



CONGRESSIONAL BUDGET OFFICE

An Overview of CBO's Microsimulation Tax Model

June 2018

The Microsimulation Tax Model

Purposes of the Model

- **Revenue forecasts:** projections of individual income and payroll taxes under current law for CBO's *Budget and Economic Outlook* and *Long-Term Budget Outlook*.
- **Distributional estimates:** estimates of how income taxes and payroll taxes are distributed among taxpayers at different income levels.
- **Macroeconomic analyses:** estimates of how tax and transfer policies affect people's incentives to work and save—and how those behaviors, in turn, affect the broader economy.

The Microsimulation Modeling Approach

- Microsimulation modeling applies the rules of the tax system to each member of a representative sample of taxpayers.

- The microsimulation modeling approach has several advantages:
 - It models all of the interactions in a complex tax system.
 - It provides more flexibility than time-series forecasting techniques, which rely on past trends (despite frequent changes in tax law) to extrapolate future tax revenues.
 - It performs simulations using individual-level data, which makes it possible to examine subgroups of the population, such as low-income earners or families with children.
 - It allows analysts to evaluate how hypothetical changes to the tax system would affect total tax revenues and the distribution of taxes.

The Structure of the Model

- The model has three core components:
 - Several data preparation routines, which allow CBO to supplement primary data from tax returns with data from other sources;
 - A projection algorithm, which projects the future tax base by adjusting data from past years for expected demographic and economic changes; and
 - A tax calculator, which estimates taxes by applying tax rules to projected tax base.
- Additional modules allow the model to do more than project taxes:
 - Transfer calculators, which can simulate the effects of certain transfer programs;
 - Marginal rate calculators, which estimate the proportion of additional income paid in taxes (accounting for income and payroll tax rates as well as the phasing out of certain deductions and credits); and
 - Labor supply calculators, which estimate how people change the amount they work in response to tax changes.

Data

Primary Data

- The Statistics of Income (SOI) individual income tax file provides the primary data used by the tax model:
 - The SOI comprises a large sample of tax returns, with more than 300,000 records;
 - It contains all the variables needed to estimate income taxes, including most elements on tax returns, with additional detail on high-income tax returns; and
 - It is administratively verified.

- However, the SOI has some limitations:
 - It contains limited demographic information and no information on nontaxable income or people who do not file;
 - It is available only with significant lags—roughly 1.5 years after the end of the tax year; and
 - Its use is limited by statute.

Supplementary Data

- Because the primary tax return data do not provide all of the information necessary to project the future tax base, CBO uses data from other sources to impute, or fill in, the missing information.

Data Preparation Routine and Source

Imputed Information

Directly match to third-party forms filed with the IRS, including Forms W-2 and 1099

- Nontaxable Social Security benefits
- Split of earnings between married spouses
- Contributions to deferred compensation plans

Statistically match to the Current Population Survey

- Estimates of transfer income
- Estimates of the population that does not file tax returns

Tabulate data from CBO's Health Insurance Simulation model

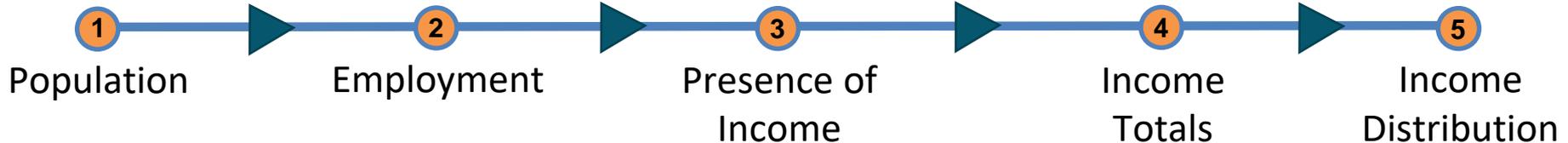
- Estimates of employer-sponsored health insurance premiums

Tabulate data from the Survey of Consumer Finances and the Consumer Expenditure Survey

