Effective Tax Rate Model

The Office's effective tax rate model is used to determine how uniformly and heavily the federal government taxes capital income and how that taxation would be affected by changes in tax policy. It is based on the effective tax rate/cost of capital methodology described in Fullerton, Gillette, and Mackie (1986), Gravelle (1994), Mackie (2002), and Ozanne and Burnham (2006), among others.[1]

Overview: Marginal effective tax rates are hypothetical tax rates showing the total fraction of capital costs, excluding economic depreciation, needed to pay taxes over the lifetime of a marginal investment (i.e., an investment assumed to just break even). If applied to economic income, they summarize the investment incentives implied by major provisions of the tax code. Those major provisions include federal tax rates on corporate and noncorporate business income, accelerated tax depreciation, business interest deductions, investment tax credits, the home mortgage interest deduction, the real estate taxes paid deduction, and various individual-level taxes (e.g., tax rates on capital gains, dividend income, interest income, distributions of nonqualified annuities). All else being equal, the higher the effective tax rate is the lower the incentive to save and invest.

The calculation of marginal effective tax rates begins with the Hall-Jorgenson user cost of capital.[2] The user cost of capital (c) is the real before-tax rate of return that a marginal investment must earn to recover the cost of the investment, pay taxes on business income, and pay an expected after-tax rate of return on marginal saving. The user cost of capital net of economic depreciation is a function of the firm's real discount rate

$$(1) \qquad c - \delta = (r - \pi + \delta) \cdot (1 - tz - k)/(1 - t) - \delta ,$$

where r is the firm's nominal discount rate, π the expected inflation rate, δ the economic depreciation rate, t the statutory business income tax rate, z the present value of tax depreciation allowances, and k an investment tax credit rate. In (1), $r - \pi$ is the weighted average of a required real return on equity (E) and a nominal market interest rate (i). Thus,

$$(2) \qquad r - \pi = f(i(1 - \lambda t) - \pi) + (1 - f)E ,$$

where f is the fraction of marginal investment financed with debt and λ the share of business interest expenses that can be deducted.

[1] Don Fullerton, Robert Gillette, and James Mackie, "Investment Incentives under the Tax Reform Act of 1986" in *Compendium of Tax Research 1987* (1987), Washington, DC: Department of the Treasury, Office of Tax Policy, pp. 131-171; Gravelle, Jane G., *The Economic Effects of Taxing Capital Income* (1994), Cambridge, MA: The MIT Press; James Mackie, "Unfinished Business of the 1986 Tax Reform Act: An Effective Tax Rate Analysis of Current Issues in the Taxation of Capital Income," *National Tax Journal* (June 2002), Vol. 55(2), pp. 293-337; Larry Ozanne and Paul Burnham, "Computing Effective Tax Rates on Capital Income," Congressional Budget Office Background Paper (December 2006).

[2] Robert Hall and Dale W. Jorgenson, "Tax Policy and Investment Behavior," *American Economic Review* (June 1967), Vol. 57(3), pp. 391-414.

Subtracting $c-\delta$ from the overall after-tax return to marginal saving (s) gives the tax wedge. Dividing that tax wedge by $c-\delta$ gives an effective *total* tax rate $(ETTR)$ of

(3) $$ETTR=(\rho-s)/\rho$$

for new investment, where $\rho=c-\delta$. In (3), s reflects weighted averages of the marginal saver's returns to debt and equity holdings in fully taxable accounts (directly-held corporate stocks and bonds, savings accounts), temporarily-deferred accounts (annuities, whole-life insurance policies), and nontaxable accounts (pension funds). If (3) is rewritten to capture only the single layer of taxes paid by the firm and to ignore the individual-level taxes paid by the marginal saver, the result is an effective tax rate (ETR) for new investment given by

(4) $$ETR=(\rho-(r'-\pi))/\rho\,.$$

In (4), $r'-\pi$ is the weighted average of the real returns paid on debt-financed investments and equity-financed investments after the firm has paid business income taxes.

The effective tax rate model calculates marginal effective tax rates using both (3) and (4).

Model Parameters. The cost-of-capital model is used to obtain effective marginal tax rates for 76 depreciable assets (equipment and structures), land, inventories, and intangibles.[3] For each asset, effective marginal tax rates are calculated separately for the corporate sector, the noncorporate sector, and the owner-occupied housing sector. For the corporate sector, they are also calculated separately for new investments financed with corporate debt and new investments financed with corporate equity.

