ETRs.xls."[1] This user's guide is intended for those who might wish to recalculate the effective tax rates using different parameters or update the capital stock data to a more recent year. The names of the worksheets are shown in boldface type, and special instructions are included in notes above the descriptions. The layouts were designed to be viewed on a 17-inch monitor with resolution set to 1,024 × 768 pixels. Most sheets span several pages. Results are on the sheets to the left in the workbook, data and parameters appear in the middle sheets, and intermediate calculations are shown on the sheets to the right. Green-shaded cells are unprotected and can be changed to reflect alternative data sources, assumptions, and policies. Values in yellow-shaded cells carry over to other sheets.

The sheets of the workbook serve as a table of contents:

- **Table 1**
- **Some detail**
- **Full detail**
- **IQ range** (Interquartile range)
- **Parameters**
- **NonresCapStk** (Nonresidential capital stock)
- **OthCapStk** (Other capital stock)
- **TxDeprFrml** (Tax depreciation formulas)
- **TxDeprMthd** (Tax depreciation methods)
- **EconDepr** (Economic depreciation)

1. The revised version corrects minor errors described in footnotes 22, 36, and 49 of the main text of this background paper.

- **Rates of return**
- **Inventories**
- **TxDeprPV_Ctot** (Tax depreciation present value, corporate, total)
- **TxDeprPV_Cdt** (Tax depreciation present value, corporate, debt financed)
- **TxDeprPV_Ceq** (Tax depreciation present value, corporate, equity financed)
- **TxDeprPV_Ntot** (Tax depreciation present value, noncorporate, total)

Table 1

Note: *This sheet has been protected and cannot be modified.*

This sheet presents effective total tax rates and measures of tax rate uniformity as shown in Table 1 of the Congressional Budget Office (CBO) paper *Taxing Capital Income: Effective Rates and Approaches to Reform* (October 2005). The effective tax rates come from the worksheet **Full detail,** the interquartile range comes from the worksheet **IQ range,** and the other measures of tax rate uniformity are calculated internally. The interquartile range is the only measure that is not updated automatically when inputs are changed in other sheets. See **IQ range** for instructions on updating the interquartile range.

Some detail

Note: *This sheet has been protected and cannot be modified.*

This sheet presents effective total tax rates, the percentage distributions of assets (for Table A-1 of *Taxing Capital Income*) and certain intermediate calculations for eight aggregated equipment types (lines 4–11), four aggregated structure types (lines 13–16), inventories (line 17), land (line 18), and total investment (line 19). It is laid out in two vertical pages as follows:

- Top page (rows 3–19): dollar distribution of assets [B] (columns B–E), cost of capital [ρ] (columns G–L), after-tax rates of return to savers [s] (column N)
- Bottom page (rows 24–40): percentage distribution of assets (columns B–E), effective total tax rates [ETTR] (columns G–L)

The values of B are aggregations of the constituent asset types from **Full detail.** The values of ρ are weighted averages of those associated with the constituent asset types from **Full detail.** Values of s come from **Rates of return.** The percentage distribution of assets and the ETTRs are calculated internally.

The aggregated asset types on **Some detail** are composed of asset types from **Full detail.** The asset types in each aggregation are separated in **Full detail** by gray dividing lines.

Full detail

Note: *This sheet has been protected and cannot be modified.*

This sheet presents effective tax rates and intermediate calculations by asset type and for specific aggregates (all equipment, all structures, all land, all business investment, all investment) on two vertical pages and three horizontal pages, as follows:

- Top vertical page (rows 3–35): equipment
- Bottom vertical page (rows 36–62): structures, inventories, land, totals
- Left horizontal page (columns B–M): asset distribution, tax splits, depreciation
- Middle horizontal page (columns O–AB): cost of capital, tax wedges
- Right horizontal page (columns AC–AM): effective tax rates, effective total tax rates

Variable names referenced in formulas in the worksheet appear in Roman type without parentheses (for example, q(c) becomes qc). Some of the same variable names appear in the formulas in the methodology section of this background paper, where they are presented in italic type and with true subscripts instead of parenthetical subscripts. There, for example, the variable is shown as q_c. In the workbook, the variables that are not defined on **Full detail** are defined either on the **Parameters** worksheet or on the **Rates of return** worksheet.

The contents of **Full detail** are summarized in Table A-1.

IQ range

Note: *If you modify any other sheet, you must modify this one as well.*

The purpose of this sheet is to feed into the interquartile range of ETTR(c) across asset types to the **Table 1** worksheet. You should not modify any cell in this sheet directly, but you may need to update the sheet if you change a parameter on another sheet. To update this sheet, select the range "A5:C56." Click on "Data/Sort." On the Sort popup, choose "column C" and "descending" as the first sort criteria; ignore the other two sort criteria. When you click "OK," the sort will execute. The updated ETTR at the first quartile will appear in cell F59, the updated ETTR at the third quartile will appear in cell G59, and the updated interquartile range (the difference between the two) will appear in cell H59.

Table A-1.

Worksheet Summary: Full detail

Column Label	Column Head	Content
A		Name of asset type
Asset Distribution		
B	Value of stock [B], $billions	Value of capital stock in 2002 in billions of dollars. Equipment and structures (lines 3–54) come from **NonresCapStk;** inventories and land (lines 55–59) come from **OthCapStk.**
C	Percentage distribution of stock	Distribution of capital stock, calculated as a percentage of all investment. This column is primarily an exhibit, but it is used to derive many of the cells in row 40 by weighting the two forms of organization for tenant-occupied housing.
Tax Splits (q)		
D	Share subject to corporate tax [q(c)]	Percentage of investments made by businesses subject to the corporate income tax. Equipment and structures come from **NonresCapStk;** inventories and land come from **OthCapStk.**
E	Share subject to individual tax [q(n)]	Percentage of business investments not subject to the corporate income tax. Calculated as 100 percent minus q(c), except for owner-occupied houses and the land under them, which are zero.
F	Share subject to no tax [q(h)]	Percentage of homeowner investments not subject to tax. Zero, except for owner-occupied housing and land, which are 100 percent in this category.
Economic Depreciation		
G	Economic depreciation rate [δ]	Depreciation rate from **EconDepr;** not applicable to inventories or land.
H	PV (corptot) of econ dep	Present value of economic depreciation per dollar of corporate investment. Calculated per equation (40) as $\delta/[\delta + r(c) - \pi]$. Column H is used only to create column I.
I	Ratio: PV tax to PV econ	Ratio of the present value of tax depreciation (column J) to the present value of economic depreciation (column H). Column I provides a direct comparison of tax and economic depreciation by asset type. If the value is greater than 1.0, taxpayers can claim depreciation allowances faster than the assets themselves depreciate. The calculation is done using corporate investment, but it would be the same for a noncorporate investment.