- Potential value of itemized deductions for non-itemizers

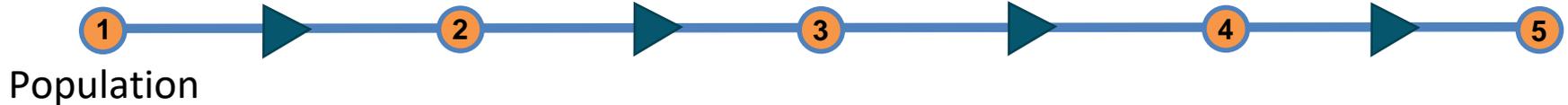
Projection Algorithm

Projecting the Future Tax Base: A Multistep Process



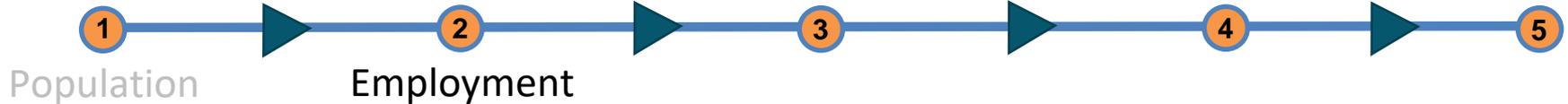
- Analyzing the future effects of the income tax system requires data that represent the expected demographic and economic characteristics of the filing population.
- To simulate the expected evolution of those characteristics, the model:
 - adjusts the weights of the tax returns in the sample to reflect expected changes in population and employment, and
 - adjusts the values of the various income items to reflect expected growth in income.

Step 1: Population



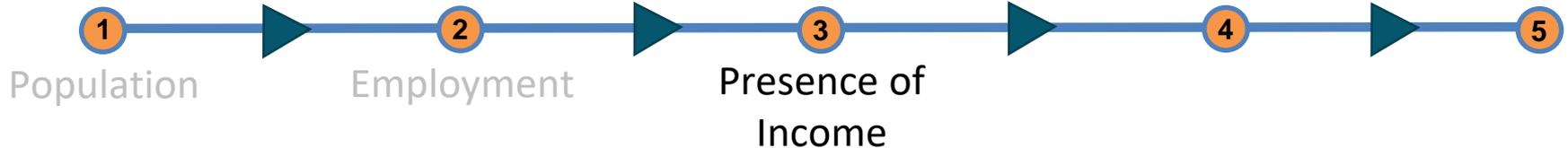
- The Congressional Budget Office Long-Term model provides projections of the population by age, sex, and marital status.
- The tax model uses the projected growth rates for each demographic group to create weight adjustment factors, which are applied to the tax model's population so that its growth and composition match the long-term model's projections.
- Married couples filing jointly are one tax unit for the purposes of the individual income tax and need only one weight adjustment—the average weight adjustment for the two spouses.

Step 2: Employment



- CBO's Macroeconomic Analysis Division provides a forecast of aggregate employment.
- The tax model creates weight adjustment factors so that the number of future workers in the model matches projected growth in aggregate employment. The demographic characteristics of the population are unchanged.

Step 3: Presence of Certain Income Sources



- CBO's Health, Retirement, and Long-Term Analysis Division and Budget Analysis Division generate target numbers of people with income from certain sources, such as employer-sponsored health insurance and unemployment insurance.
- The tax model probabilistically assigns each form of income to the target number of tax returns.

Step 4: Income Totals



- CBO's Macroeconomic Analysis Division provides a forecast of income sources that are part of national income (as defined in the national income and product accounts).
- CBO's Tax Analysis and Budget Analysis Divisions provide forecasts for some other income sources that are not part of national income, such as capital gains realizations.
- The tax model increases taxable income from each source at the same rate as its analog in the macroeconomic forecast by applying a uniform adjustment to each return in the sample.

