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The Economic Impact of Lowering Income Tax Rates in Wisconsin*

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February 24, 2023

*The views expressed herein are those of the authors and not necessarily those of the Center for Research on the Wisconsin Economy, the Department of Economics, or the University of Wisconsin – Madison.

Executive Summary

- Individual income tax rates in Wisconsin are higher than the rates in most other states. The state's statutory rate for the bottom-income bracket is the 14th highest among all states and the District of Columbia, and its statutory rate for the top-income bracket is the 10th highest. The tax has become more progressive as well: The difference between the top and the bottom statutory rates has more than doubled since 2000.
- We construct a model that captures the salient features of the Wisconsin economy and its tax system and use it to measure the effects of tax policies on gross state product, household consumption, business investment, and tax revenue.
- A key feature of our approach is modeling the behavioral responses from households and firms. Lower taxes increase business activity and household income, increasing the tax base and partially offsetting the loss of revenue from lower tax rates.
- Lower tax rates increase business investment and worker skill attainment. Both of these channels increase wages and household private consumption.
- Even low-income households who pay no income tax, and thus are not directly affected by a rate reduction, benefit from the higher wage rates induced by the lower tax rates.
- We consider 12 policies that lower the state's individual income tax rates, keeping intact other features of the tax structure, e.g., personal exemptions, standard deductions, and tax credits. We focus on the long-run impacts. We find that all 12 options would increase output and household well being. As an example, switching from the current tax system to a flat tax of 3.25% would
  - Increase gross state product by 4.5% ($13.7 billion). Because most income from pass-through businesses is subject to the top statutory rate, reducing the top rate is more effective in promoting investment and capital formation. Lowering the tax rates for other income brackets leads to more skill investments and higher levels of worker productivity.
  - Increase household consumption by 4.4% and after-tax income by 5.27%. Lower taxes increase household well being, even if they reduce government consumption expenditures valued by the household.
  - Lower tax revenue by 16.8%. The Legislative Fiscal Bureau forecasts a 21.5% decrease in revenue. The difference, about $1.1 billion, arises because our estimate accounts for the increased economic activity that results from lower tax rates.

1 The Individual Income Tax in Wisconsin

The individual income tax is the largest source of tax revenue for the state of Wisconsin. It accounted for 44.8% of the state's general fund revenue in fiscal year 2022 (Wisconsin Department of Revenue, 2022). In comparison, the general sales and use tax accounted for 34%, the corporate income tax accounted for 14.4%, excise taxes accounted for 3.2%, public utility taxes accounted for 1.9%, insurance company premium fees accounted for 1.1%, and miscellaneous taxes accounted for 0.7%.

Wisconsin has a progressive individual income tax system. The statutory marginal tax rate, which is the tax rate on the last dollar earned by a household, increases with household income. As shown in table 1, there are four taxable income brackets in 2022, where the marginal tax rate increases monotonically from 3.54% to 7.65%. The tax rate structure is cumulative, so that each tax rate applies only to income that falls within the corresponding bracket. A taxpayer with income exceeding the threshold for the top bracket would have income subject to each of the four tax rates.

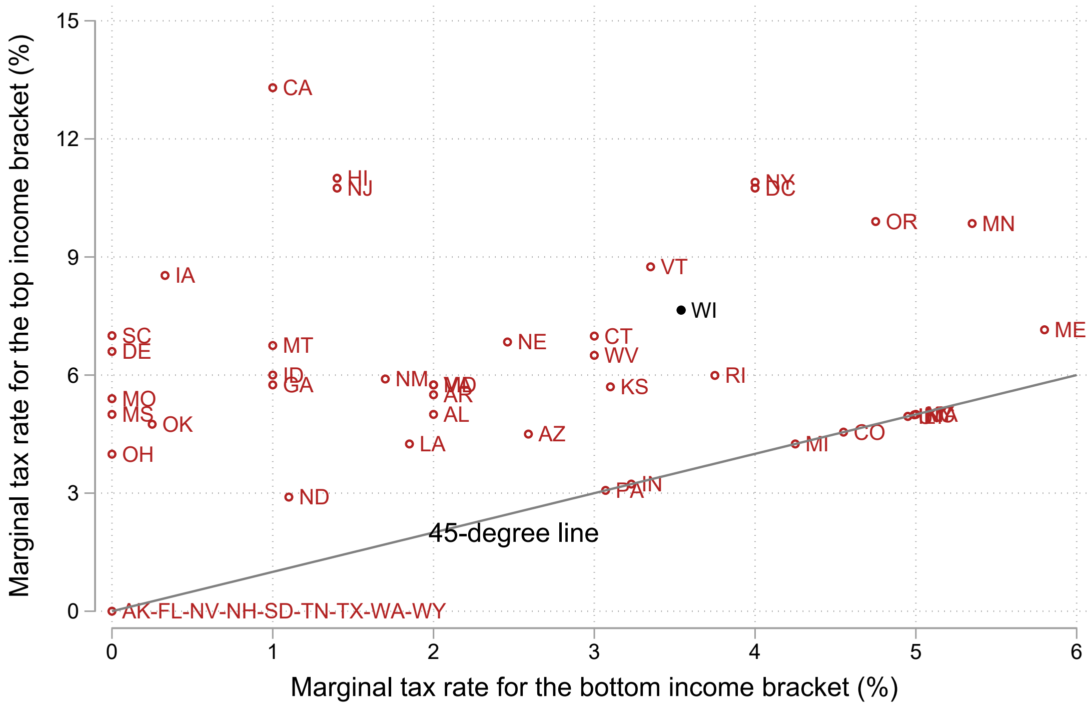
Table 1: Wisconsin Individual Income Tax Rates and Brackets: 2022

	Taxable income brackets ($)		
Marginal tax rate (%)	Single	Married jointly	Married separately
3.54	Less than 12,760	Less than 17,010	Less than 8,510
4.65	12,760 to 25,520	17,010 to 34,030	8,510 to 17,010
5.30	25,520 to 280,950	34,030 to 374,600	17,010 to 187,300
7.65	280,950 or more	374,600 or more	187,300 or more

The marginal tax rates in Wisconsin are higher than the rates in most other states. Using data compiled by the Tax Foundation (2022), figure 1 plots the marginal tax rates for wage and salary income in each U.S. state and the District of Columbia in 2022. The horizontal axis plots the marginal tax rates for the bottom income brackets, while the vertical axis plots the marginal tax rates for the top income brackets. Both rates are zero in nine states, including New Hampshire which only taxes dividend and interest income, Washington which only taxes income from capital gains, and seven states which levy no individual income tax at all (Alaska, Florida, Nevada, South Dakota, Tennessee, Texas and Wyoming). Nine other states are on the 45-degree line (Colorado, Illinois, Indiana, Kentucky, Massachusetts, Michigan, North Carolina, Pennsylvania and Utah), because they have a flat rate that does not vary with income. Wisconsin's statutory rate for the bottom income bracket is the 14th highest among all states, and its statutory rate for the top income bracket is the 10th highest.

The individual income tax in Wisconsin has become more progressive. Figure 2 shows that the statutory rate for the bottom income bracket dropped from 4.77% in 2000 to

Figure 1: Statutory Marginal Tax Rates by State: 2022



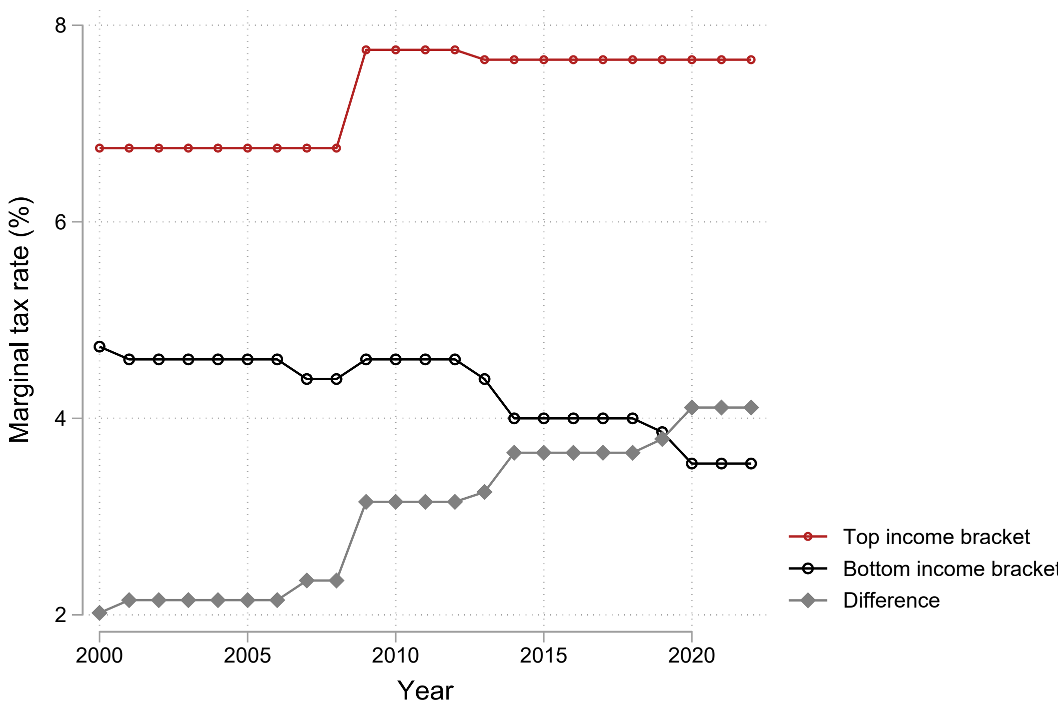
3.54% in 2022. During the same period of time, the statutory rate for the top income bracket increased from 6.77% to 7.65%. As a result, the difference in the statutory rates for the two income brackets, a measure of the progressivity of the income tax structure, has more than doubled from 2% in 2000 to 4.11% in 2022.

