TAX REFORM IN OHIO

An Economic Analysis

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Executive Summary

Ohio needs tax reform to reverse years of economic stagnation and decline. While other states have taken advantage of pandemic-induced surpluses to adopt a flat tax or eliminate their income taxes altogether, Ohio has not overhauled its tax system since 2005, making the state increasingly less competitive than peers. Nationally, Ohio's tax policy ranks in the bottom quarter and its economic performance continues to lag the national average. Even with Intel's new semiconductor plant and the potential revival of Ohio's manufacturing sector, the state will not maximize its economic opportunity without significantly modifying its outmoded tax policies.

Despite pandemic hardships, Ohio's financial house remains in reasonably good order with a budget surplus and robust rainy-day fund. But to regain some lost competitive ground, Ohio will need sturdier fiscal rules to constrain government spending and eliminate the state's individual income tax. To strengthen fiscal resolve and close accounting loopholes, the General Assembly should adopt stricter spending limits and peg future spending growth to inflation or the state's gross domestic product (GDP).

Taking these steps could allow Ohio to eliminate its personal income tax responsibly and constitutionally, which will ultimately improve the financial picture for families and businesses. The Buckeye Institute's dynamic econometric modeling shows that phasing out the income tax over 10 years will increase Ohio's GDP by almost $10 billion by 2030, with families spending almost $600 million more on goods and services that year. And even if Ohio broadens its sales tax slightly and increases the tax rate to seven percent while eliminating the income tax, its economy will still be $8.5 billion larger, with families spending $120 million more than they do today.

Pursuing overdue tax reforms, eliminating personal income taxes, reprioritizing spending, and implementing more rigorous spending limits will spur economic growth, attract new businesses and labor, and make the state more economically competitive. Maintaining Ohio's current tax policies, however, will yield none of these benefits.

Foreword

We are thrilled to present this Americans for Prosperity - Ohio study examining the potential for Ohio to eliminate its personal income tax in the next 5 years. The study provides four comprehensive scenarios, each offering a unique approach to achieving this important goal.

At least 16 states have reduced individual income and corporate tax rates since 2021. While nine states, including Texas, Tennessee & Florida have zero Personal Income Tax.

The study shows that the median Ohioan household would receive a return of $845 when the tax cuts are fully implemented. These tax cuts would provide Ohioans with more financial empowerment, allowing them to retain, consume, save, and invest more of their hard-earned money.

In addition, lawmakers must consider replacing the current state appropriation limitation with a more useful spending limit that covers all non-emergency spending, excluding federal funding. This will help ensure that Ohio is fiscally responsible and sustainable in the long run. The TaxFoundation ranked Ohio 37th overall and 41st in individual taxes in their 2023 State Business Tax Climate Index. This demonstrates the need for Ohio to take bold steps towards reducing taxes and improving its tax climate.

It is important to note that since the Personal Income Tax was first enacted in Ohio in 1972, the state has lost 8 congressional seats, going from 23 in 1972 to 15 in the 118th congress in 2023. In that same timeframe Florida has gone from 15 in 1972 to 28 in 2023. By reducing taxes and creating a more favorable business climate, Ohio can not only improve the financial well-being of its citizens, but also regain its position as a competitive state in terms of representation in Congress.

Among the possible solutions for accomplishing these historic tax reforms in a responsible manner, Ohio could adopt a structural balance spending caps tied to

economic growth rather than inflation. This approach would provide a more sustainable solution by balancing the budget over the medium term, which would promote policy stability and enable more transformative reforms.

We believe that the scenarios outlined in this study offer a promising path forward for Ohio to eliminate its personal income tax in the next 5 years. We hope that this study will serve as a valuable resource for policymakers and citizens alike, as we work together to make Ohio a more prosperous state for all.

AFP-Ohio would also like to thank the economists and economic policy experts at The Buckeye Institute's Economic Research Center who conducted the analysis presented in our study.

Sincerely,

Donovan O'Neil, State Director Americans for Prosperity - Ohio

Introduction

Ohio has attracted international attention as the site of Intel's new semiconductor manufacturing plant, signaling a bright economic future, and poised for a manufacturing rebound. To take full advantage of this opportunity, Ohio policymakers need to take bold steps to encourage business development and make Ohio more competitive with other states. Enacting fundamental tax reform that eliminates the state income tax would be one such step. With prudent spending and meaningful budget reforms, Ohio can responsibly end its graduated income tax scheme entirely while maintaining its balanced budget.

Ending the state's income tax will give employers and employees in other states another financial incentive to live, work, and do business in Ohio—hopefully, reversing the trending exodus from Ohio. And it will allow current Ohio families to keep more of their hard-earned wages, making the state more affordable.

Economically and demographically, Ohio has not compared favorably to other states in recent years. The state's population has diminished, and its economic growth has lagged regional peers. National economic rankings paint a bleak picture of a state that needs to improve. Pro-growth tax reforms and better budget rules aimed at disciplined government spending would make for dramatic improvements. A dynamic economic model analyzes likely economic outcomes and effects of eliminating the state's income tax prudently. The results, like Intel's decision to manufacture here, are encouraging.


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Ohio's Tax Policy Compared to Other States

For three decades, Ohio has endured persistent deindustrialization and depopulation. Rising automation, domestic competition, and international trade depleted Ohio's once high-paying manufacturing sector and as employment opportunities vanished in cities and rural communities alike, people looked for jobs elsewhere. From 1991 to 2015, Ohio suffered a net population loss of over 500,000 people.[1]

Ohio was not alone. Other states faced similar geopolitical and economic pressures. But as some peer states responded with pro-growth, business-friendly tax reforms, Ohio plodded along, largely content with an antiquated tax regime that did little to attract new employers or industries. The few instances of attempted tax reform were either lackluster or inadvertently made things worse.[2]

In 2005, for example, Governor Bob Taft proposed Ohio's first major tax reform in 30 years—House Bill 66. Taft's proposal included cuts to state-level income and sales taxes, repealed the corporate franchise and tangible property taxes, and introduced a gross receipts tax. Eliminating the corporate franchise tax and tangible property taxes removed regressive taxes on corporations, physical capital, and individual wealth, which significantly improved Ohio's business climate.[3] Unfortunately, adding the gross receipts or "commercial activities tax" (CAT), offset some of those laudable improvements. No other major tax reforms passed for another 16 years, and when they finally returned in 2021 to consolidate the tax code, merge the top two income brackets, and shave three percent off every income tax rate,[4] they did not go far enough.[5]

Ohio's atrocious rankings in two prominent national economic indices confirm the state's poor tax policy. The Fraser Institute's 2021 Economic Freedom of North America (EFNA) report ranked Ohio 43rd in

1 William Shkurti and Fran Stewart, The Decline of Ohio, John Glenn College of Public Affairs at The Ohio State University, 2018; Scott W. Drenkard and Rea S. Hederman Jr. Ohio Illustrated: A Visual Guide to Taxes & The Economy, Tax Foundation and The Buckeye Institute, 2017.

2 Logan Kolas, Modernizing Ohio's Policies to Size New Economic Opportunities, The Buckeye Institute, March 21, 2022.

3 Ohio Department of Taxation, Tangible Personal Property Tax, 2007; Ohio Department of Taxation, 2013 Annual Report, 2014.

4 Ulrik Boesen, Ohio Lawmakers Agree on Income Tax Cuts and Remote Work Tax Relief, Tax Foundation, June 30, 2021.

5 Ohio Department of Taxation, Ohio Tax Reform, 2006; Ohio Department of Taxation, Commercial Activity Tax: Number of Taxpayers and Tax Return Data, Fiscal Year 2021 (Last visited October 4, 2022); Kevin Kemper, Gov. Bob Taft's tax-reform proposals fail to satisfy all businesses in the state, Columbus Business First, March 7, 2005; Rea Hederman Jr.; Andrew J. Kidd, Ph.D., and James B. Woodward, Ph.D., Letting the CAT Out of The Bag: How to Improve Ohio's economy and National Rankings, The Buckeye Institute, July 29, 2020.

Economic Freedom at the subnational All-Government level and 42nd in taxes.[6] In its 2022 State Business Tax Climate Index, the Tax Foundation ranked Ohio 35th overall and 41st in Individual taxes.[7]

Macroeconomic data corroborate Ohio's poor performance in these indices. Despite boasting the seventh largest economy in America, Ohio lags nationally in almost every major economic indicator. Ohio's per capita GDP ranks 27th, its unemployment rate perches 11 percent above the national average, while its personal income per capita sits 11 percent below average.[9] And Ohio's labor market still has not recovered from the coronavirus counter-measures, and continues to trail the national average. As of July 2022, the United States nonfarm payroll finally recovered to pre-pandemic levels, but Ohio's remains 2.3 percent below February 2020's employment level, and private-sector employment is still short 96,200 jobs.[10]

Whereas other states began presciently modernizing their tax codes in 2020 to cope with new economic challenges wrought by the pandemic, Ohio largely and mistakenly stood still. As the first wave of lockdowns rolled across the nation in early 2020, many states tightened their budgets to save revenue and trim losses, and they averted the projected catastrophic fiscal shortfalls.[11] At the same time, an unprecedented shift to remote work and ecommerce made location virtually irrelevant for many employers and employees. Tax-conscious individuals could now take their work with them across state lines and take advantage of living in low-tax states. Consequently, people flocked to low-tax states 2020 and 2021 to take advantage of better tax rates that did not stymie upward mobility.[12]

Prudent states, observing the remote work trend, invested their budget surpluses into tax reform. Since 2021, 16 states have reduced individual income and corporate tax rates. Four states—Idaho, Iowa, Nebraska, and Utah—lowered both rates.[13] Kentucky and Indiana implemented plans in the spring of 2022 to further cut their flat taxes. Indiana's individual income tax rate of 3.23 percent, which is already lower than the upper half of Ohio's graduated income tax bracket, will be slashed to 3.15 percent.[14] Kentucky's five percent flat tax will drop another 10 percent for FY2023, and more reductions will automatically kick-in once Kentucky's budget's revenue triggers are met. Without a tax floor in the bill, Kentucky's personal income tax rate could decline to zero, which would make it the first new no-income tax state in more than 40 years.

As other states pursue meaningful tax reform to attract and retain workers and businesses, Ohio's economy risks falling further behind. Despite Ohio's relatively low-income tax, the state has struggled to spur job growth. The Reshoring Initiative's 2021 Data Report, for example, ranked Ohio 10th for new

6 Dean Stansel, José Torra, and Fred McMahon, Economic Freedom of North America 2021, Fraser Institute, 2021.

7 Janelle Cammenga and Jared Walczak, 2022 State Business Tax Climate Index, The Tax Foundation, 2021.

8 Per Capita Personal Income in Ohio, fred.StLouisFed.org, (Last visited September 29, 2022).

9 Ohio's August Jobs Report a Mixed Bag, The Buckeye Institute press release, September 16, 2022.

10 The Economics Daily, Employment in Idaho and Utah over 6.0 percent higher than pre-recession levels, Bureau of Labor Statistics, August 25, 2022 (Last visited September 29, 2022); Ohio Department of Job and Family Services, Ohio Seasonally Adjusted Nonagricultural Wage and Salary Employment February 2020 and July 2022.

