

Memorandum

TO: Joint Committee on Taxation Blue Ribbon Advisory Panel

FROM: Staff of the Joint Committee on Taxation

SUBJECT: Role of Joint Committee Microsimulation Models in Macroeconomic Model

DATE: October 3, 2002

One of the biggest challenges in modeling the effects of tax policy arises from the complexity of the existing tax code. On the individual side, the combination of the progressive rate structure with refundable and non-refundable tax credits, the phasing out of both credits and deductions at varying levels of adjusted gross income, and the alternative minimum tax system means that even a simple proposal such as an across-the-board rate cut can affect different taxpayers differently. Similarly, on the business side, the combination of specialized deductions, depreciation schedules, expenditure and production credits with carry-back and carry-forward rules and the corporate alternative minimum tax means a seemingly straightforward change can have unanticipated effects. The staff of the Joint Committee on Taxation (“Joint Committee staff”) has developed detailed microsimulation models for use in evaluating the effects of many of the tax proposals they are asked to estimate. The level of detail provided by these models is far greater than that embedded in the behavioral equations in macroeconomic models. However, information derived from these models is used to improve the accuracy of the modeling of specific tax proposals in all of the macroeconomic models Joint Committee staff uses. This paper provides a brief description of the two largest microsimulation models used by Joint Committee staff, and a discussion of the way information from these models is incorporated in the Joint Committee’s Macroeconomic Equilibrium Growth (“MEG”) model.

I. JOINT COMMITTEE MICROSIMULATION MODELS

(a) Individual income tax calculator

The largest microsimulation model employed by the Joint Committee staff is the individual income tax model, which uses as its primary data source a random sample of approximately 164,000 individual income tax returns. This file is provided by the Statistics of Income (“SOI”) division of the Internal Revenue Service for tax year 1998. It is a nationally representative sample of individual income tax returns, containing detailed information about each taxpayer’s sources of income, deductions, and tax liabilities. This data is statistically matched with the March 1999 Current Population Survey (“CPS”) to provide demographic and other information not available from income tax returns, and to supplement the income tax return data with information about individuals who do not file income tax returns. The matched file contains data for approximately 224,000 tax filing units and non-filer households.

Both the individual SOI data and the CPS data have weights assigned to each record¹ that allow the sample to represent the total population. The weights on the 164,000 tax returns in the SOI file are assigned to sum to the 124 million Federal tax filers with the same total incomes, deductions, and other characteristics as the population. Similarly, the weights for the CPS will sum to the total resident non-institutionalized population of the United States. The Joint Committee staff has started using a new procedure for preparing a statistical match between the individual SOI data and the CPS data.²

To adjust the data to reflect income, inflation, and population growth for the ten-year forecast period, the Joint Committee staff applies new weights and dollar adjustment factors to each record for each year in the budget forecast period. The new weights are created to ensure that the total population and a variety of population sub-groups will correspond to population forecasts of the Bureau of the Census. The dollar adjustment factors are applied to each record to account for increases in the dollar values of variables on the model and to ensure that the model corresponds with the Congressional Budget Office forecast of various sources of income and tax receipts. The Joint Committee staff target over 100 variables for each year of the forecast period. Additionally, the model has over 100 imputed variables for economic information that is not on the tax return, such as itemized deductions for non-itemizers.

To estimate the revenue effects of proposed changes in the individual income tax, the model is run twice: first calculating the tax liability for each of the sample returns on the basis of present law, essentially reproducing a tax return for each record, and a second time recalculating the tax liability for each return in the file using the new parameters contained in the proposed legislation. The tax calculator accounts for the interaction of all of the components of a taxpayer's return. For example, a 10-percent increase in the personal exemption does not necessarily increase the revenue loss associated with the personal exemption by 10 percent. Some returns will become nontaxable as a result of the increase; some returns will shift to a different marginal rate bracket; some filers may switch from itemizing to taking standard deductions; and some filers may end up paying under the alternative minimum tax system. The model will take these changes into account. After running the two iterations of the tax

¹ A "record" is the set of information from each of the matched tax returns and non-filing households obtained from the two data sets.