1.1 Statutory vs Effective Marginal Tax Rates

Taxable income brackets vary across states and over time. In Wisconsin, the thresholds for the income brackets are indexed to inflation and vary from one year to the next. The brackets are based on taxable income, which is different from gross income due to various exemptions and deductions. To be more precise, the base for Wisconsin individual income tax is Wisconsin adjusted gross income (WAGI), which is gross income adjusted for income and expenses exempt from the state's individual income tax. Taxable income is determined by subtracting standard deductions and personal exemptions from WAGI. Taxable income is multiplied by the applicable tax rates to arrive at gross tax liability. Finally, net tax liability is determined by subtracting nonrefundable and refundable tax credits from gross tax liability.

As a result of the exemptions, deductions and tax credits, the effective marginal tax rate faced by a household, defined as the derivative (i.e., the slope) of net tax liability with

Figure 2: Statutory Marginal Tax Rates in Wisconsin



respect to gross income, could be different from the statutory rate, which is the derivative of gross tax liability with respect to taxable income.

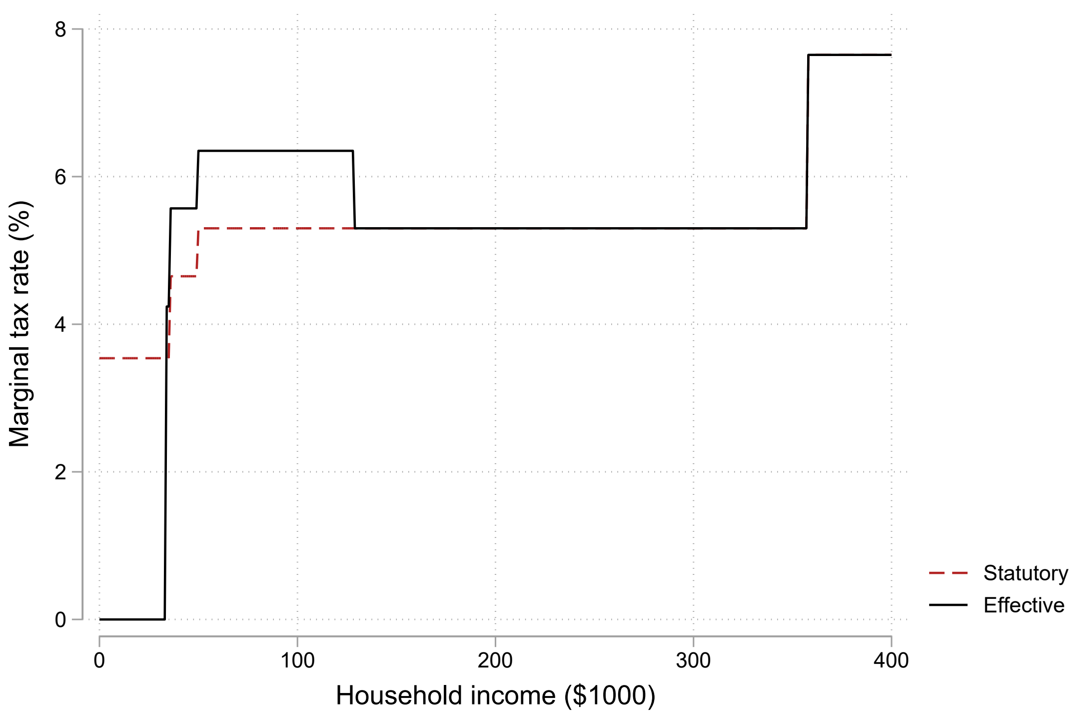
Since 2001, a $700 personal exemption is provided for each taxpayer, the taxpayer's spouse, and for each individual claimed as a dependent. An additional $250 exemption is provided for each taxpayer who has reached the age of 65 before the end of the tax year (two exemptions are provided if both the taxpayer and the taxpayer's spouse are 65 at the end of the year). Thus, for each taxpayer age 65 or over, the total exemption is $950.

Each tax unit also has a sliding-scale standard deduction. For 2022, a single taxpayer with WAGI less than $16,990 has a standard deduction of $11,790. For single taxpayers with WAGI between $16,990 and $115,240, the standard deduction declines with WAGI at a rate of 12%. For single taxpayers with WAGI in excess of $115,240, no standard deduction is provided. Similarly, married taxpayers filing a joint return have a standard deduction of $21,820 if their WAGI is less than $24,520. If their WAGI is greater than $24,520 but less than $134,845, the standard deduction decreases with WAGI at a rate of 19.778%. No standard deduction is provided for married taxpayers filing a joint return whose WAGI is greater than $134,845.

Wisconsin provides several nonrefundable and refundable tax credits that may be subtracted from gross tax liability to arrive at Wisconsin net tax. For example, two-earner families filing married-joint are eligible for a married couple credit equal to 3.0% of the earned income of the secondary wage earner, up to a maximum credit of $480. The state also offers the earned income tax credit in addition to those offered at the federal level. More details about Wisconsin's individual income tax provisions could be found in Legislative Fiscal Bureau (2023b).

Figure 3 plots the two marginal tax rates for hypothetical married couples filing jointly in Wisconsin. For simplicity, we assume each married couple is a two-earner family with no children, and the only difference across the couples is household income, which is split equally between the two earners in each family. The effective marginal tax rate is calculated using TAXSIM, a software program developed by the National Bureau of Economic Research (NBER) for calculating federal and state tax liabilities from individual data (Feenberg and Coutts, 1993). Because the latest version of TAXSIM incorporates state laws through 2021, the figure is for 2021. There was no change in the statutory rates in Wisconsin between 2021 and 2022.

Figure 3: Marginal Tax Rates for Hypothetical Married Couples Filing Jointly in Wisconsin



Due to personal exemptions and standard deductions, the effective rate is zero and lower than the statutory rate for low-income couples. The effective rate is higher than the statutory rate for middle-income couples. This is mainly due to the phase-out of standard deductions. Because standard deductions decline at a rate of 19.778%, each additional dollar increases taxable income by $1.19778, so that the effective rate is 1.19778 times the statutory rate. Finally, the effective rate is equal to the statutory rate for high-income couples where the standard deduction is zero. Guo and Williams (2019) discuss in more details how the effective rate could deviate from the statutory rate due to various tax credits.

Accounting for exemptions and deductions, Wisconsin is still a state with a high effective marginal tax rate and a high level of income tax progressivity. To see this, for each state, we calculate the effective marginal tax rates for three hypothetical married couples filing jointly. As above, we assume each married couple is a two-earner family with no children, and the only difference across the three couples in the same state is household income, which is split evenly between the two earners in each family. For each state, we set the household income of the three couples to \$10 thousand, \$70 thousand, and \$1 million, respectively.[1] Using TAXSIM, we calculate the effective marginal tax rate for each married couple in each state. We use the effective rate faced by the middle-income (\$70 thousand) couple as a measure of the level of the tax rate for the average household, and use the difference between the effective rate faced by the high-income (\$1 million) couple and the effective rate faced by the low-income (\$10 thousand) couple as a measure of the progressivity of the individual income tax in each state. Figure 4 plots the two measures for each state and the District of Columbia. Wisconsin is near the top of the distribution for each of the two measures.

1.2 Tax Distribution

Table 2 reports the distribution of the Wisconsin individual income tax in 2021. On average, the state individual income tax accounts for 3.94% of household income. This average tax rate increases from 1.09% for households in the second quintile of the income distribution to 5.49% for households in the top 1% of the income distribution. Relative to income, taxes are more concentrated among households in the top of the income distribution. For example, households in the top 1% of the income distribution account for 17.04% of total income and 23.71% of the state's total individual income tax revenue.

1.3 Federal Individual Income Tax and Pass-through Income

Wisconsin's individual income tax is levied on top of the federal individual income tax, which is also progressive. Moreover, both the federal and state taxes apply to income from pass-through businesses, which is concentrated among households in the top of the income distribution.

Figure 5 plots the federal marginal tax rates for the same hypothetical married couples used in figure 3. Similar to the state individual income tax, the federal statutory marginal

[1] \$70,000 is the approximate 2021 median household income in the United States (United States Census Bureau, 2022).

Figure 4: Effective Marginal Tax Rates for Hypothetical Married Couples Filing Jointly in Each State

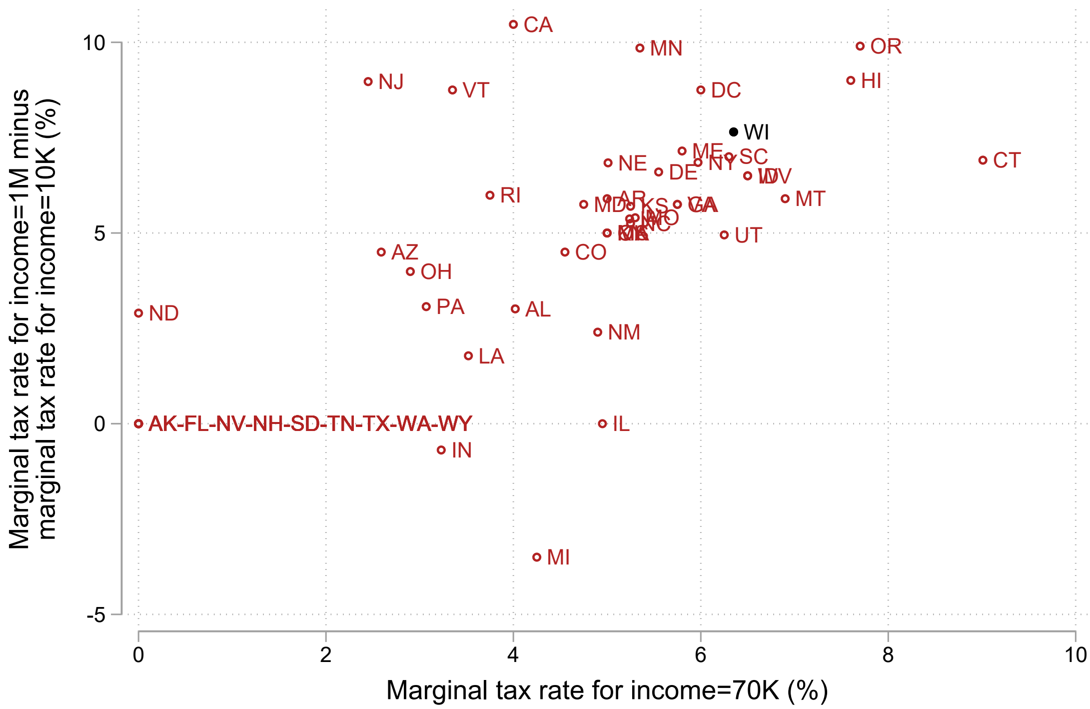


Table 2: Wisconsin Individual Income Tax in 2021

	Average			Share of	
Income distribution	income ($)	tax ($)	tax rate (%)	income (%)	tax (%)
0–20 percent	521	15	2.96	0.16	0.12
20–40 percent	19,519	214	1.09	5.83	1.62
40–60 percent	39,831	1,024	2.57	11.90	7.76
60–80 percent	69,312	2,447	3.53	20.70	18.53
80–95 percent	127,816	5,269	4.12	28.63	29.92
95–99 percent	263,478	12,113	4.60	15.74	18.34
99–100 percent	1,141,408	62,635	5.49	17.04	23.71
All	66,961	2,641	3.94		

