ALASKA POLICY FORUM

ECONOMIC RESEARCH CENTER
at THE BUCKEYE INSTITUTE

Unsustainable Spending

The State of Alaska's Budget and Economy

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Forward

Over the last 15 years it may have seemed that the State of Alaska had won the lottery. As oil prices skyrocketed, so did Alaska's state revenue. Unfortunately, just like the lottery winner who spends most of the new-found riches to pay for a new luxury lifestyle, Alaska spent rather than saved most of the revenue windfall. In all fairness, some of that bonus money was put into savings. At the time, the extra spending may have seemed justified because it was used to create and fund some wonderful programs. But just like many lottery winners, when state revenues began to fall Alaska found it hard to re-tighten its belt, reduce spending on new government programs and services, and live within its means. Instead of saving more and realigning agency budgets with lower state revenues, Alaska continued to spend. And spend. And spend.

Today, after years of overspending its income and drawing $14 billion from its savings, Alaska faces a financial crisis. The state now spends more per person for public services than any other state in the union, and having spent most of the state's financial reserves, Alaska now has enough money in savings to last just over a year. State policymakers confront the uncomfortable choice of burdening Alaskan families and businesses with new or higher taxes to maintain current spending levels, or cutting now-popular government spending and programs. The status quo is not a viable, sustainable option.

Before 2006—before the state won the revenue lottery—Alaska's general funds budget was approximately $2.6 billion and had been growing between two and 2.5 percent each year for several years. Alaska had been doing just fine on a $2.6 billion budget and had been able to provide core government services to its citizens. Returning to such a budget may not be easy, but it would be a good place to start. If the state does not curb its overspending the financial catastrophes that await us will be significantly harder. The state's Constitutional Budget Reserve has a mere $2 billion remaining that will be quickly exhausted, and any major natural disaster or sharp economic downturn could cripple the state for years, if not decades. Alaska must find a new path forward.

Some have proposed raising taxes to cover current budget shortfalls. But new taxes come with new burdens, for both the taxpayer and the state, including significant administrative costs associated with standing up new bureaucracies. Perhaps Alaska will need to raise taxes someday, but not today. Alaska lacks the proper tax base of businesses and wage earners to sustain higher taxes. The state's economy is too unstable, its budget too erratic, and its business environment too unpredictable for job creators to seriously consider Alaska and provide the tax base needed for responsible tax increases. Until that changes, policymakers must find another path to a prudent budget and sound economy.

To help policymakers chart that path among taxing and spending options, the Alaska Policy Forum has partnered with experts at The Buckeye Institute's Economic Research Center to critically examine Alaska's economy, budget, and four tax proposals. The detailed study, *Unsustainable Spending: The State of Alaska's Budget and Economy*, will allow lawmakers to make educated policy decisions based upon empirical data and dynamic economic modeling.

Alaska has an opportunity to reexamine many of its public policies and expenditures. The state can now reevaluate the real-world impact that new or higher taxes may have on households and businesses. Government programs and services can and should be reviewed for their necessity, efficiency, effectiveness, and outcomes. If Alaska will make a few short-term sacrifices, it can find a long-term, sustainable solution for providing necessary government services without burdening the families and businesses that ultimately pay for them. And the Alaska Policy Forum will continue to support the Great Land and its policymakers throughout this difficult process and all along the way.

Bethany L. Marcum
Executive Director
Alaska Policy Forum

Executive Summary

Alaska faces a budget crisis and recently has had to use its Permanent Fund earnings and Constitutional Budget Reserve Fund (CBR) to cover revenue deficits. Largely dependent on tax revenues from the volatile oil sector, federal funding, and investment returns, the state failed to collect enough revenue to fund current spending and has resorted to drawing money from its "rainy day" fund, the CBR, and then proceeded to reduce the Permanent Fund Dividend (PFD) that it pays to Alaskan residents. Due to years of undisciplined overspending, the state currently faces a projected $1.6 billion budget gap and burning through the CBR is not a sustainable strategy going forward.[1]

Hard choices now confront Alaska policymakers, but the prudent course will be to pursue policies that promote broad economic growth, and reduce or eliminate unnecessary government spending. Alaska must continue to resist the temptation to introduce or raise growth-killing taxes that stymie private investment and hinder job creation. The state must find responsible ways to generate revenue and cut spending without undermining future economic growth or harming residents.

Economists and policy analysts at The Buckeye Institute's Economic Research Center (ERC) and the Alaska Policy Forum reviewed Alaska's budget and economy to highlight the state's urgent need for spending reform. The ERC also analyzed the economic impact of four potential tax proposals and found that all four plans stunted Alaska's economic growth, created fewer jobs, and failed to generate enough revenue to cover current overspending. These findings are consistent with other empirical economic research that consistently demonstrates the harmful economic effects of taxation, and confirms that the private sector—not government spending—drives economic growth and prosperity.

Alaska must take a responsible approach to taxing and spending. Drawing down financial reserves to cover today's budget deficits is not a sustainable option and only ensures a more precarious tomorrow. Instead, policymakers should adopt pro-growth strategies and reduce state spending to better prepare for the next economic downturn.

[1] Elwood Brehmer, **OMB director: Budget must match revenue**, *Alaska Journal of Commerce*, January 2, 2019.

Introduction

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Hard choices now confront Alaska policymakers, but the prudent course will be to pursue policies that promote broad economic growth, and reduce or eliminate unnecessary government spending. Alaska must continue to resist the temptation to introduce or raise growth-killing taxes that stymie private investment and hinder job creation. The state must find responsible ways to generate revenue and cut spending without undermining future economic growth or harming residents.

[2] Elwood Brehmer, **OMB director: Budget must match revenue**, *Alaska Journal of Commerce*, January 2, 2019.

Overview of Alaska's Economy and State Budget

Alaska's state revenues come from three main sources: oil-related taxes, the federal government, and investment revenue. Oil-related revenues primarily fund unrestricted state spending, but investment revenues and federal funding significantly cover restricted state spending. Therefore, the state's budget remains subject to volatility from both the oil market and stock market. Immediately following the Great Recession, for example, rising oil prices helped Alaska's economy and job market recover quickly despite low investment returns. But when oil prices fell drastically beginning in 2014, Alaska's revenues, gross domestic product (GDP), and job market fell with them—and revenues from Washington and highly variable investment revenues that fluctuate from year-to-year were not enough to offset reduced revenues from depressed oil prices.[3] Such volatility makes prudent and sustainable state spending decisions critical to maintaining a healthy economy.

For much of the last twenty years, Alaska rode an ebbing and flowing revenue wave, and prudent state spending has been in short supply. From 2000 to 2006, state spending rose an average of 6 percent each year in constant, 2012 dollars, despite severe revenue swings, resulting in a budget shortfall of over $1.5 billion in 2006. When oil-related and other revenues spiked in 2008, creating an unrestricted budget surplus of over $6 billion, Alaska proceeded to spend rather than save that surplus. Another spike in oil revenue in 2012 encouraged more imprudent spending and helped mask an otherwise weakened fiscal position.[4] In 2011, with oil prices relatively high, the mineral sector (dominated by oil production) made up 24 percent of the state's real GDP, so the dramatic oil-price drop in 2014 revealed the fiscal weakness and vulnerability created by Alaska's rampant spending and over-reliance on fluctuating oil sector and investment revenues.[5] High investment-related revenues in 2014 helped sustain state spending, but when oil *and* investment revenues both fell in 2015 and 2016, the state turned to the CBR and the Permanent Fund Earnings Reserve to fill financial "holes" in the budget without adequately curbing state spending—drawing over $7 billion from the CBR between 2015 and 2018 to meet budget obligations.[6]

Continuing to draw on emergency funds to prop-up imprudent spending would be a mistake. Budgets that consistently syphon from savings are inherently unsustainable. Reducing the state's savings pool limits the potential investment revenue that Alaska can accrue each year, especially in the Permanent Fund. In Alaska's case, tapping the Earnings Reserve to make-up for budget

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[3] **SAGDP2N Gross Domestic Product (GDP) by state**, bea.gov, (Last visited February 19, 2019); and **Local Area Unemployment Statistics**, bls.gov, (Last visited February 19, 2019).

