The Relationship between Government Revenue and the Income Tax Rate

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Abstract

In this paper, I explore the relationship between changes in the income tax rate and government revenue at the state level using aggregated data between 1991 and 2008. Based on a time series regression of the continental United States, the data suggests that income tax rate and government revenue are negatively correlated. Additionally, the overall health of the economy, as indicated by measures such as per capita income and unemployment rate, is shown to be an important indicator of government revenue. Based on my results, I suggest that the negative correlation between income tax rate and government revenue is a product of the competition among governments for increasingly mobile citizens. Additionally, it is much more beneficial in the quest to increase government revenue to pursue policies that lead to economic prosperity for constituents rather than to manipulate the income tax rate to maximize intake among taxpayers.

Introduction

  When asked about his future with the Golden State Warriors in October 2013, center Andrew Bogut answered reporters with refreshing honesty, providing insight into the mindset of a player set to make millions of dollars. Among his many basketball related considerations, Bogut also mentioned some of his financial incentives – in this case, the disincentive he had to re-sign with the Warriors considering California's state income tax rate, the highest the country (Howard-Cooper, 2013). These incentive packages connected with teams (which the teams have no control over) are subtle but important factors in signing decisions. Even Lebron James must have considered the over five million dollars of salary to state income taxes he stood to lose in 2010 had he chosen to resign with the Cleveland Cavaliers (due to Ohio's 5.925% state income tax, plus Cleveland's additional 2% city income tax) rather than sign with the Miami Heat (and Florida's 0% state income tax) (Rovell, 2010).

  Since federal income tax was first implemented in 1913 (Terrell, 2012), it's grown to become the primary source of government funding. Given the examples above of tax payers with mobility, such as Lebron James, choosing to leave locations with unfavorable tax conditions, what is the proper balance between maintaining healthy revenue streams through income taxes while not placing rates high enough to chase away these mobile tax payers? While some studies have examined individual tax optimization and the decision making process, few have examined the same processes from the view of a government attempting to maximize revenue. With each income tax rate decision, the government is sending signals, both passively and actively, to current and future tax payers about the costs of living within its jurisdiction. Each government is implicitly competing against other governments to maximize its tax base via the limited resource of citizens. This concern has become increasingly relevant as more jobs become connected to the internet as opposed to a physical location, and it follows that workers doing that work are not bound by physical location can "vote with their feet" and choose to live in what they find to be the most desirable tax conditions. The question for government policy makers has become "how do you properly balance trying to increase tax revenues while still attracting new tax payers and retaining current ones in a world that is becoming increasingly mobile"? In this paper, I examine cross sectional tax and demographic data at the state level between 1991-2010 in an attempt to draw conclusions of how best to structure tax data to maximize tax revenue. Using a pooled-time series regression model, I examine the state data and extrapolate the findings into general principles that federal policy makers could consider to maximize tax revenue in the future.

Literature Review

  General tax policy and behavior is one of the most widely covered subjects in economics. While many studies attempt to color very detailed pictures of tax behavior with varying amounts of success, there are several key pieces of information about taxes on which most would agree. Most importantly, we know that taxes affect the decision making of those paying the tax – be they in the form of property taxes (Johnson and Walsh, 2009) or yacht taxes (Salpukas, 1992). For the purposes of this study, I looked primarily at literature related to two fields: taxpayer mobility and tax revenue and rate optimization.

  Taxpayer mobility is used to describe two unique attributes of a citizen: physical mobility describes the ability of a citizen to relocate to a new location to avoid or reduce tax obligation while income mobility describes the ability of a citizen to move up society's socioeconomic ladder (this ability can be defined uniquely in each study, but generally divided into movement between income quartiles – this method is used by US Treasury reports [2007]).

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Both forms of mobility and tax rates are in theory closely related, as citizens higher on the socioeconomic ladder are able to leverage their excess capital into a greater ability to physically relocate in comparison to those lower on the socioeconomic ladder. Those higher on the socioeconomic ladder tend to be more likely to be price setters in the job market – utilizing their increased level of skill (as shown by their increased compensation that has led to more capital in their possession) to relocate to desirable areas. This ability to price set is also a reflection of a smaller pool of workers with equivalent skills. In contrast, those lower on the socioeconomic ladder, presumably with less skill and capital, become price takers in the job market, forced to go wherever a job is located due to the abundance of replacement level labor.

