THE IMPACT OF STATE PERSONAL INCOME TAX RATES ON LEVELS OF UNEMPLOYMENT DURING AN ECONOMIC RECESSION

by

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Considering the significant discrepancies among states in revenue generation mechanisms, it is logical that there will be variations in how certain states respond to economic shocks that directly impact their tax base. Some states rely heavily on a high property tax, while others have high personal income tax rates. Additionally, some states attempt to distribute the burden more evenly between the two aforementioned components and sales tax. However, Oregon stands out as one of five states in the US that doesn't have a sales tax and the only state that has a "kicker law," a constitutional mandate to return any revenue exceeding 2% of the forecasted amount directly to taxpayers. As a result, Oregon heavily relies on its personal income tax and is unable to create a safety net through excess revenues in prosperous years.

In this thesis, I aim to determine the impact of state income tax rates by compiling the state income tax rate and unemployment rate from all 50 states between 1980 and 2018. Additionally, I create two dummy variables: one to indicate whether each state has a "kicker law" and another to denote whether the US is in an economic recession, as determined by the National Bureau of Economic Research (NBER) indicator. Using R Studio, I conducted a panel data linear regression to examine the relationship between these variables and the severity of recessions, as indicated by state-level unemployment rates. The findings reveal a statistically

significant negative relationship between state income tax rate and unemployment, suggesting that states with higher income tax rates tend to have lower levels of unemployment. As expected, there is also a statistically significant relationship between the US being in a recession and states experiencing higher unemployment rates. However, the interaction terms between recession and state tax rate, as well as recession and the presence of a kicker law, were not statistically significant. Improving our understanding of how different taxation methods affect a state's vulnerability to recessions will enable policymakers to design a budget that safeguards against the inevitable harms arising from future economic downturns.

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Introduction

In 1979, amid a severe recession, the Oregon Legislature pioneered legislation to rein in spending by creating a surplus kicker statute in conjunction with a tax relief plan and a spending limit. Oregon voters passed this proposal in 1980 and, in 2000, voters codified the kicker law in the Oregon Constitution, requiring:

> "If the revenues received from General Fund revenue sources, exclusive of those described in subsection (3) of this section, during the biennium exceed the amount estimated to be received from such sources for the biennium, by two percent or more, the total amount of the excess shall be returned to personal income taxpayers" (Oregon Constitution Article IX. § 14).

With this law, Oregon became the first and only state to mandate the return of surplus revenue to taxpayers instead of utilizing it for other expenditures or saving it in a rainy-day fund (Radnovich, 2021). Notably, Oregon is also distinctive in its fiscal policy as one of the only five states without a sales tax (Forbes, 2022). As a result, tax policy has become a contentious issue in the state with some elected officials, namely Democrats, arguing that the kicker-law results in significant tax breaks for wealthy Oregonians while simultaneously inhibiting economic development. Republicans have strongly opposed this sentiment, indicating their vehement opposition to any attempts to eliminate the kicker law (Register-Guard, 2021). Likewise, there has been no real traction in creating a state income tax as it is clear that there would be widespread bi-partisan objection among voters (Clucas et al., 2018).

Consequently, Oregon faces a competitive disadvantage compared to other states that can save surpluses and/or distribute their modes of taxation more evenly across the three primary revenue sources: income, sales, and property tax. To compensate, Oregon has slightly higher property taxes (Lincoln Institute of Land Policy, 2022) and significantly greater income tax levels (Tax Foundation, 2022) relative to most other states in the US.

As unique as Oregon might seem, it is merely one of the fifty states where policymakers and voters are engaged in constant dialogue regarding the most fiscally responsible way forward. Prompted by the rise in locational freedom due to the shift towards more online-based work post-Covid-19, research has shown that individuals are increasingly opting to reside in states with lower income tax rates (Fritts, 2022). Consequently, this research holds national significance. Moreover, recessions are inevitable, so preparing for them to minimize their negative impacts is essential. Understanding the role income tax plays in the severity of recessions allows individuals to make more informed choices of where to live and policymakers to make more informed budgeting decisions. Ultimately, by examining how states with varying tax preferences respond to recessions, as measured by unemployment levels, stakeholders can engage in a more comprehensive discussion on the effectiveness of their tax policies and develop budgets that exhibit greater resilience in the face of economic volatility.

In this project, I ask the question: how does a state's income tax rate impact the severity of a recession as indicated by unemployment levels in that state? I first examine existing literature to better contextualize the fundamental principles in tax policy. Then I will conduct an econometric analysis of 39 years of data across all 50 states to attempt to quantify the impact on unemployment of a state's income tax level, the presence of a kicker law, and whether or not the US was in a recession. Finally, I will explain how my results fit into the broader discussion of macroeconomic policy, assess limitations, and discuss the implications of my findings on future research.

This paper examines all 50 states but places a special emphasis on Oregon because its unique tax structure (the fact that it is the only state with a kicker law and one of only five without a sales tax) allows the econometric model to isolate the impact of those two policies

more easily on unemployment during a recession. The intention behind this thesis is not to uniformly declare certain types of taxation superior to others, but rather to inform the discussion so that state budgets can be sustainably crafted to better protect the interests of their residents.

Literature Review

An Idealized Version of State Revenue Sources

State fiscal policy has been a contentious topic regarding both the political viability and economic impact of changes in the tax structure. Highly regarded research at the federal level has indicated that state budgets are most robust when they adopt a "three-legged stool approach." This approach implies that their revenue sources should have equal reliance on the primary sources of income tax (both corporate and individual), property tax, and sales tax, with additional revenue derived from other tax streams like lottery, alcohol, marijuana, tobacco, etc. (National Conference of State Legislatures, 2007). Economists and legislators employ the stool imagery due to its implication that a strong tax base requires all three primary sources of revenue to withstand economic volatility. The reality is that a significant number of states deviate from this approach and encounter considerable political or economic pressure to excessively rely on specific modes of taxation while entirely neglecting others. For instance, Campbell et al. discovered that during the Great Recession, states with Democratic-controlled legislatures were more likely to increase income taxes and implement revenue enhancements (Campbell et al., 2013).