tax rate is not always equal to the effective rate due to various deductions and tax credits. For very low-income households, the effective federal tax rate is negative because (1) taxable income (gross income minus deductions and exemptions) is zero, and (2) the earned income tax credit, which is refundable, increases with gross income. As household income increases, the earned income tax credit starts to phase out, causing the effective federal tax rate to be larger than the statutory rate. For households with incomes between $150,000 and $160,000, the effective federal tax rate is 50% and much higher than the statutory rate. This is due to the phase out of the Economic Impact Payments which were enacted by the American Rescue Plan act of 2021.

For a married couple whose income is around $70,000, both the statutory and the effective rates are 12%. There is also a payroll/FICA tax rate of 7.65%, so that the total rate at the federal level is 19.65%. Adding the 6.35% effective rate at the state level, the total rate for the couple is 25.95%.

Figure 5: Federal Marginal Tax Rates for Hypothetical Married Couples Filing Jointly in Wisconsin

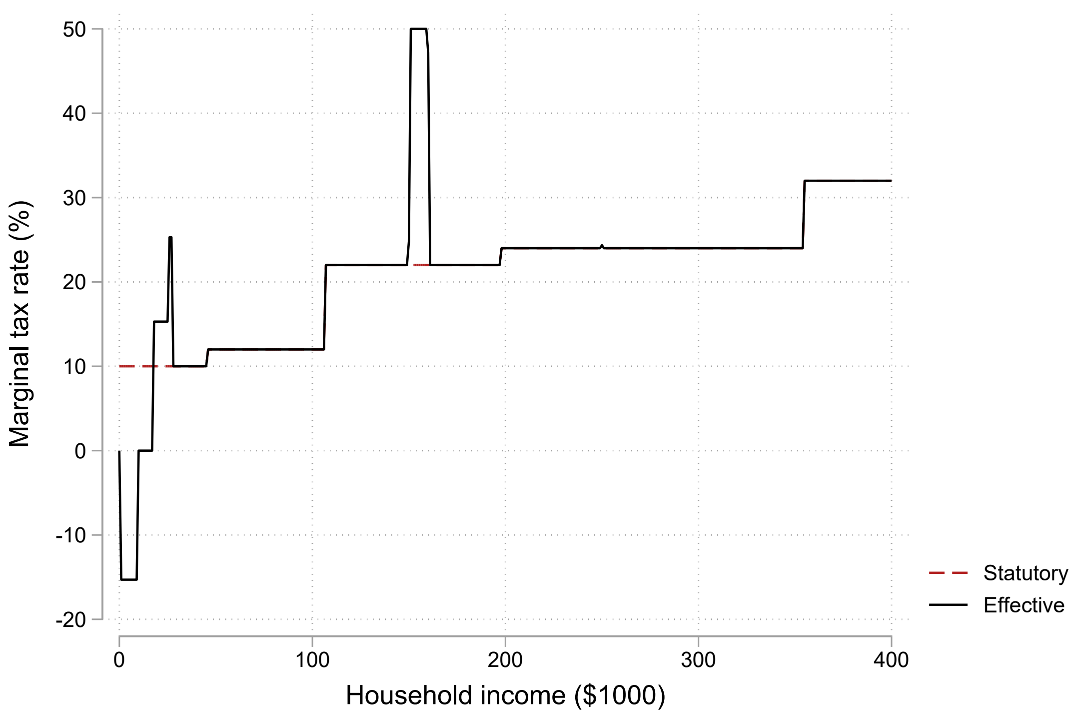


Table 3 reports the distributions of federal individual income tax and pass-through income among Wisconsin households in 2019. It is based on the state data from the Statistics of Income program of the Internal Revenue Service (2022). While the data is available until 2020, we use the 2019 data to eliminate the impact of the COVID-19 pandemic.

For each income group, the second column reports the average tax rate, defined as the ratio between total federal tax liability and adjusted gross income. On average, the federal individual income tax accounts for 12.24% of Wisconsin household income in 2019. This average tax rate increases from 1.16% among households with income between $1 and $10,000 to 26.71% for households with income at $1 million or more.

Following Williams (2021), we define pass-through income as the sum of (1) partnership/S-corp net income (less loss) and (2) business or profession net income (less loss) reported on the federal tax returns. For each income group, the third column reports the share of households with pass-through income. Because the IRS reports the number of households with each of the two types of pass-through income separately, if some households report both types of pass-through income, there would be double counting when we add the two numbers together. With this in mind, the third column shows that high-income households are more likely to have pass-through income. For example, while the last row of the table shows that only 17.33% of all households reported any pass-through income, the penultimate row suggests that almost all households with income above $1 million have pass-through income.

The last column in table 3 reports the pass-through income from each income group as a share of the total pass-through income from all income groups. It shows that pass-through income is highly concentrated among high-income households: about 42% of all pass-through income is reported by households whose income is $1 million or more, 55% by households whose income is $500 thousand or more, and 75% by households whose income is $200 thousand or more.

Table 3: Federal Individual Income Tax in Wisconsin, 2019

		Pass-through income	
Income group ($)	Average tax rate (%)	% nonzero	% of all
Less than 1	-0.41	43.87	-5.93
1 to 10,000	1.16	9.59	0.51
10,000 to 25,000	2.70	13.17	2.90
25,000 to 50,000	5.49	11.12	4.26
50,000 to 75,000	7.54	15.59	4.33
75,000 to 100,000	8.26	19.87	4.53
100,000 to 200,000	11.01	26.13	14.07
200,000 to 500,000	17.13	49.26	20.23
500,000 to 1,000,000	23.88	77.94	13.18
1,000,000 or more	26.71	101.67	41.93
All	12.24	17.33	100.00

2 A Model of the Wisconsin Economy and Tax System

This section presents a model of the Wisconsin economy and its tax system. We build on the work by Williams (2021), which in turn is based on previous works by Schmitt-Grohé and Uribe (2003) and Uribe and Schmitt-Grohé (2017). The model assumes Wisconsin is a small open economy with free capital mobility but no labor mobility, i.e., capital can move freely into and out of the state, but labor cannot. Both the federal and state governments impose taxes on households and firms in the state. The state government has to balance its budget in each period, but the federal government does not have to balance its budget in the state.

Our model is different from the one in Williams (2021) in two important ways. First, Williams (2021) assumes worker productivity is fixed, so labor supply is the main channel through which households adjust to changes in the tax rate. In our model, worker productivity is endogenous. In addition to labor supply, workers will also adjust their skills in response to changes in the tax rate. We find that skill investment is an important channel through which tax reforms could affect the economy in the long run.

Second, Williams (2021) assumes the state tax revenue has no use, and only transfers from the federal government are valued by the households. In his model, all state tax revenue, and a large part of the federal tax revenue, are wasted. In contrast, we allow the state government to make transfers to the household, and allow the household to value consumption expenditures from both the federal and the state government. Accordingly, all tax revenues are useful, and lower tax rates are not necessarily *a priori* welfare improving.

2.1 Household

There is a representative household who lives forever. In each period t, the household chooses $c_t, n_{1,t}, n_{2,t}, x_t, d_t$, and s_t to solve

$$\max \sum_{t=0}^{\infty} \beta^t u(c_t, c_{t-1}, G_t, n_t = n_{1,t} + n_{2,t}) \tag{1}$$

$$\text{s.t. } \rho_t(w_t h_t n_{1,t} + s_{t-1}\pi_t - r_{t-1}d_{t-1}) + T_t + d_t = \\ d_{t-1} + (1+\tau_{c,t})c_t + (1+\tau_{x,t})x_t + p_t(s_t - s_{t-1}) \tag{2}$$

$$h_{t+1} = (1-\delta_h)h_t + z(h_t n_{2,t})^{\gamma_1} x_t^{\gamma_2}, \tag{3}$$

where β is the discount factor, and $u(c_t, c_{t-1}, G_t, n_{1,t} + n_{2,t})$ is the flow utility in period t that depends on (private) consumption in the current period c_t, consumption in the previous period c_{t-1}, government expenditures G_t, and labor supply $n_t = n_{1,t} + n_{2,t}$.