Growth in Taxable Income: Data Sources

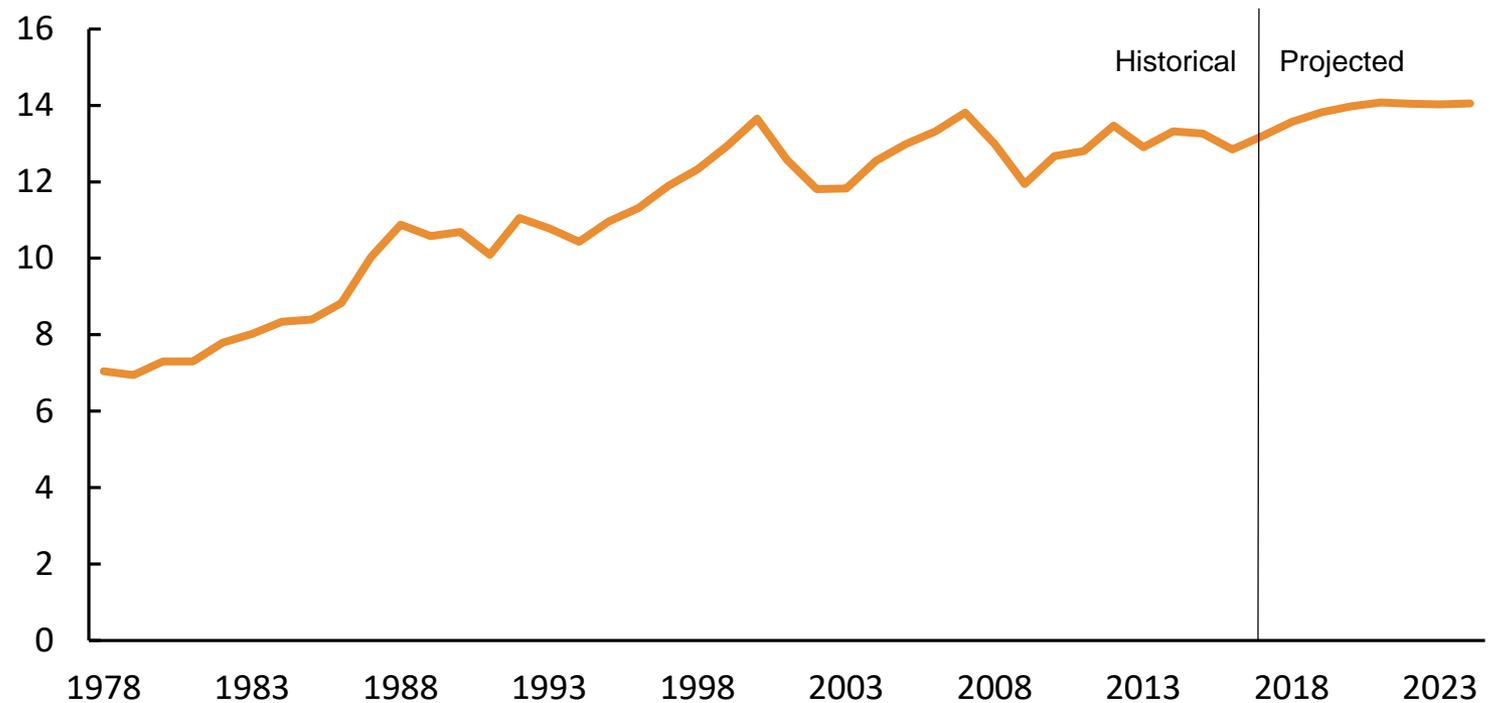
Component of Taxable Income	Data Source for Projected Growth Rates
Wages and salaries	Macroeconomic forecast of wage and salary disbursements, with adjustments for nontaxable employee contributions for fringe benefits
Interest and dividends	Macroeconomic forecast of monetary interest and personal dividend income
Business income (Schedule C and E)	Macroeconomic forecast of proprietors' income and corporate profits
Taxable pension and IRA distributions	Tax Analysis Division forecast
Capital gains realizations	Tax Analysis Division forecast
Social Security and unemployment insurance benefits	Budget Analysis Division forecast
Itemized deductions	Extrapolations from total income for each return in the sample

Step 5: Income Distribution



- The projection algorithm holds the distribution of most income sources roughly constant by applying the same growth rate to each return in the sample.
- Wages are the exception: The share of wages for the highest earners is estimated using a time-series regression.
- The distribution of overall income will change over time because the different income sources grow differentially.

Historical and Projected Share of Wages Earned by the Top 1 Percent of Earners



Sources: Congressional Budget Office, using data from Kopczuk, Saez, and Song (2010) and the Social Security Administration.

Estimates for 1978 to 1989 are based on tabulations of individual earnings records drawn from Wojciech Kopczuk, Emmanuel Saez, and Jae Song, “Earnings Inequality and Mobility in the United States: Evidence From Social Security Data Since 1937,” *Quarterly Journal of Economics*, vol. 125, no. 1 (February 2010), pp. 91–128, <http://dx.doi.org/10.1162/qjec.2010.125.1.91>.

Estimates for 1990 to 2016 are based on earnings as reported by employers on Internal Revenue Service Forms W-2 and tabulated by the Social Security Administration, “Social Security Online, Automatic Increases: Wage Statistics for 2016” (accessed September 16, 2017), www.ssa.gov/cgi-bin/netcomp.cgi?year=2016.

To account for differences in the methods used to generate the two sets of data, CBO adjusted the 1978–1989 estimates to reflect the average difference in years for which data were available for both series (1990–2004).

Projected Distribution of Adjusted Gross Income, by Income Group

Income Group	Calendar Year				
	2016	2017	2018	2019	2020
Top 1 Percent	20.1	20.9	21.2	21.5	21.3
Top 5 Percent	35.9	36.7	37.0	37.4	37.2
Top 10 Percent	47.6	48.3	48.5	48.8	48.7
Top 25 Percent	69.9	70.3	70.3	70.5	70.4
Top 50 Percent	89.7	89.8	89.6	89.7	89.6

Adjusted gross income comprises income from many sources, including wages and salaries, interest, dividends, capital gains realizations, business income, and some pension and Social Security income.

For additional data and explanatory notes, see Table 3, “Individual Income Tax Baseline Detail in CBO’s April 2018 Baseline,” in “Revenue Projections, by Category” (April 2018), www.cbo.gov/about/products/budget-economic-data#7.