Indeed, upon examining a map displaying state income tax rates, sales tax rates, and property tax rates (see Figures 1, 2, and 3), it becomes evident that no state has truly achieved a perfect equilibrium in revenue generation.

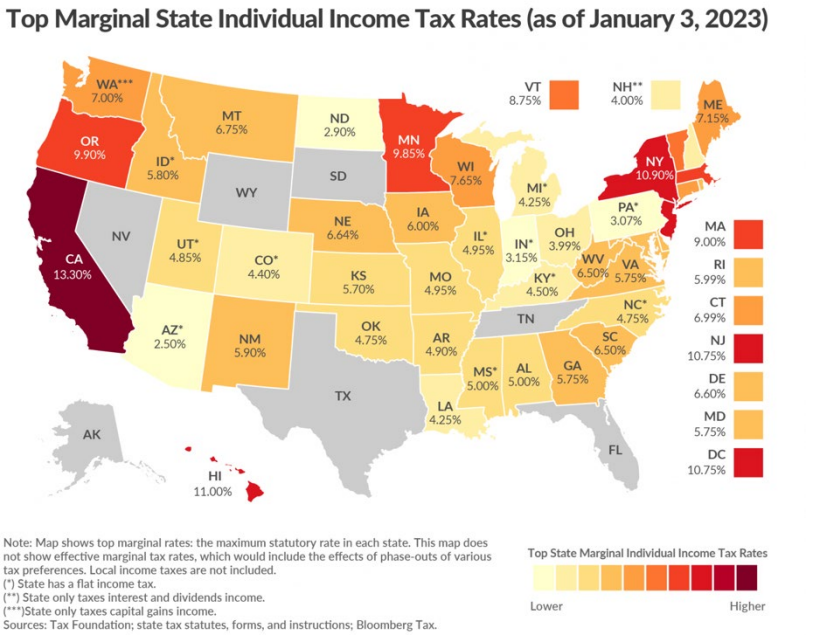

Figure 1: Map of State Income Tax Rates

Note that this map only lists the top marginal income tax rates for each state. (Source: Tax Foundation, 2023)

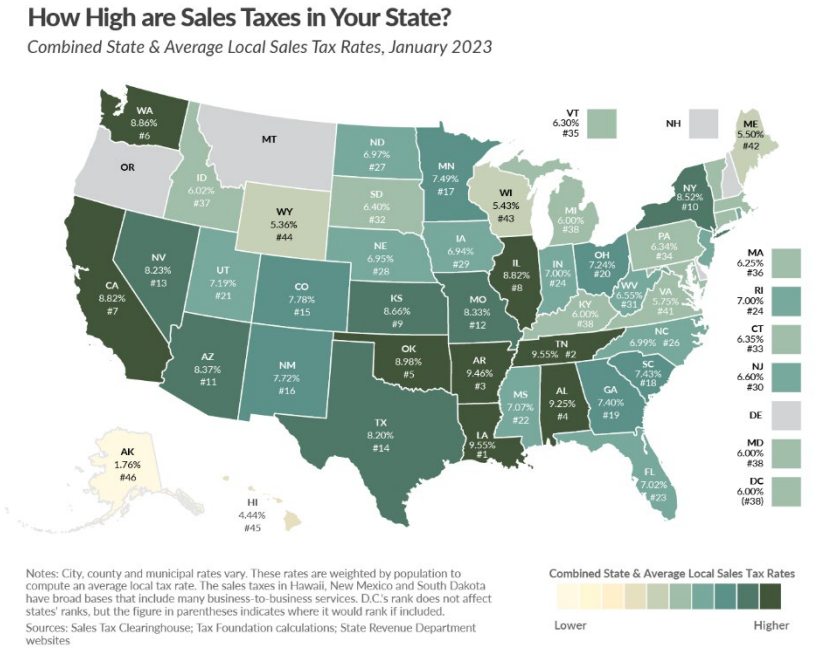

Figure 2: Map of State Sales Tax Rates

(Source: Tax Foundation, 2023)

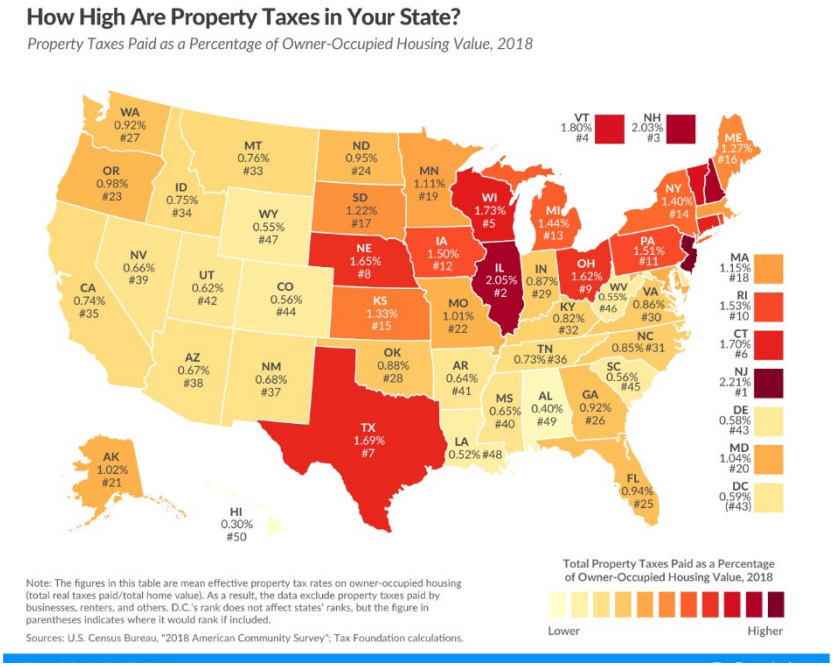

Figure 3: Map of State Property Tax Rates

Note that this map displays state property tax rates from 2018, the most recent year this information was compiled by the Tax Foundation (Source: Tax Foundation, 2019)