[4] **Table 9.1 Crude Oil Summary**, U.S. Energy Information Administration (Last visited March 5, 2019); and **Fiscal Summaries**, Alaska Division of Legislative Finance (Last visited March 5, 2019).

[5] Alaska Department of Commerce, Community, and Economic Development, ***2011 Alaska Economic Performance Report***, January 23, 2014.

[6] The CBR was established in 1991 as source of fiscal stability, a way to make up for small, short-term budget deficits. The Permanent Fund holds the vast oil wealth that Alaska has accumulated over the decades. Returns on investments from the Permanent Fund are deposited in the Earnings Reserve Account, which was traditionally devoted to paying out the PFD to residents.
Alaska Department of Revenue, ***Annual Reports on Constitutional Budget Reserve***, Calendar Years 2014-2017; Alaska Permanent Fund Corporation, ***APFC Annual Reports***, 2015-2018; and Nathaniel Herz, **Alaska House votes to more than double PFDs, splintering majority and threatening budget progress**, *Anchorage Daily News*, March 27, 2018.

shortfalls directly affects Alaskans by reducing each person's share of the PFD.[7] And although the Permanent Fund balance currently remains high, unrestricted revenues from oil and gas production have fallen 78 percent from almost $9 billion in 2012 to just under $2 billion in 2018, oil sector jobs have declined steadily since 2015, and the stellar investment revenues of 2017 and 2018 will not last indefinitely.[8] Alaska must recognize that since the late 1980s, total crude oil production has fallen by about 5 percent on average annually, and the state must financially prepare accordingly.[9]

Prudent budgets do not assume economic booms will last forever; they plan for turbulent futures by saving for rainy days and they do not outspend their savings. A more complete picture of Alaska's tax and revenue structure will help policymakers better appreciate the state's financial situation and prepare for its financial future.

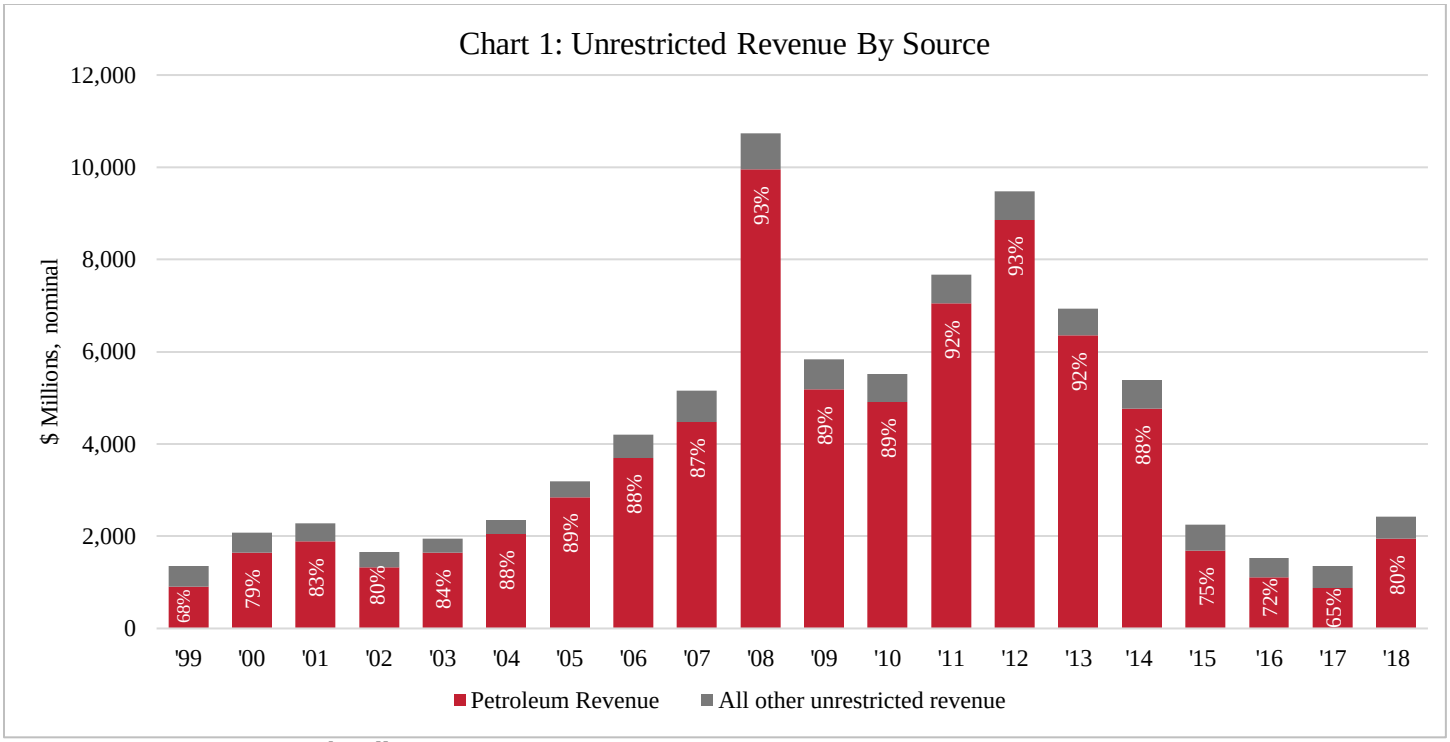
[7] **Lawmakers Must Pass SB 26: Use Alaska Permanent Fund earnings to address budget shortfall**, Editorial, *Daily News-Miner*, April 29, 2018.
[8] Alaska Department of Revenue, ***Revenue Sources Book Fall 2018: 60 Years of Revenue: 1959-2018***, December 14, 2018; and **All Employees: Mining: Oil and Gas Extraction, Well Drilling, and Support Activities in Alaska**, fred.stlouisfed.org (Last visited February 20, 2019).
[9] U.S. Energy Information Administration, **State Energy Production Estimates: 1960 Through 2016**, June 28, 2018.

Alaska's Tax and Revenue Structure

Alaska does not have an individual income tax or a state sales tax. Municipalities may levy their own sales taxes to generate revenues for local use, and in 2017, 100 municipalities imposed sales taxes and raised over $230 million.[10] Although federal funds account for more of Alaska's budget than most states, most of its tax revenues derive from oil-related economic activity, including severance taxes, a corporate income tax, an oil property tax, and royalties on oil production.[11] Oil-based tax revenues alone made up about 75 percent of Alaska's total tax revenues for Fiscal Year (FY) 2018.[12] Thus, state operating revenues depend heavily on the market price and quantity of produced oil.