Continued

Table A-1.

Continued

Column Label	Column Head	Content
Present Value of Tax Depreciation [z]		
J	Corporate: total [z(c)]	Present value of tax depreciation per dollar of corporate investment financed using a typical mix of debt and equity, from **TaxDeprPV_Ctot.**
K	Corporate: debt-financed [z(c,d)]	Present value of tax depreciation per dollar of debt-financed corporate investment, from **TaxDeprPV_Cdt.**
L	Corporate: equity-financed [z(c,e)]	Present value of tax depreciation per dollar of equity-financed corporate investment, from **TaxDeprPV_Ceq.**
M	Noncorporate [z(n)]	Present value of tax depreciation per dollar of noncorporate investment financed using a typical mix of debt and equity, from **TaxDeprPV_Ntot.**
Cost of Capital [ρ]		
O	Corporate: total [ρ(c)]	Real before-tax rate of return on all corporate investment, calculated per equation (23) as $\{[r(c) - \pi + \delta] \times [1 - uz(c)]/(1 - u)\} - \delta$.
P	Corporate: debt-financed [ρ(c,d)]	Real before-tax rate of return on debt-financed corporate investment, calculated per equation (23) (when $f(c) = 1$) as $\{[r(c,d) - \pi + \delta] \times [1 - uz(c,d)]/(1 - u)\} - \delta$.
Q	Corporate: equity-financed [ρ(c,e)]	Real before-tax rate of return on equity-financed corporate investment, calculated per equation (23) (when $f(c) = 0$) as $\{[r(c,e) - \pi + \delta] \times [1 - uz(c,e)]/(1 - u)\} - \delta$.
R	Noncorporate [ρ(n)]	Real before-tax rate of return on noncorporate investment, calculated per equation (24) as $[r(n) - \pi + \delta] \times [1 - t(n)z(n)]/[1 - t(n)]\}$.
S	Owner-occupied housing [ρ(h)]	Before-tax rate of return on investment in owner-occupied housing, calculated per equation (25) as $[r(h) - \pi] - w \times \lambda(h) \times t(h)$. This column is irrelevant for nonresidential asset types.
T	Overall [ρ]	Before-tax rate of return on all investment, calculated as a weighted average of columns O, R, and S, using columns D, E, and F as the weights.

Continued

Table A-1.

Continued

Column Label	Column Head	Content
Tax Wedges for Investors $[\rho - r]$		
U	Corporate: total	The tax wedge is the difference between the before-tax rate of return and the after-tax rate of return. Column U is the tax wedge for corporate investment with a typical mix of debt- and equity-financing, calculated as $\rho(c) - [r(c)' - \pi]$.
V	Corporate: debt-financed	Tax wedge for debt-financed corporate investment, calculated as $\rho(c,d) - [r(c,d)' - \pi]$.
W	Corporate: equity-financed	Tax wedge for equity-financed corporate investment, calculated as $\rho(c,e) - [r(c,e)' - \pi]$.
Tax Wedges for Savers $[\rho - s]$		
X	Corporate: total	Tax wedge for savers holding a typical mix of corporate stocks and bonds, calculated as $\rho(c) - s(c)$.
Y	Corporate: debt-financed	Tax wedge for savers holding corporate bonds, calculated as $\rho(c,d) - s(c,d)$.
Z	Corporate: equity-financed	Tax wedge for savers holding corporate stocks, calculated as $\rho(c,e) - s(c,e)$.
AA	Noncorporate	Tax wedge for savers holding a typical mix of noncorporate equity and debt instruments, calculated as $\rho(n) - s(n)$. Note that a noncorporate business owner is both an investor and a saver holding noncorporate equity. A saver holding non-corporate debt instruments, in contrast, is usually distinct from the investor.
AB	Owner-occupied housing	Tax wedge for savers holding a typical mix of owner-occupied housing equity and debt instruments, calculated as $\rho(h) - s(h)$. Note that a homeowner is both an investor and a saver holding housing equity. A saver holding housing debt instruments, in contrast, is distinct from the investor. Column AB is irrelevant for nonresidential asset types.
Effective Tax Rates [ETR]		Calculations follow equation (1) after using equation (23) to substitute for "before" and equation (6) to substitute for "after."
AC	Corporate: total [ETR(c)]	Effective tax rate imposed on corporate businesses on net corporate income from a typical mix of debt- and equity-financed investments is calculated as $\{\rho(c) - [r(c)' - \pi]\}/\rho(c)$.

Continued

Table A-1.

Continued

Column Label	Column Head	Content
Effective Tax Rates [ETR] (continued)		
AD	Corporate: debt-financed [ETR(c,d)]	Effective tax rate imposed on corporate businesses on net corporate income from debt-financed investments is calculated as $\{\rho(c,d) - [r(c,d)' - \pi]\}/\rho(c,d)$.
AE	Corporate: equity-financed [ETR(c,e)]	Effective tax rate imposed on corporate businesses on net corporate income from equity-financed investments is calculated as $\{\rho(c,e) - [r(c,e)' - \pi]\}/\rho(c,e)$.
Effective Total Tax Rates [ETTR]		
AF	Corporate: total [ETTR(c)]	Effective tax rate on income from a typical mix of corporate stocks and bonds, calculated per equation (12) as $[\rho(c) - s(c)]/\rho(c)$.
AG	Corporate: debt-financed [ETTR(c,d)]	Effective tax rate on income from corporate bonds, calculated per equation (12) (when $f(c) = 1$) as $[\rho(c,d) - s(c,d)]/\rho(c,d)$.
AH	Corporate: equity-financed [ETTR(c,e)]	Effective tax rate on income from corporate stocks, calculated per equation (12) (when $f(c) = 0$) as $[\rho(c,e) - s(c,e)]/\rho(c,e)$.
AI	Noncorporate [ETTR(n)]	Effective tax rate on income from a typical mix of noncorporate equity and debt instruments, calculated per equation (17) as $[\rho(n) - s(n)]/\rho(n)$.
AJ	Owner-occupied housing [ETTR(h)]	Effective tax rate on income from a typical mix of owner-occupied housing equity and debt instruments, calculated per equation (22) as $[\rho(h) - s(h)]/\rho(h)$.
AK	Overall [ETTR]	Effective tax rate on income from a typical mix of all equity and debt instruments, calculated as $(\rho - s)/\rho$.
AM	Average rate of return to savers [s]	The after-tax rate of return on all assets, calculated as a weighted average of s(c), s(n), and s(h), using columns D, E, and F as the weights.