As indicated by the maps, states often address deficiencies in one form of revenue generation by implementing significantly higher tax rates in another area. For instance, Texas does not impose any personal income tax, but it relies on relatively high property and sales taxes. Conversely, Maine has a lower sales tax rate but imposes higher income and property taxes.

Despite the differences, a strong tax policy is important in that its effectiveness can either stunt or promote economic growth. According to a 2012 pooled mean group analysis and an error-correlation model, property and sales taxes were found to have negative impacts on growth, while income taxes showed no impact at all (Ojede et al., 2012). On the other hand, growth isn't the only factor to consider. Research has shown that state sales taxes are less procyclical than other forms of taxation, meaning they are less susceptible to economic volatility (Ward, 2010). Ward cautions against excessive reliance on income taxes, stating, "One ramification of the

increasing reliance on income taxes is a heightened risk of volatility in states' revenue streams," (Ward, 2010). Economists at the Federal Bank of Chicago, studying tax cyclicality leading up to the 2001 recession, discovered "While sales tax revenue cyclicality and other tax revenue sensitivity has been essentially unchanged, individual income tax revenue cyclicality has quadrupled," (Mattoon et al., 2012).

Logically, this makes sense as individuals may be inelastic consumers regarding certain purchases, such as gas, food, and water even if they lose their jobs during a recession, thus rendering the income tax base fairly consistent. However, if someone loses their job or house in a recession, that could have a dramatic impact on the amount they pay in those respective taxes. Regarding the effectiveness of sales taxes, Ward concedes that many states have exempted many purchases, such as food or medicine, from sales tax, leading to a disprortionate burden on large purchases such as cars, boats, TVs, etc. (Ward, 2011). These big-ticket purchases do often fall off during a recession when people's disposable income is stretched or eliminated, so a sales tax isn't infallible. This larger theme has been seen in Oregon too, as Stabrowski found, "Because Oregon is so dependent on the personal and corporate income tax for revenue, any fluctuation in unemployment results in serious blows to revenue projection," (Stabrowski, 2013).

Taxation and Migration

Current modeling suggests that consumers are receptive to tax decisions and that states' fiscal policy impacts their locational and purchasing behaviors which in turn, impact state revenue. A study on the impact of Connecticut's 1991 adoption of an income tax using a Difference-in-differences model found that income taxes deterred people from moving to the state but didn't trigger an exodus from those already within the state (Afonso 2018). This

ultimately prompted a net migration decrease, which stunted economic growth. However, recent data from the Census Bureau demonstrated that in 2022, Americans left states with higher income tax rates and moved towards those with lower income tax levels (Fritts, 2023). Notably, states like New York, Illinois, Hawaii, West Virginia, and Louisiana saw their population level decrease whereas states like Florida, Idaho, Texas, Delaware, North Carolina, and Nevada saw population increases of greater than one percent. These statistics place an added responsibility on policymakers to set tax levels at an appropriate rate or risk losing citizens to other states, which in turn reduces the tax base of the home state.

An examination of a completely different type of taxation, alcohol taxes, attempted to gauge the impact of alcohol taxes in Washington to see if consumers were willing to cross the border to purchase alcohol at cheaper rates (LoPiccalo 2016). LoPiccalo concludes that there is significant movement along the border, meaning people will cross state lines to purchase goods in stores that are favorable to them in terms of pricing, and that the state of Washington lost out on revenue due to this behavior. This study supports the notion that taxpayers exhibit elasticity and are willing to adjust their behavior to maximize personal benefits, potentially resulting in revenue loss for states due to their taxation policy.

Given the cyclical nature of the global economy, recessions are inevitable. Therefore, the question is not whether the next recession will occur, but rather when it will happen. Moreover, recessions cause increases in unemployment, decreases in income, less discretionary spending money available on behalf of consumers, and subsequently reduce the strength of the tax base. Therefore, it should be the goal of states to develop a budget that is both not procyclical and encourages immigration to the state instead of spurring emigration out of the state.

Income Tax and Unemployment

The subject of this project, the impact of state income tax on the unemployment rate, has been a contentious subject among economists with no clear consensus being reached. A literature review of 26 studies between 1983 and 2012 for the Tax Foundation found that 23 of which (and every study post-1997) concluded that taxes have a negative effect on economic growth (McBride, 2012). Furthermore, the same report ranked corporate income taxes as the most detrimental to growth, followed by personal income taxes, consumption taxes (i.e. sales taxes), and finally property taxes. Specifically, McBride noted,

> "These results support the Neo-classical view that income and wealth must first be produced and then consumed, meaning that taxes on the factors of production, i.e., capital and labor, are particularly disruptive of wealth creation. Corporate and shareholder taxes reduce the incentive to invest and to build capital. Less investment means fewer productive workers and correspondingly lower wages. Taxes on income and wages reduce the incentive to work. Progressive income taxes, where higher income is taxed at higher rates, reduce the returns to education, since high incomes are associated with high levels of education, and so reduce the incentive to build human capital. Progressive taxation also reduces investment, risk taking, and entrepreneurial activity since a disproportionately large share of these activities is done by high income earners," (McBride, 2012).