11 Logan Kolas, The COVID-19 State Budget Shortfall That Wasn't, Cato Daily Podcast, February 22, 2021.

12 Jared Walczak, Eight State Tax Reforms for Mobility and Modernization, Tax Foundation, January 5, 2022.

13 Timothy Vermeer, State Tax Reform and Relief Enacted in 2022, Tax Foundation, July 13, 2022.

14 Katherine Loughead, Indiana Should Use Surplus to Expedite Rate Cuts, Index Exemptions for Inflation, Tax Foundation, July 29, 2022; Katherine Loughead, Kentucky Legislature Sends Pro-Growth Tax Changes to Governor, Tax Foundation, April 8, 2022.

manufacturing jobs created by reshoring and foreign direct investment,[15] as the state managed to add just 7,827 jobs and 56 companies. By contrast, Kentucky and North Carolina, ranked fourth and fifth respectively, have aggressively reformed their tax codes and captured a combined 34,556 manufacturing jobs across 214 companies.[16] Texas, a state with no individual income tax, won back 21,671 manufacturing jobs—the most in 2021.[17] Ohio has a long way to go to rank among these leaders, and failing to change its tax code will only make it harder.

Iowa and North Carolina provide two more examples of successful, pro-growth tax reform for Ohio to follow. Iowa began its tax reform sortie in 2018, and with further guidance from The Buckeye Institute's report, *A Better Path Forward For Iowa Tax Reform*, in 2019, Iowa continued implementing sensible, pro-growth tax policies.[18] After another round of reforms in 2021, Iowa's nine-bracket nightmare, once the sixth highest individual income tax rate in the country, will gradually consolidate into a more manageable four-bracket system, which will then be replaced with a 3.9 percent flat tax by 2026.[19] In addition to pruning the tax code, Iowa will also eliminate all levies on retirement income beginning in 2023. Since implementing these tax reforms, Iowa has seen tremendous economic results, including a per-capita personal income increase of 13.6 percent[20] and the largest year-over-year spike in real GDP between 2020-2021 since 2004.[21]

Since 2018, with the exception of the pandemic induced decline in FY2020, Iowa's individual income tax receipts have risen every year. Additionally, Iowa's ranking in the *2022 Business Climate Index's* corporate and individual tax subdivisions improved by two and eight points, respectively,[23] which helped raise the state's overall ranking from 41st in 2021 to 38th 2022.[24] Although other underlying economic factors have contributed to Iowa's recent success, the wealth generated by an income tax cut should not be discounted.

Similarly, North Carolina began comprehensive tax reforms in 2013 that have yielded significant economic benefits.[25] Replacing progressive and corporate income tax rates with lower flat taxes, North Carolina lawmakers have persistently slashed the state's corporate and individual income tax rates from 5.8 to 4.99 percent, and from six to 2.5 percent respectively for FY2023.[26] And as a result, North Carolina's economy has blossomed. Since 2011, North Carolina has attracted 647 foreign and reshoring manufacturers who brought with them more than 86,000 manufacturing jobs.[27] In 2022,

15 Harry Moser and Millar Kelley, 2021 Data Report, Reshoring Initiative, April 26, 2022.

16,17 Ibid.

18 Rea S. Hederman Jr., Andrew J. Kidd, Ph.D., and James B. Woodward, Ph.D., A Better Path Forward For Iowa Tax Reform, The Buckeye Institute and TEF Iowa (now known as Iowans for Tax Relief), December 19, 2019.

19 Jared Walczak, Iowa Enacts Sweeping Tax Reform, Tax Foundation, March 14, 2022.

20 Per Capita Income in Iowa, fred.StLouisFed.org (Last visited September 29, 2022).

21 U.S. Bureau of Economic Analysis, GDP and Personal Income, apps.bea.gov (Last visited September 29, 2022).

22 United States Census Bureau, Annual Survey of State Government Tax Collections Datasets, Census.gov (Last visited September 29, 2022).

23 Janelle Cammenga and Jared Walczak, 2022 State Business Tax Climate Index, The Tax Foundation, 2021.

24 Ibid.

25 Scott Drenkard, North Carolina Proposal Builds on Landmark 2013 Reform, The Tax Foundation, June 15, 2015.

26 Katherine Loughead, North Carolina Reinforces Its Tax Reform Legacy, Tax Foundation, December 3, 2021.

27 Harry Moser and Millar Kelley, 2021 Data Report, Reshoring Initiative, April 26, 2022.

North Carolina reported record-setting business creation in 2021, adding 178,300 new firms on top of 2020's 127,000.[28]

North Carolina's explosive business growth has attracted transplants from across the country. Prior to 2020, nearly two-thirds of North Carolina's population growth came from net migration.[29] In 2021, however, net migration accounted for 94 percent of North Carolina's population growth.[30] This phenomenal growth has come because of—and not despite—its tax cuts, and with only two exceptions, North Carolina's individual income tax collections have increased year-over-year for nearly a decade.[31]

Ohio must heed these examples and join other states already engaged in aggressive tax reforms, or risk falling farther behind. Employers and employees will continue to look elsewhere for economic and competitive advantages. As remote work takes a firmer hold and neighboring states cut tax rates, Ohioans will increasingly consider moving across state lines to keep more of their income. So, the window for Ohio to adopt meaningful tax reform and remain economically competitive is rapidly closing.

28 New Business Creation Record Smashed Yet Again in 2021, North Carolina Department of the Secretary of State press release, January 12, 2022.

29 Dr. Michael Cline, 2021 Population Estimates Show NC Growth Continues, Office of State Budget and Management, December 22, 2021.

30 Ibid.

31 United States Census Bureau, Annual Survey of State Government Tax Collections Datasets, Census.gov (Last visited September 29, 2022).

Budget Reform as Tax Reform

State budget and appropriations rules can help protect taxpayers—individual and corporate— from reckless government spending that will inevitably cost taxpayers in the end. Strong budget rules that provide firm spending discipline and taxpayer protection can serve as a kind of tax policy insofar as they help make government spending predictable and prevent the need for damaging tax increases down the road. Despite a constitutional requirement to produce a balanced operating budget, Ohio's current budget rules offer scant, ineffective protection for taxpayers. Making structural reforms to the state's budget process could serve as a protective aid in preserving tax reforms and retaining their benefits.[32]

Ohio taxpayers are modestly protected against state overspending by the "state appropriation limitation" (SAL), which limits the growth of the general revenue fund to 3.5 percent annually or the rate of inflation plus population rate changes.[33] Regrettably, the General Assembly can override this constraint by declaring an emergency or by a two-thirds vote of the Ohio House and Senate, making the SAL a lower hurdle than spending limits enacted through popular vote or constitutional amendment.[34] The General Assembly can also circumvent some SAL restrictions altogether by moving previous non-general revenue spending into the general revenue budget.[35]

And it gets worse. Ohio spends much more than its operating budget. More than half of total state spending is not included in the general revenue operating fund and thus not subject to the same spending limitations. Transportation funding, the Ohio capital budget, and almost $72 billion in other state spending fall outside the state's operating budget.[36]

Several budget process reforms can help. First, Ohio must make its total spending and tax collections more transparent. Multiple

32 Therese J. McGuire and Kim S. Rueben, The Colorado Revenue Limit: The Economic Effects of TABOR, Economic Policy Institute, March 21, 2006.

33 Ohio Legislative Service Commission, A Guidebook for Ohio Legislators, 134th Ohio General Assembly, 2021.

34 Michael J. New "U. S. Tax and Expenditure Limitations: A Comparable Political Analysis," State Politics and Policy Quarterly, Volume 10, Issue 1 (March 2010) p.25-50.

35 Greg R. Lawson Beware the Shadow Budget: Ohio Spends More than Many Think, The Buckeye Institute, January 27, 2021.

36 Legislative Budget Office of the Legislative Service Commission, Appropriation Spreadsheet House Bill 62 133rd General Assembly Transportation Budget Bill (FY 2020-FY2021) Adjusted, October 16, 2020.

budget bills and ledgers create too much room for accounting mischief, make spending difficult to track, and deprive taxpayers the transparency and protection they deserve. Reforms like OhioCheckBook.com have undoubtedly improved transparency, but there is no requirement to maintain or update the website, making it potentially obsolete over time. Lawmakers should codify the use and maintenance of Ohio Checkbook and make it permanent.

Second, Ohio should create a unified budget in which taxes and spending are enumerated in one or two bills instead of many different bills across different years. Fourteen states use a one-budget bill approach to spending, and another sixteen states use less than five budget bills.[37] A unified budget will make it easier to compare spending levels and assess spending priorities, while making it harder to disguise spending increases by moving expenditures across an array of appropriations bills. And a unified budget could then subject all state spending to statutory protections, putting an end to the dizzying shell game currently played with various budgets, and strengthening taxpayer confidence. Emergency spending could be exempt from hard spending limits, but such spending should require a super-majority vote of the General Assembly.[38]

Third, lawmakers should replace the current SAL with a stronger spending limit that covers all non-emergency spending, excluding federal funding. The limit on spending increases should be changed to reflect a combination of the inflation rate plus the population growth rate. When inflation rises, spending may rise, but inflation falls so will state spending, barring a surprising surge in population.

Alternatively, Ohio could adopt a structural balanced spending cap tied to economic growth rather than inflation. to achieve structural balance could be achieved as an alternative to a cap based on inflation. Under such an approach, state spending will grow less during strong economic cycles, and grow more during weaker ones. The key is to maintain a structurally balanced budget throughout the business cycle and several years into the future even if spending temporarily exceeds tax revenues during difficult times.[39] By spending less during periods of strong economic growth, Ohio can fund its rainy-day account, be better prepared for more difficult economic times, and avoid raising taxes on families and businesses during economic downturns that require more state services and spending.

Either of these recommended budget caps should be codified and would improve on the current SAL. By enacting meaningful spending restraints, Ohio could aggressively pursue fundamental tax reform without jeopardizing a structurally balanced budget or borrowing heavily at the expense of future taxpayers.

37 Kurt Couchman, Unified Budgets Can Help Revive Congress, Americans for Prosperity, December 1, 2021.

38 Greg R. Lawson Beware the Shadow Budget: Ohio Spends More than Many Think, The Buckeye Institute, January 27, 2021.

39 Achieving a Structurally Balanced Budget, Government Finance Officers Association, (Last visited October 3, 2022).

Tax Scenarios to End the Income Tax

Economists at The Buckeye Institute's Economic Research Center (ERC) developed a dynamic scoring model to determine how state-level tax policy changes impact government revenues, economic activity, job creation, and business investment. Using publicly available state and federal data, the model is calibrated to Ohio's economic characteristics and uses a framework similar to federal-level models, including decisions made by businesses and households. As explained in detail in the appendix, the ERC model analyzes state policy scenarios using the same methods for analyzing federal tax policy scenarios, modified to address a state's specific economic conditions.

For this report, the ERC modeled four scenarios demonstrating the likely economic outcomes of eliminating the state of Ohio's income tax. Taxes on income distort the decisions of Ohio households and families to save, invest, and work. By eliminating the income tax, Ohioans will be encouraged to find gainful employment, and spend or invest their own hard-earned dollars. Pro-growth tax reform cannot pay for itself entirely but increased economic activity does make up some of the gap—about a quarter of the financial cost of the tax cuts that would be lost absent increased economic activity. Cutting state spending and constraining future state spending growth will also be necessary to balance Ohio's budget.

By constraining state spending to a real fiscal rule, the Ohio budget will grow much slower over time and protect future taxpayers. Research finds that state budgets can save billions of dollars over time as the growth of future state budgets is slowed.[40] These compounding savings can provide the fiscal space for eventual elimination of the income tax.