In the model, some key parameters, including tax rates, the inflation rate, the nominal interest rate, and the real before-tax return on equity, are constant across all sectors and assets (see Table 1). However, the fraction of marginal investment financed with debt as well as the percentage of marginal savings exempted or deferred varies among the corporate, noncorporate, and owner-occupied housing sectors. In addition, economic depreciation rates and the tax depreciation methods used to calculate z vary across assets (see Table 2). Economic depreciation rates are taken from Hulten and Wykoff (1981) and BEA (2003).[4] The assignment of tax life and tax recovery method by asset type and industry is largely guided by IRS *Publication 946*.[5] Under current law, tax depreciation generally has a higher present value than does economic depreciation.

[3] Stock values for most categories of assets are taken from BEA's detailed fixed asset tables. See http://www.bea.gov/national/FA2004/Details/Index.html. The cost-of-capital model assumes that firms expense system integrators, custom software, and own-account software.

[4] Charles R. Hulten and Frank C. Wykoff, "The Measurement of Economic Depreciation" in *Depreciation, Inflation, and the Taxation of Capital Income* (1981), Washington, DC: The Urban Institute, pp. 81-125; US Department of Commerce, Bureau of Economic Analysis, "Fixed Assets and Consumer Durable Goods in the United States, 1925-1997" (September 2003), available at http://www.bea.gov/national/pdf/Fixed_Assets_1925_97.pdf. For an update of BEA's September 2003 depreciation estimates, see http://www.bea.gov/national/FA2004/Tablecandtext.pdf.

[5] US Department of the Treasury, Internal Revenue Service, *Publication 946 How to Depreciate Property, for Use in Preparing 2009 Returns*, available at http://www.irs.gov/pub/irs-pdf/p946.pdf. The present value of tax

Owner-Occupied Housing. The effective tax rate model uses (1) to calculate the real before-tax return on new equipment and structures in the corporate and noncorporate sectors. It uses

$$(5) \qquad \rho = r_h - \pi - w\lambda_h t_h$$

to obtain the real before-tax return on owner-occupied housing. In (5), w is a property tax rate, λ_h the fraction of real estate taxes deducted by home owners, and t_h the tax rate applying to marginal investments in owner-occupied housing.[6]

Equation (5) reflects several differences in the tax treatment of owner-occupied housing. For example, income from an investment in owner-occupied housing is not taxed $(t = 0)$, and no depreciation deductions are permitted for owner-occupied housing $(z = 0)$. Home owners who itemize can deduct property taxes. The value of the real estate tax deduction is given by $w\lambda_h t_h$. Home owners who itemize can also deduct home mortgage interest expenses. From (2), the value of the home mortgage interest deduction is given by $f_h i\lambda_h t_h$.

Limitations of the Effective Tax Rate Model. The effective tax rate model omits features of the federal tax code that may influence incentives to save and invest. For example, the effective tax rate calculations exclude federal estate and gift taxes. They generally ignore special credits, deductions, rates, and other tax provisions intended to encourage investment in specific assets or industries. They assume that firms use all available deductions and credits when such deductions and credits are likely to be of little use to a firm in a loss position or with a stock of unused tax losses and credit carry-forwards. However, the effective tax rate model can include taxation of capital income at both the federal level and at the state and local levels, taking into account the effects of state and local income taxes, sales taxes, and property taxes on investment incentives.

The effective tax rate model also assumes that all savers and investors are subject to federal taxes. However, foreign savers do not pay federal individual-level taxes, and U.S. firms with investments abroad do not pay federal business income taxes unless profits are repatriated. This means that preferential capital gains rates, lower federal corporate income tax rates, and other tax measures intended to reduce US marginal effective tax rates on new investment may have less of an influence in an economy that is open to international capital flows.

depreciation is calculated by asset and industry for each sector. Table 3 is the result of aggregating the present value of tax depreciation by asset across industries using 2008 capital stock weights.

[6] In the model, λ_h equals to the fraction of home mortgage interest that is deducted. t_h is a weighted average of income-weighted federal marginal income tax rates calculated for the home mortgage interest deduction and the real estate taxes paid deduction.