However, it is important to note that the Tax Foundation is a conservative-leaning think tank that tends to skew anti-tax so that bias should be noted when examining McBride's analysis though much of the research from the Tax Foundation is highly regarded and broadly used. In contrast, certain previous research suggesting that taxes hinder economic growth has been replicated for different time periods, challenging the earlier findings and indicating a lack of conclusive evidence that tax revenues impede growth or that tax cuts stimulate growth (Gale et al., 2015). The same study revealed that although firm formation exhibits a negative correlation with corporate income tax rates, the economic impact is negligible, and property tax rates may even exhibit a correlation with economic growth (Gale et al., 2015).

There is a logical reasoning to support both propositions. As McBride noted, decreasing tax rates could incentivize people to work, spend more money, and lead to more firm creation which would in turn create even more jobs. Alternatively, the use of tax dollars on social services, job placement assistance, transportation, etc. could make the job market accessible to individuals who may otherwise be out of the labor force. Additionally, there is evidence to support the idea that government spending, as a result of increased tax revenue, creates jobs that create growth. This paper aims to further examine the relationship between income tax rates and employment, specifically within the context of a recession. I hope that a wider time range can better illuminate historical economic trends.

Tax Policy in Oregon and the "Kicker Law"

As previously mentioned, Oregon is unique in the realm of tax policy because of its incredibly unusual tax structure. In a sense, Oregon attempts to straddle both ideologies: having no sales tax and returning surpluses to taxpayers seemingly affirming the notion that lower taxes create growth, while also having comparatively greater income tax rates alluding to the idea that government spending causes growth. While Oregon might not have the highest upper bound marginal personal income tax rate, its tax structure is especially impactful because it has both a relatively high upper bound and a relatively high lower bound. This means that the top earners in Oregon are paying more in taxes compared to high earners in many other states, but lower- and middle-class earners are also paying more than they would in other many other locals. Oregon is noteworthy in this regard since many states with high average income tax rates typically have either a higher upper bound or a higher lower bound, but not both.

	TAX RATE RANGE (in percents)				Number of Brackets
	Low		High		
ALABAMA	2.0	-	5.0		3
ALASKA	No State Income Tax				
ARIZONA	2.5				1
ARKANSAS (a)	2.0	-	4.9	(f)	3
CALIFORNIA (a)	1.0		12.3	(g)	9
COLORADO	4.40				1
CONNECTICUT	3.0	-	6.99		7
DELAWARE	0.0	-	6.6		7
FLORIDA	No State Income Tax				
GEORGIA	1.0	-	5.75		6
HAWAII	1.4	-	11.0		12
IDAHO	5.8	-			1
ILLINOIS (a)	4.95				1
INDIANA	3.15				1
IOWA (a)	4.40	-	6.0	(bb)	4
KANSAS	3.1	-	5.7		3
KENTUCKY	4.5				1
LOUISIANA (aa)	1.85	-	4.25	(bb)	3
MAINE (a)	5.8	-	7.15		3
MARYLAND	2.0	-	5.75		8
MASSACHUSETTS	5.0	(m)			1
MICHIGAN	4.25				1
MINNESOTA (a)	5.35	-	9.85		4
MISSISSIPPI	0	-	5.0		2
MISSOURI (a)	0.0	-	4.95		6
MONTANA (a)	1.0	-	6.75		7
NEBRASKA (a)	2.46	-	6.64	(bb)	4
NEVADA	No State Income Tax				
NEW HAMPSHIRE	State Income Tax of 5% on Divi				
NEW JERSEY	1.4	-	10.75		7
NEW MEXICO	1.7	-	5.9		5
NEW YORK (a)	4.0	-	10.9		9
NORTH CAROLINA	4.75				1
NORTH DAKOTA (a)	1.10	-	2.90		5
OHIO (a)	0.0		3.99		5
OKLAHOMA	0.25	-	4.75		6
OREGON (a)	4.75	-	9.9		4
PENNSYLVANIA	3.07				1
RHODE ISLAND (a)	3.75	-	5.99		3
SOUTH CAROLINA (a)	0.0	-	6.4	(bb)	3
SOUTH DAKOTA	No State Income Tax				
TENNESSEE	No State Income Tax				
TEXAS	No State Income Tax				
UTAH	4.85				1
VERMONT (a)	3.35	-	8.75		4
VIRGINIA	2.0	-	5.75		4
WASHINGTON	No State Income Tax				
WEST VIRGINIA	3.0	-	6.5		5
WISCONSIN (a)	3.54	-	7.65		4
WYOMING	No State Income Tax				
DIST. OF COLUMBIA	4.0	-	10.75		7

Figure 4: State Personal Income Tax Brackets

(Source: Federation of Tax Administrators, 2023)

Figure 4 illustrates that Oregon (4.75%) is tied with North Carolina for the 6th highest lower tax rate range, trailing behind Utah (4.85%), Illinois (4.95%), Massachusetts (5.0%), Minnesota (5.35%), and Maine (5.8%) respectively (Federation of Tax Administrators, 2023). Oregon (9.9%) also ranks 6th in terms of the highest tax rate range, trailing Washington D.C. (10.75%), New Jersey (10.75%), New York (10.9%), Hawaii (11%), and California (13.3%) respectively (Federation of Tax Administrators, 2023). It is worth noting that Oregon has neither

a greater upper bound than the states with a higher lower bound nor a greater lower bound than the states with a higher upper bound. Consequently, this suggests that Oregon's marginal income tax rates are relatively high in both the upper and lower ranges.