² In the past, Treasury's Office of Tax Analysis ("OTA") has provided Joint Committee staff with a CPS-matched file. However, the last year for which OTA has created such a file is 1995. While OTA has been developing other methods for adding non-tax information to the SOI files, Joint Committee staff believes that a revised and updated CPS-matched file best meets its current revenue estimating needs. The statistical match described in this section was completed in December of 2000. The matching method used by the Joint Committee staff is a statistically constrained predicted mean matching algorithm. For a general discussion of statistical matching techniques see J. Armstrong (1989), "An Evaluation of Statistical Matching Methods", Working Paper No. BSMD 90-003e. Also, for a discussion of the predictive mean matching technique used by the Joint Committee staff see D.B. Rubin (1986), "Statistical Matching using file concatenation with adjusted weights and multiple imputations", *Journal of Business and Economic Statistics*, 4, 87-94.

calculator, the model calculates the difference in total revenues between present law and the proposal. This result is often only the first step in estimating the revenue effect of a proposal. For example, as discussed below, the Joint Committee staff often must make adjustments to account for changes in taxpayer behavior, to reflect interaction among a package of proposals, or to reflect fiscal year budget reporting.³

(b) Corporate Tax Model

The JCT corporate tax model is a microsimulation model that is similar in structure to the individual tax model. This model uses as its main data source a sample of approximately 140,000 corporate tax returns provided by SOI. The model comprises a detailed set of calculations that replicate the present law construction of taxable income, regular tax and tax credits, and the alternative minimum tax and minimum tax credit. As in the individual model, the sample returns are weighted to represent the entire population of approximately five million U.S. corporations, with major income and deduction items summed to the totals observed for the entire population. The model simulates the aggregate corporate income tax by calculating the tax liability for each return in the sample file.

To simulate a policy change, the tax calculations are modified to reflect the proposed change, including any anticipated behavioral effects. The model then recalculates the tax and compares taxes generated under the proposal against those generated under present law. These results can be reviewed for specific corporations, grouped by industry, or considered in the aggregate. In order to complete the revenue analysis, the simulation results are extrapolated out through the budget forecast period.

Depending on the requirements of the policy simulation, the corporate model can be run either on a full cross section of sampled tax returns, i.e., one full year, or on a panel of returns constructed from any combination of tax years in the 1987 through 1998 period. The resulting panel run will require some re-weighting in order to correct for corporations that are not sampled in every year and therefore removed from the panel. This panel feature is particularly useful in tracking net operating losses and credits that can be either carried back or carried forward to other tax years. For example, the corporate alternative minimum tax gives rise to a credit against the regular tax in subsequent years. A panel run allows the characteristics of each corporation to

³ To be useful tools in budget analyses, estimates must be presented in a form consistent with the Federal government's cash-flow accounting system. Under this system, amounts received by the Treasury are accounted for at the time of receipt and disbursements are accounted for during the period when paid out.

To be consistent with the cash-flow measure of budget receipts, revenue estimates are shown in a format that corresponds to fiscal-year receipts of the Treasury Department. Because taxes are most often calculated on a calendar-year basis, changes in calendar year tax liabilities are translated into changes in fiscal-year receipt of taxes.

be tracked over a period of years and thereby simulate the initial generation of the minimum tax liability and the subsequent use of the credit.

Many changes that affect corporate taxation also affect other forms of business entities. For example, a change in the calculation of a depreciation deduction generally applies across all business forms. As a result, the corporate model is supplemented with a variety of other models and data bases in order to estimate the revenue effects of provisions that change general business taxation. These supplemental sources include a depreciation model, the SOI partnership, sole proprietor, and farm data files, and their related models.

II. USE OF MICROSIMULATION RESULTS TO MODEL TAX POLICY CHANGES IN JOINT COMMITTEE MACROECONOMIC MODELS

Tax policy changes are typically incorporated in macroeconomic models, including the Joint Committee MEG model, through changes in average and marginal tax rates on different sources of income, and through any effect the policy might have on the after-tax cost of capital in the model. Joint Committee staff use the microsimulation models to determine average tax rates and average marginal tax rates for total personal income, and for each of five sources of individual income is modeled separately in MEG: compensation, dividends, interest, business income, and capital gains. Corporate taxable income is separately modeled in MEG. The average tax rates and the average marginal tax rates are calculated using the microsimulation models for the current (initialized) year and each year in the budget forecast period both under present law and under the proposal. The values are then weighted by income and inserted into the appropriate equations in Joint Committee macroeconomic models. The average tax rates calculated from the models are weighted by the incomes of the taxpayers, rather than by the number of taxpayers. Weighting the tax rate variables by income provides the best measure of the amount of economic activity affected by particular tax proposals. The next two sections provide examples of this procedure. The first example is of an across-the board individual tax rate cut. The second example is of a proposal to increase the amount of equipment that may be expensed.