The ERC modeled the effects of several scenarios varying in tax bracket structure, length of time to phase out the income tax, and methods to finance the income tax cuts.

Scenario 1: Economic Growth $12.9 Billion, 81,000 Jobs Added in 2032

Ohio Senator Steve Huffman has proposed legislation that would lower Ohio's income tax rate in each tax bracket by 10 percent from its 2022 rate for 10 years until the state's income tax is eliminated.[41] The first scenario analyzes the economic effects of phasing out the income tax over 10 years offset by reducing government spending with no other taxes increased. Eliminating the income tax in this way would preserve the current structure of the income tax code until full elimination is achieved.

41 Repeal state income tax on nonbusiness income, ten-year phase-out, Senate Bill 327, 134th General Assembly, 2021-2022.

40 Vance Ginn and Daniel Sancez-Pinol, The 2024-25 Conservative Texas Budget, Texas Public Policy Foundation, December 2022.

Table 1: Change in Income Tax Rates Over 10 Years[41]

Ohio Taxable Income	$0 - $25,000	$25,001 - $44,250	$44,251 - $88,450	$88,451 - $110,650	$110,651+
Existing	0.000%	$346.16 + 2.765% of excess over $25,000	$878.42 + 3.226% of excess over $44,250	$2304.31 + 3.688% of excess over $88,450	$3123.05 + 3.990% of excess over $110,650
2024	0.000%	$284.56 + 2.489% of excess over $25,000	$763.60 + 2.904% of excess over $44,250	$2046.90+ 3.320% of excess over $88,450	$2783.76 + 3.592% of excess over $110,650
2025	0.000%	$252.94 + 2.212% of excess over $25,000	$678.75 + 2.581% of excess over $44,250	$1819.47 + 2.950% of excess over $88,450	$2474.46 + 3.192% of excess over $110,650
2026	0.000%	$221.33 + 1.936% of excess over $25,000	$593.91 + 2.258% of excess over $44,250	$1592.03 + 2.582% of excess over $88,450	$2165.15 + 2.793% of excess over $110,650
2027	0.000%	$189.71 + 1.659% of excess over $25,000	$509.07 + 1.936% of excess over $44,250	$1364.60 + 2.213% of excess over $88,450	$1855.84 + 2.394% of excess over $110,650
2028	0.000%	$158.09 + 1.383% of excess over $25,000	$424.22 + 1.613% of excess over $44,250	$1137.17 + 1.844% of excess over $88,450	$1546.54 + 1.995% of excess over $110650
2029	0.000%	$126.47 + 1.106% of excess over $25,000	$339.38 + 1.290% of excess over $44,250	$909.73 + 1.475% of excess over $88,450	$1237.23 + 1.596% of excess over $110,650
2030	0.000%	$94.85 + 0.830% of excess over $25,000	$254.53 + 0.968% of excess over $44,250	$682.30 + 1.106% of excess over $88,450	$927.92 + 1.197% of excess over $110,650
2031	0.000%	$63.24 + 0.553% of excess over $25,000	$169.69 + 0.645% of excess over $44,250	$454.87 + .0738% of excess over $88,450	$618.61 + 0.798% of excess over $110,650
2032	0.000%	$31.62 + 0.277% of excess over $25,000	$84.84 + 0.323% of excess over $44,250	$227.43 + 0.369% of excess over $88,450	$309.31 + 0.399% of excess over $110,650
2033	0.000%	0.000%	0.000%	0.000%	0.000%

42 Row 2 (white) shows Ohio's currently existing income tax rate schedule. Starting in 2024, the income tax rate begins phasing out over 10 years. There is a fixed amount paid on income above $25,000 beginning when an individual makes $25,001 in Ohio ($346.16 currently). That fixed amount is lowered by one-tenth of the existing value each year until the income tax is eliminated in 2033. For each income tax bracket above $44,250 in annual income, the flat amount owed is the flat fee plus the tax rate on the entirety of the previous bracket. Ohio charges no income tax on the first $25,000 of income.

Table 1 shows the changes to the personal income tax rates by taxable income brackets. The typical taxpayer would receive significant tax savings under this scenario. The median income earner in Ohio makes about $41,000 annually and phasing out the income tax would empower them to save, invest, or consume an additional $790 each year.

Table 2 presents the static estimates for full elimination of the income tax over 10 years. Eliminating the income tax is expected to reduce state revenue by $10.66 billion each year after full implementation, and is paid for by reducing government spending. Later tax reform options model the effects of increasing the sales tax to partially offset decreases in government revenue. That method of financing tax reform dampens some of the positive economic benefits of income tax elimination—such as output and investment—but requires less spending restraint.

Table 2: Static Revenue Change for Scenario 1

	Static Revenue Change (in millions)
Income Tax Elimination	-$10,660
Sales Tax Increase	$0
Total Change	**-$10,660**

Static estimates do not account for economic responses to tax changes—such as household decisions to invest, save, or spend additional tax savings. The ERC's dynamic scoring model incorporates household and business responses to changes in tax policy, and how those changing decisions affect government revenues, economic activity, job creation, and business investment.

Table 3 presents the dynamic effects of Scenario 1 and reveals that these policy changes will lead to $1.32 billion in state GDP growth in the first year (2024) that tax rates are cut by one-tenth for all tax brackets. In year 2032, GDP will increase by $12.9 billion.

Although eliminating the income tax is expected to decrease state-level revenue by $10.66 billion annually after the income tax is fully implemented, the state is expected to make up about a quarter of the lost revenue through increased economic activity. Empowering Ohio families to save, spend, and invest their own dollars generates more investment, more consumption, and more economic activity. And phasing out the income tax—which also functions as a penalty on work—would lead to 81,000 more Ohio jobs in 2032.

Scenario 2: Economic Growth $11.2 Billion, 64,000 Jobs Added Over a Decade

Scenario 2 analyzes the effect of pro-growth personal income tax elimination over 10 years as the previous scenario, but now also broadens the sales tax base by $500 million and then incrementally increases the sales tax rate from 5.75 percent to 7.0 percent over 10 years. These changes statically offset more than one-third of the lost revenue from income tax elimination. (See Table 5.)

43 There are other means to raise funds to offset the lost revenue from the income tax cut other than broadening the sales tax base or raising the sales tax rate—although changes to the sales tax are among the most efficient options. Ohio could instead, for example, broaden the base of the commercial activities tax.

Table 3: Effects of Phasing Out the Income Tax Over 10 Years with No Sale Tax Increase[42]

Baseline					
Year	GDP 2021	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$730,979	5,618	$31,766	$501,557	$170,333
2024	$741,348	5,708	$31,196	$512,225	$173,679
2025	$747,697	5,739	$31,486	$520,164	$173,976
2026	$753,827	5,760	$31,775	$527,518	$175,848
2027	$759,477	5,779	$32,061	$534,121	$178,384
2028	$765,962	5,794	$32,347	$542,308	$181,484
2029	$772,897	5,811	$32,632	$551,897	$184,381
2030	$780,126	5,794	$32,917	$561,781	$187,815
2031	$787,380	5,811	$33,207	$571,814	$191,310
2032	$794,625	5,840	$33,503	$582,106	$194,641
Difference from Baseline					
Year	GDP	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$0	0	$0	$0	$0
2024	$1,320	8	-$760	$70	$460
2025	$2,670	17	-$1,500	$140	$900
2026	$4,050	26	-$2,260	$230	$1,340
2027	$5,440	35	-$3,000	$310	$1,780
2028	$6,870	44	-$3,740	$390	$2,240
2029	$8,320	53	-$4,480	$490	$2,690
2030	$9,800	62	-$5,200	$580	$3,160
2031	$11,320	71	-$5,940	$680	$3,650
2032	$12,860	81	-$6,650	$780	$4,140

42 Source: The ERC's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2021 dollars. Employment is full-time equivalent non-farm jobs, in thousands of jobs. Difference from baseline results are rounded to the nearest $10 million for GDP, tax revenue, consumption and investment and are rounded to the nearest thousand for employment.

Table 4: Change in Sales Tax Rates Over 10 Years

Existing Statutory	5.750%
2024	5.875%
2025	6.000%
2026	6.125%
2027	6.250%
2028	6.375%
2029	6.500%
2030	6.625%
2031	6.750%
2032	6.875%
2033	7.000%

The static model estimates that eliminating the Ohio state income tax will reduce revenue by $7 billion annually. But Ohio can recoup some of the lost revenue by eliminating unnecessary carveouts to broaden the sales tax base and then raising the existing 5.75 percent sales tax rate to seven percent.[43] (See Table 5.) Even with a broader sales tax base and a 1.25-cent sales tax increase, the median Ohio earner will keep significantly more of their income. Although the median Ohio taxpayer will pay $233 more in sales tax annually, they will keep $790 more in earned income.

Table 5: Static Revenue Change for Scenario 2

	Static Revenue Change (in millions)
Income Tax Elimination	-$10,660
Sales Tax Increase (Base Broadening andRate Increase)	$3,660
Total Change	**-$7,000**

Ohio currently exempts many goods and services from sales taxes, reducing the size of the sales tax base. In Fiscal Year 2023 Ohio will narrow its sales and use tax bases by $567 million by not taxing transportation of persons and property, motor vehicle trade-ins, and vehicles used outside of Ohio. Taxing those goods and services would have generated $278 million, $227 million, and $62 million, respectively. Ohio would be better served by eliminating expenditures on other low hanging fruit such as copyrighted motion pictures, mobile homes, and aircraft. Lawmakers should not be picking economic winners and losers. Instead, the tax code should treat all taxpayers more equitably. Tax carveouts and favoritism benefit some businesses and industries over others—contributing to a regressive tax structure that disproportionally burdens low-income households left without exemptions to sales and use taxes.[45] Ohio needs a tax on consumption that lowers the rate for everyone, not just the well-connected.

44 Ohio Department of Taxation, Tax Expenditure Report: The State of Ohio Executive Budget for Fiscal Year 2022 – 2023, October 29, 2020; Rea S. Hederman Jr., Andrew J. Kidd, Ph.D., and James B. Woodward, Ph.D., A Better Path Forward For Iowa Tax Reform, The Buckeye Institute and TEF Iowa (now known as Iowans for Tax Relief), December 19, 2019; Renu Zaretsky, Sales Tax Carveouts: They're All About That Base, Tax Policy Center, March 2, 2022.

45 Ohio Department of Taxation, Tax Expenditure Report: The State of Ohio Executive Budget for Fiscal Year 2022 – 2023, October 29, 2020.

Table 6: Revenue Lost to Major Sales & Use Tax Expenditures[46]

Tax Expenditure	Lost Revenue
Transportation of persons and property	$278,200,000
Value of motor vehicle trade-ins	$227,100,000
Sales of qualified property used in an eligible computer data center	$74,200,000
Motor vehicles sold in Ohio for use outside the state	$62,100,000
Drugs distributed to physicians as free samples	$45,000,000
Exemption for certain purchases by electronic publishers	$21,000,000
$800 tax cap on qualified fractionally-owned aircraft	$11,700,000
Sales of cable, video and audio/audiovisual works bought or sold by cable or video service providers	$11,400,000
Copyrighted motion pictures and films	$8,500,000
Qualified used manufactured and mobile homes	$5,200,000
Total Lost Revenue	**$744,400,000**

Broadening the sales tax base and then raising the tax rate on that broader base would significantly improve the budget outlook while also generating significant, though somewhat reduced, improvements to output, investment, consumption, and employment. Under Scenario 2, state GDP grows by more than $11 billion in 2032, driven by significantly increased investment every year this decade. With more economic activity, Ohio households will increase consumption and thus increase sales tax revenue. Additionally, research has shown that taxes on consumption are more efficient than income taxes.[47] Distortions to household decisions to save and invest are more muted than other types of taxes, and are less wasteful than taxes on income or capital (e.g., commercial activities or corporate taxes). Replacing income taxes with sales taxes, therefore, is better for economic activity and employment. And replacing part of the lost revenue from the income tax by broadening the sales tax base and raising the rate would create 64,000 jobs in year 2032. Tax revenue, comparatively, falls by $3.74 billion in 2032—one year before full implementation—assisted by a more efficient tax code with a higher percentage of its revenue from consumption taxation.