The state's General Fund (GF) has "restricted" and "unrestricted" revenue categories. Policymakers draw from GF revenues for normal government operations, such as paying employees and funding public programs. In FY 2018, Alaska realized unrestricted oil and gas revenue (taxes, royalties, rents, and other sources) of $1.9 billion, 80 percent of total unrestricted revenue; while the interest earned from the Permanent Fund made up over 55 percent of restricted revenue.[13] Yet, of the total state revenues, approximately 45 percent comes from investment returns.[14] Surprisingly, because oil revenue is expected to decline, oil-related revenue is projected to provide only between 29 percent and 40 percent of the GF's unrestricted revenue over the next 10 years—much lower than historical norms—making current state spending levels unsustainable in the foreseeable future, especially as rising Medicaid costs shift to the state.[15]

[10] Alaska Department of Commerce, Community, and Economic Development, ***Alaska Taxable 2017 Report***, January, 2018.
[11] Katherine Loughhead, **Which States Rely the Most on Federal Aid?**, TaxFoundation.org, January 9, 2019.
[12] Alaska Department of Revenue, ***Revenue Sources Book Fall 2018: 60 Years of Revenue: 1959-2018***, December 14, 2018.
[13] *Ibid*.
[14] *Ibid*.
[15] Alaska Department of Revenue, ***Revenue Sources Book Fall 2018: 60 Years of Revenue: 1959-2018***, December 14, 2018; and Alaska Department of Revenue, ***Annual Reports on Constitutional Budget Reserve***, Calendar Years 2014-2017.



Source: Revenue Sources Book Fall 2018: 60
Years of Revenue: 1959-2018, Alaska Department of Revenue.

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Origins of Alaska's Current Budget Deficit

Alaska currently faces a budget crisis. After enacting Senate Bill 26 (SB 26), a portion of the Permanent Fund earnings became "unrestricted" revenue beginning in FY 2019.[16] Thus, $1.7 billion are appropriated from the Permanent Fund earnings to pay for government operations in FY 2019, about 63 percent of the total draw**,** while the remaining $1 billion will be paid as dividends to residents.[17] SB 26 breaks from the historical trend of treating draws from the Permanent Fund as "restricted" revenue to pay resident dividends according to a predetermined formula.[18] More recently, however, the Alaska legislature has used a portion of the resident dividend on an ad-hoc basis due to depressed oil prices, fluctuating investment revenues, and undisciplined government spending.[19] Because the legislature had already drawn heavily upon the CBR, SB 26 was passed as an intended stop-gap measure; however, it fails to address the underlying causes of the budget crisis.

Two related problems plague Alaska's state revenues: revenue growth depends almost entirely on the price of oil; and oil-related taxes, the backbone of Alaskan tax revenue collections, are declining. Although these problems contribute significantly to the state's current budget problems, the crisis could have been averted if short-sighted government spending had been curbed and legislators had resisted the temptation to raid the CBR and the Permanent Fund. In 2015, for example, the CBR held more than $10 billion. As of February 28, 2019, it totaled just $1.74 billion.[20]

Unrestricted oil revenue from all sources peaked in 2012 at more than $8.8 billion before dropping precipitously in 2015 to just $1.7 billion—19 percent of the peak. Since then, oil revenue has been relatively flat and investment revenues have varied greatly from year-to-year, from a high of $8.1 billion in 2014 to as low as $0.6 billion in 2016.[21] Prudence required policymakers to control government spending during the robust years, knowing that high revenues could not be sustained consistently. Instead, policymakers over-spent during fat and lean years, and have now resorted to reducing the resident dividend and finding "creative" ways to fund government services with the Permanent Fund and the CBR.

Economists warned of Alaska's oil-related budget problems since at least 2011 when Scott Goldsmith with the University of Alaska Anchorage Institute of Social and Economic Research likened the state's dependence on oil revenue to a drug addict needing a "fix." Goldsmith warned that the government was considering a FY 2012 budget that would draw $5.5 billion from the the state's oil wealth. At the time, Goldsmith said such a short-sighted maneuver would "erod[e] the

[16] **Lawmakers Must Pass SB 26: Use Alaska Permanent Fund earnings to address budget shortfall**, Editorial, *Daily News-Miner*, April 29, 2018.
[17] Alaska Department of Revenue, ***Revenue Sources Book Fall 2018: 60 Years of Revenue: 1959-2018***, December 14, 2018.
[18] **Lawmakers Must Pass SB 26: Use Alaska Permanent Fund earnings to address budget shortfall**, Editorial, *Daily News-Miner*, April 29, 2018.
[19] Alaska Department of Revenue, ***Revenue Sources Book Fall 2018: 60 Years of Revenue: 1959-2018***, December 14, 2018.
[20] **Constitutional Budget Reserve**, treasury.dor.alaska.gov (Last visited April 4, 2019).
[21] Alaska Department of Revenue, ***Revenue Sources Book Fall 2018: 60 Years of Revenue: 1959-2018***, December 14, 2018.

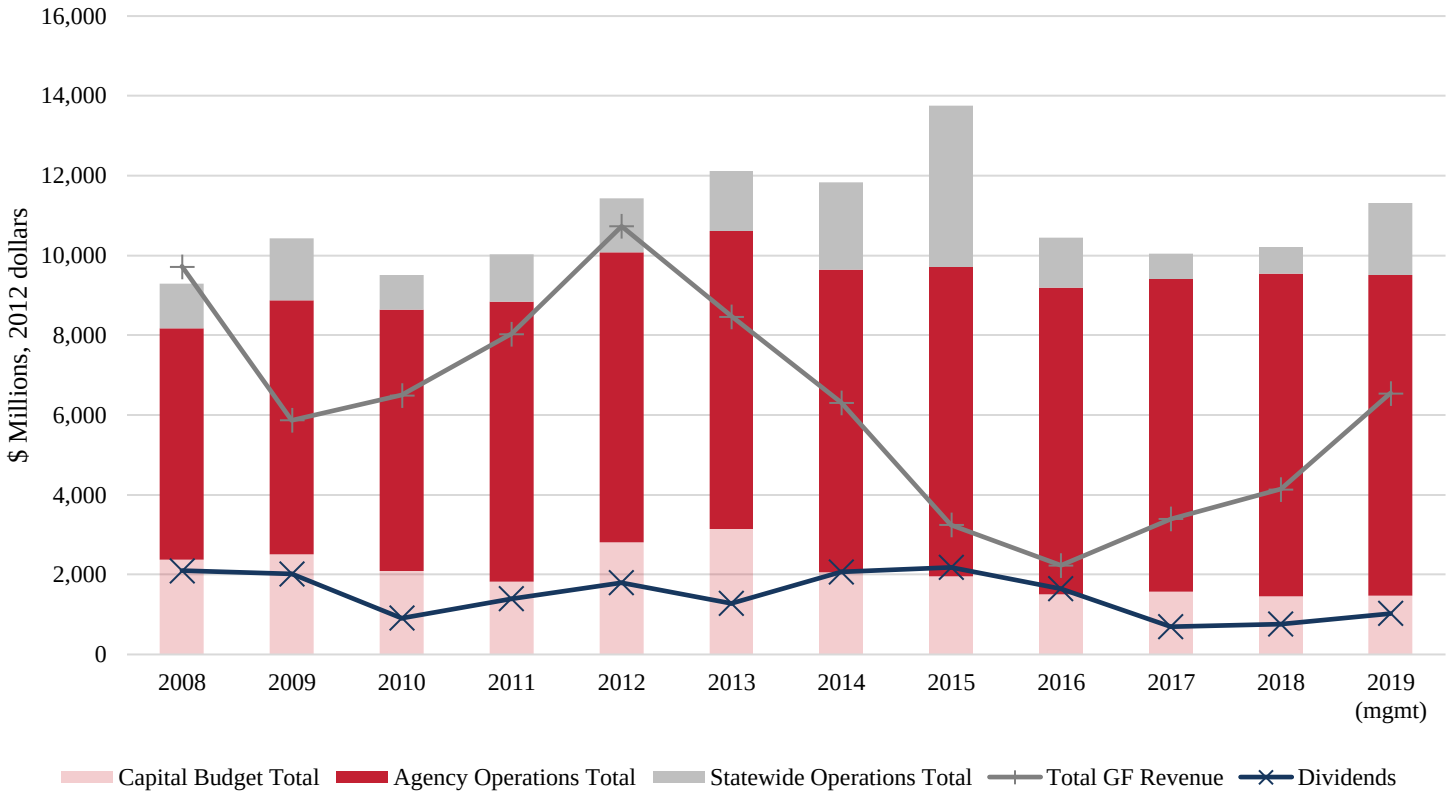
value of [Alaska's] oil wealth and put[] a fiscal burden on future generations," according to Goldsmith.[22] Similarly, some state leaders lamented Alaska's "waste" and "bloated" "spending problem" under Governor Bill Walker's fiscal plan in a 2016 article that went on to observe that Alaska had allocated 38 percent more state and local spending per resident than any other state in 2013.[23]