$n_{1,t}$ is the work time that results in labor income $w_t h_t n_{1,t}$, where h_t is the household's productivity or human capital, and w_t is the wage rate per unit of human capital. The household also receives dividend income $s_{t-1}\pi_t$, where π_t is firm profits and s_{t-1} is the household's share of the firm determined in the previous period. Both types of income are taxable. Given the interest rate r_{t-1} and debt level d_{t-1} determined in the previous period, the household makes an interest payment of $r_{t-1}d_{t-1}$, and receives a deduction in the same amount when filing for the income tax. After-tax income, $\rho_t(w_t h_t n_{1,t} + s_{t-1}\pi_t - r_{t-1}d_{t-1})$, is

$$\begin{aligned}\rho_t(w_t h_t n_{1,t} + s_{t-1}\pi_t - r_{t-1}d_{t-1}) = {} & w_t h_t n_{1,t} + s_{t-1}\pi_t - r_{t-1}d_{t-1} \\ & - \tau^f_{y,t}(w_t h_t n_{1,t} + \theta_c s_{t-1}\pi_t - r_{t-1}d_{t-1} - \gamma^f_t) \\ & - \tau^s_{y,t}(w_t h_t n_{1,t} + \theta_c s_{t-1}\pi_t - r_{t-1}d_{t-1} - \gamma^s_t)\end{aligned} \tag{4}$$

where $\tau^f_{y,t}$ and γ^f_t are the federal individual income tax rate and deductions/exemptions, and $\tau^s_{y,t}$ and γ^s_t are the state individual income tax rate and deductions.

T_t is the amount of government transfers, d_t is the debt level chosen in the current period, $\tau_{c,t}$ is the tax rate on consumption goods, $\tau_{x,t}$ is the tax rate on goods x_t used to produce the household's human capital in the next period h_{t+1}. Following Ben-Porath (1967), we assume h_{t+1} depends on the current level of human capital h_t, a depreciation rate δ_h, learning ability z, learning time $n_{2,t}$ and goods input x_t. Finally, p_t is the price of one share of the firm, s_t.

The law of motion for human capital implies

$$x_t = \left(\frac{h_{t+1} - (1-\delta_h)h_t}{z(h_t n_{2,t})^{\gamma_1}}\right)^{\frac{1}{\gamma_2}}. \tag{5}$$

Substituting this into the budget constraint, we have

$$\begin{aligned}&\rho_t(w_t h_t n_{1,t} + s_{t-1}\pi_t - r_{t-1}d_{t-1}) + T_t + d_t = \\ &\qquad d_{t-1} + (1+\tau_{c,t})c_t + (1+\tau_{x,t})\left(\frac{h_{t+1} - (1-\delta_h)h_t}{z(h_t n_{2,t})^{\gamma_1}}\right)^{\frac{1}{\gamma_2}} + p_t(s_t - s_{t-1}).\end{aligned} \tag{6}$$

Let λ_t be the Lagrange multiplier for this budget constraint. The first order conditions for

c_t, $n_{1,t}$, $n_{2,t}$, d_t, s_t and h_{t+1} are

$$\lambda_t(1+\tau_{c,t}) = u_1(c_t, c_{t-1}, G_t, n_t) + \beta u_2(c_t, c_{t-1}, G_t, n_t) \tag{7}$$

$$u_4(c_t, c_{t-1}, G_t, n_t) = -\lambda_t w_t h_t (1-\tau_{y,t}) \tag{8}$$

$$u_4(c_t, c_{t-1}, G_t, n_t) = \lambda_t (1+\tau_{x,t}) \frac{\partial x_t}{\partial n_{2,t}} \tag{9}$$

$$\lambda_t = \beta \lambda_{t+1}(1 + (1-\tau_{y,t}) r_t) \tag{10}$$

$$\lambda_t p_t = \beta \lambda_{t+1}(p_{t+1} + (1-\tau_{y,t+1}\theta_c)\pi_{t+1}) \tag{11}$$

$$\lambda_t(1+\tau_{x,t})\frac{\partial x_t}{\partial h_{t+1}} = \beta \lambda_{t+1}(w_{t+1} n_{1,t+1}(1-\tau_{y,t+1}) - (1+\tau_{x,t+1})\frac{\partial x_{t+1}}{\partial h_{t+1}}), \tag{12}$$

where $u_i(c_t, c_{t-1}, G_t, n_t)$ is the partial derivative of $u(c_t, c_{t-1}, G_t, n_t)$ with respect to its ith argument, and

$$\frac{\partial x_t}{\partial n_{2,t}} = -\frac{\gamma_1}{\gamma_2} n_{2,t}^{-\frac{\gamma_1}{\gamma_2}-1} \left(\frac{h_{t+1} - (1-\delta_h) h_t}{z h_t^{\gamma_1}} \right)^{1/\gamma_2} \tag{13}$$

$$\frac{\partial x_t}{\partial h_{t+1}} = \frac{1}{\gamma_2}(h_{t+1} - (1-\delta_h)h_t)^{\frac{1}{\gamma_2}-1}(z(h_t n_{2,t})^{\gamma_1})^{-\frac{1}{\gamma_2}} \tag{14}$$

$$\frac{\partial x_t}{\partial h_t} = -[1 - \delta_h + \gamma_1(h_{t+1}/h_t - 1 + \delta_h)]\frac{\partial x_t}{\partial h_{t+1}}. \tag{15}$$

2.2 Firms

Following Williams (2021), we assume there are three types of firms: a fraction θ_c are C-corporations, θ_p are pass-throughs, and θ_g are non-profits and government. All types produce with a common production function $F(k, l) = Ak^{\alpha} l^{1-\alpha}$, where k is (physical) capital and l is labor input measured in efficiency units. Each type $o \in \{c, p, g\}$ faces a different tax $\tau_{o,t}$ on its net income in period t, which is taken to be output minus the wage bill and a depreciation allowance with rate δ. Let $i_{o,t}$ be the investment of a type-o firm in period t. The after-tax profit $\pi_{o,t}$ of the firm is

$$\pi_{o,t} = F(k_{o,t}, l_{o,t}) - w_t l_{o,t} - i_{o,t} - \tau_{o,t}(F(k_{o,t}, l_{o,t}) - w_t l_{o,t} - \delta k_{o,t}). \tag{16}$$

C-corporations face the combined federal and state corporate tax denoted as $\tau_{c,t} = \tau^f_{c,t} + \tau^s_{c,t}$, pass-throughs face the combined federal and state personal income tax rate $\tau_{p,t} = \tau^f_{p,t} + \tau^s_{p,t}$, and non-profits are not taxed. Because the ownership of pass-through businesses is particularly concentrated among high-income earners, the tax rate on pass-through income is allowed to differ from the tax rate on other sources of income, e.g., $\tau^f_{y,t}$ and $\tau^s_{y,t}$.

In general, firms of different types facing different tax rates will choose different levels of capital and labor. In order to preserve simple aggregation, following Williams (2021), we assume firms hire from a common labor market, and the shares of the different types are fixed over time, such that, for any $o \in \{c, p, g\}$, $k_{o,t} = \theta_o k_t$, $l_{o,t} = \theta_o l_t$ and $i_{o,t} = \theta_o i_t$, where k_t, l_t and i_t are aggregate capital, labor and investment at time t, and the total profit π_t of all firms at time t is

$$\pi_t = \sum_o \pi_{o,t} = F(k_t, l_t) - w_t l_t - i_t - \tau_{f,t}(F(k_t, l_t) - w_t l_t - \delta k_t), \tag{17}$$

where

$$\tau_{f,t} = \sum_{o \in \{c,p,g\}} \theta_o \tau_{o,t} \tag{18}$$

is the average tax rate for firms at time t.

The firms are owned by the household, and they maximize the present discounted value of profits, $\sum_t \beta^t \lambda_t \pi_t$, by choosing labor, l_t, and investment, i_t. The first-order condition for labor is

$$F_l(k_t, l_t) = w_t. \tag{19}$$

Let $k_{t+1} = k_t(1 - \delta) + i_t$ be the law of motion for capital. The first-order condition for k_{t+1} is

$$\lambda_t = \beta \lambda_{t+1}(1 + (1 - \tau_{f,t+1})(F_k(k_{t+1}, l_{t+1}) - \delta)). \tag{20}$$

2.3 Government

There are two levels of government. The federal government imposes three types of taxes: the individual income tax (with tax rate $\tau^f_{y,t}$ and exemptions γ^f_t), the corporate tax (with tax rate $\tau^f_{c,t}$), and the tax on pass-through businesses (with tax rate $\tau^f_{p,t}$).

The federal government does not have to balance its budget in the state. Let REV^f_t be the federal tax revenue from the state, G^f_t be federal (consumption) expenditures in the state, and T^f_t be the federal transfers to the household in the state. We assume

$$G^f_t + T^f_t = (1 + m^f_t) REV^f_t, \tag{21}$$

with m^f_t being a measure of the net transfers from the federal government to the state in period t. Let $s^f_{G,t} = \frac{G^f_t}{G^f_t + T^f_t}$ be the consumption share of federal expenditures in the state. We assume $s^f_{G,t}$ is time-invariant.

The state government imposes four types of taxes: the individual income tax (with tax rate $\tau^s_{y,t}$ and exemptions γ^s_t), the corporate tax (with tax rate $\tau^s_{c,t}$), the tax on pass-through businesses (with tax rate $\tau^s_{p,t}$), and sales taxes on consumption (with tax rate $\tau_{c,t}$) and goods input for skill production (with tax rate $\tau_{x,t}$).

Let REV^s_t be the state tax revenue in period t, G^s_t be state government expenditures, and T^s_t be the transfers from the state government to the household. We assume the state government must balance its budget in each period, so that

$$G^s_t + T^s_t = REV^s_t \tag{22}$$

for each t. Let $s^s_{G,t} = \frac{G^s_t}{G^s_t + T^s_t}$ be the consumption share of state government expenditures. We assume $s^s_{G,t}$ is time-invariant.

The combined federal and state government expenditures in period t is $G_t = G^f_t + G^s_t$. The combined federal and state transfers to the household in period t is $T_t = T^f_t + T^s_t$.

2.4 Equilibrium

In equilibrium, both the household and the firms' decisions must be optimal, and they must be consistent with each other and the government's policies. In particular, the government expenditures G_t and transfers T_t taken as given by the household must be consistent with those determined by the federal and state governments.

Assuming workers cannot move across the state border, labor demand l_t must equal labor supply $h_t n_{1,t}$. Since capital can move freely across the state border, capital demand k_t does not have to equal its supply in the state, $-d_t$. Instead, we assume the interest rate r_t faced by the household and firms in the state is given by

$$(1 - \tau^f_{y,t} - \tau^s_{y,t})r_t = (1 - \tau^f_{y,t})r^*_t, \tag{23}$$

where r^*_t is determined outside the state and could be viewed as the interest rate faced by households and firms in states with no individual income tax ($\tau^s_{y,t} = 0$).