46 Alex Muresianu, Reviewing Options to Raise Tax Revenue and the Trade-offs for Economic Growth and Progressivity, Tax Foundation, May 3, 2021; Eric York and Garrett Watson, Taxing Consumption Progressively Is a Better Way to Tax the Wealthy, Tax Foundation, June 8, 2021.

47 Source: The ERC's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2021 dollars. Employment is full-time equivalent non-farm jobs, in thousands of jobs. Difference from Baseline results are rounded to the nearest $10 million for GDP, tax revenue, consumption and investment and are rounded to the nearest thousand for employment.

Table 7: Effects of Eliminating Income Tax Over 10 Years, Eliminating $500 Million in Sales Tax Expenditures, and Raising Sales Tax to 7% Over 10 Years[47]

Baseline					
Year	GDP 2021	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$730,979	5,618	$31,766	$501,557	$170,333
2024	$741,348	5,708	$31,196	$512,225	$173,679
2025	$747,697	5,739	$31,486	$520,164	$173,976
2026	$753,827	5,760	$31,775	$527,518	$175,848
2027	$759,477	5,779	$32,061	$534,121	$178,384
2028	$765,962	5,794	$32,347	$542,308	$181,484
2029	$772,897	5,811	$32,632	$551,897	$184,381
2030	$780,126	5,794	$32,917	$561,781	$187,815
2031	$787,380	5,811	$33,207	$571,814	$191,310
2032	$794,625	5,840	$33,503	$582,106	$194,641

Difference from Baseline					
Year	GDP	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$0	0	$0	$0	$0
2024	$1,320	8	-$760	$70	$460
2025	$2,670	17	-$1,500	$140	$900
2026	$4,050	26	-$2,260	$230	$1,340
2027	$5,440	35	-$3,000	$310	$1,780
2028	$6,870	44	-$3,740	$390	$2,240
2029	$8,320	53	-$4,480	$490	$2,690
2030	$9,800	62	-$5,200	$580	$3,160
2031	$11,320	71	-$5,940	$680	$3,650
2032	$12,860	81	-$6,650	$780	$4,140

Scenario 3: Economic Growth $14.3 Billion, 89,000 Jobs Added in 2032

A more aggressive, pro-growth tax reform would eliminate and reform distortionary taxes more quickly, rather than waiting, reducing the burdens of distortionary income taxation and shifting the benefits of reform forward so they compound over time. Instituting a flat income tax instead of the current graduated system comes with many benefits: larger tax bases requiring smaller income tax rates, increased tax transparency and simplicity, improved work incentives, reduced distortions on investment and savings decisions, and increased economic output.[48] More aggressive changes to Ohio's income tax today, mean more significant economic benefits today and tomorrow.

Scenario 3 replaces Ohio's graduated income tax system with a flat income tax of 3.19 percent on income above $25,000 in 2024, while still cutting the expected income tax revenue by one-fifth on average. The income tax rate is then reduced by one-fifth of the current structure for the following four years until the income tax is eliminated.

Under this scenario, the static model estimates, as before, that eliminating the state income tax reduces revenue by $10.66 billion each year following full implementation in 2028. Under Scenario 3, income tax elimination is paid for by reducing government spending equivalently over five years.

Table 9: Static Revenue Change for Scenario 3

	Static Revenue Change (in millions)
Income Tax Elimination	-$10,660
Sales Tax Increase	$0
Total Change	**-$10,660**

Table 8: Change in Income Tax Rates Over 5 Years

Ohio Taxable Income	$0 - $25,000	$25,001 - $44,250	$44,251 - $88,450	$88,451 - $110,650	$110,651+
Existing	0.0%	$346.16 + 2.765% of excess over $25,000	$346.16 + 2.765% of excess over $25,000	$2,304.31 + 3.688% of excess over $88,450	$3,123.05 + 3.990% of excess over $110,650
2024	0.0%	$364.95 + 3.191% of excess over $25,000			
2025	0.0%	$273.71 + 2.393% of excess over $25,000			
2026	0.0%	$182.48 + 1.197% of excess over $25,000			
2027	0.0%	$91.24 + 0.299% of excess over $25,000			
2028	0.0%	0%			

48 Source: The ERC's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2021 dollars. Employment is full-time equivalent non-farm jobs, in thousands of jobs. Difference from Baseline results are rounded to the nearest $10 million for GDP, tax revenue, consumption and investment and are rounded to the nearest thousand for employment

49 Jaeger Nelson and Kerk Phillips, The Economic Effects of Financing a Large and Permanent Increase in Government Spending, working paper, Congressional Budget Office, March 2021; Bibek Adhikari and James Alm, "Evaluating the Economic Effects of Flat Tax Reforms Using Synthetic Control Methods," Southern Economic Journal, Volume 83, Number 2 (October 2016), pp. 437-463; Daniel Mitchell, Flat Tax or Sales Tax? A Win-Win Choice For America, The Heritage Foundation, August 14, 1997; Jared Walczak, States Inaugurate a Flat Tax Revolution, Tax Foundation, September 7, 2022.

By flattening and then phasing out the income tax over five years (starting in 2024) Ohio would create 89,000 jobs in 2032—about 8,000 additional jobs than in 2032 if the income tax were eliminated over 10 years as in Scenario 1. As a tradeoff for significantly diminished income tax revenue, Ohioans would benefit from large increases to economic output, investment, and consumption, with upwards of $14.2 billion more in economic activity generated by 2033. Although Ohio would statically lose

Table 10: Effects of Changing to a Flat Income Tax with a Phaseout Over 10 Years[50]

Baseline					
Year	GDP 2021	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$730,979	5,618	$31,766	$501,557	$170,333
2024	$741,348	5,708	$31,196	$512,225	$173,679
2025	$747,697	5,739	$31,486	$520,164	$173,976
2026	$753,827	5,760	$31,775	$527,518	$175,848
2027	$759,477	5,779	$32,061	$534,121	$178,384
2028	$765,962	5,794	$32,347	$542,308	$181,484
2029	$772,897	5,811	$32,632	$551,897	$184,381
2030	$780,126	5,794	$32,917	$561,781	$187,815
2031	$787,380	5,811	$33,207	$571,814	$191,310
2032	$794,625	5,840	$33,503	$582,106	$194,641

Difference from Baseline					
Year	GDP	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$0	0	$0	$0	$0
2024	$2,620	16	-$1,520	$130	$910
2025	$5,340	34	-$2,990	$300	$1,800
2026	$8,120	52	-$4,410	$440	$2,680
2027	$10,910	70	-$5,790	$600	$3,580
2028	$13,780	89	-$7,130	$780	$4,490
2029	$13,900	89	-$7,190	$790	$4,530
2030	$14,030	89	-$7,250	$810	$4,560
2031	$14,170	89	-$7,320	$820	$4,600
2032	$14,290	89	-$7,380	$820	$4,630

50 Source: The ERC's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2021 dollars. Employment is full-time equivalent non-farm jobs, in thousands of jobs. Difference from Baseline results are rounded to the nearest $10 million for GDP, tax revenue, consumption and investment and are rounded to the nearest thousand for employment

a little less than $10.7 billion in income tax revenue annually by eliminating the income tax over five years, the dynamic effects of increased investment and economic activity make up about a quarter of the gap, with Ohio instead foregoing a little more than $7.1 billion in revenue annually starting in 2028 when the income tax is fully repealed.

Scenario 4: Economic Growth $12.4 Billion, 71,000 Jobs Added in 2032

Although better for economic activity, growth, and job creation, a more aggressive approach to income tax elimination also requires more aggressive cuts to government spending. For this reason, ambitious, pro-growth income tax cuts may benefit from replacing some lost income tax revenue with more efficient methods of revenue creation, such as broadening the sales tax base and increasing its rate, like Scenario 2, as Ohio transitions into a no-income tax state.

Scenario 4 replaces Ohio's graduated income tax rate by flattening the income tax to a revenue neutral rate in 2024 and then reduces the rate by one-fifth of the flat rate each year for five years (starting in 2024) until the income tax is eliminated (same as Scenario 3). Table 4 shows what Ohio's sales tax rate would look like if it was proportionally raised to seven percent by 2028.

Table 11: Change in Sales Tax Rates Over 5 Years

Existing Statutory	5.75%
2024	6.00%
2025	6.25%
2026	6.50%
2027	6.75%
2028	7.00%

The static model estimates that eliminating the state income tax reduces annual revenue by $2.1 billion in 2024, building to a reduction in static revenue of $10.66 billion each year after implementation in 2028. Like Scenario 2, Ohio lawmakers can fill some of the gap in foregone revenue by broadening the sales tax base by $500 million and then increasing the sales tax rate from 5.75 percent to seven percent on the larger base. (See Table 11.)

Table 12: Static Revenue Change for Scenario 4

	Static Revenue Change (in millions)
Income Tax Elimination	-$10,660
Sales Tax Increase (Base Broadening and Rate Increase	$3,660
Total Change	**-$7,000**

Eliminating the income tax over five years shows significant gains in economic activity—even though the effects are somewhat muted compared to eliminating the income tax over five years solely by decreasing government spending. Starting in 2029, one year following the complete phaseout of the income tax, Ohio's economic output routinely surpasses $12 billion each year, and is boosted by significant investment increases achieved by replacing distortionary income taxes with reductions in government spending and more efficient sales tax offsets.

Shifting income tax elimination from a 10-year path to a five-year path comes with significant economic benefits—even with a broader and raised sales tax. In 2032, economic growth will rise by $12.4 billion and 71,000 jobs will be created—slightly smaller than 10-year path to elimination with an offset in government spending. Compared to eliminating the income tax over 10 years with

no sales tax offset, eliminating the income tax over five years with a $3.6 billion dollar increase to the sales tax would increase economic output for an average year over the decade by more than 34 percent while creating more than 9,000 more jobs, on average, than the 10-year elimination with no sales tax increase. Reforming the tax code in this way illustrates the distortive nature of the income tax and how consumption taxes are generally more efficient taxes.