(a) Change in individual income tax rates

The computation of average tax rates from the individual tax calculator is straightforward. Results of the simulations are typically configured to report changes in taxable income and in tax liability by adjusted gross income and by tax filing status. For purposes of providing information for the MEG model, results are also broken down by the four types of income separately modeled in MEG. Average tax rates for total individual income are computed by a simple division of total individual tax receipts by taxable income.⁴ Because deductions,

⁴ Because the income measures to which the MEG model are calibrated are based on data from the National Income and Product Accounts (“NIPA”), which does not define all forms of income in the same way as the Internal Revenue Code, it is necessary to make further adjustments to calibrate the taxable income in the MEG model to the taxable income aggregates obtained from the Joint Committee tax files. Joint Committee staff has used two approaches to reconciling these differences. The simplest is to calculate the percent change in tax rates from the microsimulation models, and change the tax rates generated endogenously in MEG by the

credits, and exemptions on individual tax returns do not always correspond to specific sources of income, yet they have an impact on the taxpayer’s average and marginal tax rates, rates for the separate sources of income are calculated by attributing tax liability to each income source in proportion to the amount that source contributes to the taxpayer’s total income. Marginal tax rates for each taxpayer are computed by giving each taxpayer an additional \$1000 in income, computing the change in tax liability for each taxpayer due to the increase in income, and dividing that by the \$1000 change in income. Average marginal rates are weighted by the income of the taxpayers. For evaluation of the effects of a proposed change in rates, the same computation is performed for the new tax rates, thus enabling a calculation of the change in marginal tax rates as a result of the proposal.

As an example of the impact of using the microsimulation model to calculate effective rate changes, Table I shows the average marginal rate change derived from the microsimulation model for a proposal to reduce individual income tax rates by 10 percent.

Table I: Percent Change in the Average and Marginal Tax Rates, With no AMT Adjustment

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Wage	-8.8%	-7.8%	-5.7%	-3.7%	-3.3%	-2.8%	-2.8%	-2.8%	-5.9%	-5.8%
Interest	-8.4%	-6.1%	-5.2%	-2.7%	-2.7%	-2.3%	-2.2%	-1.8%	-5.3%	-4.9%
Dividends	-8.0%	-6.7%	-6.4%	-1.6%	-2.0%	-1.6%	-1.2%	-1.2%	-4.3%	-2.9%
Capital Gains	-6.1%	-5.2%	-5.1%	-0.4%	-2.5%	-1.4%	-1.4%	-1.4%	-4.3%	-3.4%
Average	-8.3%	-7.6%	-6.0%	-5.3%	-4.5%	-3.7%	-3.6%	-3.6%	-6.4%	-5.7%

Because of the phasing in and out of various credits and the alternative minimum tax under present law, a ten percent statutory rate cut in the regular tax with no change to the minimum tax reduces both marginal and average rates by less than ten percent, and it reduces the marginal rates by less than the average rate.

As Table II shows, ignoring the alternative minimum and implementing the same ten percent rate cut yields a much different change in average and marginal tax rates. In addition, the average and marginal rate cuts are not exactly equal to the ten percent statutory cut because of the other complexities of the tax system.

same percentage. A separate method is to modify the NIPA income measures in MEG such that the taxable income bases match those from the tax models, carefully accounting for all definitional sources of the differences. While the second approach is theoretically better, it has also proved to be quite difficult to implement. In the end, it is necessary to apply a “calibration” factor to the income measures in MEG to ensure a match for the two tax bases. The unaccounted for differences are generally explained as compliance and other reporting error factors.