2.5 Steady State

We now describe how some of the key variables are determined in the steady state, where all variables are time invariant. These expressions are useful for understanding the effects of the tax reforms described in the next section. For brevity, we ignore the t subscript unless it is helpful.

Combining the first-order condition for labor demand l (equation 19)and the equilibrium condition where labor demand equals to labor supply $l = hn_1$, we have

$$w = (1 - \alpha)A \left(\frac{k}{hn_1}\right)^{\alpha}. \tag{24}$$

Combining the first-order conditions for work time n_1 and learning time n_2 from the household, we have

$$n_2 = \left(\frac{\gamma_1(1+\tau_x)}{\gamma_2 wh(1-\tau_y)}\right)^{\frac{\gamma_2}{\gamma_1+\gamma_2}} \left(\frac{\delta_h h}{zh^{\gamma_1}}\right)^{\frac{1}{\gamma_1+\gamma_2}}. \tag{25}$$

Combining the first-order condition for household debt d_t from the household and the first order condition for capital k_{t+1} (equation 20) from the firm, we have

$$\frac{(1-\tau_y^f)r^*}{1-\tau_f} + \delta = F_k(k, hn_1) = \alpha A\left(\frac{k}{hn_1}\right)^{\alpha-1}. \tag{26}$$

Combining the first-order condition for household debt d_t with the first order condition for human capital in the next period h_{t+1}, we have

$$\frac{1-\tau_y}{1+\tau_x} wn_1 = \frac{(1-\tau_y)r + (1-\gamma_1)\delta_h}{\gamma_2}(\delta_h h)^{\frac{1}{\gamma_2}-1}(z(hn_2)^{\gamma_1})^{-\frac{1}{\gamma_2}}. \tag{27}$$

Combining the first-order conditions for current consumption c_t and work time $n_{1,t}$, we have

$$\frac{1-\tau_y}{1+\tau_c} wh = -\frac{u_n(c, c_{-1}, G, n)}{u_c(c, c_{-1}, G, n) + \beta u_{c_{-1}}(c, c_{-1}, G, n)}. \tag{28}$$

3 Quantitative Analysis

We first calibrate the model to match the Wisconsin economy and its current tax system, and then use it to evaluate the effects of lower individual income tax rates.

3.1 Calibration

We assume the flow utility in period t is

$$u(c_t, c_{t-1}, G_t, n_t) = \log(\hat{c}_t - \kappa\frac{n_t^{1+\omega}}{1+\omega}) \tag{29}$$

$$\hat{c}_t = \{\phi(c_t - bc_{t-1})^{\frac{\nu-1}{\nu}} + (1-\phi)G_t^{\frac{\nu-1}{\nu}}\}^{\frac{\nu}{\nu-1}} \tag{30}$$

Following Sims and Wolff (2018), we assume the relative importance of private consumption is $\phi = 0.8$, the degree of consumption habit is $b = 0.722$, and the elasticity of substitution between private and government consumption is $\nu = 0.285$. With $\nu < 1$, consumption c and government spending G are complements. Other things equal, a reduction in G resulting from lower tax revenue would reduce the marginal utility of consumption and, in turn, labor supply n. As a result, lowering the tax rate does not necessarily lead to economic growth or improve welfare.

Following Williams (2021), we set

- $\omega = 1$. This is the elasticity of labor supply in the special case where households do not value government expenditures ($\phi = 1$) and have no consumption habit ($b = 0$). Unit aggregate labor supply elasticities are common in the macroeconomics literature (e.g., Prescott, 2004), although most microeconomic studies estimate lower labor supply elasticities. Chetty et al. (2011) and Keane and Rogerson (2012) discuss how aggregate elasticities capture different adjustment margins, and so small micro elasticities are consistent with large aggregate elasticities.
- the labor share to $1 - \alpha = 0.599$. This is the average of the total labor share from 2010 to 2020, where the total labor share in each year is the sum of the payroll labor share (which accounts for wages and salaries) and the proprietor's labor share. The payroll labor share is estimated using state-level data from the Bureau of Economic Analysis (BEA), while the proprietor's labor share is estimated using national data on Major Sector Productivity and Costs from the BEA.
- the physical capital depreciation rate to $\delta = 0.075$. This is based on the BEA's national data in the Fixed Assets Tables.
- the share of C-corporations to $\theta_c = 0.431$, and the share of pass-through businesses to $\theta_p = 0.424$. These are the payroll shares estimated from the County Business Patterns and the Nonemployer Statistics.
- the net transfers from the federal government to the state to $m_f = 0.13$, and the consumption share of federal expenditures in the state to $s_G^f = 0.538$. These are calibrated using data on federal spending in Wisconsin from the Rockefeller Institute of Government (2021), data on Personal Income by State from the BEA, and the IRS Statistics of Income data on federal tax revenue raised within Wisconsin. Net transfers are defined as personal current transfer receipts minus contributions for government social insurance. Federal government consumption G_t^f is the difference between federal expenditures in Wisconsin and net transfers.
- the national interest rate to $r^* = 0.04$ and the discount factor to $\beta = 1/(1+(1-\tau_y^f)r^*) = 0.97$.

Because pass-through income is highly concentrated among households in the top of the income distribution, we set the state tax rate for pass-through businesses to $\tau_p^s = 0.0765$, the top marginal rate for the individual income tax in Wisconsin, and set the federal tax rate for pass-through businesses to $\tau_p^f = 0.37$, the top marginal rate for the federal individual income tax.

Williams (2021) uses a lower federal rate $\tau_p^f = 0.28$ to account for the 20% deductions created by the Tax Cuts and Jobs Act of 2017. However, not all households are eligible for the deductions. For example, in 2021, married couples with taxable income above $329,800 and single filers with taxable income above $164,900 are not eligible. The results reported below are similar when we use either the lower value $\tau_p^f = 0.28$ or some value in between.

In 2021, the median household income in Wisconsin was $69,934 (United States Census Bureau, 2022). Figure 3 shows that the statutory marginal tax rate for married couples filing jointly with this median income is 5.3%, and the effective rate is 6.35%. The difference is due to the standard deduction, which phases out with income at a rate of 19.778%. Accordingly, we set the state individual income tax rate to $\tau_y^s = 0.0635$. Figure 5 shows that, for married couples filing jointly with the median income, the federal marginal tax rate is 12%. Adding the payroll/FICA rate of 7.65%, we set the federal individual income tax rate to $\tau_y^f = 0.1965$. These marginal rates are higher than the average tax rates for the median-income household shown in tables 2 and 3. The differences are accounted by deductions and exemptions, γ^f and γ^s, calibrated below.

We normalize total factor productivity to $A = 1$, and set $\tau_x = 0$ so that educational expenditures are not taxed. We set the human capital depreciation rate to $\delta_h = 0.035$. This is in the middle of the estimates used in the literature. For example, Heckman et al. (1998) assume human capital does not depreciate ($\delta_h = 0$), while Fan et al. (2022) find the depreciation rate is over 8%.

According to the Annual Fiscal Report of the State of Wisconsin (2022), 24.2% of its General Purpose Revenue was budgeted for aids to individuals. We take this as a measure of the state transfers to households and set $s_G^s = 1 - 0.242 = 0.758$.

The remaining parameters are chosen so that some steady-state statistics in the model match their values in the data. There are 9 parameters and 9 moments. The first two moments are (1) work time as a share of total discretionary time and (2) learning time as a share of total discretionary time. Assuming an individual has 14 hours of discretionary time per day, and they spend 8 hours on either work or training, we set $n_1 + n_2 = 0.571$. In the 60 years between age 6 and age 65, individuals in the U.S. spend about 14 years on education on average. Adding the training time after individuals leave school, we set $\frac{n_2}{n_1+n_2} = 0.25$. These two moments imply $n_1 = 0.428$ and $n_2 = 0.143$. These values are comparable with those used by Badel et al. (2020). They calculate the average work hours among individuals surveyed by the Panel Study of Income Dynamics, and find it accounts for about 40% of their discretionary time.

The third moment is educational expenditures as a share of the state's GDP. According to the Organisation for Economic Co-operation and Development (2022), private spending on education in the U.S. accounts for 1.89% of GDP in 2019, including 0.29% on primary and secondary education and 1.6% on tertiary education. This ignores other expenditures, such as early childhood education and on-the-job training. Gould and Blair (2020) estimate that U.S. parents spend about $42 billion each year on early childhood care and education, Additionally, they forgo roughly $30–35 billion in income because the high cost leads many parents to leave the paid labor force, or reduce their paid work hours, to care for their children. The direct cost and forgone income account for about 0.38% of U.S. GDP. Adding all of these together, we assume educational expenditures account for 7.2% of GDP.

The last six moments (and their values in the data) are: federal corporate income tax revenue in Wisconsin as a share of the state's GDP (1.02%), state corporate income tax revenue as a share of state GDP (0.47%), federal individual income tax revenue (including FICA) in Wisconsin as a share of the state's GDP (13.8%), state individual income tax revenue as a share of the state's GDP (2.53%), personal consumption expenditures as a share of the state's GDP (70.7%), and sales taxes as a share of the state's GDP (2.08%). We obtain the state GDP and personal consumption expenditures from the Bureau of Economic Analysis, obtain the state tax revenues from the Wisconsin Department of Revenue, and obtain the federal tax revenues in Wisconsin from the IRS. We use the data in 2019 to avoid the impact of the COVID-19 pandemic. The numbers are similar in other years. For example, state individual income tax revenue as a share of the state's GDP is 2.5% in 2021, only slightly smaller than the value of 2.53% in 2019.