Table 13: Effects of Eliminating Income Tax Over 5 Years, Eliminating $500 Million in Sales Tax Expenditures, and Raising Sales Tax to 7% Over 5 Years[51]

Baseline					
Year	GDP 2021	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$730,979	5,618	$31,766	$501,557	$170,333
2024	$741,348	5,708	$31,196	$512,225	$173,679
2025	$747,697	5,739	$31,486	$520,164	$173,976
2026	$753,827	5,760	$31,775	$527,518	$175,848
2027	$759,477	5,779	$32,061	$534,121	$178,384
2028	$765,962	5,794	$32,347	$542,308	$181,484
2029	$772,897	5,811	$32,632	$551,897	$184,381
2030	$780,126	5,794	$32,917	$561,781	$187,815
2031	$787,380	5,811	$33,207	$571,814	$191,310
2032	$794,625	5,840	$33,503	$582,106	$194,641
2032	$794,625	5,840	$33,503	$582,106	$194,641
Difference from Baseline					
Year	GDP	Employment	Tax Revenue 2021	Consumption 2021	Investment 2021
2023	$0	0	$0	$0	$0
2024	$2,280	14	-$820	$20	$830
2025	$4,650	28	-$1,620	$50	$1,650
2026	$7,050	42	-$2,440	$80	$2,440
2027	$9,480	56	-$3,240	$110	$3,260
2028	$11,970	70	-$4,030	$150	$4,090
2029	$12,080	71	-$4,050	$150	$4,110
2030	$12,190	70	-$4,090	$150	$4,150
2031	$12,300	71	-$4,120	$150	$4,180
2032	$12,420	71	-$4,170	$170	$4,210
2032	$12,860	81	-$6,650	$780	$4,140

51 Source: The ERC's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2021 dollars. Employment is full-time equivalent non-farm jobs, in thousands of jobs. Difference from Baseline results are rounded to the nearest $10 million for GDP, tax revenue, consumption and investment and are rounded to the nearest thousand for employment.

Conclusion

Eliminating Ohio's individual income tax responsibly, while maintaining a balanced budget, will spur significant economic growth. With a budget surplus and a manufacturing revival underway, now is the time to take advantage of economic opportunities to reverse disturbing demographic trends by making Ohio's outmoded tax policies more competitive. Other states have already moved to flat taxes or eliminated their income tax brackets entirely, and those states are climbing the national economic rankings while Ohio lags further and further behind.

Making prudent spending decisions, reprioritizing expenses, and adopting tougher rule-based spending controls will be necessary to balance the budget while following-through on major tax reforms. But the Buckeye Institute's dynamic economic modeling provides several scenarios that show how this can be accomplished successfully. With discipline and boldness, the Ohio General Assembly can take advantage of today's economic opportunities and pursue better tax policies that will make Ohio a better place to live and work.

Appendix

The Buckeye Institute's Economic Research Center Tax Model Methodology

Economists at The Buckeye Institute's Economic Research Center (ERC) have developed and maintain a dynamic scoring model to analyze how changes to tax policy impact not only government revenues but also economic output, job creation, and business investment. Unlike static models that do not account for human or market responses to policy changes, the ERC's dynamic model predicts how individuals, households, and businesses will alter their economic choices in response to changes in the private economy and public policy over time.

For this paper, the ERC calibrated the model for Ohio using publicly available state and federal data, and relied on a similar dynamic scoring framework used by federal agencies to evaluate federal tax proposals to predict how certain policy changes will affect gross domestic product, job creation or loss, and government revenue.

The ERC's model has undergone a double-blind peer review and incorporated comments from those reviews consistent with current academic standards and methodologies. The model's full technical description provided below will allow researchers to validate the model's accuracy and the conclusions that the ERC has drawn.

The Model Framework

The ERC's dynamic model provides a framework representing a generic state economy, with its parameters calibrated to the specific state being analyzed. It allows researchers to study the interaction of households' economic choices and firms' profit maximizing decisions with a state government that pays for its budget by taxing households and businesses. The model framework is similar to those used to study national policy, modified with some conditions tailored to the specific economic conditions of a state. Because states have more limits to trade and debt relative to a national economy, for example, the ERC's model includes a condition in which state governments satisfy a budget constraint where debt cannot increase beyond a certain level.

ERC's model is comprised of the following three parts:

1. *The Household Problem:* Households choose how much to consume and how much to work based on their preferences and their budgets. Households can also choose to take on debt or invest in capital used by firms. Their budgets factor in sales and excise taxes on consumption, labor income (both at the state and federal level), capital income (both at the state and federal level), and licensing. The parameters governing these taxes are estimated using state and federal data.

2. *The Firm Problem:* Firms choose labor and capital, supplied by the household, to maximize profits taking the costs of production (wages, the price of capital, and taxes) as given. Using state-level data, the model simulates production within separate sectors. The output produced is used for consumption, government expenditures, or investments in factors of production.

3. *The Government Sector:* The government sets taxes to collect revenue to pay for its expenditures; however, deficits and surpluses are allowed to a limited degree. The state's trade balance is a mathematical output of what is consumed, invested in, and government expenditures less total production in the economy.

With this framework, the ERC then explicitly defines how households and firms make their economic choices.

In the model environment, time is discrete and lasts forever. In every period the economy is populated by heterogeneous households specialized in the production of one of s types of goods. The Bureau of Economic Analysis (BEA) reports macroeconomic data for the 50 states in yearly intervals, so each period represents a year in this framework. Each sector s is populated by a large number of firms specialized in the production in their sector. The economy also features a government sector that collects taxes and purchases goods from all sectors. A share $q^e \in (0,1)$ of households has earning ability $e = \{1, \dots, E\}$ These shares are such that the total population is $\sum_{e=1}^{E} q^e = 1.$ The share of households with the required skills to work in sector s is $\mu_s \in (0,1)$ such that $\sum_{s=1}^{S} \mu_s = 1.$ The ERC then outlines each part of the model: the household problem, the firm problem, and the government sector.

The Household Problem

The household has preferences between consumption and leisure. These preferences are represented by a period t utility function $U_t,$ which takes the following form:

$$U_t = \sum_{s=1}^{S} \alpha_s \ln\left(c_{e,t}(s)\right) - \chi_e l_{e,t}(s)^{\left(1+\frac{1}{\psi_e}\right)}$$

Taking the prices, taxes, and previous period *t-1* choices as given, each period t, household e chooses: how much to consume $c_{e,t}(s)$ from each sector s; the amount of future capital stock $k_{e,t}(s)$ for each sector s; investment $x_{e,t}(s)$ for each sector s; how much to borrow in debt $d_{e,t}$; and how much to work $l_{e,t}(s)$ in each sector s. Households place a utility weight on consumption goods according to $\alpha_s \in (0,1)$ where α_s represents the share of total GDP in sector s. Period time is split between labor and leisure such that total time is normalized to 1. Leisure h_(e, can be defined as:

where h $h_{e,t}$) [0 and l_(e,t) (s) [0 . The

$$h_{e,t} = 1 - \sum_{s=1}^{S} l_{e,t}(s)$$

parameter that regulates the Frisch elastici $h_{e,t} \in [0,1]$ · sup $l_{e,t}(s) \in [0,1]$ d _e. _ is a scaling factor that helps match hours worked observed in the data. The ho $\psi_e \cdot \chi_e$ d seeks to maximize its utility by solving the following problem:

The economic decisions for period t are subject to the following constraints:

$$V_{e,t}(s) = \max_{c_{e,t}(s), x_{e,t}(s), l_{e,t}(s), k_{e,t}(s), d_{e,t}} U(c_{e,t}) - \chi_e l_{e,t}(s)^{\left(1+\frac{1}{\psi_e}\right)} + \beta E[V_{e,t+1}(s)]$$

V_(e,t) defines expected utility discounted at a patient factor [0,1]. As in Mendoza

$$\begin{aligned} d_{e,t} * DMute = {} & (1+\tau_t^c+\tau_t^{ex})\sum_{s=1}^{S} c_{e,t}(s) + \sum_{s=1}^{S} x_{e,t}(s) + (1+i_{r,t-1})d_{e,t-1} + \tau_t^k \sum_{s=1}^{S} k_{e,t-1}(s) \\ & + \left[\frac{\phi}{2}\left(\sum_{s=1}^{S} k_{e,t}(s) - \sum_{s=1}^{S} k_{e,t-1}(s)\right)^2\right] - (1-(1-\eta_{e,t}^{i,n})\tau_{e,t}^{i,n} - \tau_t^o \\ & - \tau_{e,t}^{i,n,f})\sum_{s=1}^{S} w_{e,t}(s) l_{e,t}(s) - (1-(1-\eta_{e,t}^{i,r})\tau_{e,t}^{i,r} - \tau_t^o - \tau_{e,t}^{i,r,f} \\ & - \tau_t^{corp})\sum_{s=1}^{S} r_{e,t}(s) k_{e,t-1}(s) \end{aligned}$$

$$k_{e,t}(s) = x_{e,t}(s) + (1-\delta)k_{e,t-1}(s)$$
$$c_{e,t}(s) \geq 0$$
$$k_{e,t}(s) \geq 0,\ k_{e,t+1}(s) = 0$$

$V_{e,t}(s)$ denotes a capital adjustment cost. The return or $\beta \in [0,1]$. lent to firms is r_(e, ϕ . The wage paid to workers of type e in sector s is w_(e,t) Future c $r_{e,t}(s)$ stock k_(e,t) is the sum of current capital stock k_(e,t- accou $w_{e,t}(s)$. or depreciation , and $k_{e,t}(s)$ ment x_(e,t) (s). idenotes the intere $k_{e,t-1}(s)$ t which domestic residents δ, an borrow from i $x_{e,t}(s)$. $i_{r,t}$ al markets in period t, and d_(e is household debt. *DMute* is a parameter that accounts for the change in personal d $d_{e,t}$ etween 2005 and the starting year of the study. Federal Reserve data are used to calculate this parameter.

Following Schmitt-Grohé and Uribe (2003), the ERC assumes a debt elastic interest rate. This is modeled as

where is the world $i_{r,t} = i_{r,w} + \zeta(e^{D_t - D} - 1)$ $i_{r,w}$ interest rate faced by domestic agents and is assumed to be constant and and D are cons ζ ant parameters that are calibrated to match the state's economy. (e^(D_t-D)-1) is $\zeta(e^{D_t - D} - 1)$ ific interest rate premium that increases with the level of debt. D_t represent D_t e aggregate state level of debt, such that _t^ is the $D_t = \sum_{e=1}^{E} d_{e,t}$.

τ_t^c on household consumption purchases, which includes general sales tax, and _t is th τ_t^{ex} cise tax rate. _ is th $\tau_{e,t}^{i,n}$ atutory individual labor income tax rate, and _(e,is the i $\tau_{e,t}^{i,r}$ idual capital income tax rate. $\eta_{e,t}^{i,n}$ and $\eta_{e,t}^{i,r}$, are the proportions of labor income and capital income respectively that are deducted or otherwise exempt from income taxes. $\tau_{e,t}^{i,n,f}$ is the individual labor income tax collected by the federal government, and $\tau_{e,t}^{i,r,f}$, is the individual capital income tax collected by the federal government. Income tax rates depend on the individual earning ability e. τ_t^k is a tax on fixed assets owned by households. τ_t^{corp} is the corporate income tax faced by the owners of capital. τ_t^o is the share of income paid to all other taxes, fees, and revenue sources for the state government not included specifically in the model.

The variables representing households' economic decisions for each period t and sector s can be summarized as the set:

$$\left\{\left\{c_{e,t}(s), x_{e,t}(s), l_{e,t}(s), k_{e,t+1}(s)\right\}_{s=1}^{S}, d_{e,t}\right\}_{t=0}^{\infty}.$$

The household then maximizes the utility function subject to the resource constraint and a no-Ponzi scheme constraint that implies that the household's debt position must be expected to grow at a rate lower than the interest rate in the long-run.