Source: Congressional Budget Office.

Parameters

This sheet is the repository of most parameters that do not vary by asset type. It also contains information on where to enter parameters that do vary by asset type. The sheet is laid out in four vertical pages as follows:

- Top page (rows 3–28): marginal investments, depreciation, sources of financing, market rates of return
- Second page (rows 29–57): sources of marginal saving
- Third page (rows 58–86): tax parameters
- Bottom page (rows 87–89): inventory parameters

Except where noted, the implementation section of this background paper describes how the CBO selected the values it used for the parameters.

Variable names referenced in formulas in the sheet appear without the parentheses (for example, "t(div)" becomes "tdiv"). For legibility in the formulas, Greek characters with subscripts are shown as their capital Roman counterparts (specifically, "α" is "A" and "λ" is "L"). Greek characters without subscripts are simply spelled out (specifically, "π" is "pi," "γ" is "gamma," and "ϕ" is "phi"). Some of the same variable names appear in formulas in the methodology section, where they are shown with true subscripts instead of parenthetical subscripts.

Marginal investments

These parameters vary by asset type and are not entered on this sheet. The amounts of marginal investment by type of asset, B, are entered on the **NonresCapStk** and **OthCapStk** worksheets and appear in column B of the **Full detail** worksheet. The tax shares—q(c), q(n), and q(h)—are also entered on the **NonresCapStk** and **OthCapStk** worksheets and appear in columns D–F of **Full detail.**

Depreciation

These parameters, which vary by asset type and in some cases by industry, also are not entered on this sheet. The tax depreciation parameters are entered on two sheets. The depreciation formulas themselves are entered on **TaxDeprFrml.** Those formulas are assigned to asset types and industries on the **TaxDeprMthd** worksheet. The present values of depreciation deductions per dollar invested, z, are displayed on the four **TaxDeprPV** worksheets, and the weighted-average values of z by asset type are displayed in columns J–M of **Full detail.** Economic depreciation rates, δ, are entered on the **EconDepr** worksheet and displayed in column G of **Full detail.**

Sources of financing

Cells A16–A18 show the percentage of marginal investment financed by debt—labeled f(c), f(n), and f(h) for corporate, noncorporate, and owner-occupied housing

investment, respectively. The values are used in the **Rates of return** worksheet to calculate weighted-average values of the after-tax rates of return to savers, s(c), s(n), and s(h). They also are used there to compute the discount rates of businesses, $r(c) - \pi$ and $r(n) - \pi$; and homeowners, $r(h) - \pi$.

Cell A19 is for m, the share of after-tax profits retained by C corporations. The value depends on whether one accepts the new view or the old view of the tax on corporate dividends. The value is used in the **Rates of Return** worksheet to calculate the after-tax rate of return on corporate equity in fully taxable accounts, s(c,e,ft).

Market rates of return

Cell A22 shows π, the rate of inflation, a value used extensively throughout the workbook, particularly to convert a real (inflation-adjusted) rate of return to a nominal rate and to calculate the present value of depreciation deductions.

Cell A23 is the real pretax rate of return on corporate equity, E. The value is used extensively throughout the workbook, particularly for calculating average rates of return on investment financed with a typical mix of debt and equity, and for calculating the pretax rate of return on equity-financed corporate investment by asset type.

Cell A24 shows the nominal interest rate, i. The value is used extensively in the **Rates of return** worksheet to calculate average rates of return on investment financed with debt and with a typical mix of debt and equity.

Sources of marginal saving

The calculation of ETTRs considers three sources of marginal saving: fully taxable accounts, temporarily deferred accounts (such as whole-life insurance and nonqualified annuities), and nontaxable accounts (such as individual retirement accounts and employment-based pensions). The percentages representing each source, α, are entered in this section. Different splits are permitted by tax treatment (corporate, noncorporate, owner-occupied housing) and by source of financing (equity, debt). Equity-financed investment by noncorporate businesses (rows 39–41) and by homeowners (rows 47–49) is assumed to come entirely from taxable accounts. In the other four blocks, entries are made for fully taxable accounts and for temporarily deferred accounts, leaving the percentage coming from nontaxable accounts as the residual. The values are used in the **Rates of return** worksheet to calculate after-tax rates of return to savers using a typical mix of taxable, temporarily deferred, and nontaxable accounts. The entries and their uses are summarized in Table A-2.

Table A-2.

Parameters Summary, Sources of Marginal Saving

Marginal-Saving Source	Name[a]	Cell in Parameters Worksheet
Corporate Equity-Financed Investment		
Taxable accounts	α(c,e,ft)	A31
Temporarily deferred accounts	α(c,e,td)	A32
Corporate Debt-Financed Investment		
Taxable accounts	α(c,d,fd)	A35
Temporarily deferred accounts	α(c,d,td)	A36
Noncorporate Debt-Financed Investment		
Taxable accounts	α(n,d,ft)	A39
Temporarily deferred accounts	α(n,d,td)	A40
Owner-Occupied Housing Debt-Financed Investment		
Taxable accounts	α(h,d,ft)	A43
Temporarily deferred accounts	α(h,d,td)	A44

Source: Congressional Budget Office.

a. For improved legibility, α is shown as A in the spreadsheet's formulas.