Large windfalls in revenues by the end of the 2000s allowed spending growth to continue out of control and by FY 2009, even spending increases in line with inflation and population could not prevent the current fiscal situation. Between FY 2009 and FY 2019, Alaska's budget for agency operations increased by just under 30 percent or an average of about three percent each year.[24] Over the same decade, inflation averaged 1.73 percent per year and Alaska's population grew an average of 0.4 percent per year.[25] If policymakers had kept spending in line with inflation and population growth, the agency operations portion of Alaska's budget would have grown an average of roughly 2.11 percent per year—instead of 3 percent per year—and saved the state in excess of $551 million over 10 years, more than one-third of its current budget deficit. Alaska still would be left with a billion-dollar deficit, however, even with cautious spending policy—so more spending cuts are still needed.

Alaska's budget crisis was foreseeable and preventable. Overspending and a lack of disciplined saving during good financial times—including general appropriations from the CBR—created the current fiscal situation, and SB 26 merely kicks the proverbial can down the road without solving the problem with a genuine solution. Chart 2 illustrates Alaska's recent undisciplined spending, as budgets outpaced revenues even when oil revenues were high. More importantly, it shows spending choices diverging further from what the state could afford once oil revenues and investment revenues began to fall. Rather than scale back spending, Alaska dipped into savings reserves, reduced resident dividends, and found other ways to avoid making tough spending cuts. The state must now make a series of difficult decisions to reduce government spending, maximize value and efficiency, and balance Alaska's budget without further burdening taxpayers and by doing the least possible harm to the economy.

[22] Margaret Bauman, **State is Overspending Oil Wealth, ISER study says**, *Anchorage Daily News*, February 16, 2011; and Scott Goldsmith, ***How Much Should Alaska Save?***, Institute of Social and Economic Research, February 2011.
[23] Andrew Kitchenman, **Alaska has the highest level of state spending, but that's not the whole story**, Alaska Public Media, July 25, 2016.
[24] **Fiscal Summaries**, Alaska Division of Legislative Finance (Last visited March 5, 2019).
[25] **CPI Inflation Calculator**, bls.gov (Last visited February 20, 2019); and **QuickFacts Alaska**, census.gov (Last visited February 20, 2019).

Chart 2: General Fund Revenues vs. Appropriations vs. Dividends



Source: Fiscal Summaries, Alaska Division of Legislative Finance

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Reduce Spending, Grow Alaska's Economy

Policymakers tend to ignore the significant benefits of reducing government spending, namely, economic growth and a steadier stream of tax revenue. Preferring to focus on increasing government revenue, they too often miss real opportunities to spur growth and raise revenue simply by spending less and leaving more money in taxpayer wallets.

Private sector economic activity—not government spending—is the engine that drives economic growth. Research consistently shows that government spending crowds out private investment and deters economic growth. The economics literature confirms that lower taxes and lower government spending are the keys to promoting growth and reducing government deficits.[26] Romer and Romer (2010), for example, examined the economic effects of tax changes by looking at federal taxes between 1945 and 2007, and concluded that "tax increases appear to have a very large, sustained and highly significant negative effect on output [GDP]," while "tax cuts have very large and persistent positive output effects."[27] Ramey and Zubairy (2018) studied federal spending's effect on the U.S. economy between 1889 and 2015, and found that the economy would have performed better if, instead of spending, the government had allowed households to keep and spend their own money.[28]

Governments need revenue, of course, to ensure public safety, and to build and maintain necessary infrastructure. But higher taxes and excessive government spending remove vital investment capital from the private sector, burdening families and businesses, and slowing the very engine that generates government revenue.

[26] Valerie A. Ramey, "**Identifying Government Spending Shocks: It's all in the Timing**," *The Quarterly Journal of Economics*, Volume 126, Issue 1 (February 2011) p. 1-50; Valerie A. Ramey and Sarah Zubairy, "**Government Spending Multipliers in Good Times and in Bad: Evidence from US Historical Data**," *Journal of Political Economy*, Volume 126, Number 2 (April 2018) p. 850-901; Kevin B. Grier and Gordon Tullock, "**An empirical analysis of cross-national economic growth, 1951-1980**," *Journal of Monetary Economics*, Volume 24, Issue 2 (September 1989) p. 259-276; Stefan Fölster and Magnus Henrekson, "**Growth effects of government expenditure and taxation in rich countries**," *European Economic Review*, Volume 45, Issue 8 (August 2001) p. 1501-1520; Alberto Alesina and Roberto Perotti, "**Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects**," *IMF Economic Review*, Volume 44, Issue 2 (June 1997) p. 210-248; Alberto Alesina and Silvia Ardagna, "**Large Changes in Fiscal Policy: Taxes versus Spending**," *Tax Policy and the Economy*, Volume 24, ed. Jeffrey R. Brown (August 2010) p. 35-68; Alberto Alesina and Silvia Ardagna, "**The Design of Fiscal Adjustments**," *Tax Policy and the Economy*, Volume 27, ed. Jeffrey R. Brown (October 2013) p. 19-67; Christina D. Romer and David H. Romer, "**The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks**," *American Economic Review*, Volume 100, Number 3 (June, 2010) p.763-801; and Andrew Mountford and Harald Uhlig, "**What are the effects of fiscal policy shocks?**" *Journal of Applied Econometrics*, Volume 24, Issue 6 (September/October 2009) p. 960-992.

[27] Christina D. Romer and David H. Romer, "**The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks**," *American Economic Review*, Volume 100, Number 3 (June, 2010) p.763-801.

