Tax Module

Penn Wharton Budget Model’s Tax Module (PWBM-TM) uses a highly detailed simulation and projection of U.S. demographics from the Penn Wharton Budget Model Microsimulation model (PWBMsim). PWBM-TM incorporates the details from PWBMsim to forecast federal tax revenues attributable to different types of tax filers (individuals, families, head of households). It also allows an attribution by type of tax paid (income, payroll, business source). PWBM-TM uses PWBMsim output to split total income into business and labor income. Subsequently, business income is allocated across organizational form and subjected to corporate level taxation, where appropriate.

PWBM-TM uses PWBMsim inputs to better inform PWBM’s dynamic OLG model. The dynamic OLG model uses the tax functions generated by the PWBM-TM to produce a baseline of the U.S. macroeconomy and to calculate how changes in tax policy affect the U.S. macroeconomy accounting for how the changes feed back into the federal budget. Any discussion of fiscal policy is incomplete without considering the feedback effects estimated by the dynamic model (also called dynamic feedback effects or dynamic scoring). A careful analysis of any contemplated policy change includes the estimated macroeconomic feedback from those policy changes that affect revenues and outlays and is essential to understanding the true effect of any policy decision.
The Microsimulation outputs a myriad of variables. These variables include information on households (wage, gender, kids, etc.) as well as macroeconomic series.

These changes can take many forms. Examples include changes in statutory rates, deduction allowances, or credit eligibility.

The outputs of the Tax Module include revenues, outlays, and distributional analytics.

Revenues, outlays, and tax rates

Microsimulation

PWBMsim produces a set of individuals and families that are designated as tax filers. PWBM-TM uses these filers to forecast federal tax revenues. The tax filing units are not of interest independently for PWBM-TM. PWBM matches these tax filing units with the Internal Revenue Service (IRS) Statistics of Income (SOI) data. The SOI makes available a representative sample of the individual income tax-filers. This Public Use File (PUF)
allows PWBM to forecast the line items necessary to calculate a filer’s tax liability. It also gives PWBM enough information to model changes in the tax code that directly affect individuals. The latest version of this PUF is for tax year 2010.1

Static: Individual and Payroll

PWBM-TM uses income information from PWBMsim to subject each filing unit to the tax code. PWBM-TM calculates tax liability for each filing unit by accounting for the relevant income tax bracket, preferred tax rate, deduction, credits and the alternative minimum tax (AMT). By utilizing the associated schedules, PWBM-TM also accounts for business income/loss derived from corporate and non-corporate entities.

A tax filer’s labor income is subject to either Federal Insurance Contributions Act (FECA) or Self Employment Contributions Act (SECA) taxes. The tax rate applied depends on the total amount of labor income. The Social Security portion of FICA or SECA taxes is applied to income below a limit set by the IRS. PWBM forecasts this limit beyond the current tax year using PWBMsim’s estimate of the growth of nominal wages. The Medicare portion of FICA and SECA is not subject to an income limit.

A tax filer’s capital income is also subject to the requisite taxes. These taxes include the preferential rate on capital gains and dividends and the Net Investment Income Tax (NIIT). Capital income is derived from either corporate or non-corporate entities. Most corporations pay dividends or capital gains to owners net of a corporate level tax. Pass-through entities, sole proprietorship, partnerships and S corporations are not subject to an entity level tax. However, sole proprietorship and most partnership income is subject to payroll tax. Only S corporation income is subject to neither payroll nor an entity-level tax. PWBM-TM accounts for each of these tax situations.

The application of the tax rates under current law to the income projected from PWBMsim results in the baseline or current law projection. The current law projection is then adjusted as one or more proposed changes to the tax code are implemented. When changes to the tax code are considered, PWBM addresses potential behavior of tax filers.

Income Shifting due to Organizational Form

As an example, PWBM-TM is calibrated to reflect the current structure of business organization. The structure is dependent upon both the taxes faced by capital income received from both corporate and pass-through entities. As the relative difference in these taxes change, PWBM-TM applies an income-shifting elasticity to the baseline of business income. The result is a new income allocation between corporate and pass-through business form and therefore, new growth rates for corporate and pass-through income. This methodology is set forth in the literature and described in more detail here.