Tax Calculator

The Microsimulation Model's Tax Calculator

- The core of the model is an income and payroll tax calculator, which can simulate the effects of past and future tax laws.
 - The calculator represents most values in tax law (such as tax brackets and the value of the standard deduction) with easily changeable parameters.
 - The calculator also accounts for the effects of certain government transfers, including Medicare Part B premiums and Supplemental Nutrition Assistance Program benefits.
 - Estimated tax liabilities for the current year are compared with taxpayers' actual liabilities to verify the accuracy of the computations.
 - The calculator generally estimates the change in taxes before taxpayers adjust their behavior.
 - Most behavioral estimates are produced with other tools, but the calculator is used to estimate some simple tax-minimizing behavior (such as choosing whether to claim the standard deduction or itemized deductions) and the effect of tax laws on the labor supply.

Individual Income Tax Details

From CBO's April 2018 Baseline

Billions of Dollars	Calendar Year				
	2016	2017	2018	2019	2020
Calculation of Adjusted Gross Income					
Salaries and wages	7,320	7,550	7,964	8,436	8,854
Taxable interest and ordinary dividends (excludes qualified dividends)	157	162	170	184	201
Qualified dividends	192	192	204	222	235
Capital gain or loss	631	821	905	947	907
Net business income (all income and loss reported on Schedule C, E, and F)	1,052	1,071	1,042	1,122	1,190
Taxable pensions and annuities and IRA distributions	962	1,051	1,125	1,188	1,241
Taxable Social Security benefits	289	312	338	369	399
All other sources of income	-83	-87	-94	-136	-141
Total income	10,520	11,072	11,654	12,332	12,886
<i>Subtract</i> statutory adjustments	153	154	156	166	175
Adjusted gross income	10,368	10,918	11,567	12,242	12,795
Calculation of Taxable Income					
<i>Subtract</i> Personal Exemption amount (before limit)	1,194	1,205	0	0	0
<i>Subtract</i> Standard deduction (non-itemizers only)	909	925	2,356	2,412	2,441
<i>Subtract</i> Total itemized deductions (itemizers only)	1,354	1,401	869	948	1,080
Total exemptions and deductions after limits	3,384	3,450	3,109	3,228	3,368
Taxable income	7,452	7,932	8,886	9,455	9,887
Calculation of Income Tax Liability					
Total income tax (including alternative minimum tax) before credits	1,531	1,635	1,627	1,748	1,840
Total credits (refundable and nonrefundable)	172	174	248	253	256
Income tax after credits	1,459	1,562	1,498	1,615	1,704
Net investment income tax	20	25	27	29	29
Individual income tax liability	1,479	1,587	1,525	1,643	1,733

For additional data and explanatory notes, see Table 3, "Individual Income Tax Baseline Detail in CBO's April 2018 Baseline," in "Revenue Projections, by Category" (April 2018), www.cbo.gov/about/products/budget-economic-data#7.

Examples of CBO Analyses Using the Microsimulation Model

- Revenue forecasts:
 - *The Budget and Economic Outlook: 2018 to 2028* (April 2018), www.cbo.gov/publication/53651.
 - *The 2017 Long-Term Budget Outlook* (March 2017), www.cbo.gov/publication/52480.

- Distributional estimates:
 - *The Distribution of Household Income, 2014* (March 2018), www.cbo.gov/publication/53597.
 - *The Distribution of Major Tax Expenditures in the Individual Income Tax System* (May 2013), www.cbo.gov/publication/43768.

Examples of CBO Analyses Using the Microsimulation Model (Continued)

- Analyses of the macroeconomic effects of changes to tax policy:
 - “Appendix B: The Effects of the 2017 Tax Act on CBO’s Economic and Budget Projections,” in *The Budget and Economic Outlook: 2018 to 2028* (April 2018), pp. 105–130, www.cbo.gov/publication/53651.
 - *How CBO Estimates the Effects of the Affordable Care Act on the Labor Market* (December 2015), www.cbo.gov/publication/51065.

- Analyses of marginal tax rates:
 - *Taxing Capital Income: Effective Marginal Tax Rates Under 2014 Law and Selected Policy Options* (December 2016), www.cbo.gov/publication/49817.
 - *Effective Marginal Tax Rates for Low- and Moderate-Income Workers* (November 2012), www.cbo.gov/publication/50923.

About This Document

These slides were prepared to enhance the transparency of the work of the Congressional Budget Office and to encourage external review of that work. In keeping with CBO's mandate to provide objective, impartial analysis, this document makes no recommendations.

Ed Harris composed this document and Christine Browne edited it. An electronic version is available on CBO's website (www.cbo.gov/publication/54096).