Given these statistics, we find the effective consumption tax rate is $\tau_c = 3.39\%$, the effective federal corporate tax rate is $\tau_c^f = 15.7\%$, the effective state corporate tax rate is $\tau_c^s = 7.24\%$, the deductions for the federal individual income tax is $\gamma^f = 0.062$, the deductions for the state individual income tax is $\gamma^s = 0.211$, the steady-state debt level is $d = -0.603$ (which implies a positive level of savings), and the three parameters in the human capital production function are $(z, \gamma_1, \gamma_2) = (0.143, 0.518, 0.252)$, which are within the range of values used in the literature (Browning et al., 1999).

3.2 Effects of Lower Individual Income Tax Rates

With the calibrated model, we show what happens when we reduce state individual income tax rates. The related parameters are τ_y^s and τ_p^s. As shown previously, τ_p^s is effectively the top statutory rate shown in table 1, while τ_y^s is the effective marginal rate for the median-income ($69,934 in 2021) household, which is 1.19778 times the second-highest statutory rate shown in table 1.

We consider three values for the second-highest statutory rate, (4%, 3.25%, 2.5%), and five values for the top statutory rate, (6%, 5%, 4%, 3.25%, 2.5%). Because the top statutory rate must be (weakly) higher than the second-highest statutory rate, these values give us 12 options, which are listed in table 4.

Table 4: Alternative Statutory Marginal Tax Rates (%)

First	Second	Third	Fourth
Current policy			
3.54	4.65	5.3	7.65
Three brackets			
3.54	4.0	4.0	6.0
3.54	4.0	4.0	5.0
Two brackets			
3.54	4.0	4.0	4.0
3.25	3.25	3.25	6.0
3.25	3.25	3.25	5.0
3.25	3.25	3.25	4.0
2.5	2.5	2.5	6.0
2.5	2.5	2.5	5.0
2.5	2.5	2.5	4.0
2.5	2.5	2.5	3.25
One bracket			
3.25	3.25	3.25	3.25
2.5	2.5	2.5	2.5

While the model only incorporates two of the four statutory rates shown in table 1, because the two lowest statutory rates must be (weakly) lower than the second-highest rate, all 12 options also reduce the second-lowest rate, and the 9 options where the second-highest rate is less than 3.54% also reduce the lowest statutory rate. The policies considered also feature bracket collapse, including two flat tax proposals that collapse the tax structure into a single bracket.

One of the flat-tax rates we consider is 3.25%. The impact of switching to such a flat rate on Wisconsin's tax revenue was evaluated recently by the state's Legislative Fiscal Bureau (Legislative Fiscal Bureau, 2023c). The Legislative Fiscal Bureau's methodology does not consider behavioral responses from households and firms and does not provide estimates of the response of investment, labor supply, or human skills upgrading. We provide a more comprehensive analysis of this policy and other options that lower the state's individual income tax rates in the following.

For each option listed in table 4, we set τ_p^s to the top statutory rate, and set τ_y^s to 1.19778 times the second-highest statutory rate. We solve the steady state under the new parameter values, and compare it with the steady state in the baseline calibration.

Table 5 reports the effects of each option on capital k, labor l, and output $F(k,l)$. The value in each cell represents the percentage change in the outcome variable when we move from the current statutory rates to the lower rates given by the column and row titles. For example, the first number in the top panel shows that lowering the top statutory rate to 6% (from 7.65%) and the second-highest rate to 4% (from 5.3%) would raise the state's capital stock by 2.30%; the first number in the middle panel shows that the reform would increase the state's labor supply (measured in efficiency units) by 1.68%; and the first number in the bottom panel shows that the reform would increase the state's output by 1.93%. Unless noted otherwise, the same interpretation applies to the remaining tables in this section.

Table 5: Effects on Capital, Labor and Output

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
	Capital k				
4.00	2.30	3.05	3.81		
3.25	3.26	4.07	4.87	5.49	
2.50	4.45	5.32	6.19	6.85	7.52
	Labor l				
4.00	1.68	2.05	2.42		
3.25	2.63	3.05	3.48	3.80	
2.50	3.82	4.29	4.78	5.15	5.52
	Output $F(k,l)$				
4.00	1.93	2.45	2.98		
3.25	2.88	3.46	4.04	4.47	
2.50	4.07	4.70	5.34	5.83	6.32

Reading across each row, the effects are larger as the top statutory rate gets smaller. Similarly, reading down each column, the effects are larger as the second-highest statutory rate gets smaller. This suggests that lowering the two statutory rates, either individually or jointly, would raise the stocks of both capital and labor and, ultimately, output in Wisconsin.

Quantitatively, the effects are large. For example, the model suggests that reducing the top two statutory rates to 4% would raise output by about 3%, switching to a flat rate of 3.25% would raise output by about 4.5%, and switching to a flat rate of 2.5% would raise output by over 6%. Measured in 2021 dollars, the three options would raise the state's output by \$9.12 billion, \$13.71 billion, and \$19.36 billion, respectively.

Table 6: Effects on Output and State Tax Revenue: Billions of 2021 Dollars

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
		Output			
4.00	5.91	7.51	9.12		
3.25	8.84	10.60	12.37	13.71	
2.50	12.48	14.42	16.38	17.86	19.36
		State Tax Revenue			
4.00	-2.01	-2.16	-2.31		
3.25	-3.02	-3.17	-3.33	-3.44	
2.50	-4.02	-4.18	-4.34	-4.46	-4.58

While economic theories tend to predict a positive effect of tax cuts on economic growth, there is little consensus on the magnitude of this effect. Some studies find no or even a negative impact (e.g., Gale and Potter, 2002), while other studies find the effect is positive and large (e.g., Romer and Romer, 2010; Barro and Redlick, 2011; Mertens and Ravn, 2013; Zidar, 2019). The differences are partly due to the empirical method used to identify which tax cuts are exogenous and which are not. For example, the large effects estimated by Romer and Romer (2010), Mertens and Ravn (2013) and Zidar (2019) are all based on the more attractive narrative approach that uses historical records (such as congressional records, economic reports, and presidential speeches) to identify tax changes that were implemented for more exogenous reasons such as pursuing long-run growth or deficit reduction. Moreover, Gale and Samwick (2017) find the effects of tax cuts depend on how the tax cuts are financed. In particular, they find deficit-financed tax cuts are poorly designed to stimulate long-term growth and that tax cuts financed by spending cuts are more likely to have a positive impact on economic growth. Because our model requires the state government to balance its budget period by period, by construction, all tax cuts are financed by spending cuts.

It is not easy to compare our estimates, which focus on the long run, with the empirical estimates in the literature, which tend to focus on the short run due to data and identification issues. With this caveat in mind, some of the empirical estimates suggest that our estimates are reasonable. For example, Mertens and Ravn (2013) find a one percentage point cut in the average personal income tax rate raises real GDP per capita by 1.4% on impact and by up to 1.8% after three quarters. When the second-highest statutory rate is reduced from its current value of 5.3% to 3.25%, the effective tax rate τ_y^s for the household in the model is reduced by about $1.19778 \times (5.3 - 3.25) = 2.46$ percentage points. According to the estimates by Mertens and Ravn (2013), this could raise output by up to $2.46 \times 1.8 = 4.43\%$ after three quarters, which is not very different from our estimate of

4.47% in the long run.

The channels through which the two statutory rates affect the economy are different. Because the top statutory rate affects the tax rate for pass-through businesses (τ_p^s), the direct impact of a lower top statutory rate is that it reduces the average tax rate on firms (equation 18). The lower tax rate on firms τ_f leads to an increase in investment and, ultimately, the capital-labor ratio (equation 20, or equation 26 in the steady state). The higher capital-labor ratio raises the wage rate (w_t in equation 19, or w in equation 24 in the steady state). This effect on the wage rate is shown in table 7. Reading across each row, where the second-highest statutory rate is fixed, the percentage increase in the wage rate rises as the top statutory rate falls. Other things equal, a larger wage raises labor supply, hn_1, by raising both human capital h (equation 27) and work time n_1 (equation 28). As investment and labor supply increase, output also increases.

Table 7: Effects on the Wage Rate (w)

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
4.00	0.25	0.39	0.54		
3.25	0.25	0.39	0.54	0.65	
2.50	0.25	0.39	0.54	0.65	0.76

In contrast, the second-highest statutory rate has no impact on either the capital-labor ratio or the wage rate. The latter can be seen in table 7. Reading down each column, where the top statutory rate is fixed, we see the effect on the wage rate is the same even though the second-highest rate is changing. The direct effect of a lower second-highest statutory rate is that it increases labor supply (h in equation 27 and n_1 in equation 28). This induces investment by firms so that the capital-labor ratio remains unchanged, as dictated by the exogenous interest rate r^*. As labor supply and investment increase, output also increases.

The differences in the effects from changing the two statutory rates are a result of the model assumption that all income from pass-through businesses is subject to the top statutory rate, and all other income is subject to the second-highest statutory rate (scaled up by a factor of 1.19778 due to the phase-out of standard deductions). In reality, not all households with income from pass-through businesses are in the top income bracket, so lowering the statutory rates for other income brackets could also have a direct impact on investment and the wage rate. Similarly, the top income bracket may include some households with no pass-through income, so that lowering the top statutory rate could also have a direct impact on household human capital accumulation and labor supply.

Table 8 shows that lower tax rates raise human capital h but reduce work time n_1. Moreover, the increase in human capital is due to more goods input x, while the effect on the learning time n_2 is negative. The negative effects on n_1 and n_2 follow from two model features. First, household consumption c and government expenditures G are complements. Second, lowering the two tax rates reduces state tax revenue and, in turn, both state and total government expenditures. The lower government expenditures G reduces the marginal utility of consumption $u_c(c, c_{-1}, G, n)$. Other things equal, this has a negative effect on both work time n_1 (equation 28) and learning time n_2 (equation 25). Given the positive effects of lower tax rates on work time and learning time, discussed above, which work through human capital accumulation, the total effects depend on the relative strength of the two opposing forces. While we find a small negative effect under the current set of parameters, the effect could be zero or even positive under other parameter values, especially when the parameter υ representing the elasticity of substitution between household consumption c and government expenditures G is larger.