Table 1. Key Model Parameters

Market Rates of Return		
Inflation Rate[a]	π	0.0189
Real Return on Equity	E	0.0660
Nominal Interest Rate[b]	i	0.0610
Current-Law Federal Tax Rates		
Statutory Corporate Income Tax Rate[c]	t_c	0.3404
Individual-Level Tax Rates on:[d]		
Dividend Income	t_{div}	0.2206
Long-term Capital Gains	t_{lcg}	0.2006
Short-term Capital Gains	t_{scg}	0.3213
Interest Income	t_{int}	0.2751
Home Mortgage Interest and Real Estate Tax Deductions[e]	t_h	0.2031
Noncorporate Business Income	t_n	0.3126
Distributions of Nonqualified Annuities	t_{td}	0.2293
Fraction of Marginal Investment Financed with Debt (by Sector)[f]		
C-Corporations	f_c	0.4059
Noncorporate Business	f_n	0.2734
Owner-Occupied Housing	f_h	0.5952

Notes: Values for π and i are taken from the Administration's fiscal-year (FY) 2014 mid-session review baseline forecast. E is a long-term historical average (real) rate of return to large company stocks. It is taken from the Ibbotson *2010 Classic Yearbook*. Tax rates are taken from current-law baseline revenue forecasts done for the FY 2014 mid-session review. Current-law tax rates assume no change in tax provisions or tax rates unless such a change is already included in current law.

a. Average GDP deflator between 2014 and 2023.
b. Average prime rate between 2014 and 2023.
c. The statutory corporate income tax rate includes the domestic production activities deduction.
d. Average of 2014-2023 income-weighted federal marginal tax rates from the Individual Tax Model.
e. A weighted average of income-weighted federal marginal income tax rates calculated for the home mortgage interest deduction and the real estate taxes paid deduction.
f. Calculated using 2013 Flow of Funds data.

Table 2: Cost Recovery Parameters

Asset	Economic Depreciation Rate (δ) [a]	Tax Depreciation Method[b]	
		Tax Life (Years)	Tax Recovery Method
Nonresidential Equipment[c]			
Mainframes	0.4532	5	DBSL (200)
PCs	0.4009	5	DBSL (200)
Printers	0.3656	5	DBSL (200)
Terminals	0.2341	5	DBSL (200)
Storage devices	0.3896	5	DBSL (200)
System integrators[d]	0.0000	NA	NA
Prepackaged software	0.5500	3	SL
Custom software[d]	0.3300	NA	NA
Own-account software[d]	0.3300	NA	NA
Communications equipment	0.1125	7	DBSL (200)
Nonelectro medical Instruments	0.1350	7	DBSL (200)
Electro medical instruments	0.1834	7	DBSL (200)
Nonmedical instruments	0.1350	7	DBSL (200)
Photocopy and related equipment	0.1800	5	DBSL (200)
Office and accounting equipment	0.3119	5	DBSL (200)
Nuclear fuel	0.2672	5	DBSL (200)
Other fabricated metal products	0.0917	7	DBSL (200)
Steam engines	0.0516	15	DBSL (150)
Internal combustion engines	0.2063	7	DBSL (200)
Metal-working machinery	0.1076	7	DBSL (200)
Special industrial machinery	0.1023	7	DBSL (200)
General industrial equipment	0.0998	7	DBSL (200)
Electric transmission and distribution	0.0500	15	DBSL (150)
Light trucks (including utility vehicles)	0.1925	5	DBSL (200)
Other trucks, buses and truck trailers	0.1725	5	DBSL (200)
Autos	0.3333	5	DBSL (200)
Aircraft	0.0687	5	DBSL (200)
Ships and boats	0.0611	10	DBSL (200)
Railroad equipment	0.0589	7	DBSL (200)
Household furniture	0.1375	5	DBSL (200)
Other furniture	0.1179	7	DBSL (200)
Other agricultural machinery	0.1179	7	DBSL (200)
Farm tractors	0.1452	7	DBSL (200)
Other construction machinery	0.1550	7	DBSL (200)
Construction tractors	0.1633	7	DBSL (200)
Mining and oilfield machinery	0.1500	7	DBSL (200)
Service industry machinery	0.1526	7	DBSL (200)
Household appliances	0.1650	5	DBSL (200)
Other electrical equipment	0.1834	7	DBSL (200)
Other nonresidential equipment	0.1473	7	DBSL (200)
Residential Equipment	0.1500	5	DBSL (200)

Table 2: Cost Recovery Parameters, Cont'd.