Table II: Percent Change in Average and Marginal Tax Rates, With AMT Adjustment

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Wage	-10.0%	-9.8%	-9.4%	-9.4%	-9.3%	-9.4%	-9.7%	-9.7%	-9.5%	-9.9%
Interest	-9.6%	-8.2%	-8.3%	-7.3%	-7.3%	-7.4%	-7.4%	-7.5%	-7.7%	-7.7%
Dividends	-9.8%	-9.3%	-9.4%	-6.5%	-6.5%	-7.0%	-6.6%	-6.6%	-7.2%	-6.2%
Capital Gains	-8.1%	-7.6%	-8.2%	-4.9%	-6.7%	-6.4%	-6.1%	-6.5%	-7.0%	-5.7%
Average	-10.0%	-10.0%	-10.1%	-9.6%	-9.5%	-10.3%	-9.5%	-10.3%	-9.9%	-10.4%

In one specification of the MEG model, labor supply is determined by the changes in average tax rates on total income and average marginal tax rates on wages for four different groups of taxpayers.⁵ The individual tax calculator is used to compute separate average and marginal tax rates for each group under present law for purposes of calibrating the baseline, as well as under the proposals.

(b) Change in depreciation deduction

Joint Committee microsimulation tax calculators are also used to help assess the effect of a tax proposal on the user cost of capital, which determines investment in the MEG model. For example, a key component of the user cost of capital is the net present value of the tax deduction for depreciation. For a proposal that would significantly increase the rate of depreciation for some classes of property, such as a proposal to allow immediate expensing of 50 percent of the cost of purchase of new equipment, an accurate evaluation of the change in cost of capital would take into account features of the present law tax system that affect how much equipment spending can actually be expensed in a given year. Because some businesses are organized as C-corporations, and some are organized as flow-through entities that are taxed as individuals, it is necessary to use both the corporate and individual microsimulation models to evaluate the effects of an expensing proposal on the cost of capital.⁶

Tax return data in these models provides the necessary detail on the amount of property placed in service in each of the Modified Accelerated Cost Recovery System (“MACRS”) classes each year. This is crucial information, of course, because the change in the cost of capital from an expensing proposal depends heavily on what the present law depreciation allowance is. Tax return data also provides information about the amount of depreciation deductions firms are taking for capital placed in service for prior years, as well as other tax credits and deductions available to the firms. To obtain the present value of a 50 percent expensing proposal, for example, the depreciable basis in the tax calculators is adjusted to reflect the 50 percent expensing plus MACRS depreciation for the remaining basis. The tax calculators are run for

⁵ See “Consumption, Labor Supply, and Saving in the Joint Committee Macroeconomic Equilibrium Growth Model” for more information on these equations.

⁶ The MEG model currently has just one business sector (plus a separate housing sector), which is called “corporate,” but is calibrated to account for the entire business sector. One of the future improvements planned for the MEG model is disaggregating the business sector into two sectors.

present law, and for the proposal, and the increase in deductions due to the expensing proposal is computed.

Because some firms are operating at or near a net operating loss (“NOL”) position, not all of the 50 percent equipment expense can be deducted by each firm each year. Because businesses are generally allowed to carry losses back for two years and forward for 20 years, some of the firms that can’t make full use of the expensing in the first year may still accelerate deductions relative to the MACRS schedule by carrying the unused expensing forward. The corporate panel is especially useful for this information, as it allows multi-year simulations for the same firm, which provides information about the pattern of NOLs carried forward as well as the initial expensing deduction. This information is used to provide a pattern of allowable equipment depreciation deductions under 50 percent expensing.

In addition to providing information about the pattern of deductions for equipment, the corporate and individual models are used to calculate the average business tax rates for those businesses able to take the expense deduction. It is a straightforward calculation to determine the present value of the tax depreciation deduction. When the information from the microsimulation models is included in the calculation of the effects of the 50 percent expensing proposal, the change in the net present value of the tax depreciation due to the proposal can be significantly different from the change that would be calculated assuming the expensing could be fully used in each year. The following table shows the present value of the 50 percent expensing proposal assuming all of it is used, and assuming the usage rate indicated by Joint Committee staff tax calculators for several different rates of return.

Table III: Net Present Value of Tax Depreciation Under 50 Percent Expensing

Rate of Return	Percent Change in Unadjusted Calculation	Percent Change in Microsimulation Simulation	Percent Difference
0.05	6.5%	6.0%	-7.7%
0.1	12.5%	11.2%	-10.4%
0.15	18.0%	15.8%	-12.2%