Table 8: Effects on Human Capital and Work Time

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
	Human Capital h				
4.00	1.89	2.21	2.54		
3.25	2.93	3.29	3.66	3.94	
2.50	4.15	4.56	4.97	5.28	5.60
	Work Time n_1				
4.00	-0.20	-0.16	-0.11		
3.25	-0.29	-0.23	-0.17	-0.13	
2.50	-0.32	-0.25	-0.18	-0.13	-0.07
	Learning Time n_2				
4.00	-0.20	-0.16	-0.11		
3.25	-0.29	-0.23	-0.17	-0.13	
2.50	-0.32	-0.25	-0.18	-0.13	-0.07
	Educational Expenditures x				
4.00	4.07	4.60	5.14		
3.25	6.30	6.89	7.49	7.94	
2.50	8.79	9.45	10.12	10.62	11.14

Table 9 reports the effect on state tax revenue. Not surprisingly, lowering the two tax rates significantly reduces individual income tax revenue. However, the effect on total revenue is much smaller, both because the individual income tax accounts for less than one half of total revenue, and because lowering the individual income tax rates raises the revenue from other sources. In particular, more output leads to more corporate tax revenue, and more consumption (table 12) leads to more sales tax revenue. Table 6 reports the effects on total revenue in billions of 2021 dollars, which are much smaller than the corresponding effects on output.

Table 9: Effects on State Tax Revenue

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
	Individual Income Tax				
4.00	-21.55	-23.43	-25.32		
3.25	-32.37	-34.34	-36.32	-37.80	
2.50	-43.37	-45.46	-47.55	-49.13	-50.70
	Corporate Income Tax				
4.00	1.31	1.45	1.60		
3.25	2.26	2.45	2.64	2.79	
2.50	3.44	3.68	3.93	4.12	4.32
	Sales Tax				
4.00	1.97	2.44	2.92		
3.25	2.98	3.51	4.03	4.43	
2.50	4.22	4.80	5.38	5.83	6.27
	Total Revenue				
4.00	-9.81	-10.54	-11.27		
3.25	-14.69	-15.44	-16.19	-16.75	
2.50	-19.56	-20.33	-21.11	-21.70	-22.28

One benefit of having a model, such as the one in this paper, is that it allows us to account for the behavioral responses by households and firms to policy changes. In contrast, government agencies tend to estimate the static effects of policy changes by ignoring the behavioral responses. While useful, the static effects could be significantly different from the total effects incorporating behavioral responses, and policies based purely on the static effects could lead to sub-optimal outcomes.

One related example is a recent report by the Wisconsin Legislative Fiscal Bureau (2023c). The report estimates the changes in revenue from switching to a flat tax rate of 3.25%. It finds that, in 2026, the first year when the new flat rate is fully implemented, the state's tax revenue would be $5,059 million lower than what it would have been under the current tax schedule. Legislative Fiscal Bureau (2023a) projects that, under the current tax schedule, the state's total tax revenue in 2024 would be $22,391.4 million. Assuming the total revenue in 2026 is 5% higher, switching to a flat rate of 3.25% would reduce the state's total revenue by 21.5%.

For comparison, we also estimate the static effects on state tax revenue using our model. For each option listed in table 4, we calculate the new revenue by applying the new tax rates to the steady state outcomes under the current tax rates, and compare it with the tax revenue under the current tax rates. Because we do not calculate the new steady state under the new tax rates, this calculation ignores the behavioral responses and is thus static.

Table 10 reports our estimates of the static effects on state tax revenue. Because we only change the individual income tax rates, the effects on corporate income tax and sales tax are zero by construction, and thus not reported in the table.

Table 10: Static Effects on State Tax Revenue

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
	Individual Income Tax				
4.00	-23.96	-26.48	-29.01		
3.25	-35.37	-37.90	-40.42	-42.32	
2.50	-46.79	-49.32	-51.84	-53.74	-55.63
	Total Revenue				
4.00	-11.93	-13.19	-14.45		
3.25	-17.62	-18.87	-20.13	-21.08	
2.50	-23.30	-24.56	-25.82	-26.76	-27.70

The estimates suggest that, in the absence of behavioral responses, switching to a flat rate of 3.25% would reduce the state's total tax revenue by 21.08%. This is very close to the value of 21.5% implied by the LFB reports discussed above. This suggests that our model does a good job in capturing the key features of the Wisconsin economy and its tax system.

The static effects on individual income tax and total revenue are much larger (in absolute values) than the total effects reported in table 9. For example, the total effect from switching to a flat rate of 3.25% is 20.5% smaller than the static effect (16.75% vs 21.08%). This is not surprising given the positive effects of lower tax rates on capital, labor and output discussed above, and the positive effects on consumption reported below.

Table 11 reports the effects on federal tax revenue in Wisconsin and the combined federal and state government consumption expenditures G in Wisconsin. Due to the positive effects on capital, labor and output, lower tax rates raise federal revenue in Wisconsin. Because we assume government consumption expenditures as a share of government revenue is fixed for both the federal and the state governments, and the positive effects on federal revenue are smaller (in absolute values) than the negative effects on state revenue, the combined federal and state government consumption expenditures in Wisconsin declines in all cases. This reduction in G reduces the marginal utility of consumption c

and is responsible for the negative effects on both the work time n_1 and the learning time n_2 discussed above.

Table 11: Effects on Federal Revenue and Government Expenditures in Wisconsin

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
	Federal Revenue				
4.00	1.84	2.34	2.84		
3.25	2.81	3.36	3.91	4.33	
2.50	4.03	4.64	5.26	5.73	6.20
	Government Consumption Expenditures G				
4.00	-1.64	-1.52	-1.39		
3.25	-2.43	-2.27	-2.11	-1.98	
2.50	-3.03	-2.84	-2.64	-2.48	-2.33

Quantitatively, the negative effects on government expenditures G are much smaller than the effects on state tax revenue. This is partly because federal revenue in Wisconsin is much larger than state revenue ($61.6 billion vs $19.6 billion in fiscal year 2021), so that, relative to the reductions in state revenue and state consumption expenditures, the increases in federal revenue and the associated federal government consumption expenditures in Wisconsin are larger in dollars than they are in percentages. In other words, the large presence of the federal government significantly reduces the negative effects of lower state tax rates on total government consumption expenditures in the state.

Finally, table 12 reports the effects on after-tax income, consumption and utility. The effects are positive in all cases. In particular, the model suggests that switching to a flat rate of 3.25% would raise after-tax income by 5.27%, consumption by 4.43%, and utility by 1.15%.[2]

3.3 A 10% Reduction in τ_y^s

In his 2023–2025 budget, Governor Tony Evers announced a 10% tax cut for single filers at or below $100,000 in annual adjusted gross income and married-joint filers at or below $150,000 (Evers, 2023). The credit would gradually phase out for single filers with adjusted gross incomes between $100,000 and $120,000 and married-joint filers with incomes between $150,000 and $175,000. Below the start of the phase-out thresholds, the credit will have a $100 minimum for single and married-joint filers and a $50 minimum for married-separate filers.

In the model, a 10% reduction in τ_y^s raises the state's capital stock, labor supply and output by 0.38%, after-tax income by 0.61% and consumption by 0.43%. It reduces the

[2] The steady-state change in utility is an upper bound on the welfare effect of the tax cut.

Table 12: Effects on After-tax Income, Consumption and Utility

	Top Statutory Rate				
2nd highest rate	6.00	5.00	4.00	3.25	2.50
	After-tax Income ρ				
4.00	2.47	2.97	3.47		
3.25	3.74	4.30	4.85	5.27	
2.50	5.25	5.86	6.48	6.95	7.42
	Consumption c				
4.00	1.97	2.44	2.92		
3.25	2.98	3.51	4.03	4.43	
2.50	4.22	4.80	5.38	5.83	6.27
	Utility $u(c, c_{-1}, G, n)$				
4.00	0.44	0.61	0.77		
3.25	0.65	0.83	1.01	1.15	
2.50	0.94	1.13	1.33	1.48	1.63

state's tax revenue by 3.54%. These effects are much smaller than the effects of the other options reported above. This is because (1) a 10% reduction in τ_y^s would only lower the second-highest statutory rate from its current value of 5.3% to 4.77%, which is higher than all options considered above, and (2) in the model, larger reductions in the tax rates lead to larger effects on the economy. Moreover, because the 10% tax cut proposed by Governor Evers excludes high-income households, while a 10% reduction in τ_y^s in the model applies to all households, the effects of the Governor's proposal could be much smaller than those reported above.

3.4 Heterogeneity

We now show how the effects of lowering tax rates could vary across households with different incomes. In addition to the median-income household, which is the focus of our calibration and the results discussed above, we consider two other households. We set the (pre-tax) income of the first household to $60,000, which is 14.29% below the median household income of about $70,000 in 2021, and we set the income of the second household to $80,000, which is 14.29% above the median household income. Figures 3 and 5 show that these two households face the same marginal tax rates as the median-income household studied above. Accordingly, they would face the same changes in the tax rates as the median-income household. We assume the fundamental difference across the three households (low-income, median-income and high-income) is their innate learning ability, z, and show that, because of this difference, the same changes in the tax rates could lead to different behavioral responses and outcomes.

In addition to learning ability, we also allow the three households to face different federal and state exemptions, γ_f and γ_s. Let inc_i be the income of household i. We assume the household's federal income tax is given by

$$\text{tax}_i^f = \tau_i^f(\text{inc}_i - \gamma_i^f) \tag{31}$$

where τ_i^f is the federal income tax rate and γ_i^f is the federal exemption faced by the household. Using the tax rate τ_i^f and taxes tax_i^f from TAXSIM, we calculate the federal exemptions γ_i^s for each of the three households. We normalize the exemptions so that $\gamma_i^f = \gamma^f$ for the median-income household. We calibrate the state exemptions for each of the three households in the same way. Table 13 shows that, not surprisingly, both federal and state exemptions are decreasing in household income.