As mentioned, a prime reason for these high levels is Oregon's lack of a sales tax. Having already discussed Oregonians' opposition to changes in the sales tax structure and the unlikelihood of a sales tax ever being enacted, it is imperative to shift our attention to examining the context of the kicker law within Oregon's fiscal policy. The "kicker" or 2% surplus refund operates on a biennium calendar, allowing refunds to occur exclusively in odd-numbered years. Since the passage of the law in 1980, the 2% surplus refund has been triggered in 12 out of 21 possible biennia, including every period since 2011. The largest surplus recorded was an astounding 18.6% in the 2005-07 tax period (Oregon Department of Revenue, 2012).

The kicker is not exempt from controversy, with opponents arguing that it makes it difficult for the state to create a rainy-day fund, thereby increasing vulnerability to economic volatility. In fact, the kicker was triggered during the last 4 major recessions, including when the major kickback was given in 2007, shortly followed by significant cuts to education and social services in 2008 amidst a budget shortfall during the Great Recession (Oregon Center for Public Policy, 2019). As a direct result of the kicker, legislators were unable to save a surplus ahead of looming recessions and instead had to make difficult spending cuts amidst economic turmoil. Significant concern exists regarding the kicker's propensity to disproportionately benefit the wealthiest Oregonians, as the top 20% of taxpayers reaping 66% of the kickback (Oregon Center for Public Policy, 2019).

Since Oregon is the only state with such a rebate, there is an insufficient amount of research related to its impact on unemployment and economic volatility. Eliminating or

amending the kicker would require a constitutional amendment, so it is unlikely to change in the near term. Accordingly, further research on its ramifications is warranted, an undertaking which this paper aims to address.

Data and Methodology

Overview

To evaluate the impact of state impact rates on unemployment rates, specifically during a recession, I collected data from all 50 states for 39 years between 1980 and 2018 including each state's respective unemployment rate, whether the US economy was in a recession during that year, the state income tax rate, and whether the state has a "kicker law" and compiled them in an Excel spreadsheet. I then ran a panel data linear models (PLM) regression in R studio to examine the variables' impact on recessions.

It is unsurprising that I found a statistically significant relationship between the US being in a recession and states having a higher unemployment rate. The interaction terms between recession*state income tax rate and recession*kicker were both not statistically significant. Notably, I found a statistically significant negative relationship between the state income tax rate and less unemployment. Ultimately, I reject the null hypothesis for the recession and state income tax rate variables and do not reject the null hypothesis for the interaction terms between recession*kicker and recession*state tax rate.

Data

To conduct this project, I initially gathered data from the U.S. Census Bureau's Current Population Survey to obtain the US national per capita income in 2021 dollars for each year from 1980 to 2018 (U.S. Census Bureau, 2023). I organized the data by creating an Excel spreadsheet that had all 39 years listed in the column, repeated next to each state in column B in alphabetical order (i.e., 1980 was listed 50 times starting with Alabama and ending in Wyoming, this list then repeated for 1981, and so on). Finally, in column C, I recorded the average per capita income for

each year in 2021 dollars. I then forwarded this data to Dr. Colas who used the program TAXSIM in Stata to calculate the tax burden, the average personal income tax rate, and the marginal tax rate faced by the individual.

Additionally, I used data from the St. Louis branch of the Federal Reserve Economic Data catalog to determine if the US experienced a recession in a specific year (Federal Reserve Bank of St. Louis, n.d.). The economic indicator that I used was the NBER indicator as it was the most all-encompassing recession indicator and it also used unemployment in part of its classification methodology which was pertinent to my research. It's important to note that this indicator determined whether the US was in a recession on January 1st of a particular year, meaning that sometimes this indicator could lag if a recession started in the latter months of the year. Between the years I sampled, the US was only in a recession based on NBER five times: 1980, 1982, 2001, 2008, and 2009. I used a dummy variable to display whether the U.S. was in a recession: a 0 value indicated the U.S. was not experiencing a recession whereas a value of 1 indicated that it was.

Subsequently, I identified Oregon as the sole state with a distinct feature referred to colloquially as a "kicker law". Accordingly, the Oregon Constitution mandates that if revenue for a biennium exceeds projected revenue by at least 2%, the surplus must be returned to taxpayers. Oregon is the only state in the U.S. with such a law, so I wanted to examine its impact on levels of unemployment as the "kicker" could theoretically prevent Oregon legislators from building a surplus that could serve as a safety net during times of economic downturn leaving the state at a competitive disadvantage relative to its counterparts thus potentially increasing the unemployment consequences seen during a recession. Similarly, I employed a dummy variable

where a value of 0 indicated the absence of a "kicker law" in a state, and a value of 1 – which was exclusively applicable to Oregon – indicated that the state did have a kicker law.

Finally, I obtained the annual average unemployment rate for all 50 states from the Local "Area Unemployment Statistics and Current Population Survey" available in the "U.S. Bureau of Labor Statistics" database (US Bureau of Labor Statistics, 2019). It is important to acknowledge that these unemployment rates are the average rates for the entire year, which may result in some minor discrepancies compared against the NBER indicator. The NBER indicator is based on the status as of January 1st and, therefore, may not fully capture the yearly average provided by the unemployment rate.

Methodology

I cleaned up the data and combined it into a single Excel file via R Studio. I decided to use a panel data liner model (PLM) rather than an ordinary least squares model (OLS) because my dataset contained observations on multiple subjects (in this case states) over multiple time periods (in this case 39 years); thus, I felt that PLM could better analyze the intricacies of my dataset.