Tax Parameters

Cell A59 is the corporate tax rate, u. The value is used in **Rates of return** to calculate the after-tax rate of return to corporate investors using debt financing, $r(c,d) - \pi$ and $r(c) - \pi$, and in the **Full detail** (columns O, P, and Q) and **Inventories** (rows 9–14) worksheets to calculate the before-tax rate of return on corporate capital, $\rho(c)$.

The individual income tax rates on specific types of income or expenses are contained in cells A61–A70:

Cell A61 gives the tax rate on dividend income, t(div). The value is used in **Rates of return** to calculate the after-tax rate of return to savers holding corporate equity in fully taxable accounts, s(c,e,ft).

Cell A62 shows the tax rate on capital gains not realized prior to death, t(xcg). The value (zero, under current law) is strictly an exhibit.

Cells A63 and A64 show the tax rates on realized long-term capital gains, t(lcg); the first on real gains and the second on inflationary gains. The values are typically the same, but providing two parameters facilitates the simulation of the partial integration proposal and the indexing of capital gains for inflation in the President's 2003 budget. The values are used in **Rates of return,** where they ultimately feed into the after-tax rate of return to savers holding corporate equity in fully taxable accounts, s(c,e,ft).

Cells A65 and A66 are for the tax rates on realized short-term capital gains, t(scg); the first on real gains and the second on inflationary gains. The values are used in **Rates of return,** where they ultimately feed into the after-tax rate of return to savers holding corporate equity in fully taxable accounts, s(c,e,ft).

Cell A67 shows the tax rate on interest income, t(int). The value is used in **Rates of return** to calculate the after-tax rate of return to savers holding corporate debt in fully taxable accounts, s(c,d,ft).

Cell A68 shows the tax rate on mortgage interest deductions, t(h). The value is used in **Rates of return** to calculate the after-tax rate of return to homeowners using a typical mix of debt and equity financing, $r(h) - \pi$, and in **Full detail** (column S) to calculate the before-tax rate of return on owner-occupied-housing capital, $\rho(h)$.

Cell A69 shows the tax rate on noncorporate business income, t(n). The value is used in **Rates of return** to calculate the after-tax rate of return to noncorporate business investors, $r(n) - \pi$, and in **Full detail** (column R) and **Inventories** (rows 19 and 20) to calculate the before-tax rate of return on noncorporate business capital, $\rho(n)$.

Cell A70 is the tax rate on nonqualified annuities, t(td). The value is used in **Rates of return** to calculate the after-tax rate of return to savers holding corporate equity and debt—s(c,e,td) and s(c,d,td), respectively—in temporarily deferred accounts.

Cell A71 is the average property tax rate, w. The value is used in **Full detail** (column S) to calculate the before-tax rate of return on owner-occupied-housing capital, $\rho(h)$.

Cell A73 is the deductible share of mortgage interest and property taxes, $\lambda(h)$. The value is used in the **Rates of return** worksheet to calculate the after-tax rate of return to homeowners, $r(h) - \pi$, and in **Full detail** (column S) to calculate the before-tax rate of return on owner-occupied-housing capital, $\rho(h)$.

Cell A74 shows the deductible share of business interest, $\lambda(c)$ and $\lambda(n)$. Under current law, this parameter has a value of 1.0, but it would be zero under a pure consumption tax or a wage tax. It is used in **Rates of return** to calculate the after-tax rate of return to business investors using debt financing, $r(c) - \pi$ and $r(n) - \pi$, and in **Inventories** to calculate the cost of debt-financed capital.

The deferral of tax on capital gains complicates the calculation of s(c,e,ft), the after-tax rate of return to savers who hold corporate equity in fully taxable accounts. The parameters required to complete that calculation are entered in cells in the range A76–A83. The capital gains portion, g, of the calculation of s(c,e,ft) is performed on the top page of **Rates of return.** The parameters are as follows:

Cell A77 is the percentage of realized capital gains that are short term (that is, the assets sold were held for less than one year). The long-term percentage is calculated as a residual and displayed in cell A76.

Cell A79 shows the percentage of capital gains that are not realized before a shareholder dies. The realized capital gains are apportioned between long- and short-term gains in cells A76 and A77, respectively.

Cells A82 and A83 contain the average holding period for long-term, Y(lcg), and short-term, Y(scg), capital gains, respectively.

The deferral of tax on investment earnings in whole-life insurance and nonqualified annuities complicates the calculation (in the **Rates of return** worksheet) of the after-tax rate of return to savers holding debt in those temporarily deferred accounts, s(c,d,td). The parameters required to complete that calculation are entered in cells A80 and A84.

Cell A80 shows the percentage of payments made from temporarily deferred accounts that are nontaxable death benefits, γ.

Cell A84 shows the average holding period of assets in temporarily deferred accounts, Y(td).

Inventories

This section contains two parameters that feed into the **Inventories** worksheet.

Cell A88 is for the average holding period of inventories, Y(v).

Cell A89 contains the percentage of inventories accounted for with the "first-in, first-out" method, ϕ.

NonresCapStk

Note: *You can modify only the green-shaded cells in this sheet.*

This worksheet has two functions: to specify a distribution of nonresidential investment in equipment and structures by industry and asset type, and to convert tax splits by industry into tax splits by asset type.

Industries are arrayed vertically over two pages and asset types are arrayed horizontally over seven pages. Industries are repeated three times as follows:

- First block (rows 2–67): all investment
- Second block (rows 68–133): corporate investment (in blue)

- Third block (rows 134–199): noncorporate investment (in green)

Distribution of Investment by Industry and Asset Type

To represent the base case and all policy alternatives, CBO assumed that marginal nonresidential investment by industry and asset type was proportional to the current value of nonresidential assets in 2002. You might want to modify that distribution (contained in the range E5–AY67) if you believe either that investment is distributed differently than current assets or that it would be more appropriate to use data for a different year.

The source of the current value of nonresidential assets was the spreadsheet called "detailnonres_stk1.xls," which is available from the Department of Commerce Bureau of Economic Analysis (BEA): www.bea.gov/bea/dn/FA2004/Details/Index.html. (Note that the 2002 data in this spreadsheet have been updated since CBO originally downloaded them.) That spreadsheet carries the following disclaimer:

> The Bureau of Economic Analysis (BEA) does not include detailed estimates by industry and by type in the tables published in the Survey of Current Business or the Fixed Assets and Consumer Durables volume because their quality is significantly less than that of the higher level aggregates in which they are included. Compared to these aggregates, the detailed estimates are more likely to be either based on judgmental trends, on trends in the higher level aggregate, or on less reliable source data.