[28] Valerie A. Ramey and Sarah Zubairy, "**Government Spending Multipliers in Good Times and in Bad: Evidence from US Historical Data**," *Journal of Political Economy*, Volume 126, Number 2 (April 2018) p. 850-901.

The Impact of Tax Proposals on Alaska's Economy

Like most states, Alaska has been tempted to introduce or increase taxes in order to raise revenue and reduce deficits. Policymakers should continue to resist that temptation and carefully weigh the supposed benefits of potentially higher revenues against the all-but guaranteed drag that new taxes will impose on the state's economy.

Economists at the ERC analyzed four recently proposed tax plans to give Alaska policymakers a better understanding of how each proposal will affect Alaska's businesses, households, economy, and state revenues. A dynamic scoring model developed by the ERC reveals how tax proposals will impact not only government revenues, but economic output, job creation, and business investment as well. 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 economy and public policy over time. State leaders can use this analysis to make well-informed policy decisions for their citizens.

The ERC calibrated the model to current Alaska law, used publicly available state and federal data, and relied on a dynamic scoring framework similar to one that federal agencies use to predict how federal tax proposals and policy changes will affect gross domestic product (GDP), job creation or loss, and government revenue. Consistent with academic standards and methodologies, the ERC's model has undergone a double-blind peer review and incorporated comments from those reviews. The model's full technical description provided in the accompanying appendices will allow researchers to validate the model's accuracy and the conclusions drawn.

Findings

Applying the ERC's dynamic scoring model to each of Alaska's tax proposals revealed the following first-year effects:

- Sales Tax: $200 million in state revenue, 1,700 fewer jobs created;
- Flat Income Tax: $276 million in state revenue, 2,300 fewer jobs created;
- Progressive Income Tax: $336 million in state revenue, 2,700 fewer jobs created, stagnant GDP by year eight; and
- Proportional Income Tax: $90 million in state revenue, 700 fewer jobs created.

Introducing a Sales Tax

In 2016, the Alaska legislature proposed introducing a new three percent sales tax with exemptions on a variety of goods and services.[29] As a type of consumption tax, sales taxes are less distortionary than more disruptive taxes on labor or capital income. The proposed sales tax, however, would still be expected to reduce Alaska's economic output and lower expected job creation relative to a baseline of a balanced budget.

A static estimate using Alaska's fiscal notes predicted that the proposed sales tax would generate approximately $244 million in state revenue. Static estimates, however, do not account for how the new tax will influence the behavior of workers, families, and businesses, which will in turn affect the estimated revenues.

By contrast, as shown in Table 1 on the following page, the ERC's dynamic model accounts for behavioral changes and estimates that under the proposed new sales tax Alaska will see 1,700 fewer jobs created in the first year, trending toward 1,900 fewer jobs created within three years. The more reliable dynamic model also estimates that the proposed sales tax will only generate approximately $200 million in state revenue, or 18 percent less than the static estimate.

[29] The full list of exemptions in the original bill include the following: sales to and by government agencies; licenses; permits; sales by corporations; sales of properties or services to, or used by a corporation; dues paid to a tax-exempt organization; sales of food for human off-premise consumption; intangibles; wages, salaries; commissions; tips; other forms of remuneration for personal services if paid by an employer to an employee; financial services; isolated or occasional sale or lease of property or service, not regularly engaged in or with; sale of personal items; resales; real property; certain fuel sold for aircrafts; property held for lease; insurance premiums; certain intrastate transportation and services in interstate commerce; health care; and child care services.

Table 1: Impact of the Sales Tax Proposal on Alaska's Economy

	Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
Year 1	$49,374	344,485	$1,232	$26,514	$9,677
Year 2	$50,235	348,365	$1,253	$26,976	$9,846
Year 3	$51,112	352,290	$1,275	$27,447	$10,018
Year 4	$52,003	356,258	$1,297	$27,926	$10,193
Year 5	$52,910	360,271	$1,320	$28,413	$10,370
Year 6	$53,833	364,329	$1,343	$28,908	$10,551
Year 7	$54,772	368,433	$1,366	$29,413	$10,735
Year 8	$55,727	372,583	$1,390	$29,926	$10,923

	Difference from Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
Year 1	($224)	(1,700)	$185	($128)	($105)
Year 2	($243)	(1,800)	$188	($131)	($65)
Year 3	($251)	(1,800)	$191	($133)	($57)
Year 4	($258)	(1,800)	$195	($135)	($54)
Year 5	($263)	(1,800)	$198	($137)	($54)
Year 6	($268)	(1,900)	$202	($140)	($54)
Year 7	($273)	(1,900)	$205	($142)	($54)
Year 8	($278)	(1,900)	$209	($145)	($55)

Source: The Economic Research Center's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2012 dollars. Employment is full-time equivalent non-farm jobs, rounded to the nearest hundred.

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Introducing a Flat Income Tax

In 2018, the Alaska legislature proposed introducing a new flat income tax, levied on both capital and labor income. The proposal would impose a 1.5 percent tax rate on wages or net earnings from self-employment, with a cap on the value of the tax liability not to exceed the greater of twice the value of the permanent fund dividend for the calendar year or $2,200 per worker (inflated from a base of July 1, 2017, in the Anchorage metropolitan area).

Taxes on capital and labor income are more distortionary than sales or consumption taxes, discouraging labor, private investment, and job creation, and thus hindering economic growth. As shown in Table 2 on the following page, the dynamic scoring model estimates that under the proposed flat income tax Alaska will see slower economic growth, 2,300 fewer jobs created in the first year, and 2,500 fewer jobs created by year three—decidedly more harmful than the proposed sales tax.

Using the most current Alaska tax data available, the ERC also estimated the flat income tax proposal's likely effect on state revenue. Whereas a static model expects the flat income tax to generate approximately $326 million in revenue, the dynamic model reveals only $276 million in expected tax revenue in the first year due to a shrinking state economy—significantly lower than the static model estimate. Moreover, a strict tax increase reduces economic activity substantially by $540 million in state GDP during the first year, cutting economic growth in half.

Table 2: Impact of the Flat Income Tax Proposal on Alaska's Economy

	Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
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Year 8	$55,727	372,583	$1,390	$29,926	$10,923

	Difference from Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
Year 1	($540)	(2,300)	$276	($161)	($557)
Year 2	($632)	(2,400)	$280	($164)	($349)
Year 3	($669)	(2,500)	$284	($168)	($299)
Year 4	($692)	(2,500)	$289	($171)	($283)
Year 5	($710)	(2,600)	$294	($175)	($277)
Year 6	($725)	(2,600)	$299	($178)	($277)
Year 7	($740)	(2,600)	$305	($182)	($278)
Year 8	($753)	(2,700)	$310	($186)	($281)

Source: The Economic Research Center's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2012 dollars. Employment is full-time equivalent non-farm jobs, rounded to the nearest hundred.

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Introducing a Progressive Income Tax

In 2018, the Alaska legislature proposed introducing a progressive income tax with tax brackets separated for single filers and those married filing jointly. The first $14,300 for single filers ($28,600 for joint filers) and the income from the state's Permanent Fund dividends would not be subject to the tax. Under the proposal, filers with dependents would receive a $4,000 deduction for each dependent—subtracted from the filer's income to determine taxable income. Table 3 illustrates the proposed tax structure. Table 4 shows the proposal's negative effect on Alaska's economy.