The Firm Problem

In each sector s, a large number of competitive firms produce goods according to the following constant elasticity of substitution (CES) production function:

$$y_t(s) = a_t\left(\sum_{e=1}^{E}\left((\theta_s)\left(k_{e,t-1}(s)\right)^{-\rho} + (1-\theta_s)\left(z_e\, l_{e,t}(s)\right)^{-\rho}\right)^{-\frac{1}{\rho}}\right)$$

where a_t is total factor productivity (TFP), θ_s is associated with the capital share of total output in sector s, and $\sigma_{CES} = \frac{1}{1-\rho}$ is the constant elasticity of substitution between capital and labor. z_e is labor productivity specific to a household member's earning ability. These firms solve the following profit maximization problem:

$$\Pi_t = (1-\tau_t^{CAT})a_t\left(\sum_{e=1}^{E}\left((\theta_s)\left(k_{e,t-1}(s)\right)^{-\rho} + (1-\theta_s)\left(z_e\, l_{e,t}(s)\right)^{-\rho}\right)^{-\frac{1}{\rho}}\right) - \sum_{e=1}^{E} w_{e,t}(s)l_{e,t}(s) - \sum_{e=1}^{E} r_{e,t}(s)k_{t-1}(s)$$

It is important to note that the demand for labor and capital is sector s specific. τ_t^{CAT} is a commercial activity tax, modeled as a tax on a firm's revenues.

The representative firm in sector s hires labor according to the following condition:

$$(1-\tau_t^{CAT})\,(1-\theta_s)a_t\left((\theta_s)\left(k_{e,t-1}(s)\right)^{-\rho} + (1-\theta_s)\left(z_e\, l_{e,t}(s)\right)^{-\rho}\right)^{-\frac{1}{\rho}-1}\left(z_e l_{e,t}(s)\right)^{-\rho-1} z_e = w_{e,t}(s),$$

where $w_{e.t}(s)$ is the wage rate for type e in sector s. The demand for capital is such that:

$$(1-\tau_t^{CAT})(\theta_s)a_t\left((\theta_s)\left(k_{e,t-1}(s)\right)^{-\rho} + (1-\theta_s)\left(z_e\, l_{e,t}(s)\right)^{-\rho}\right)^{-\frac{1}{\rho}-1}\left(k_{e,t-1}(s)\right)^{-\rho-1} = r_{e,t}(s),$$

The ERC assumes a_t follows a stationary mean zero autoregressive process of order 1 in the log, which can be represented in the following way:

$$(a_t) = \rho_A(a_{t-1}) + \epsilon_{A,t}$$

The innovation shock $\epsilon_{A,t}$ is drawn from a standard normal distribution.

The Government Sector

The government sets taxes and collects revenue to make purchases. Its contribution to the rainy-day fund RF_t is the excess of tax revenue plus federal government transfers net of government spending added to the previous period's balance.

$$RF_t = TR_t + FF_t - g_t + (1+i_{r,t})RF_{t-1}$$

Deficits—negative contributions—to the rainy-day fund reduce the fund's balance.

The state government's tax revenues TR_t are given by:

$$TR_t = \sum_{s=1}^{S}\left(\sum_{e=1}^{E}\left(\tau_t^{\mathrm{CAT}} y_{(e,t)}(s) + (\tau_t^{c} + \tau_t^{ex})c_{e,t}(s) + (1-\eta_{e,t}^{i,n})\tau_{e,t}^{i,n}\, w_{e,t}(s)l_{e,t}(s) + (1-\eta_{e,t}^{i,r})\tau_{e,t}^{i,r}\, r_{e,t}(s)k_{e,t-1}(s) + \tau_t^{k}k_{e,t-1}(s)\right) + \tau_t^{o}\, y_t(s)\right)$$

Government spending is proportional to GDP and is specified as $g_t = \hat{g}_t y_t$. This implies that government spending is assumed to grow as the economy grows. Spending policy $\hat{g}_t$ is assumed to evolve according to:

$$\hat{g}_t = (1-\rho_{g,h})(\hat{g}) + \rho_{g,h}(\hat{g}_{t-1}) + \epsilon_g$$

where $\hat{g}$ is the state share of income spent by the government sector in the long-run, the steady-state equilibrium. Variables without the time subscript denote steady-state values.

The tax instruments follow the exogenous processes:

$$\tau_t^{i,n} = (1-\rho_{i,n})\tau^{i,n} + \rho_{i,n}\tau_{t-1}^{i,n} + \epsilon_{i,n}$$
$$\tau_t^{i,r} = (1-\rho_{i,r})\tau^{i,r} + \rho_{i,r}\tau_{t-1}^{i,r} + \epsilon_{i,r}$$
$$\tau_t^{c} = (1-\rho_{c})\tau^{c} + \rho_{c}\tau_{t-1}^{c} + \epsilon_{c}$$
$$\tau_t^{ex} = (1-\rho_{ex})\tau^{ex} + \rho_{ex}\tau_{t-1}^{ex} + \epsilon_{ex}$$
$$\tau_t^{corp} = (1-\rho_{corp})\tau^{corp} + \rho_{corp}\tau_{t-1}^{corp} + \epsilon_{corp}$$
$$\tau_t^{k} = (1-\rho_{k})\tau^{k} + \rho_{k}\tau_{t-1}^{k} + \epsilon_{k}$$
$$\tau_t^{o} = (1-\rho_{o})\tau^{o} + \rho_{o}\tau_{t-1}^{o} + \epsilon_{o}$$
$$\tau_t^{i,n,f} = (1-\rho_{i,n,f})\tau^{i,n,f} + \rho_{i,n,f}\tau_{t-1}^{i,n,f} + \epsilon_{i,n,f}$$
$$\tau_t^{i,r,f} = (1-\rho_{i,r,f})\tau^{i,r,f} + \rho_{i,r,f}\tau_{t-1}^{i,r,f} + \epsilon_{i,r,f}$$
$$\eta_t^{i,n} = (1-\rho_{\eta,n})\eta^{i,n} + \rho_{\eta,n}\tau_{t-1}^{i,n} + \epsilon_{\eta,n}$$
$$\eta_t^{i,r} = (1-\rho_{\eta,r})\eta^{i,r} + \rho_{\eta,r}\eta_{t-1}^{i,r} + \epsilon_{\eta,r}$$

As in Schmitt-Grohé and Uribe (2003), the ERC writes the trade balance to GDP ratio (TB) in steady-state as:

$$TB = 1 - \frac{[c + x + g]}{y}$$

The Competitive Equilibrium

A competitive equilibrium is such that given the set of exogenous processes, households solve the household utility maximization problem, firms solve the profit maximization problem, and the capital and labor markets clear.

The Deterministic Steady-State

The characterization of the deterministic steady state is of interest for two reasons. First, the steady-state facilitates the calibration of the model. This is because the deterministic steady-state coincides with the average position of the model economy to a first approximation. Because of this, matching average values of endogenous variables to their observed counterparts (e.g., matching predicted and observed average values of the labor share, the consumption shares, or the trade-balance-to-output ratio) can reveal information about structural parameters that can be used in the calibration of the model. Second, the deterministic steady-state is often used as a convenient point around which to approximate equilibrium conditions of the stochastic economy (see Schmitt-Grohe and Uribe, 2003). For any variable, the ERC denotes its steady-state value by removing the time subscript.

Using the solution from the households' and firms' choice problems, the steady-state implies that:

$$1 = \beta\left[\left(1-(1-\eta_e^{i,r})\tau_e^{i,r} - \tau^{o} - \tau_e^{i,r,f} - \tau^{corp}\right)r_e(s) + 1 - \delta - \tau^{k}\right]$$
$$y(s) = a\left(\sum_{e=1}^{E}\left((\theta_s)\left(k_e(s)\right)^{-\rho} + (1-\theta_s)\left(z_e\, l_e(s)\right)^{-\rho}\right)^{-\frac{1}{\rho}}\right)$$
$$(1-\tau^{CAT})a\left[\theta_s\left(\frac{k_e(s)}{l_e(s)}\right)^{-\rho} + (1-\theta_s)z_e^{-\rho}\right]^{-\frac{1}{\rho}-1}\theta_s\left(\frac{k_e(s)}{l_e(s)}\right)^{-\rho-1} = r_e(s)$$

These expressions deliver the steady-state capital-labor ratio, which the ERC denotes $\omega_e(s)$

$$\omega_e(s) \equiv \frac{k_e(s)}{l_e(s)} = (1-\theta_s)^{-\frac{1}{\rho}}(z_e)\left(\frac{\beta^{-1} - 1 + \delta + \tau^{k}}{a(1-\tau^{CAT})\theta_s\left(1-(1-\eta_{e,t}^{i,r})\tau_e^{i,r} - \tau^{o} - \tau_e^{i,r,f} - \tau^{corp}\right)} - \theta_s\right)^{\frac{1}{\rho}}$$

The steady-state level of capital is:

$$k_e(s) = \omega_e(s) l_e(s)$$

Finally, the steady-state level of consumption can be obtained by evaluating the resource constraint at the steady-state:

$$\sum_{e=1}^{E} c_e(s) = y(s) - \delta\sum_{e=1}^{E} k_e(s) - g\mu_s - TBy(s)$$

which implies: $y = c + x + g + TBy$

As for the parameter that dictates households' preference for leisure:

$$\chi_e = \frac{\alpha_s}{(1+\tau^{c}+\tau^{ex})c_e(s)} \times \frac{(1-(1-\eta_{e,t}^{i,n})\tau_e^{i,n} - \tau^{o} - \tau_e^{i,n,f})w_e(s)}{\left(1+\frac{1}{\psi_e}\right)l_e(s)^{\frac{1}{\sigma_e}}}$$

Data and Calibration

The ERC's data for calibrating the model come from publicly available federal and state data sources. First, the ERC presents its sources for the model's output variables. Then the ERC presents the sources for the model parameters and its empirical methodology for calibrating the model.

Output Variables

Primarily, the ERC utilizes BEA Regional Economic Accounts for Ohio for its output. All GDP variables are reported in real (2012 dollars) per capita terms using the U.S. GDP deflator reported by the BEA and, if not declared otherwise, the ERC refers to the period of 1963-2017.

The ERC's GDP projections use the latest GDP values for the state and apply projected growth rates for each year based on the product of a Congressional Budget Office (CBO) forecast of the national economy and average ratio of GDP between the state and the country from 1990 to 2021.[52]

For the ERC's measure of consumption, consumption expenditures on durable goods are subtracted from total personal consumption expenditures (PCE). The ERC considers durable goods as investment goods, as is standard in the macroeconomics literature. The values for PCE are not available on the state-level prior to 1997.

The ERC therefore uses the long-run average share of consumption in GDP to obtain the level of consumption for each year from 1963-1997. Because the BEA does not report private fixed investment at the state level, the ERC uses the U.S. share of non-residential investment in GDP from the BEA, and multiply it by the state GDP to estimate non-residential gross investment. The sum of non-residential investment and consumption expenditures on durable goods represents the ERC's measure of investment. The ERC's methodology excludes residential investment from its measure of investment (residential investment is excluded from GDP as well).