CBO retained all asset types in the BEA spreadsheet. For the most part, the industries in the BEA spreadsheet also were retained. Some limited aggregation of the industries was necessary, however, because the same level of detail was not available for the tax split parameters (see Box 2 on page 31).

The BEA figures include the assets of nonprofit organizations. Because they are nontaxable entities, there is no tax burden on their investment, so it is unnecessary to calculate an effective tax rate. If those assets were retained in the data, they would serve to overweight the effective tax rates on asset types that are most commonly owned by nonprofits. Therefore, those assets were removed from the data as described in the methodology section of this background paper.

Total investment by asset type is summed over all industries and displayed in row 3. After dividing by 1,000, those amounts are fed into column B of **Full detail.**

Converting Tax Splits by Industry to Tax Splits by Asset Type

The share of assets in each industry that is held by businesses subject to the corporate income tax is contained in the range D71–D133 of the worksheet **NonresCapStk.** The method by which these values were estimated was described in the main text, but the values could be modified to reflect more recent information or to correct for any distortion inherent in using tax data to perform the estimates. The share of assets in

each industry held by businesses that are not subject to the corporate income tax is calculated as the difference between 100 percent and the corporate share, and it is displayed in cells D137–D199 (which cannot be modified directly).

The corporate share in each industry is multiplied by the corresponding industry's investment in each asset type to yield an estimate, by industry and by asset type, of investment subject to the corporate income tax. The results, which cannot be modified directly, are contained in the range E71–AY133. Total corporate investment in each asset type (row 69) is divided by total business investment in that asset type (row 3) to derive an estimate of the corporate share by asset type (row 68), which is fed to column D of the **Full detail** worksheet.

Noncorporate investment is the difference between total investment and corporate investment. Those amounts are calculated and displayed in the range E137–AY199 (which cannot be modified directly). Total noncorporate investment by asset type appears on line 135, and the noncorporate share by asset type (which corresponds to column E of **Full detail**) appears in row 134.

OthCapStk

Note: *You can modify only the green-shaded cells in this sheet.*

This worksheet specifies distributions of investment in residential equipment and structures, inventories, and land among the three tax treatments. The values feed into cells in columns B and D of rows 14, 37–40, 55, and 57–59 in the **Full Detail** worksheet. **OthCapStk** is displayed on a single page in two parts: Rows 1–6 cover residential equipment and structures; rows 15–20 cover inventories and land.

Residential Equipment and Structures

To be consistent with nonresidential investment, CBO assumed that marginal residential investment was proportional to the current value of residential assets in 2002. You can modify those figures (contained in cells E3, G3, I3, and K3) if you believe either that investment is distributed differently than current assets or that data for a different year would be more appropriate. The value of residential assets was aggregated from BEA data as described in the implementation section of this background paper. That section also describes how the values were distributed among tax treatments. The resulting values and corporate shares are placed in **OthCapStk** as shown in Table A-3.

Corresponding figures for noncorporate shares (100 percent, less the corporate share) can be found in row 5 of the corresponding columns (D, H, and J). By definition, the owner-occupied housing share is zero, as shown in row 6 of the corresponding columns. Under federal law, income from owner-occupied houses is not subject to the corporate or individual income tax, so the owner-occupied-housing share is 100 percent. The tax shares were set accordingly in the range F4–F6.

Table A-3.

Residential Capital Stock: Amounts and Tax Treatment

	Cell Contents	
Asset type	Value	Corporate Share
Equipment	E3	D4
Owner-Occupied Structures	G3	n.a.
Corporate-Owned Tenant-Occupied Structures	I3	H4
Noncorporate-Owned Tenant-Occupied Structures	K3	J4

Source: Congressional Budget Office.

Note: n.a. = not applicable.

Inventories and Land

Sources of data for inventories and land also are described in the implementation section. The amounts for inventories were entered into cell E17, and the data on land were available for owner-occupied housing (cell G17) and for tenant-occupied housing owned by a corporation (cell I17) or noncorporate businesses (cell K17). Those data should not be confused with the tax treatment shares below.

Tax shares were calculated as described in the implementation section. The values for inventories, corporate land, and noncorporate land were entered in cells D18, H18, and J18, respectively. All land attached to owner-occupied housing was assigned to homeowners. The tax shares were set accordingly in the range F18–F20.

TxDeprFrml

Note: *You can modify only the green-shaded cells in this sheet.*

In this worksheet, the formulas from the methodology section that are used to compute the present value of tax depreciation allowances are applied to the main parameters allowed by federal tax laws in place from 2000 through 2006. The computations are grouped by the two generic methods of depreciation: declining balance and straight line. Within each generic method, present values are computed for each combination of the main parameter values allowed under the tax law. All combinations of parameters can accommodate partial expensing and the trivial extension to full expensing. Parameters that define the annual percentage recovery method proposed by the President's Advisory Panel on Federal Tax Reform also are included.

As identified in the methodology section of this background paper, present values depend on discount rates of the firms making the investments and on the tax depreciation formulas allowed by tax law. The discount rates used in the calculations on this sheet are for the following tax treatments and sources of financing:

- Corporations using a typical mix of debt and equity, r(c),

- Corporations using debt financing, r(c,d),
- Corporations using equity financing, r(c,e), and
- Noncorporate businesses using a typical mix of debt and equity financing, r(n).

This worksheet is laid out in two vertical pages as follows:

- Top page: declining-balance method with a switch to straight-line depreciation (rows 2–30)
- Bottom page: straight-line method (rows 32–40), annual recovery percentage method (rows 42–50)

Each generic method is associated with a series of predetermined parameter values that are combined to generate names representing specific methods you can assign to asset types and industries on the worksheet **TxDeprMthd.**

For example, the five-year straight-line method is "sl_5." The parameters that define the specific methods are not protected, so they can be changed. The names, however, cannot be changed. Thus, it is permissible to replace five-year straight-line depreciation with six-year straight-line depreciation, but the name will remain "sl_5."