Increased ability to physically relocate among a tax paying population should lead to a lower tax rate via application of Adam Smith's invisible hand principle to governmental policy; taxing physically mobile citizens at a rate they determine to be too high will cause them to use their mobility to relocate to more favorable tax conditions. However, similar to businesses unable to sustain themselves at low prices despite high sales volume, adopting a tax rate that is too low to attempt to attract new citizens or appease current ones can prevent a government from providing necessary public goods, and again drive customers/citizens away to governments providing more for their citizens. This principle is explored implicitly by Johnson and Walsh (2009) concerning property taxes. They found that local property tax levels significantly affected the decision surrounding purchases of vacation homes, and that the level of tax affected the number of homes up for sale. Hendricks (1999) also explored this principle by examining the competition between governments for citizens using a modeling based on tax policy and transfer payment policy. Hendricks found that as the poor become increasingly mobile, the use of a progressive tax became increasing more effective at meeting governmental goals of redistributing income across citizens. In contrast, the use of transfer payments showed the opposite relationship– the less mobile the poor, the more effective direct transfer payments were at redistributing income.

Income mobility is also very important. In America, income mobility has generally increased historically, enabling citizens to slowly diversify their held assets, a common form of tax manipulation, as many assets are taxed at different rates. (Carroll, Joulfaian, Rider, 2006). According to Carroll, Joulfaian, and Rider, in the period between 1979 and 1995, income mobility increased for all income quintiles. They cite that nearly one half of all members of the bottom income quintile were able to move up the next quintile of income as evidence to support this claim, indicating they achieved a greater level of financial mobility. A 2007 Treasury report found similar indications of strong upward movement between 1996 and 2005 (US Department of the Treasury, 2008).

In a study of property taxes and elderly homeowners, those argued to be most affected by increased property taxes due to their limited income, Shan (2008) found that a $100 increase in property taxes was associated with a .73 percentage point increase in the two year mobility rate. This correlated to an 8% increase from the standard two year mobility rate of 9%, indicating that in some cases, those with valuable assets (in this case, the homes of the elderly) are not restricted in their mobility by increased taxes. This may be due to the innate value of their taxable assets as opposed to any increase in mobility granted by taxes. Essentially, although the elders typically hold smaller amounts of liquid assets, their non-liquid assets, such as property, as a whole tend to have higher value on the market, thus enabling the elderly to leverage valuable assets into mobility if necessary.

Because of mobility issues, it becomes necessary for governments to pursue optimal tax rates. The optimal tax rate could be defined using several different criteria such as the rate that raises the greatest tax revenue or the rate which raises enough revenue to prevent a budget deficit. The most commonly known explanation of tax optimization is the Laffer curve, which graphs tax rates against tax revenues to attempt to determine an optimal tax rate (Laffer, 2004). Laffer attempted to create a theoretical framework within which one could suggest tax rates which would maximize government revenue. However, tax optimization is often not as simple as merely acquiring the most revenue. Given previous research that suggests that the tax code directly affects the way businesses are structured – meaning that business will restructure as necessary to minimize tax obligation (Luna and Murray, 2010), merely attempting to blindly maximize revenue could easily lead to unforeseen consequences in the private sector.

Beyond determining the tax rate, it is also important to determine what you choose to tax. Different taxes cause people to react differently. Those who argue that the income tax should be lowered often argue for an increase in consumption or value added manufacturing tax in its stead (Wessel, 2013), so that all citizens have an incentive to work and provide economic value. Although tax incentives have been found to be less effective than direct subsidies in achieving societal goals, they do still change behaviors (Surrey, 1970).

Tax Data

It was advantageous to look at state government policy in order to increase the amount of data available[1]. Comparing states also allows mobility to factor into the model more directly, as it is much more practical to move to a new state as opposed to a new country when tax policy changes, allowing for more obvious changes from year to year when policy changes occur. I began building the model by identifying the key variables. I identified income tax revenue as my dependent variable, with income tax rate as the primary independent variable. After determining unique demographic attributes that would differentiate each state economically, such as total population, per capita income, party of the governor, total tax revenue, and total government spending were added as central variables in the model. Population was noted to be especially relevant, as states with large populations are more likely to collect higher income tax revenues regardless of the income tax rate due to the larger amount of taxable incomes. After consideration, state GDP and percentage of population over age 65 were added to the model prior to the first modeling. State GDP was added as an attempt to potentially differentiate between large and small scale economies, whereas the percentage of the population over age 65 was designed to show differences between states more likely to need to collect money to fund transfer payment programs, which are most commonly aimed at senior citizens. After running an initial modeling of data, it was determined that another tax rate was needed to act as a counter balance to movements in income tax rate, as it is not the sole means through which governments collect income. It was hypothesized that if the income tax rate was lower, governments must replace potential revenue in other forms of taxes, as to the government, any tax revenue created should be of equal value to another. For the purposes of this study, the most logical tax to compare to was sales tax, as common arguments opposing income taxes view raising sales tax rates (or more accurately, creating or raising a consumption tax) as an adequate substitute for lowering income tax to make up for any perceived lost tax revenue (Wessel, 2013).