Like a flat income tax, a progressive income tax assesses capital and labor income, and thus distorts financial behaviors and decision-making of households and firms, reducing job creation and hindering economic growth. Using a static model, the ERC estimates that the proposed progressive tax will generate state revenue of $583 million, well short of Alaska's $1.6 billion budget deficit. The ERC's dynamic model forecasts Alaska would see only $336 million in revenue and 3,300 fewer jobs created in the first year, and much slower economic growth trending toward a stagnant GDP with no growth by year eight. Relative to the other tax proposals, the progressive income tax would have the most harmful economic impact on the state.

Table 3: Structure of the Progressive Income Tax Proposal

Single Filers		Joint Filers	
Alaska Taxable Income	Proposed Tax Liability	Alaska Taxable Income	Proposed Tax Liability
<$10,300	$0	<$20,600	$0
$10,300- $50,000	2.5% of excess more than $10,300	$20,600- $100,000	2.5% of excess more than $20,600
$50,000 - $100,000	$992.50 + 4% of excess more than $50,000	$100,000 - $200,000	$1,985 + 4% of excess more than $100,000
$100,000 - $200,000	$2,992.50 + 5% of excess more than $100,000	$200,000 - $400,000	$5,985 + 5% of excess more than $200,000
$200,000-$250,000	$7,992.50 + 6% of excess more than $200,000	$400,000-$500,000	$15,985 + 6% of excess more than $400,000
>$250,000	$10,992.50 + 7% of excess more than $250,000	>$500,000	$21,985 + 7% of excess more than $500,000

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Table 4: Impact of the Progressive Income Tax Proposal on Alaska's Economy

	Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
Year 1	$49,374	344,485	$1,232	$26,514	$9,677
Year 2	$50,235	348,365	$1,253	$26,976	$9,846
Year 3	$51,112	352,290	$1,275	$27,447	$10,018
Year 4	$52,003	356,258	$1,297	$27,926	$10,193
Year 5	$52,910	360,271	$1,320	$28,413	$10,370
Year 6	$53,833	364,329	$1,343	$28,908	$10,551
Year 7	$54,772	368,433	$1,366	$29,413	$10,735
Year 8	$55,727	372,583	$1,390	$29,926	$10,923

	Difference from Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
Year 1	($774)	(2,700)	$336	($203)	($890)
Year 2	($923)	(3,000)	$341	($208)	($553)
Year 3	($982)	(3,100)	$347	($212)	($471)
Year 4	($1,018)	(3,100)	$353	($217)	($444)
Year 5	($1,046)	(3,200)	$359	($221)	($435)
Year 6	($1,069)	(3,200)	$365	($226)	($433)
Year 7	($1,091)	(3,200)	$371	($231)	($435)
Year 8	($1,111)	(3,300)	$378	($236)	($439)

Source: The Economic Research Center's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2012 dollars. Employment is full-time equivalent non-farm jobs, rounded to the nearest hundred.

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Introducing a Proportional Income Tax

In 2016, the Alaska legislature proposed ntroducing a proportional income tax, which would create a state income tax equal to six percent of a filer's federal income tax liability. Although this proposed tax distorts labor and capital investment decisions, it negatively affects the state economy less than the other three proposals because the proposed change is so much smaller by comparison.

Using a static model, the ERC would expect the proportional income tax to generate approximately $209 million in state revenue. As shown in Table 5, however, the ERC's dynamic model predicts the proposal will generate only about $90 million in annual revenue, with a slower growing economy and 800 fewer jobs created by the second year.

Table 5: Effect of Proportional Income Tax Proposal on Alaska's Economy

	Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
Year 1	$49,374	344,485	$1,232	$26,514	$9,677
Year 2	$50,235	348,365	$1,253	$26,976	$9,846
Year 3	$51,112	352,290	$1,275	$27,447	$10,018
Year 4	$52,003	356,258	$1,297	$27,926	$10,193
Year 5	$52,910	360,271	$1,320	$28,413	$10,370
Year 6	$53,833	364,329	$1,343	$28,908	$10,551
Year 7	$54,772	368,433	$1,366	$29,413	$10,735
Year 8	$55,727	372,583	$1,390	$29,926	$10,923

	Difference from Baseline				
Year	GDP	Employment	Tax Revenue	Consumption	Investment
Year 1	($184)	(700)	$87	($53)	($199)
Year 2	($217)	(800)	$88	($55)	($124)
Year 3	($230)	(800)	$90	($56)	($105)
Year 4	($238)	(800)	$91	($57)	($99)
Year 5	($245)	(800)	$93	($58)	($97)
Year 6	($250)	(800)	$95	($59)	($97)
Year 7	($255)	(800)	$96	($61)	($98)
Year 8	($260)	(800)	$98	($62)	($99)

Source: The Economic Research Center's dynamic scoring model. Note: GDP, tax revenues, consumption and investment in millions of 2012 dollars. Employment is full-time equivalent non-farm jobs, rounded to the nearest hundred.

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Conclusion

Alaska faces a precarious fiscal situation. Having spent more than it collected in tax revenues, it now draws routinely from its rainy-day fund to make ends meet. Oil and natural gas production historically have offered the state a stable base for economic growth and tax revenues, but lower and increasingly volatile oil prices have weakened Alaska's economy and provided lower, less predictable revenue for several years. By continuing to outspend collected revenues, Alaska confronts a budget crisis largely of its own making—and one that will not correct itself.

Overspending annual revenues will make Alaska vulnerable to the next economic downturn or drop in oil prices. State revenues already have fallen or stagnated, with the only bright spot being high earnings from the Permanent Fund. Unfortunately, policymakers have been using proceeds from the Permanent Fund and the CBR to cover budget shortfalls, rather than reining in government spending. Alaska's current spending habits and unsustainable withdrawals from the Permanent Fund and the CBR, threaten the state's present and future economic wellbeing.

The solution to Alaska's problem lies in restraining government spending and adopting pro-growth economic strategies that will generate higher future tax revenues and greater prosperity for businesses and residents. Prudence demands that Alaska make some difficult decisions today in order to ensure a better tomorrow.

Appendix A: The Economic Research Center Tax Model

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 economy and public policy over time.

For this paper, the ERC calibrated the model for Alaska 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 (GDP), 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 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. Our 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, we then explicitly define 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 $\sum_{s=1}^{S} \mu_s = 1$. We then outline 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 $h_{e,t}$ can be defined as:

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

where $h_{e,t} \in [0,1]$ and $l_{e,t}(s) \in [0,1]$. The parameter that regulates the Frisch elasticity of labor supply is denoted ψ_e. χ_e is a scaling factor that helps match hours worked observed in the data. The household seeks to maximize its utility by solving the following problem:

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

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

$$d_{e,t} = (1 + \tau_t^c + \tau_t^{ex}) \sum_{s=1}^{S} c_{e,t}(s) + \sum_{s=1}^{S} x_{e,t}(s) + \left(1 + i_{r,t-1}\right) d_{e,t-1} + \tau_t^k \sum_{s=1}^{S} k_{e,t-1}(s)$$
$$+ \left[\frac{\phi}{2}\left(\sum_{s=1}^{S} k_{e,t}(s) - \sum_{s=1}^{S} k_{e,t-1}(s)\right)^2\right] - \left(1 - (1 - \eta_{e,t}^{i,n})\tau_{e,t}^{i,n} - \tau_t^o\right.$$
$$\left. - \tau_{e,t}^{i,n,f}\right) \sum_{s=1}^{S} w_{e,t}(s) l_{e,t}(s) - \left(1 - (1 - \eta_{e,t}^{i,r})\tau_{e,t}^{i,r} - \tau_t^o - \tau_{e,t}^{i,r,f}\right.$$
$$\left. - \tau_t^{corp}\right) \sum_{s=1}^{S} r_{e,t}(s) k_{e,t-1}(s)$$
$$k_{e,t}(s) = x_{e,t}(s) + (1 - \delta) k_{e,t-1}(s)$$
$$c_{e,t}(s) \geq 0$$
$$k_{e,t}(s) \geq 0,\ k_{e,T+1}(s) = 0$$