Declining-Balance Method with Switch to Straight-Line Method

The declining-balance method accelerates depreciation into the early years of an asset's life. Under current law, when the depreciation deductions under the declining-balance method fall below those under the straight-line method, the taxpayer switches to straight-line depreciation. That switch is reflected in the present values calculated in this section of **TxDeprFrml.**

The declining-balance method is defined by the discount rate and two parameters: the tax life, Y, and the rate of acceleration, *b.* The tax life is the period over which an asset can be completely depreciated. The acceleration rate determines the timing of the depreciation deductions; the higher the acceleration rate, the higher the percentage that can be deducted in the early years. Ten combinations of Y and *b* used under current law are entered in columns E–N. Values of Y are shown on row 4, and values of *b* are shown on row 5. The names are shown in row 3, with the naming convention db*b*_Y, where "db" stands for declining balance. Row 6 contains a parameter, x, to permit partial or full expensing.

Rows 8 and 9 contain intermediate calculations of the geometric rate of decay, β, and Y*, the time at which the declining-balance method gives way to the straight-line method. The present values of depreciation deductions under this method are presented in four blocks of five lines each (rows 11–30). The four blocks represent the different tax treatments and sources of financing listed above.

Table A-4.

TxDeprMthd Worksheet Locations of Values Associated with Declining-Balance Depreciation

Cell	Name	Cell	Name	Cell	Name	Cell	Name
E15	db2_3	E20	Ddb2_3	E25	Edb2_3	E30	Ndb2_3
F15	db2_5	F20	Ddb2_5	F25	Edb2_5	F30	Ndb2_5
G15	db2_7	G20	Ddb2_7	G25	Edb2_7	G30	Ndb2_7
H15	db2_10	H20	Ddb2_10	H25	Edb2_10	H30	Ndb2_10
I15	db1.5_3	I20	Ddb1.5_3	I25	Edb1.5_3	I30	Ndb1.5_3
J15	db1.5_5	J20	Ddb1.5_5	J25	Edb1.5_5	J30	Ndb1.5_5
K15	db1.5_7	K20	Ddb1.5_7	K25	Edb1.5_7	K30	Ndb1.5_7
L15	db1.5_10	L20	Ddb1.5_10	L25	Edb1.5_10	L30	Ndb1.5_10
M15	db1.5_15	M20	Ddb1.5_15	M25	Edb1.5_15	M30	Ndb1.5_15
N15	db1.5_20	N20	Ddb1.5_20	N25	Edb1.5_20	N30	Ndb1.5_20

Source: Congressional Budget Office.

Within each block, the first four rows represent intermediate calculations (which are useful for deconstructing the formula); the last row represents the corresponding present value for a particular tax treatment and source of financing as specified in equation (34) in the methodology section. These are the cells that are named so they can be referenced in the worksheet **TxDeprMthd.** The names are constructed by combining a prefix that represents the tax treatment or source of financing from column B with the specific method name from row 3. The cells are named as shown in Table A-4.

Straight-Line Method

As shown by equation (28) in the methodology section, the straight-line method is defined by the discount rate and a single parameter—the tax life, Y. Depreciation deductions equal to an asset's acquisition cost are spaced out evenly over that period. The eight different values of Y used under current law are entered in the range E34–L34. The names are shown in row 33 by the following naming convention: sl_Y, where "sl" stands for straight line. Row 35 contains a parameter, x, to permit partial or full expensing.

The present values of depreciation deductions under the straight-line method are presented on rows 37–40, each representing one of the combinations of tax treatment and source of financing listed above. Each cell is named so it can be referenced in the **TxDeprMthd** worksheet. The names are constructed by combining a prefix that represents the tax treatment or source of financing from column B with the specific method name from row 33. The cells are named as shown in Table A-5.

Table A-5.

TxDeprMethd Worksheet Locations of Values Associated with Straight-Line Depreciation

Cell	Name	Cell	Name	Cell	Name	Cell	Name
E37	sl_3	E38	Dsl_3	E39	Esl_3	E40	Nsl_3
F37	sl_5	F38	Dsl_5	F39	Esl_5	F40	Nsl_5
G37	sl_7	G38	Dsl_7	G39	Esl_7	G40	Nsl_7
H37	sl_10	H38	Dsl_10	H39	Esl_10	H40	Nsl_10
I37	sl_15	I38	Dsl_15	I39	Esl_15	I40	Nsl_15
J37	sl_20	J38	Dsl_2	J39	Esl_20	J40	Nsl_20
K37	sl_27.5	K38	Dsl_27.5	K39	Esl_27.5	K40	Nsl_27.5
L37	sl_39	L38	Dsl_39	L39	Esl_39	L40	Nsl_39

Source: Congressional Budget Office.

Annual Recovery Percentage Method

Under the annual recovery method, a fixed percentage of the undepreciated value of an asset is deducted each year. As shown in equation (36) in the methodology section, the method is defined by the discount rate and a single parameter—the annual recovery percentage, β—which is conceptually identical to the geometric rate of decay used above. Eight values of β are entered in the range E44–L44. The names are shown in row 43 using the following naming convention: arp_β, where "arp" means annual recovery percentage. Row 45 contains a parameter, x, which permits partial or full expensing.

The present values of depreciation deductions under this method are presented on four rows (47–50), each representing one combination of tax treatment and source of financing, as listed above. Each cell is named so it can be referenced in the worksheet **TxDeprMthd.** The names are constructed by combining a prefix that represents the tax treatment or source of financing from column B with the specific method name from row 43. The cells are named as shown in Table A-6.

TxDeprMthd

Note: *The cells in this sheet are not protected. Cells shaded in blue rather than in green, however, should be modified only in exceptional circumstances.*

This sheet identifies the specific tax depreciation method to apply to each asset type in each industry. Asset types are arrayed horizontally over five pages, and industries are arrayed vertically over two pages. Hybrid methods can be created on a third vertical page for cases in which tax definitions of asset types or industries do not correspond closely to those used by BEA in generating its data on current asset values.

Table A-6.