Table 13: Difference from the Median-Income Household in the Initial Steady State (%)

	Low	High
Pre-tax income	-14.29	14.29
Federal exemptions	16.85	-12.42
State exemptions	16.73	-12.45
Learning ability	-0.73	1.41
Human capital	-14.75	15.15
State income tax	-52.65	47.73
After-tax income	-11.66	11.98
Consumption	-9.30	9.61

Given the exemptions, we calibrate the learning ability of low- and high-income households by matching their (pre-tax) income, which is measured relative to the income of the median-income household in the initial steady state under the current tax code. We assume each household takes the wage rate and other equilibrium outcomes, such as government consumption expenditures in the initial steady state as given. Given a guess of the learning ability, z, we solve the household's problem and obtain the household's income. We choose z such that the household's income is equal to the target value discussed above.

Table 13 reports the calibrated learning ability for low- and high-income households, and some other outcomes under the calibrated learning ability. All variables are measured as percentage differences from the median-income household. Not surprisingly, we find learning ability, human capital, income tax, after-tax income and consumption are all increasing in household income.

Table 14 reports the effects of switching to a flat rate of 3.25% on the three households. All values are percentage differences between the new steady state under the flat rate and the initial steady state under the current tax code. As in the initial steady state, each household solves its problem in the new steady state by taking the wage rate, w, and other equilibrium outcomes in the new steady state as given.

Table 14: Effects from Switching to A Flat Rate of 3.25%

	Household Income		
	Low	Median	High
Human capital	8.26	3.94	0.16
Pre-tax income	8.42	4.16	0.16
State income tax	-18.18	-33.37	-38.95
After-tax income	8.44	5.27	1.96
Consumption	6.80	4.43	1.78

Notes: The table report the percentage change of a variable from its value in the model with the current tax code to its value in a model with a flat tax of 3.25%.

The rate change induces an increase in human capital, income and consumption of all three households. Due to decreasing returns in creating human capital, the effect on human capital is decreasing in household income, so the effects on income and consumption are larger for the low- and median-income households than they are for the high-income household, while the opposite is true for the effect on the income tax. Based on these measures, all three households would benefit from the rate reduction, and the low-income household would benefit the most.

The three households face the same tax rates and rate reductions, so the different effects arise solely from behavioral responses. In a model in which households face different tax rates, switching to a flat rate may imply a smaller rate reduction for some low-income households who have a low tax rate to begin with. However, the larger responses from the low-income household studied here suggest that low-income households in Wisconsin could benefit significantly even for a smaller rate reduction. In fact, even the very-low income households who have no income tax and thus are not directly affected by a rate reduction could benefit from the higher wage rates induced by the lower tax rates discussed above.

4 Conclusion

We present a model of the Wisconsin economy and its tax system, and show that reducing the state's individual income tax rates will increase output and household consumption significantly. Because most income from pass-through businesses is subject to the top statutory rate, reducing the top rate is more effective in promoting investment and capital formation. Lowering the tax rates for other income brackets leads to more skill investments and higher levels of worker productivity. Both increase steady-state utility, even if they reduce the state tax revenue and government consumption expenditures. We show that the increased economic activity resulting from lower tax rates means that the reduction in state tax revenue is about 20% smaller than static estimates by government agencies. Due to the presence of the federal government in the state, the reduction in the combined federal and state government consumption expenditures in the state, which households value, in addition to their private consumption and leisure, is even smaller.

One important channel ignored in this paper is interstate migration. As more Americans move to states with lower tax rates, (e.g., Loughead, 2022), incorporating interstate migration could lead to even larger effects of lowering the individual income tax rates on economic activity. This is particularly important for Wisconsin which has a tight labor market.

References

Badel, Alejandro, Mark Huggett, and Wenlan Luo, "Taxing top earners: a human capital perspective," *The Economic Journal*, 2020, *130* (629), 1200–1225.

Barro, Robert J and Charles J Redlick, "Macroeconomic effects from government purchases and taxes," *The Quarterly Journal of Economics*, 2011, *126* (1), 51–102.

Ben-Porath, Yoram, "The production of human capital and the life cycle of earnings," *Journal of Political Economy*, 1967, *75* (4, Part 1), 352–365.

Browning, Martin, Lars Peter Hansen, and James J Heckman, "Micro data and general equilibrium models," *Handbook of Macroeconomics*, 1999, *1*, 543–633.

Chetty, Raj, Adam Guren, Day Manoli, and Andrea Weber, "Are micro and macro labor supply elasticities consistent? A review of evidence on the intensive and extensive margins," *American Economic Review*, 2011, *101* (3), 471–475.

Evers, Tony, "Gov. Evers to deliver on promise of 10-Percent middle-class tax cut," Technical Report, Office of the Governor, state of Wisconsin 2023. `https://content.govdelivery.com/accounts/WIGOV/bulletins/34829dd`.

Fan, Xiaodong, Ananth Seshadri, and Christopher R Taber, "Estimation of a life-cycle model with human capital, labor supply and retirement," Technical Report, National Bureau of Economic Research 2022.

Feenberg, Daniel and Elisabeth Coutts, "An introduction to the TAXSIM model," *Journal of Policy Analysis and Management*, 1993, *12* (1), 189–194.

Gale, William G and Andrew A Samwick, "Effects of income tax changes on economic growth," *The Economics of Tax Policy*, 2017, pp. 13–39.

_ **and Samara R Potter**, "An economic evaluation of the economic growth and tax relief reconciliation act of 2001," *National Tax Journal*, 2002, *55* (1), 133–186.

Gould, Elise and Hunter Blair, "Who's paying now?," Technical Report, Economic Policy Institute 2020. https://www.epi.org/publication/whos-paying-now-costs-of-the-current-ece-system/.

Guo, Junjie and Noah Williams, "Marginal tax rates and individual income tax reforms in Wisconsin," Technical Report, Center for Research on the Wisconsin Economy 2019. https://crowe.wisc.edu/wp-content/uploads/sites/313/2019/05/TaxRates-1.pdf.

Heckman, James J, Lance Lochner, and Christopher Taber, "Explaining rising wage inequality: Explorations with a dynamic general equilibrium model of labor earnings with heterogeneous agents," *Review of Economic Dynamics*, 1998, *1* (1), 1–58.

Internal Revenue Service, "SOI tax stats — Individual income tax state data," Technical Report, Internal Revenue Service 2022. https://www.irs.gov/statistics/soi-tax-stats-individual-income-tax-state-data.

Keane, Michael and Richard Rogerson, "Micro and macro labor supply elasticities: A reassessment of conventional wisdom," *Journal of Economic Literature*, 2012, *50* (2), 464–476.

Legislative Fiscal Bureau, "General fund revenue and expenditure projections," Technical Report, Legislative Fiscal Bureau 2023. https://docs.legis.wisconsin.gov/misc/lfb/revenue_estimates/186_january_25_2023.pdf.

_ , "Individual income tax," Technical Report, Legislative Fiscal Bureau 2023. https://docs.legis.wisconsin.gov/misc/lfb/informational_papers/january_2023/0002_individual_income_tax_informational_paper_2.pdf.

_ , "Individual income tax four-year phase-in of 3.25% tax rate," Technical Report, Legislative Fiscal Bureau 2023. https://www.wheelerbilltracking.com/upload/files/frontpage/doc_122770752063c1846c9d9456.70204616.pdf.

Loughead, Katherine, "How do taxes affect interstate migration?," Technical Report, The Tax Foundation 2022. https://taxfoundation.org/taxes-affect-state-migration-trends/.

Mertens, Karel and Morten O Ravn, "The dynamic effects of personal and corporate income tax changes in the United States," *American Economic Review*, 2013, *103* (4), 1212–1247.

Organisation for Economic Co-operation and Development, "Private spending on education," Technical Report, Organisation for Economic Co-operation and Development 2022. https://data.oecd.org/eduresource/private-spending-on-education.htm.

Prescott, Edward C, "Why do Americans work so much more than Europeans?," *Federal Reserve Bank of Minneapolis Quarterly Review*, 2004, *28* (Jul), 2–13.

Rockefeller Institute of Government, "Who gives and who gets? Explore the balance of payments between states and the federal government," Technical Report, Rockefeller Institute of Government 2021. https://rockinst.org/issue-areas/fiscal-analysis/balance-of-payments-portal/.

Romer, Christina D and David H Romer, "The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks," *American Economic Review*, 2010, *100* (3), 763–801.

Schmitt-Grohé, Stephanie and Martın Uribe, "Closing small open economy models," *Journal of international Economics*, 2003, *61* (1), 163–185.

Sims, Eric and Jonathan Wolff, "The output and welfare effects of government spending shocks over the business cycle," *International Economic Review*, 2018, *59* (3), 1403–1435.

State of Wisconsin, "Annual fiscal report," Technical Report, State of Wisconsin 2022. `https://doa.wi.gov/budget/SCO/2022%20WI%20AFR.pdf`.

Tax Foundation, "State Individual Income Tax Rates and Brackets for 2022," Technical Report, Tax Foundation 2022. `https://taxfoundation.org/state-income-tax-rates-2022/`.

United States Census Bureau, "Income in the United States: 2021," Technical Report, United States Census Bureau 2022. `https://www.census.gov/library/publications/2022/demo/p60-276.html`.

Uribe, Martin and Stephanie Schmitt-Grohé, *Open Economy Macroeconomics*, Princeton University Press, 2017.

Williams, Noah, "Fundamental state tax reform: Eliminating the income tax in Wisconsin," Technical Report, Center for Research on the Wisconsin Economy 2021. `https://crowe.wisc.edu/2021/12/16/fundamental-state-tax-reform-eliminating-the-income-tax-in-wisconsin/`.

Wisconsin Department of Revenue, "General fund revenue-FY2022," Technical Report, Wisconsin Department of Revenue 2022. `https://public.tableau.com/app/profile/research.policy/viz/Act66StateFiscalDashboard/Story1`.

Zidar, Owen, "Tax cuts for whom? Heterogeneous effects of income tax changes on growth and employment," *Journal of Political Economy*, 2019, *127* (3), 1437–1472.