$V_{e,t}(s)$ defines expected utility discounted at a patient factor $\beta \in [0,1]$. As in Mendoza (1991), ϕ denotes a capital adjustment cost. The return on capital lent to firms is $r_{e,t}(s)$. The wage paid to workers of type e in sector s is $w_{e,t}(s)$. Future capital stock $k_{e,t}(s)$ is the sum of current capital stock $k_{e,t-1}(s)$, accounting for depreciation δ, and investment $x_{e,t}(s)$. $i_{r,t}$ denotes the interest rate at which domestic residents can borrow from international markets in period t, and $d_{e,t}$ is household debt.

Following Schmitt-Grohé and Uribe (2003), we assume a debt elastic interest rate. This is modeled as $i_{r,t} = i_{r,w} + \zeta(e^{D_t - D} - 1)$ where $i_{r,w}$ is the world interest rate faced by domestic agents and is assumed to be constant and ζ and D are constant parameters that are calibrated to match the state's economy. $\zeta(e^{D_t - D} - 1)$ is the state specific interest rate premium that increases with the level of debt. D_t represents the aggregate state level of debt, such that $D_t = \sum_{e=1}^{E} d_{e,t}$.

τ_t^c is the tax on household consumption purchases, which includes general sales tax, and τ_t^{ex} is the excise tax rate. $\tau_{e,t}^{i,n}$ is the statutory individual labor income tax rate, and $\tau_{e,t}^{i,r}$ is the individual 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:

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

We assume 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.

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

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

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

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

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:

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

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), we write 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, we denote 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 we denote $\omega_e(s)$

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

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

Our data for calibrating the model come from publicly available federal and state data sources. First, we present our sources for the model's output variables. Then we present the sources for the model parameters and our empirical methodology for calibrating the model.

Output Variables

Primarily, we utilize BEA Regional Economic Accounts for Alaska for our 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, we refer to the period of 1963-2017.

Our GDP projections use the latest GDP values and apply the state's GDP long-run annual growth rate of 1.74 percent from 1992-2017.

For our measure of consumption, consumption expenditures on durable goods are subtracted from total personal consumption expenditures (PCE). We consider 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.

We therefore use 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, we use 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 our measure of investment. Our methodology excludes residential investment from our measure of investment (residential investment is excluded from GDP as well).

We base our employment data for the number of non-farm jobs on data from the Bureau of Labor Statistics. We calculate the employment shares per sector using data from the BEA Regional Economic Accounts. We 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 its annual growth rate for 1992-2017 of 1.13 percent.

We 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, we use employment multiplied by the average hours worked per year. 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).

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. We utilize moments in state and federal data to estimate the model parameters.

Because depreciation data are not reported at the state level by the BEA, we refer 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 1963-2015. The average over this period represents the depreciation rate in our 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, we use data from the BEA Regional Income Division. Similar to Gomme and Rupert (2004), we divide the compensation of employees by the personal income for each sector. As personal income is not available for sectors, we construct 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 1998-2017. The sector specific parameter θ_s is set to match the observed average labor shares for each of the $S = 9$ production sectors.[30] 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 ν, 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.[31]

The earning ability for household types is based on the distribution of income and population as reported in the Internal Revenue Service Statistics of Income for the State of Alaska for Tax Year 2016.[32]

- Earning ability 1 has an adjusted gross income (AGI) of up to $50,000 per year; and
- Earning ability 2 has an AGI of more than $50,000.

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. We take our Frisch elasticity estimate $\psi_e = 0.4$ from Reichling and Whalen (2012). The parameter D is set to match the observed average trade-balance to output ratio since $TB = i_{r,w}\frac{D}{y}$. We estimate tax rates similar to the methodology used by McDaniel (2007).[33]

The full list of parameters is included in Appendix B.

[30] See complete list of sectors in Appendix B.

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

[32] **SOI Tax Stats – Historic Table 2 (Alaska)**, IRS.gov (Last visited February 13, 2019).

[33] A complete explanation of the methodology is included in Appendix B.

Appendix B: Tax Model Parameters

Tax Rate Estimates

The state tax rates calculated in this paper are average Alaska 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, we divide each category of tax revenue by the corresponding income or expenditure. Since we compute tax rates in the same fashion each year, we 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), Internal Revenue Service Statistics of Income for the State of Alaska, the Alaska Department of Revenue Annual Report for Fiscal Year 2018, and data provided by the Alaska Chief Economist.[34] 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 we take 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, we calculate 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. We make the same assumption.

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:

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

[34] **2017 Annual Survey of State Government Tax Collections Detailed Table**, U.S. Census Bureau (Last visited January 14, 2019); **SOI Tax Stats – Historic Table 2 (Alaska)**, IRS.gov (Last visited February 13, 2019); and Colleen M. Glover, ***Annual Report 2018***, Tax Division, Alaska Department of Revenue, 2018.

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 − θ) 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, we calculate 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 Internal Revenue Service Statistics of Income for the State of Alaska.[35] 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 − θ) 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

[35] **SOI Tax Stats – Historic Table 2 (Alaska)**, IRS.gov (Last visited February 13, 2019).

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.

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, we calculate 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:

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

Since 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 economy is $\theta(GDP - (TPI - Sub))$. $OSGOV$ 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 we first approximate the share of corporate tax paid by Alaska.

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

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

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

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

At the state level household capital income tax is

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

Where the household income and tax burden are once again distributed according to the distribution reported in the Internal Revenue Service Statistics of Income for the State of Alaska.[36]

The state household capital income tax rate is then

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

[36] **SOI Tax Stats – Historic Table 2 (Alaska)**, IRS.gov (Last visited February 13, 2019).

Sectors

Our model uses nine production sectors. The BEA reports GDP for each two-digit North American Industry Classification System (NAICS) industries, which we use to calculate each sector's percentage in total GDP (see Table B-4). Some of our 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

Parameters

The following tables present the calibrated parameters for the model.