TxDeprMthd Worksheet Locations of Values Associated with Annual Recovery Percentage Depreciation

Cell	Name	Cell	Name	Cell	Name	Cell	Name
E47	arp_30	E48	Darp_30	E49	Earp_30	E50	Narp_30
F47	arp_20	F48	Darp_20	F49	Earp_20	F50	Narp_20
G47	arp_15	G48	Darp_15	G49	Earp_15	G50	Narp_15
H47	arp_10	H48	Darp_10	H49	Earp_10	H50	Narp_10
I47	arp_7.5	I48	Darp_7.5	I49	Earp_7.5	I50	Narp_7.5
J47	arp_5	J48	Darp_5	J49	Earp_5	J50	Narp_5
K47	arp_4	K48	Darp_4	K49	Earp_4	K50	Narp_4
L47	arp_3	L48	Darp_3	L49	Earp_3	L50	Narp_3

Source: Congressional Budget Office.

Depreciation methods are identified by entering the name of the specific depreciation method defined in **TxDeprFrml** into each cell. The names shown on rows 3, 33, and 43 of that sheet are valid here—the prefixes shown in column B should not be included in the names.

It is not necessary to type the desired name into each cell. For every asset type, row 67 (shaded green at the bottom of the middle vertical page) contains the name of a default depreciation method that automatically appears in every row for that asset type, unless it is manually overridden. Such overrides are necessary when assets in a particular industry are treated differently from those in other industries. The overrides used for current law are shown with darker blue shading.

Cells filled with default values under current law are shaded lighter blue, but they are not protected and can be overridden if necessary. The name in each cell of the **TxDeprMthd** worksheet is used to identify the cell in the worksheet **TxDeprFrml** from which the present value of depreciation deductions should be fed into the corresponding cells in **TxDeprPV.** For example, if cell C3 contains a value of "sl_3," then cell C3 in **TxDeprPV_Ctot** will, under current law, be fed a value of 0.9005, because that is the content of the cell named "sl_3" (E37) in **TxDeprFrml.**

In addition to the names defined on the **TxDeprFrml** worksheet, two other entries are valid:

- "Mixed" may be entered to create a hybrid method, which is defined using the parameters on the bottom page. Rows 70 and 72 identify two methods; rows 71 and 73 are then used to weight those methods. Corresponding cells in the **TxDeprPV** worksheets will contain a weighted average of the two present values from **TxDeprFrml.** Only one hybrid method can be defined per asset type.

- "Econ" may be entered to make tax depreciation equal to economic depreciation for the asset class from the **EconDepr** worksheet. For uniform economic depreciation, enter "Econ" into all green and dark blue cells.

The list of asset types across row A includes all of those from **NonresCapStk** plus three entries for the residential capital stock: equipment, corporate-owned structures, and noncorporate-owned structures. The distinction between corporate and noncorporate follows the definitions used by BEA and conforms to the "legal form of organization" concept, not the "tax treatment" concept. The depreciation method for the three residential asset types is entered on row 67; there is no industry breakdown.

EconDepr

This sheet specifies rates of economic depreciation, δ, by asset type. The sheet is laid out over two vertical pages:

- Top (rows 3–34): nonresidential equipment
- Bottom (rows 36–59): residential equipment, all structures

Economic depreciation rates are entered in column B. They feed into column G of **Full detail,** where they are used to calculate ρ, the before-tax rate of return on capital. They are also available to enter the calculation of present value of depreciation deductions in the **TxDeprPV** worksheets whenever a value of "econ" is entered into a cell of the **TxDeprMthd** sheet. (Because asset types are arrayed horizontally in the tax depreciation worksheets, values of δ are transposed in **EconDepr** in the range D2–BA2.)

Rates of return

Note: *This sheet has been protected and cannot be modified.*

This sheet is for calculation and display of the various after-tax rates of return used to calculate the effective tax rate (ETR) and effective total tax rate (ETTR). It is laid out in two vertical pages as follows:

- Top (rows 3–15): capital gains portion of the return on corporate equity
- Bottom (rows 20–46): after-tax rates of return to savers and investors

Variable names referenced in formulas in the sheet appear without parentheses or commas; for example, s(c,e) becomes sce. Greek variables with subscripts appear in formulas as their Roman capital counterparts ("α" is "A," "λ" is "L," "ω" is "W"). Greek variables without subscripts are spelled out ("π" is "pi"). Some of the same variable names appear in the formulas in the methodology section, where they are presented with true subscripts.

Capital Gains

The capital gains section of the **Rates of return** worksheet constructs the capital gains portion of the after-tax rate of return on corporate equity. Cells in the range A5–A11 use the information in cells A77 and A79 from the **Parameters** worksheet to create weights for short-term capital gains, ω(scg); long-term capital gains, ω(lcg); and capital gains not realized prior to death, ω(xcg).

Cell A13 computes the real after-tax rate of return for short-term gains, g(scg), using equation (46) from the methodology section (and, in the case of the President's integration proposal, equation (50) from the methodology section). Cell A14 computes the analogous return for long-term gains, g(lcg), substituting equation (47) for equation (46). Cell A15 computes the untaxed rate of return on gains held until death, g(xcg). Each cell uses a variety of values from the "Market rates of return" and "Tax parameters" sections of the **Parameters** worksheet. Cell A16 applies the weights to the rates of return to produce a weighted average of the capital gain portion of the after-tax rate of return on corporate equity, g. That value is combined with the dividend portion below in cell A25.

Real After-Tax Rates of Return to Savers

This section calculates after-tax rates of return to savers by source of financing and type of account, then applies weights to generate more aggregated rates of return. The most basic calculations, which use a variety of values from the **Parameters** worksheet sections labeled "Market rates of return" and "Tax parameters," are as follows:

Cell A26 shows the return on equity held in fully taxable accounts, s(c,e,ft), per equation (9) from the methodology section.

Cell A27 shows return on equity held in temporarily deferred accounts, s(c,e,td), per equation (53).

Cell A28 shows return on equity held in nontaxable accounts, s(c,e,nt).

Cell A30 shows return on debt held in fully taxable accounts, s(c,d,ft), per the first term on the right-hand side of equation (8) in the methodology section.

Cell A32 shows return on debt held in temporarily deferred accounts when not applied to death benefits, per equation (51).