Asset	Economic Depreciation Rate (δ)[a]	Tax Depreciation Method[b]	
		Tax Life (Years)	Tax Recovery Method
Nonresidential Structures			
Office	0.0247	39	SL
Hospitals	0.0188	39	SL
Special care	0.0188	39	SL
Medical buildings	0.0247	39	SL
Multimerchandise shopping	0.0262	39	SL
Food and beverage establishments	0.0262	15	SL
Warehouses	0.0222	39	SL
Mobile structures	0.0556	39	SL
Other commercial	0.0262	39	SL
Manufacturing	0.0314	39	SL
Electric power structures[e]	0.0211	20/15	DBSL (150)
Gas structures	0.0237	20	DBSL (150)
Petroleum pipelines	0.0237	15	DBSL (150)
Wind and solar	0.0303	5	DBSL (200)
Communication	0.0237	15	DBSL (150)
Petroleum and natural gas	0.0751	5	DBSL (200)
Mining	0.0450	7	DBSL (200)
Educational and vocational	0.0188	39	SL
Lodging	0.0281	39	SL
Amusement and recreation	0.0300	7	DBSL (200)
Air transportation	0.0237	39	SL
Other transportation	0.0237	39	SL
Other railroad	0.0176	20	DBSL (150)
Track replacement	0.0249	7	DBSL (200)
Local transit structures	0.0237	39	SL
Other land transportation	0.0237	5	DBSL (200)
Farm	0.0239	20	DBSL (150)
Water supply	0.0225	25	SL
Sewage and waste disposal	0.0225	25	SL
Public safety	0.0237	39	SL
Highway, conservation, and development	0.0225	15	DBSL (150)
Residential Structures			
Owner-occupied buildings	0.0146	NA	NA
Tenant-occupied buildings			
Corporate ownership	0.0166	27.5	SL
Noncorporate ownership	0.0165	27.5	SL

Source: U.S. Department of the Treasury, Office of Tax Analysis

Notes: NA = not applicable. Assets are depreciated using the modified accelerated cost recovery system (MACRS). Under MACRS, tax life and tax recovery method jointly determine the depreciation schedule for an asset. The cost-of-capital model assigns one of nine different tax lives to each asset—3, 5, 7, 10, 15, 20, and 25 years for equipment and certain nonresidential structures; 27.5 years for residential rental property; and 39 years for most nonresidential real property. It also assigns one of three different tax recovery methods—straight

line (SL), 150 percent declining balance with a switch to straight line (DBSL (150)), and 200 percent declining balance with a switch to straight line (DBSL (200)). Tax life and tax recovery method can vary by industry. For example, the tax life of structures owned by farm businesses is limited to 20 years; farm businesses are assumed to depreciate all equipment and structures using the 150-percent declining balance method. Table 6 gives the tax lives and tax recovery methods that the cost-of-capital model generally assigns to depreciable assets owned by nonfarm businesses.

a. Economic depreciation rates are taken from Hulten and Wykoff (1981) and BEA (2003).
b. IRS *Publication 946* largely determines the assignment of tax life and tax recovery method by asset and industry.
c. Tape drives and disk access storage devices DASD are omitted from the listing of nonresidential equipment because their stock values had fallen to zero by 2008.
d. We assume that firms expense system integrators, custom software, and own-account software.
e. In calculating the present value of tax depreciation, almost 80 percent of electric power structures are assumed to have a recovery period of 20 years and just over 20 percent to have a recovery period of 15 years.

See Charles R. Hulten and Frank C. Wykoff, 1981, "The Measurement of Economic Depreciation" in *Depreciation, Inflation, and the Taxation of Capital Income*, Washington, DC: The Urban Institute, pp. 81-125; U.S. Department of Commerce, Bureau of Economic Analysis, 2003, "Fixed Assets and Consumer Durable Goods in the United States, 1925-1997" (September), available at http://www.bea.gov/national/pdf/Fixed_Assets_1925_97.pdf; U.S. Department of the Treasury, Internal Revenue Service, *Publication 946 How to Depreciate Property, for Use in Preparing 2012 Returns*, available at http://www.irs.gov/pub/irs-pdf/p946.pdf.