Table B-2: Household Parameters*

Disutility of Labor	$\chi_e = 32$
Real Interest Rate	$i_{r,w} = 0.04$
Annual Depreciation Rate of Capital	$\delta = 0.1$
Frisch Elasticity of Labor Supply	$\psi_e = 0.4$
Holding Cost of Capital	$\nu = 0.01$

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*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
$z_1 = 1$	$q^1 = 0.547$
$z_2 = 5.69$	$q^2 = 0.453$

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Table B-4: Sector Specific Parameters

Sector	Output Share	Employment Share	Capital Share
Agriculture, Forestry, Fishing, and Hunting	$\alpha_1 = 0.013$	$\mu_1 = 0.040$	$\theta_1 = 0.850$
Mining	$\alpha_2 = 0.286$	$\mu_2 = 0.048$	$\theta_2 = 0.188$
Utilities, Transportation, and Warehousing	$\alpha_3 = 0.143$	$\mu_3 = 0.076$	$\theta_3 = 0.286$
Construction	$\alpha_4 = 0.055$	$\mu_4 = 0.074$	$\theta_4 = 0.453$
Manufacturing	$\alpha_5 = 0.038$	$\mu_5 = 0.046$	$\theta_5 = 0.258$
Trade	$\alpha_6 = 0.088$	$\mu_6 = 0.159$	$\theta_6 = 0.328$
Services	$\alpha_7 = 0.204$	$\mu_7 = 0.381$	$\theta_7 = 0.375$
Real Estate, Rental, and Leasing	$\alpha_8 = 0.106$	$\mu_8 = 0.044$	$\theta_8 = 0.598$
Health Care and Social Assistance	$\alpha_9 = 0.067$	$\mu_9 = 0.128$	$\theta_9 = 0.341$

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Table B-5: Tax Parameters

Federal individual labor income tax rate for AGI 1	$\tau_1^{i,n,f} = 0.1141$
Federal individual capital income tax rate for AGI 1	$\tau_1^{i,r,f} = 0.0611$
Federal individual labor income tax rate for AGI 2	$\tau_2^{i,n,f} = 0.2099$
Federal individual capital income tax rate for AGI 2	$\tau_2^{i,r,f} = 0.1294$
State individual labor income tax rate for AGI 1	$\tau_1^{i,n} = 0$
State individual capital income tax rate for AGI 1	$\tau_1^{i,r} = 0$
State individual labor income tax rate for AGI 2	$\tau_2^{i,n} = 0$
State individual capital income tax rate for AGI 2	$\tau_2^{i,r} = 0$
General sales tax rate	$\tau^{c} = 0$
Excise tax rate (effective rate)	$\tau^{ex} = 0.0250$
Severance tax rate (effective rate) (only applies to mining sector)	$\tau^{s} = 0.16$
Corporate income tax rate, Lower Profit Firms (effective rate)	$\tau_1^{corp} = 0.0012$
Corporate income tax rate, Higher Profit Firms (effective rate)	$\tau_2^{corp} = 0.0182$
Franchise tax rate	$\tau^{k} = 0$
State tax revenues proportion of GDP	$\frac{TR}{Y} = 0.025$
Other state collections	$\tau^{o} = 0.009$
Transfers from the federal government	$\frac{FF}{Y} = 0.2$

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Appendix C: Glossary of Terms

Calibrated – Matching the simulated model to the observable, real-life data by adjusting parameters to ensure the model represents the economy.

Capital adjustment cost – The time and monetary costs of changing the capital a firm uses, such as installing new machinery at a factory.

Capital share – Relative to labor, the proportion of output attributable to capital.

Cobb-Douglas production function – A simple production function in which different combinations of labor and capital quantities are used to obtain a certain quantity of product.

Comparative statics – A method of comparing different economic outcomes before and after a specified change.

Constant elasticity of substitution production function – A production function that assumes the elasticity of substitution is constant, meaning that a change in input factors will result in a constant change in output.

Debt elastic interest rate – An economy-wide interest rate that changes based on the economy's foreign debt holdings.

Depreciation rate – The rate at which capital, such as a car or computer, loses value over time.

Discrete – Measured as separate, distinct points in time, e.g., a person's age in years.

Dynamic scoring – A model that evaluates how changes in policy will change people's economic behavior, or the secondary impacts of a change (e.g., examining the employment and GDP changes that occur as a result of a policy change).

Elasticity – A measure of how the demand of a good responds to a price change for that good.

Employment share – The proportion of the working population employed in each sector of the economy.

Exogenous processes – External factors that influence household decisions.

Lagrangian function – A function that allows you to optimize a variable dependent on constraints, effectively combining a function being optimized with constraint functions.

Markets clear – The result when producers use the price that consumers are willing to pay for a product and there is no shortage or extra product.

Output share – The proportion of the total output of the economy produced by each sector.

Ponzi scheme – An investment fraud in which old investors are paid with money from new investors. Scammers often promise high returns with little or no risk.

Production function – An equation that shows how much product can be made from every combination of input factors, such as capital and labor.

Return on capital – Reveals how well a company is using its capital to make a profit.

Static analysis – A policy analysis that does not consider the economic behavior changes that may occur as a result of a policy change. Primarily, such analysis focuses solely on the changes to tax revenue due to a policy change without factoring in the human response to that change.

Steady-state capital-labor ratio – The ratio of the amount of capital to the amount of labor utilized for production when all markets clear in an economy.

Steady-state equilibrium – The economic choices and prices when market supply and demand are balanced and constant over time.

Stochastic economy – An economy that is affected by random, outside effects.

Tax instruments – The different ways that a government can levy a tax, or different types of taxes (e.g, corporate income tax, sales tax, and property tax).

Utility – The total gratification received from a person consuming a good or service. Economists use utility to capture individual's preferences for differing goods and services. It is assumed that people want to maximize their utility.

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About the Authors

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Prior to joining Buckeye, Hederman was director, and a founding member of the Center for Data Analysis (CDA) at the Heritage Foundation, where he served as the organization's top "number cruncher." Under Hederman's leadership, the CDA provided state-of-the-art economic modeling, database products, and original studies.

While at Heritage, Hederman oversaw technical research on taxes, health care, income and poverty, entitlements, energy, education, and employment, among other policy and economic issues, and he was responsible for managing the foundation's legislative statistical analysis and econometric modeling.

In 2014, Hederman was admitted into the prestigious Cosmos Club as a recognition of his scholarship. He graduated from Georgetown Public Policy Institute with a Master of Public Policy degree and holds a Bachelor of Arts degree in history and foreign affairs from the University of Virginia.

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Prior to joining The Buckeye Institute, Kidd worked in litigation consulting, providing expert testimony related to economic damages in legal cases. Kidd also served as a research assistant at the UW Population Health Institute at the University of Wisconsin-Madison, which, through its health policy group, performs research and analysis projects on health care access, cost, financing, health system performance, and quality. During his time at the University of Wisconsin-Madison, Kidd's research focus was in demography, education, labor outcomes, and the effects of public policy on labor, education, and health outcomes. He was a College of Letters and Science teaching fellow and was awarded the Anna Morris Ely Teaching Award from the Department of Economics. While there, he taught classes in wages and the labor market, analytical public finance, the principles of microeconomics, and the principles of macroeconomics.

Kidd continues to study questions regarding labor markets and the effects of public policy and demographics on labor market outcomes and behaviors, as well as evaluating health care policy and education policy. A native of Lima, Ohio, Kidd received his bachelor's degree in economics and mathematics from the University of Notre Dame before completing his master's degree and his doctorate in economics from the University of Wisconsin-Madison.

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Shankel attended the University of Colorado Boulder's economics doctorate program before returning to Columbus. While at the University of Colorado, he worked on a project that examined the causal factors relating to internal migration patterns within Canada, to be compared with their effects on new immigrants settling throughout Canada.

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Woodward has also spent time researching public economics, health economics, and occupational licensing. His dissertation, *American Obesity: Rooted in Uncertainty, Institutions, and Public Policy*, looked at the role bad public policy (as opposed to consumers and/or market forces) may have played in the rapid increase in obesity rates.

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