The regression I ran was:

Unemployment ~ Recession + Recession_staterate + Recession_kicker + Staterate.

Therefore, "Unemployment" was my dependent variable. "Recession" was a dummy independent variable that equaled 1 during a recession and 0 otherwise. "Recession_staterate" was an independent variable that represented the interaction between the recession dummy variable and the state's personal income tax rate. "Recession_kicker" was another independent

variable interaction term that captured the relationship between the recession dummy variable and the state's tax rate. "staterate" was the state's personal income tax rate.

The equation could be expressed as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

Y = Unemployment rate

X_1 = Recession (dummy variable)

X_2 = Recession_staterate (interaction term between the dummy recession variable and state's income tax level)

X_3 = Recession_kicker (interaction term between the dummy recession variable and the dummy variable indicating the presence of a kicker law)

X_4 = Staterate (personal income tax rate)

β_0 = Intercept

β_1- β_4 = Coefficients for each independent variable. The coefficients represent a change in the dependent variable if there was a one-unit change in the independent variable whilst all other variables were held constant.

ε = Error term

I ran this formula in RStudio by entering the following command:

"plm(formula=Unemployment ~ Recession + Recession_staterate + Recession_kicker + staterate, data = data_sub, model = "within", index = c("State", "year"))".

Moreover, I used the packages "readxl", "dplyr", "tidyr", "broom", "plm", and "ggplot2" within R Studio to run and analyze my regression.

Results

My regression analysis yielded the following results:

Table 1: PLM Regression Results

Variable	Estimate	Std. Error	t-value	Pr(> |t|)
Recession	0.75983	0.21585	3.5202	0.0004413 ***
Recession_staterate	7.51867	8.03905	0.9353	0.3497690
Recession_kicker	0.79497	0.88141	0.9019	0.3672074
staterate	-76.83571	7.80261	-9.8474	< 2.2e-16 ***”

Balanced Panel: n = 50, T = 39, N = 1950

Residuals:

Min. 1st Qu. Median 3rd Qu. Max.

-4.60202 -1.17438 -0.28592 0.96395 9.03764

Signif. codes:

0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Total Sum of Squares: 6215.1

Residual Sum of Squares: 5659.6

R-Squared: 0.089377

Adj. R-Squared: 0.063922

F-statistic: 46.523 on 4 and 1896 DF, p-value: < 2.22e-16

The “balanced panel” section indicates that I was working with a panel set that has 50 cross-sectional states and 39 time periods. The N value is given by multiplying n*T (50*39) and demonstrates that I am not missing any unit for any state during any time period. Based on my results, the coefficients for “Recession” and “staterate” are both statistically significant indicated by the “***” and “***” symbols respectively as their P values were less than 0.05. The variables “Recession_staterate” and “Recession_kicker” were not statistically significant as their P-values

were greater than 0.05 meaning I can't say that they have a real effect on unemployment holding all else constant.

Unsurprisingly, the coefficient for "Recession" implies that the unemployment rate is 0.76 percent greater during a recession than it is during non-recession years on average holding all else constant. The coefficient for "staterate", on the other hand, was negative (as shown by the downward sloping line of best fit in Figure 5) and highly statistically significant and it implies that a one percentage point increase in a state's income tax rate is associated with a 76.84 percentage point decrease in the state's unemployment rate, all else held constant. Hypothetically, if a state had a current income tax rate of 5% and their mean value for unemployment is 4%, if they increased their income tax rate to 6%, the new unemployment rate would be 3.2%. This number is incredibly large and warrants further research; however, there are almost certainly diminishing marginal returns as a state could not indefinitely increase its income tax rate to make its unemployment rate become zero. It goes without saying, a state could not make their unemployment rate go below zero either. Figure 6 is a boxplot of the state's unemployment rate over the entire time period to better contextualize which states have had higher levels of unemployment.

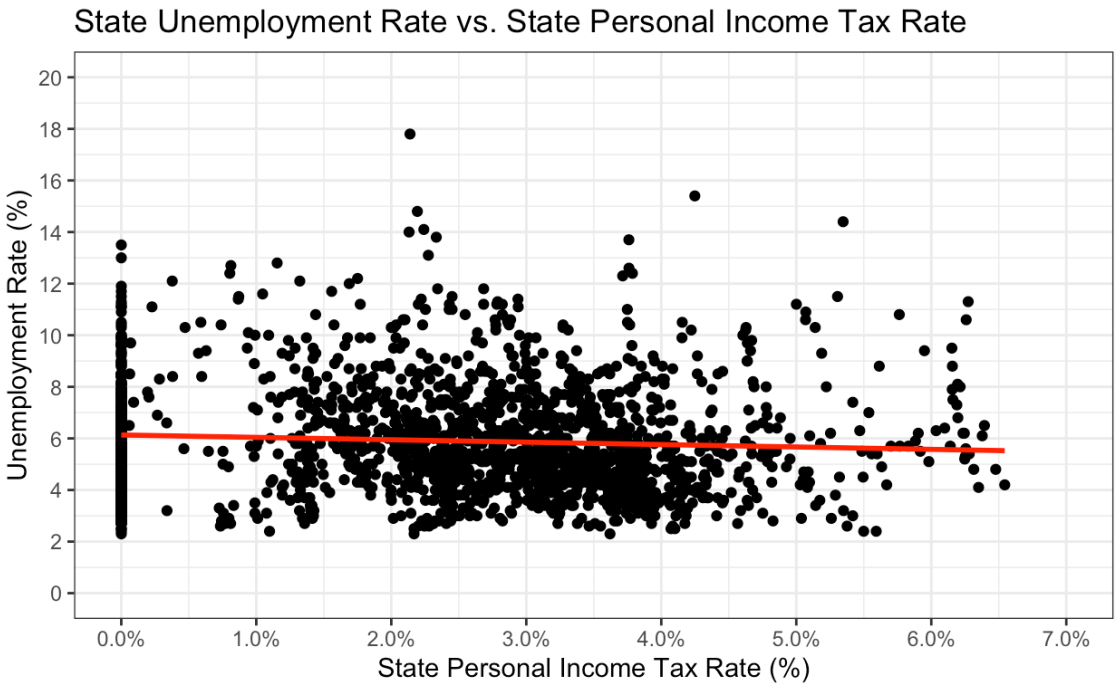

Figure 5: State Unemployment Rate vs. State Personal Income Tax Rate trends overtime