Cell A33 shows return on debt held in temporarily deferred accounts when applied to death benefits, per equation (52).

Cell A34 shows return on debt held in nontaxable accounts, s(c,d,nt).

The remaining cells contain rates of return that reflect different levels of aggregation. Their values are calculated by applying weights either from the **Parameters** worksheet

Table A-7.

Aggregated Rates of Return to Savers

Aggregation	Cell	Components	Weights
Distribution Form (Death benefit, other)			
Corporate debt in temporarily deferred accounts, s(c,d,td)	A31	A33, A32	γ, $1-\gamma$
Account Type (Fully taxable, temporarily deferred, nontaxable)			
Corporate equity, s(c,e), per equation (10)	A25	A26, A27, A28	$\alpha[c,e,ft]$, $\alpha[c,e,td]$, $\alpha[c,e,nt]$
Corporate debt, s(c,d), per equation (8)	A29	A30, A31, A34	$\alpha[c,d,ft]$, $\alpha[c,d,td]$, $\alpha[c,d,nt]$
Noncorporate equity, s(n,e)	A36	A25	None
Noncorporate debt, s(n,d), per equation (15)	A37	A30, A31, A34	$\alpha[n,d,ft]$, $\alpha[n,d,td]$, $\alpha[n,d,nt]$
Owner-occupied housing equity, s(h,e)	A39	A25	None
Owner-occupied housing debt, s(h,d), per equation (20)	A40	A30, A31, A34	$\alpha[n,d,ft]$, $\alpha[n,d,td]$, $\alpha[n,d,nt]$
Financing Source (Equity, debt)			
Corporate investment, s(c), per equation (11)	A24	A25, A29	$1-f[c]$, $f[c]$
Noncorporate investment, s(n), per equation (16)	A35	A36, A37	$1-f[n]$, $f[n]$
Owner-occupied housing investment, s(h), per equation (21)	A38	A39, A40	$1-f[h]$, $f[h]$
Tax Treatment (Corporate, noncorporate, owner-occupied housing)			
Business investment	A23	A24, A35	$q[c]$, $q[n]$
Total investment	A22	A24, A35, A39	$q[c]$, $q[n]$, $q[h]$

Source: Congressional Budget Office.

or from the **Full detail** worksheet, as appropriate. Table A-7 summarizes the construction of the aggregate measures.

After-Tax Rates of Return to Businesses and Homeowners

This section calculates discount rates and after-tax rates of return to businesses and homeowners by source of financing. It applies weights to generate aggregated discount rates and after-tax rates of return by tax treatment. The type of account in which assets are held is not important to investors. The calculations for corporate equity (cell A44) and debt (cell A45) use a variety of values from the "Market rates of return" and "Tax parameters" sections of the **Parameters** worksheet.

Cells A43, A46, and A47 contain rates of return that aggregate over different sources of financing using the same weights shown in Table A-7 for cells A24, A35, and A37.

Cells A43, A44, and A45 are based on equation (5) of the methodology section. Cell A46 is based on equation (14), and cell A47 is based on equation (19).

The corresponding after-tax rates of return, per equation (6) in the methodology section, are contained in column D.

Inventories

Note: *This sheet has been protected and cannot be modified.*

This sheet is for calculation and display of the rates of return and effective tax rates on inventories. The calculations for inventories differ from those for other types of assets, so isolating them is the least confusing option. The sheet is laid out in two vertical pages as follows:

- Top: nominal discount rates (rows 3–5), cost of capital (rows 7–21)
- Bottom: effective tax rates on investors (rows 26–36), effective tax rates on savers (rows 38–49)

Calculations for inventories, unlike those for other assets, must consider the accounting method used: LIFO (last-in, first-out) or FIFO (first-in, first-out). Before-tax rates of return, ρ, and effective tax rates, ETR and ETTR, are first calculated by source of financing for each accounting method using tax rates u and t(n); holding periods Y(v); and inflation rates, π; from the **Parameters** worksheet.

The before-tax rates of return are computed according to equations (55) and (57) in the methodology section of this background paper. Weighted averages of the two accounting methods are then calculated using ϕ from **Parameters.** Weighted averages of debt and equity financing also are calculated using f(c) from **Parameters.** The resulting values are fed into row 55 of **Full detail.**

TxDeprPV_

Note: *These sheets have been protected and cannot be modified.*

There are four sheets that show the present value of depreciation deductions per dollar invested:

- **TxDeprPV_Ctot** is for corporate investment using a typical mix of debt and equity financing.
- **TxDeprPV_Cdt** is for corporate investment using debt financing.
- **TxDeprPV_Ceq** is for corporate investment using equity financing.
- **TxDeprPV_Ntot** is for noncorporate investment using a typical mix of debt and equity financing.

The sheets are used to calculate average present values of depreciation deductions over all industries for each asset type. Industries are arrayed vertically over two pages; asset types are arrayed horizontally over five pages, as they are for the worksheet **TxDeprMthd.**

Each cell in **TxDeprPV_Ctot** that is associated with an industry and an asset class contains a present value of depreciation deductions per dollar invested. The value is drawn from the **TxDeprFrml** worksheet on the basis of instructions from the worksheet **TxDeprMthd.** For example, if cell C3 of **TxDeprMthd** contains a value of "sl_3," then cell C3 in **TxDeprPV_Ctot** will, under current law, be fed a value of 0.9005, because that is the content of the cell named "sl_3" (E37) in **TxDeprFrml.**

The other three sheets use different discount rates to calculate the present value. To identify the proper discount rate, a prefix is added to the method name identified in **TxDeprMthd.** For the **Cdt** sheet, the prefix is "D"; for **Ceq,** it is "E"; and for **Ntot,** it is "N." Therefore, cell C3 of **TxDeprPV_Cdt** will, under current law, contain a value of 0.9330, because that is the content of the cell named "Dsl_3" (E38) in **TxDeprFrml.**

On row 67, a weighted-average present value is calculated for each nonresidential asset type using amounts from column B of **NonresCapStk** to derive the weights. The depreciation of the three types of residential assets cannot differ by industry. Therefore, the present values of tax depreciation for those asset types are entered directly on row 67. The values for all columns of row 67 are then fed into columns J–M of **Full detail.**