The ERC bases its employment data for the number of non-farm jobs on data from the Bureau of Labor Statistics. The ERC calculates the employment shares per sector using data from the BEA Regional Economic Accounts. The ERC took the average weekly hours worked from the Annual Social and Economic Supplement of the Current Population Survey. The average weekly hours worked at all jobs is divided by the total number of hours per week (168 hours) to calculate average labor supply used for the model calibration. For the baseline projections, employment is assumed to grow at the forecasted rates of employment from the CBO.[53]

The ERC used the following methodology to estimate the effects of the tax policy scenarios on employment because the model measures employment in hours worked (intensive margin). First, the ERC used employment multiplied by the average hours worked per year (2,102 hours). This total number of hours worked per year is multiplied by the effect of the corresponding scenario in order to obtain the change in total hours worked for each scenario. Finally, the change in hours is converted into the number of full-time equivalent jobs gained or lost by dividing it by 2,080, which is the number of hours worked by a full-time equivalent employee according to the CBO's definition (Harris and Mok, 2015).[54]

52 10-Year Economic Projections, May 2022, CBO.gov (Last visited August 2022).

53 Ibid.

54 Edward Harris and Shannon Mok, How CBO Estimates the Effects of the Affordable Care Act on the Labor Market, working paper 2015-09, Congressional Budget Office, December 2015.

Model Parameters and Calibration

Typically, a calibration assigns values to the model parameters by matching first and second moments of the data that the model aims to explain. The ERC utilizes moments in state and federal data to estimate the model parameters.

Because depreciation data are not reported at the state level by the BEA, the ERC refers to data for the U.S. economy. The sum of current cost depreciation in nonresidential private fixed assets and consumer durable goods is divided by the sum of current cost net stock of nonresidential private fixed assets and consumer durable goods for the years 1963-2021. The average over this period represents the depreciation rate in the ERC's model. The depreciation rate of capital is $\delta = 0.1.$

The world interest rate is $i_{r,w} = 0.04,$ based on the difference between the nominal interest rate for three-month treasury bill and the GDP deflator.

To compute the sector-specific labor shares, the ERC uses data from the BEA Regional Income Division. Similar to Gomme and Rupert (2004), Buckeye divides the compensation of employees by the personal income for each sector.[55] As personal income is not available for sectors, the ERC constructs it by multiplying the earnings per sector by the total economy's personal income-to-earnings ratio, which is from the BEA Regional Income Division. The capital share is simply one minus the labor share. The values refer to the years 2013-2021. The sector specific parameter θ_s is set to match the observed average labor shares for each of the S=9 production sectors.[56] In the present model, the labor share is given by the ratio of labor income to output which is $1 - \theta_s$ at all times. To ensure that capital and investment are not being overstated (or understated), the parameter *v*, a cost on holding capital, is applied to adjust the steady state rental rate of capital, calibrating it to match the state's investment share of GDP.[57]

The earning ability for household types is based on the distribution of income and population as reported in the Ohio Department of Revenue individual income tax annual report for Tax Year 2021.[58]

- Earning ability 1 has an adjusted gross income (AGI) of up to $20,000 per year;
- Earning ability 2 has an AGI from $20,000 to $50,000;
- Earning ability 3 has an AGI from $50,000 to $75,000;
- Earning ability 4 has an AGI from $75,000 to $100,000;
- Earning ability 5 has an AGI from $100,000 to $150,000;
- Earning ability 6 has an AGI from $150,000 to $200,000;
- Earning ability 7 has an AGI from $200,000 to $250,000;
- Earning ability 8 has an AGI from $250,000-$500,000;
- Earning ability 9 has an AGI from $500,000 to $1,000,000; and
- Earning ability 10 has an AGI of more than $1,000,000 per year.

55 Paul Gomme and Peter Rupert, Measuring Labors Share of Income, working paper, Federal Reserve Bank of Cleveland, Policy Discussion Paper number 04-07, November 2004.

56 See complete list of sectors in the Tax Model Parameters section.

57 The holding cost of capital is incorporated mathematically in the following way to steady state rental rate of capital: $r^*_{e,s} = \frac{\frac{1}{\beta}+\tau^p_e+v-(1-\delta)}{(1-(1-\eta^{i,r}_{e,s})\tau^{i,r}_e-\tau^{i,r,f}_e-\tau^{co}-\tau^s_e-\tau^o)}$.

58 Ohio Department of Taxation, Ohio Department of Taxation Annual Report Fiscal Year 2021, 2022.

The share of household members by earning ability, q^e, is the share of returns per earning ability group. The labor productivity per earning ability, Z_e, is the income per return for each earning ability with the labor productivity for group 1 being normalized to one. The ERC takes its Frisch elasticity estimate $\psi_e = 0.4$ from Reichling and Whalen (2012).[59] The parameter D is set to match the observed average trade-balance to output ratio since $TB = i_{r,w}\frac{D}{y}$. The ERC estimates tax rates similar to the methodology used by McDaniel (2007).[60]

The full list of parameters is included in the following section.

The Buckeye Institute's Economic Research Center Tax Model Parameters

Tax Rate Estimates

The state tax rates calculated in this paper are average Ohio tax rates. The general strategy employed is as follows. First, total income is categorized as labor income or capital income and private expenditures are categorized as consumption or investment. Second, tax revenues are classified as revenues generated from taxes on labor income, capital income, private consumption expenditures, or private investment. To find a given tax rate, the ERC divides each category of tax revenue by the corresponding income or expenditure. Since the ERC computes tax rates in the same fashion each year, they drop time subscripts for the rest of this section.

Data on tax revenues come from U.S. Census Bureau Survey of State Government Tax Collections (STC) and the Ohio Department of Taxation's Annual Report for Fiscal Year 2021.[61] Data on income and expenditures come from regional BEA data. In any given year, total tax revenues collected by the government are the sum of taxes on production and imports (TPI), social security contributions, direct taxes on households (HHT), and direct taxes on corporations. The following sections detail the steps the ERC takes to categorize these tax revenues and calculate average tax rates.

Share of the Income Tax that Falls on Labor

The average tax rate on labor income is found by dividing labor income tax revenues by economy-wide total wage and salary labor income. To compute the labor income tax rate, the ERC calculates labor income tax revenues and labor income. Labor income tax revenues come from two sources: the household income tax and social security taxes. However, household income taxes represent taxes on total income. Since only a portion of this income is generated from labor, only a portion of these taxes reflects taxes on labor income.

Unfortunately, the STC and BEA do not break down household income taxes according to type of income. For this reason, papers calculating average tax rates on labor and capital income based on aggregate data, such as Mendoza et al. (1994), assume that the tax rate on household labor income is the same as the tax rate on household capital income.[62] The ERC makes the same assumption.

59 Felix Reichling and Charles Whalen, Review of Estimates of the Frisch Elasticity of Labor Supply, working paper 2012-13, Congressional Budget Office, October 2012.

60 A complete explanation of the methodology is included in the Tax Mode Parameters section; Cara McDaniel, Average tax rates on consumption, investment, labor, and capital in the OECD 1950-2003, working paper, March 2007.

61 2020 Annual Survey of State Government Tax Collections Detailed Table, U.S. Department of Commerce, U.S. Census Bureau (Last visited August 2022); and Ohio Department of Taxation, Ohio Department of Taxation Annual Report 2021, 2022.

62 Enrique G. Mendoza, Assaf Razin, and Linda L. Tesar, "Effective tax rates in macroeconomics: Cross-country estimates of tax rates on factor incomes and consumption," Journal of Monetary Economics, Volume 34, Issue 3 (December 1994) p.297-323.

The federal income tax rate is found by dividing total federal taxes on income of the household, FHHT, by total household income in each period. Household income is defined as gross domestic product less net taxes on production and imports, or GDP-(TPI-Sub). The household income tax rate is therefore measured as:

$$\tau^{i,f} = \frac{FHHT}{GDP - (TPI - Sub)}$$

It remains to divide income into payment to capital and payment to labor. Let θ be the share of income attributed to capital, with the remaining $(1-\theta)$ share attributed to labor. Total household income taxes paid on labor income are represented by

$$FHHT_L = \tau^{i,l,f}(1-\theta)\big(GDP - (TPI - Sub)\big)$$

The second source of tax revenue generated from taxes on labor income are social security taxes, SS. This corresponds to an exact entry in the BEA data, no further adjustment is required. Social security taxes combined with HHTL represent total tax revenues that are classified as taxes paid on labor income, so the average tax rate on labor income is measured as:

$$\tau^{i,n,f} = \frac{SS + FHHT_L}{(1-\theta)\big(GDP - (TPI - Sub)\big)}$$

At the state level, the ERC calculates income tax rates for a variety of earning groups. The state income tax rate is found by dividing total state taxes on income of the household, $SHHT_e$, by total household income in each period. Household income, total state taxes on income of the household, as well as population are distributed according to the distribution reported in the Ohio Department of Taxation's Annual Report for Fiscal Year 2021.[63] Household income is defined as gross domestic product less net taxes on production and imports, or GDP - (TPI - Sub). The household income tax rate is therefore measured as:

$$\tau^{i} = \frac{SHHT_e}{\big(GDP - (TPI - Sub)\big)_i}$$

It remains to divide income into payment to capital and payment to labor. Let θ be the share of income attributed to capital, with the remaining $(1-\theta)$ share attributed to labor. Total household income taxes paid on labor income are represented by

$$SHHT_{e,i} = \tau^{i,n}(1-\theta)\big(GDP - (TPI - Sub)\big)_i$$

The average state tax rate on labor income is measured as:

$$\tau^{i,n} = \frac{SHHT_{e,i}}{(1-\theta)\big(GDP - (TPI - Sub)\big)_i}$$

Consumption and Investment Tax Rates

Revenue collected from taxes levied on consumption and investment expenditures are included in taxes on production and imports, TPI. Consumption and investment expenditures are subsidized by the amount Sub. TPI includes general taxes on goods and services, excise taxes, import duties and property taxes. The task remains to properly allocate TPI to the relevant tax revenue category. This requires the proper division of TPI across consumption and investment. TPI includes the following components: Property taxes, general taxes on goods and services, excise taxes, taxes on specific services, and taxes on the use of goods to perform activities.

63 Ohio Department of Taxation, Ohio Department of Taxation Annual Report 2021, 2022.

Some of the taxes included in TPI fall only on consumption expenditures. Others fall on both consumption and investment expenditures. Revenue from taxes that fall on both consumption and investment expenditures are assumed to be split between consumption tax revenue and investment tax revenue according to consumption and investment share in private expenditures. Taxes that fall strictly on consumption are excise taxes and taxes on specific services, reported as select sales taxes in the STC data.

Taxes that fall on both consumption and investment are general sales and use taxes, and taxes on use of goods to perform activities, which includes motor vehicle taxes, highway taxes, license taxes, etc. These goods are used in the production of both investment goods and consumption goods, and can be calculated by subtracting select sales taxes, total income taxes, and corporation license taxes from total taxes in the STC data.

After identifying taxes that fall strictly on consumption expenditures, the ERC calculates λ, their share of TPI. Revenue collected from taxes levied on consumption expenditures is calculated as:

$$TPI_C = \left(\lambda + (1-\lambda)\left(\frac{C}{C+I}\right)\right)(TPI - Sub)$$

Consumption expenditures are reported in the national accounts gross of taxes. Taxable consumption expenditures are then $C - TPI_c$ and the consumption tax is measured as:

$$\tau^C = \frac{TPI_C}{C}$$

TPI_c: TPI_c represents revenue from consumption taxes, the remaining portion of TPI-Sub is attributed to taxes on investment.

$$TPI_X = TPI - Sub - TPI_C$$

Share of the Income Tax that Falls on Capital

As calculated previously, income paid to capital in the econ$\theta(GDP - (TPI - Sub))$. OSGOV is gross operating surplus earned by the government, and therefore is not subject to tax. Taxable capital income is therefore $\theta(GDP - (TPI - Sub)) - OSGOV$. Capital tax revenues come from the following sources: the household income tax, and taxes levied on corporate income. Federal household taxes on capital, $FHHT_K$, is then

$$FHHT_K = \tau^{i,r,f}\theta\big(GDP - (TPI - Sub)\big)$$

The federal household capital income tax rate is then

$$\tau^{i,k,f} = \frac{FHHT_k}{\theta\big(GDP - (TPI - Sub)\big) - OSGOV}$$

Federal corporate tax data (FCT) is only available at the national level, therefore the ERC first approximates the share of corporate tax paid by Ohio.