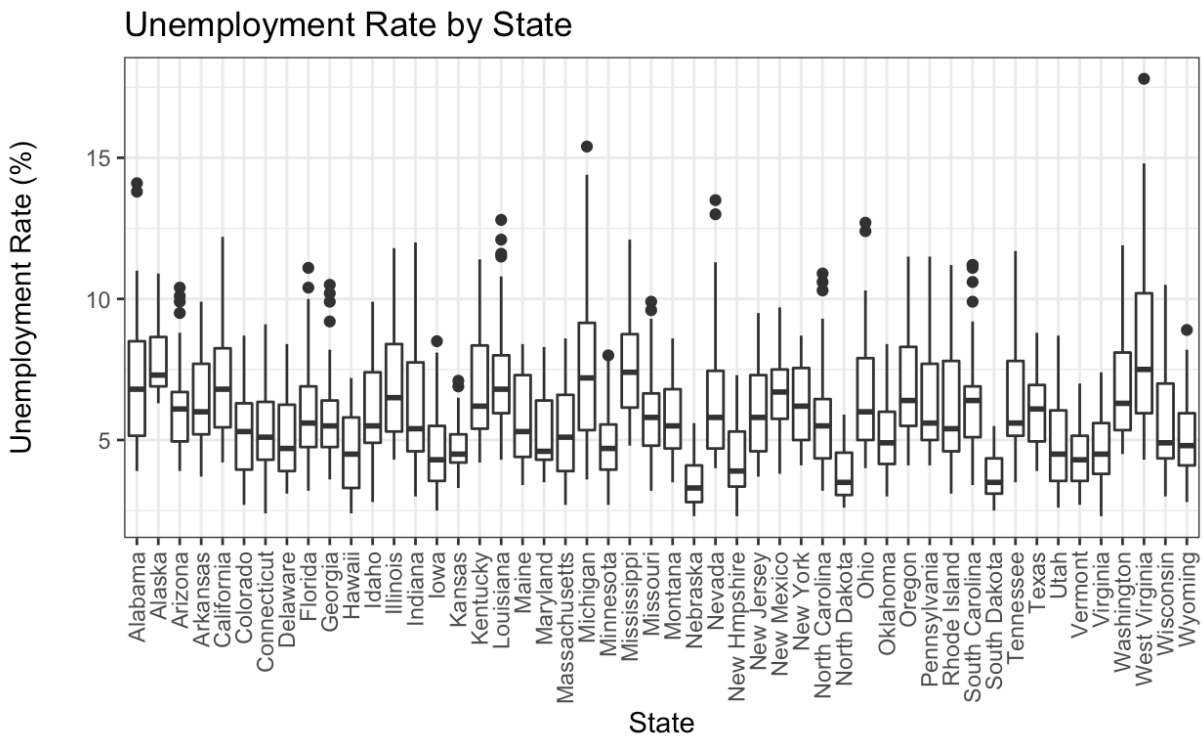

Figure 6: Unemployment Rates by State

Had it been statistically significant, the coefficient for the interaction term "Recession_staterate" would imply that a one-unit increase in the state income tax rate is 7.52 percentage points stronger during a period of recession. Likewise, had it been statistically significant, the coefficient for "Recession kicker" would imply that the unemployment rate increased by 0.79 percentage points in Oregon relative to other states holding all else equal.

The regression model overall had an adjusted R-squared value of just 0.063922 which means that the independent variables included in the model explained only about 6.4% of the variation of unemployment levels through states and years after accounting for the number of variables in the model. This adjusted R-squared model is small and thus implies that many factors that were not included in my model also impacted levels of unemployment.

Conversely, my F-statistic is highly significant with a p-value of less than 0.001 which implies that the regression model fits the data adequately.

Discussion

Findings

Based on the results of the PLM regression, I found that the variable "Recession" was positively correlated with the unemployment rate at a statistically significant level. This finding is unsurprising and entirely consistent with existing economic research, which shows that unemployment increases during a recession. It also reaffirms the importance of policymakers anticipating that income tax revenue will fall during a recession in their budgets, as individuals are likely to lose their jobs.

Considering the variables "Recession_staterate" and "Recession_kicker" were found to be statistically insignificant, it must be assumed that Oregon possessing a kicker law does not make a recession in-state more severe, and that the impact of state income tax rates on levels of unemployment are not stronger during a recession. These findings would suggest that policymakers need not immediately reduce income tax rates during a recession as they won't have a greater-than-normal impact on the employment rate. Additionally, my research indicates that Oregon legislators need not be concerned about the kicker law making the state more vulnerable to economic shocks.

The kicker results, in particular, were surprising. It was anticipated that because Oregon was incapable of significantly establishing a rainy-day fund, when budget shortfalls occurred, they would have to lay off workers in important government sectors like social workers and job placement officials. The hypothesis was that this would compound the number of unemployed people, as there would be both more people losing their jobs and fewer people to help the newly disenfranchised workers find new employment. Despite my research not finding any link between a kicker law and increased unemployment, future research is encouraged to examine

other potential economic ramifications of the kicker law. Considering the kicker's proclivity to benefit wealthier Oregonians, other regressions may show, for example, that the law exacerbated income inequality within certain states. Further scrutiny of the kicker could help legislators either abolish the policy or alter it to make it less regressive or prohibitive to state savings.