Proposals affecting Types of pass-through businesses

PWBM uses available data to account for changes in the tax code that affect certain industries or sectors. A recent proposal limited the types of pass-through businesses that benefit from a lower tax rate. PWBM uses the aggregate share of net income by industry to limit the amount of income subject to the lower rate.

In both the above cases, PWBM is limited by the available data. A tax filer’s schedule E contains aggregate amounts of pass-through income. That is, if a tax filer is in multiple businesses, the data will reveal only the total net income. It does not allow a decomposition into X net income from business A and Y income from business B. As such, the income shifted to or from corporate form cannot be properly allocated to certain
PWBM’s Tax Module

businesses and certain tax filers. Therefore, PWBM allocates the income shift by shares of aggregate net income. This difficulty is also present in limiting pass-through businesses subject to certain proposed provisions. Given the absence of information on specific pass-through businesses, the income subject to the relevant provisions is limited by determining the aggregate share of net income of those businesses and then applying that share to all pass-through income.

Income Reclassification

PWBM accounts for behavior related to income reclassification. As the relative tax rates change, tax filers may be induced to not only change the organizational form of their businesses but also change their employment status and form a pass-through business to take advantage of lower tax rates. PWBM considers the effort involved in starting a business as well as the non-monetary benefits of employment in determining the amount of this income reclassification. The model randomly selects wage earners with high enough income and subsequently reclassifies the wage income. The percentage of wage earners selected increases over time. The share of wage earners reclassifying does not equal one since PWBM believes there are certain occupations and jobs that will not allow this reclassification.

Income Realization

The economics literature has found evidence that individuals respond to tax changes by adjusting the timing of income realization. Therefore, PWBM-TM models this behavior. PWBM-TM uses a supporting model to adjust income levels across time. The amount of income that moves across time is dependent upon the Elasticity of Taxable Income (ETI). PWBM-TM implements an elasticity in the middle of the range of estimates.4

Distributional Analysis

The individual side of PWBM-TM produces two distributional measures. The first measure is the traditional distributional measure. It indicates the share of the total value of the tax change that accrues to various income groups. The second measure is the share of tax paid by certain income groups. Both measures are calculated directly as part of PWBM-TM’s standard output. PWBM is equipped to provide any output that relates taxes to filing status, income group or type of income.

Static: Corporate and International

Corporate Data

Unfortunately, there is no available microdata for business entities. PWBM uses the aggregate SOI data to forecast the line items on business tax forms. These forms include the various 1120s as well as the 1065 and the associated schedules. PWBM utilizes the available SOI data to distinguish among entities by certain characteristics. These characteristics include major and minor industry defined by two-digit and three-digit North American Industry Classification System (NAICS) code and size by both total assets and business receipts. PWBM creates cross-tabulations by merging the available size and industry data to create distinctions between firms by size, industry and size and industry. This disaggregation allows PWBM to use models that forecast business activity and tax liability for each of these sub-aggregate groups. For pass-through entities (1065, 1120-S, 1120-REIT, 1120-RIC), the aggregate amounts are shared out to ultimate taxpayers when the data is available. PWBM also split the sub-aggregate data by 1120 filers excluding REITs, RICs and S corporations. The data is available from the IRS tax stats website.

Corporate Liability
Corporate income tax is estimated using the sub-aggregate data. Each sub-aggregate model simulates a single representative corporation’s behavior. Total corporate liability is calculated by combining the results from each sub-aggregate model. In this way, the PWBM-TM allows for heterogeneity across firms in forecasting income and deductions.

Depreciation

An important aspect of the corporate model is the benefit of depreciation. PWBM uses a model that forecasts the usage of 15 different classes of investments with differing depreciation schedules across the sub-aggregate groups. The corporate tax module uses this model to adjust the amount of depreciation deductions as the incentives for investment change. For example, under a temporary expensing provision, the expectation is that corporations would move investment corporations would have undertaken in later years into years where immediate expensing is allowed. The amount of timing shift is estimated by PWBM using historical data.5

Net Operating Losses (NOLs)

NOLs are also an important aspect of the corporate tax code because it allows corporations to smooth income across a number of years (two years back and up to 20 years forward). As such, it is important to model the use of NOLs. In modeling the use of NOLs, PWBM relies upon the literature on the differential tax treatment of losses for corporations.6 PWBM uses the analysis in the literature to model limitations on the use of NOLs for each sub-aggregate group.7

Other Deductions

PWBM forecasts other deductions on the sub-aggregate business returns by estimating the relationship between the deductions and macroeconomic variables forecasted by PWBMsim. These deductions include the net interest and the research and experimentation deductions among others.