The federal corporate tax rate is computed using national data as:

$$\tau^{CT,F} = \frac{FCT}{\theta\big(GGDP - (TPI - Sub)\big) - OSGOV}$$

$$\tau^{i,r,f} = \tau^{CT,F} + \tau^{i,k,f}$$

As owners of corporations, households are subject to all corporate taxation. The total federal capital income tax is then:

At the state level household capital income tax is

$$SHHT_{K,i} = \tau^{i,k}\left(\theta\left(GDP - (TPI - Sub)\right)_i\right)$$

Where the household income and tax burden are once again distributed according to the distribution reported in the Ohio Department of Taxation's Annual Report for Fiscal Year 2021.[64]

The state household capital income tax rate is then

$$\tau^{i,r} = \frac{\left(SHHT_{K,i} + SCT_i\right)}{\theta\left(GDP - (TPI - Sub)\right)_i - OSGOV_i}$$

Sectors

The ERC's model uses nine production sectors. The BEA reports GDP for each two-digit North American Industry Classification System (NAICS) industries, which the ERC uses to calculate each sector's percentage in total GDP (see Table B-4). Some of Buckeye's sectors are the same as reported by the BEA, the remaining sectors are constructed by combining several NAICS industries as shown in Table B-1.

Table B-1: Definition of Sectors

Sector	NAICS Sectors
Agriculture, Forestry, Fishing, and Hunting	Agriculture, Forestry, Fishing, and Hunting
Mining	Mining
Utilities, Transportation, and Warehousing	Utilities, Transportation, and Warehousing
Construction	Construction
Manufacturing	Manufacturing
Trade	Wholesale Trade Retail Trade
Services	Information Finance and Insurance Professional, Scientific, and Technical Services Management of Companies and Enterprises Administrative and Waste Management Services Educational Services Arts, Entertainment, and Recreation Accommodation and Food Services Other Services
Real Estate, Rental, and Leasing	Real Estate, Rental and Leasing
Health Care and Social Assistance	Health Care and Social Assistance

64 Ohio Department of Taxation, Ohio Department of Taxation Annual Report 2021, 2022.

Parameters

The following tables present the calibrated parameters for the model.

Table B-2: Household Parameters*

Disutility of Labor	χ_e =240.0
Real Interest Rate	$i_{r,w}$ =0.04
Annual Depreciation Rate of Capital	δ =0.1
Frisch Elasticity of Labor Supply	ψ_e =0.4
Holding Cost of Capital	v = -0.0103
2028	7.00%

*The real interest rate is based on the difference between the nominal interest rate for three-month Treasury bill and the GDP deflator from 1950 to 2015 using St. Louis Federal Reserve Bank FRED data. The annual depreciation rate of capital is based on data from the BEA for the U.S. economy. It is the average of the sum of current cost depreciation in nonresidential private fixed assets and consumer durable goods divided by the sum of current cost net stock of nonresidential private fixed assets and consumer durable goods for the years 1963 to 2015. The Frisch elasticity of labor supply is based on the central estimate from Reichling and Whalen (2012).

Table B-3: Labor Productivity

Labor Productivity	Population Distribution
z_1=1	q^1=0.248
z_2=3.45	q^2=0.326
z_3=6.25	q^3=0.159
z_4=8.88	q^4=0.095
z_5=12.51	q^5=0.098
z_6=18.27	q^6=0.034
z_7=24.66	q^7=0.014
z_8=39.91	q^8=0.019
z_9=97.11	q^9=0.005
z_{10}=1317.01	q^{10}=0.002

Table B-4: Sector Specific Parameters

Sector			
Agriculture, Forestry, Fishing, and Hunting	α_1 =0.007	μ_1=0.017	θ_1 =0.655
Mining	α_2 =0.009	μ_2=0.005	θ_2 =0.545
Utilities, Transportation, and Warehousing	α_3 =0.054	μ_3=0.049	θ_3 =0.450
Construction	α_4 =0.041	μ_4=0.055	θ_4 =0.513
Manufacturing	α_5 =0.185	μ_5=0.116	θ_5 =0.321
Trade	α_6 =0.137	μ_6 =0.153	θ_6 =0.352
Services	α_7 =0.344	μ_7=0.415	θ_7 =0.387
Real Estate, Rental, and Leasing	α_8 =0.127	μ_8=0.045	θ_8 =0.578
Health Care and Social Assistance	α_9 =0.098	μ_9 =0.146	θ_9 =0.345

Table B-5: Federal Tax Parameters

Federal individual labor income tax rate for AGI 1	$\tau_1^{i,n,f}$ =0.0030w
Federal individual capital income tax rate for AGI 1	$\tau_1^{i,r,f}$ =0.0028
Federal individual labor income tax rate for AGI 2	$\tau_2^{i,n,f}$ =0.0354
Federal individual capital income tax rate for AGI 2	$\tau_2^{i,r,f}$ =0.0339
Federal individual labor income tax rate for AGI 3	$\tau_3^{i,n,f}$ =0.0429
Federal individual capital income tax rate for AGI 3	$\tau_3^{i,r,f}$ =0.0409
Federal individual labor income tax rate for AGI 4	$\tau_4^{i,n,f}$ =0.0477
Federal individual capital income tax rate for AGI 4	$\tau_4^{i,r,f}$ =0.0454
Federal individual labor income tax rate for AGI 5	$\tau_5^{i,n,f}$ =0.0634
Federal individual capital income tax rate for AGI 5	$\tau_5^{i,r,f}$ =0.0619
Federal individual labor income tax rate for AGI 6	$\tau_6^{i,n,f}$ =0.0634
Federal individual capital income tax rate for AGI 6	$\tau_6^{i,r,f}$ =0.0619
Federal individual labor income tax rate for AGI 7	$\tau_7^{i,n,f}$ =0.1283
Federal individual capital income tax rate for AGI 7	$\tau_7^{i,r,f}$ =0.1192
Federal individual labor income tax rate for AGI 8	$\tau_8^{i,n,f}$ =0.0944
Federal individual capital income tax rate for AGI 8	$\tau_8^{i,r,f}$ =0.0892
Federal individual labor income tax rate for AGI 9	$\tau_9^{i,n,f}$ =0.1323
Federal individual capital income tax rate for AGI 9	$\tau_9^{i,r,f}$ =0.1235
Federal individual labor income tax rate for AGI 10	$\tau_{10}^{i,n,f}$ =0.1494
Federal individual capital income tax rate for AGI 10	$\tau_{10}^{i,r,f}$ =0.1399

Table B-6: State Income Tax Parameters I

State individual labor income tax rate for AGI 1	$\tau_1^{i,n}$ =0.0000
State individual capital income tax rate for AGI 1	$\tau_1^{i,r}$ =0.0000
State individual labor income tax rate for AGI 2	$\tau_2^{i,n}$ =0.0128
State individual capital income tax rate for AGI 2	$\tau_2^{i,r}$ =0.0128
State individual labor income tax rate for AGI 3	$\tau_3^{i,n,}$ =0.0207
State individual capital income tax rate for AGI 3	$\tau_3^{i,r,}$ =0.0207
State individual labor income tax rate for AGI 4	$\tau_4^{i,n}$ =0.0234
State individual capital income tax rate for AGI 4	$\tau_4^{i,r}$ =0.0234
State individual labor income tax rate for AGI 5	$\tau_5^{i,n}$ =0.0266
State individual capital income tax rate for AGI 5	$\tau_5^{i,r}$ =0.0266
State individual labor income tax rate for AGI 6	$\tau_6^{i,n}$ =0.0294
State individual capital income tax rate for AGI 6	$\tau_6^{i,r}$ =0.0294
State individual labor income tax rate for AGI 7	$\tau_7^{i,n}$ =0.0311
State individual capital income tax rate for AGI 7	$\tau_7^{i,r}$ =0.0311
State individual labor income tax rate for AGI 8	$\tau_8^{i,n}$ =0.0328
State individual capital income tax rate for AGI 8	$\tau_8^{i,r}$ =0.0328
State individual labor income tax rate for AGI 9	$\tau_9^{i,n}$ =0.0346
State individual capital income tax rate for AGI 9	$\tau_9^{i,r}$ =0.0346
State individual labor income tax rate for AGI 10	$\tau_{10}^{i,n}$ =0.0355
State individual capital income tax rate for AGI 10	$\tau_{10}^{i,r}$ =0.0355

Table B-7: State Income Tax Parameters II

State individual labor income tax exemption rate for AGI 1	$\eta_1^{i,n}$ =0.0000
State individual capital income tax exemption rate for AGI 1	$\eta_1^{i,r}$ =0.0000
State individual labor income tax exemption rate for AGI 2	$\eta_2^{i,n}$ =0.4327
State individual capital income tax exemption rate for AGI 2	$\eta_2^{i,r}$ =0.3957
State individual labor income tax exemption rate for AGI 3	$\eta_3^{i,n}$ =0.3803
State individual capital income tax exemption rate for AGI 3	$\eta_3^{i,r}$ =0.3399
State individual labor income tax exemption rate for AGI 4	$\eta_4^{i,n}$ =0.3787
State individual capital income tax exemption rate for AGI 4	$\eta_4^{i,r}$ =0.3381
State individual labor income tax exemption rate for AGI 5	$\eta_5^{i,n}$ =0.3675
State individual capital income tax exemption rate for AGI 5	$\eta_5^{i,r}$ =0.3262
State individual labor income tax exemption rate for AGI 6	$\eta_6^{i,n}$ =0.3709
State individual capital income tax exemption rate for AGI 6	$\eta_6^{i,r}$ =0.3299
State individual labor income tax exemption rate for AGI 7	$\eta_7^{i,n}$ =0.4065
State individual capital income tax exemption rate for AGI 7	$\eta_7^{i,r}$ =0.3678
State individual labor income tax exemption rate for AGI 8	$\eta_8^{i,n}$ =0.4458
State individual capital income tax exemption rate for AGI 8	$\eta_8^{i,r}$ =0.4096
State individual labor income tax exemption rate for AGI 9	$\eta_9^{i,n}$ =0.5400
State individual capital income tax exemption rate for AGI 9	$\eta_9^{i,r}$ =0.5099
State individual labor income tax exemption rate for AGI 10	$\eta_{10}^{i,n}$ =0.8931
State individual capital income tax exemption rate for AGI 10	$\eta_{10}^{i,r}$ =0.8862

Table B-8: Other State Tax Parameters

General sales tax rate (effective rate)	τ^{c}=0.0286
Excise tax rate (effective rate)	τ^{ex}=0.0152
State tax revenues proportion of GDP	$\frac{TR}{Y}$ = 0.0459
Other state tax collections rate Debt adjustment factor	τ^{0}=0.00047
Debt Adjustment Factor	$DMute$ = 0.80
2028	7.00%

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