The most surprising finding was the notion that the state income tax rate had a considerable statistically significant negative effect on the unemployment rate. This finding could prove important in macroeconomic understanding as it contradicts much of the existing research, such as McBride, that argues that tax increases stunt growth and subsequently increase unemployment. Rather, it supports the recent findings by Gale et al. that show that tax increases either have no effect or perhaps even a positive one on employment growth.

There are a couple of possibilities why state income tax rates had negative effects on unemployment. First, it could support the theoretical idea that the government puts taxes to good use by investing in social services and education which help individuals attain employment. However, the return on soft skills is often prolonged or unquantifiable and this conclusion would be based on the faulty assumption that tax dollars are uniformly put to good use across all 50 states in a manner that directly benefits the employability of a state's constituents. For these reasons, it is led to believe that investment of tax dollars isn't necessarily the driving force in the negative relationship between income tax and unemployment, even if it is a contributing factor.

Second, this result could indicate that taxation spurs growth and, as an extension of the first possibility, government revenue supports firm creation which in turn hires more people, decreasing the unemployment rate. While I am also skeptical about this logic for similar reasons, I do lend credence to the idea that more tax revenue at least increases government jobs (even at a

basic level, considering the administrative positions that are required to deal with taxation), giving this theory some validity.

The third, and most likely, explanation for the negative relationship between income tax and unemployment is that it is likely a matter of correlation rather than causation. If states are experiencing high employment levels, that is usually a sign of a healthy economy and a large potential tax base, so legislators could raise income tax rates without fear of economic blowback. Therefore, low unemployment rates could coincide with higher income tax rates. Conversely, if a state is experiencing higher levels of unemployment, reliance on income tax as the primary mode of taxation could be ineffective because if people aren't earning an income, they wouldn't pay an income tax. As such, states would potentially lower an income tax rate in favor of cutting spending or raising a hypothetical sales tax rate (or both) during times of high unemployment, thus explaining the negative relationship. In reality, this finding may be a combination of all three possibilities, but I would place a larger emphasis on the correlation over causation possibility.

Future Research

As aforementioned, I believe that the impacts of the kicker law deserve further examination. On a broader scale, future research can expand on the findings by examining the relationships between recessions, income tax levels, and other contributing factors that influence unemployment, such as tax credits, other modes of taxation, education levels, etc. Specifically, it would be interesting to see how corporate income tax rates affect unemployment as well as the impact of supplemental taxes like marijuana or gambling on unemployment.

Additionally, the model was not comprehensive as it could be because of the complexities of the economic structure in states. Building a more robust model, that better

encompasses the economy and studying different timeframes could better help expand on my findings as well.

Limitations

There were three key limitations in my research: the redundancy between the NBER recession indicator and unemployment, the simplicity of my model, and the presence of omitted variable bias. While NBER is a very effective indicator of whether the US is in a recession, it could be redundant within my model because it includes the national unemployment rate in its calculations while I examine the changes in unemployment during a recession. Therefore, unemployment is effectively double-counted in both the dependent and independent variables. Due to the simplicity of my model and my desire to study the direct impacts of recessions on unemployment, this problem was somewhat unavoidable, but should nonetheless be mitigated in future research.

The second and third limitations go hand-in-hand in that my model was very simple meaning that there is also considerable omitted variable bias. The macroeconomic policies of individual states were incredibly complex, and it was unrealistic to explain their nuances through only the presence of a kicker, whether there was a recession, and the level of the income tax rate. Likewise, states had considerable variation in terms of economic fortitude, industry, political ideologies/pressure, etc., and so one should be very careful when generalizing results as I did. Ultimately, it is best to view my thesis as exploratory which can shed light on potential conclusions (like the negative relationship between income tax levels and unemployment) that deserve future research, rather than treating my findings as a smoking gun.

Conclusion

Tax policy in the US will undoubtedly remain a contentious and unresolved issue. While the theoretical best approach is to evenly split revenue generation among the three primary modes of taxation -- sales, property, and income -- the reality is that this paradigm simply isn't pragmatic for the vast majority of states. The challenge then becomes finding the optimal modes of taxation that protect states' interests while also safeguarding against the inevitable volatilities that will result from the cyclical US economy.

Oregon's tax system is not impervious to economic volatility either. Due to the inability to build up revenue savings because of the kicker law and the over-reliance on income-tax levels, Oregon is at risk of being unnecessarily vulnerable to economic recessions. The literature review highlighted that higher income tax rates impact people's locational preferences, have the potential to stunt economic growth, and are especially procyclical. The literature also indicated that Oregon is fervently resistant to change and thus unlikely to see tangible alterations in its tax policy.

In better news for states like Oregon, I used a PLM regression in R Studio to find that there is a statistically significant negative relationship between state personal income tax rates and levels of unemployment. Likewise, a statistically significant relationship was found between the U.S. being in a recession and states having higher levels of unemployment. My findings need to be contextualized as the model was oversimplistic as many omitted variables impact unemployment levels; however, the F-statistic does imply that the regression model is holistically a good fit for my data.

I hope that my research will influence future research on the impact of income tax rates and economic growth as well as the implications of having a surplus kickback on budgeting.

Ideally, this will translate into a meaningful discussion regarding the efficacy of other modes of taxation to construct a less regressive, more sustainable monetary future across all 50 states.

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