Effective Tax Rates

PWBM’s corporate tax module produces average effective tax rates (ETR). The nature of the sub-aggregate models based on PWBM’s merging of available SOI data allows for a calculation of ETRs by size, industry or size and industry. Each sub-aggregate model projects income and expenses and therefore, liability (as noted here).

International Income Shifting

The modeling of international income shifting is not unlike the modeling of organizational form shifting mentioned above and described in detail here with the relevant tax rate comparison between the U.S. and a worldwide rate. The economics literature has produced a number of semi-elasticities for the relationship between profits and tax rates of foreign countries. PWBM uses an elasticity in the middle of the range of estimates (0.8) to calibrate the corporate tax module.8 As the U.S. corporate tax rate falls/increases, the model increases/decreases the amount of corporate income on the representative 1120. This change in income represents both repatriation of income by U.S. multinationals and increased investment by foreign multinationals (1120-F).9

PWBM-TM Output
The combination of the individual, corporate and international simulators produce the static revenue and outlay effects that would result from a change in either the macroeconomy as forecasted by the PWBMsim or the tax code. These changes are described in the distributional analysis of the changes, the change in marginal and average tax rates and the change in corporate ETRs. The results are also used to construct tax functions that are used as an input to PWBM’s dynamic model. These tax functions describe the tax rates faced by both labor and capital income. The results of PWBM-TM are useful for any discussion of policies that affect the tax code. This usefulness is evident in the distributional display and data visualization. However, policy analysis that does not consider how proposed policy changes affect both the macroeconomy and feed back into the federal budget is incomplete.

Dynamic OLG Model

PWBM’s dynamic OLG model is detailed here. PWBM-TM’s tax functions are an important input into PWBM’s dynamic general equilibrium OLG model since the tax functions account for household and firm heterogeneity. This model is used to evaluate proposed policy changes over long time horizons by calculating the macroeconomic effects of those policy proposals on individual households and the macroeconomy. These macroeconomic effects feed back into the budget primarily through changes to interest rates and wages. This type of analysis is important in understanding the true budgetary effect of any policy change that affects the macroeconomy (including changes to outlays and revenues as well as changes that affect immigration or national infrastructure). By allowing for the macroeconomic feedback associated with any policy change, the dynamic OLG model better describes the timepath of the variables of interest than an independent static model. The model traces the timepath by allowing the behavioral responses of households to change economic aggregates prices and economic aggregates and therefore, the path of the economy. The dynamic OLG uses the tax functions, the revenues and the outlays from PWBM-TM to produce two sets of results: static and dynamic. The former is the set of results from the dynamic model that does not allow agents to optimize their behavior. The latter is the set of results from the dynamic model that does allow agents to optimize their behavior.

Post Processing

Our dynamic OLG model does not explicitly account for all of the demographic richness present in PWBMsim due to computational constraints. In the final, post-processing step, we combine the output of the dynamic OLG model and PWBMsim to produce predictions which incorporate the demographic richness of the PWBMsim with the dynamic effects of the OLG model. In post processing, the percent changes in macroeconomic and budget aggregates between the static and the dynamic versions of the dynamic OLG models are calculated. These ‘deltas’ reflect the macroeconomic feedback effects present in the economy. Tools developed by PWBM combine PWBMsim with the dynamic OLG by using the deltas. This approach captures the richness of detail in the microsimulation model along with the behavioral changes observed in the dynamic OLG model. Our data visualization tool (pictured) automatically compiles the results for use by our researchers.
1. The 2012 data has been ordered.  

2. PWBM-TM also accounts for the associated SECA deduction.  

3. This proposal was included in the Tax Cuts and Job Act of 2017.  


7. PWBM benefited greatly from conversations with Matthew Knittel of Pennsylvania’s Independent Fiscal Office as well as Treasury experts.  


9. PWBM is unable to distinguish due to lack of data.