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[1]For years with changing data (i.e. the income tax rate was raised on May 31 of the year), the data that was used for the greater part of the year was used for the entirety of that year in the regression analysis.

To examine these relationships, I used a pooled time series regression analysis to examine data from 1991-2008. The variables included in my regressions, along with sourcing, are listed below:

Variable	Expected Relationship to Government Income Tax Revenue	Source
party of the governor (D=1, R=0)	+	Public Record
per capita income	+	Bureau of Business and Economic Research, University of New Mexico[2]
Population Growth	+	Census Bureau[3]
Sales tax rate	-	Book of the States (1970-1971 through 2010)
income tax rate	+	The National Bureau of Economic Research
unemployment rate	-	Bureau of Labor Statistics
percentage of the population over age 65	+	Census Bureau

Most variables seemed to have a relatively clear expected relationship with income tax revenue. Per capita income, population, and state GDP all could be expected to correlate positively with income tax revenue, as tax revenue should rise when the economy is doing well and many new citizens are coming into existence. Unemployment rate would then be expected to correlate negatively, as a high rate indicates a poor economy. Sales tax rate, as an expected substitute for income tax rate, was also expected to show a negative correlation. While initially counter-intuitive because many senior citizens have fixed incomes, an increase in the percentage of population over age 65 was expected to show a positive correlation was expected based on Johnson and Walsh's 2009 study of the elderly and property taxes, supported by the logic that as healthcare becomes better, more workers are working past 65, and older workers tend to make more, thus generating more in income taxes. The income tax rate and party of the governor were seen to be related to but have an unclear relationship with income tax revenue. Both ultimately show the influence of politics on tax revenue. Because Republicans are generally associated with lower tax rates, and Democrats are generally associated with higher tax rates, depending on the findings of the model in regards to income tax rate, the relationship between party of the Governor could conceivable be related to income tax revenue in either direction.

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[2] This study chose to measure income tax rate with the highest marginal tax rate in each state.

[3] All Census Bureau data was obtained through direct correspondence with the Bureau. For more information about how to acquire this data from the Bureau or about the specific data used in this project, please contact the author at awost1@mail.rmu.edu.

Results

To test for relationships between variables, a pooled time-series regression technique was used, based on the following function:

Income Tax Revenue = f(income tax rate, population growth, party of the governor, per capita income, % of population > 65, sales tax rate, unemployment rate)

The first regression included observations of all fifty states from the years 1991-2008 using income tax revenue as the dependent variable. Results can be found in Table 1.

This first regression established several key things. The R-square statistic of .928465 (adjusted R-squared of 0.928378), established the model as a good fit for the data in question. There were no highly erratic or unexpected results. Population growth showing a negative sign was the only non-expected outcome. However, this is not alarming in the overall scheme of the model because 1) the corresponding T-stat is low and 2) the growth rate of a population is heavily a function of the birth rate. The higher birth rate produces more citizens but lowers the percentage of citizens who pay taxes (as most newborns won't contribute to tax collections in any real way for a minimum of twenty years), thus causing a higher population growth to seemingly lower government income tax revenue. Additionally, tax deductions associated with children are available on income tax filings.

Table 1. Basic Regression results on Total Income Tax Revenue (1991-1998, 50 states)

Variable	Coefficient (T-Stat in parentheses)
Income Tax Rate	-479945* (-12.2820)
Per Capita Income	433.9599* (101.5132)
Unemployment Rate	-280476* (-17.4859)
Party of the Governor	100511.1* (2.4743)
Population Growth	-354369.3 (0.8440)
Citizens over age 65	2337906* (30.1968)
Constant	15532745 (6.2958)
N	950
R-square	0.928
Adjusted R-square	0.928
* Significant at 1% level	

This first regression established several key things. The R-square statistic of .928 (adjusted R-squared of 0.928) established the model as a good fit for the data in question. There were no highly erratic or unexpected results based on initial expectations of the model. Population growth showing a negative sign was the only non-expected outcome. However, this could be easily explained because the growth rate of a population is heavily a function of the

birth rate. The higher birth rate produces more citizens but lowers the percentage of citizens who pay taxes (as most newborns won't contribute to tax collections in any real way for a minimum of twenty years), thus causing a higher population growth to seemingly lower government income tax revenue.

After this initial regression, some adjustments to the model were made. First, the sales tax rate was added as a control variable. Sales tax rate was added as an attempt to counter balance changes in income tax rate, as well as to account for changes in the tax laws of states with no income tax rate. It was assumed that sales tax could function as an imperfect substitute for income tax rate, and thus should be negatively correlated with it. Secondly, Hawaii and Alaska were excluded in this regression; Hawaii was deemed to be too unique geographically which leads to unique purchasing conditions not seen in any other jurisdiction, while Alaska's unique riches in the natural resource of oil allow to pay dividends to residents of the state each year (D'Oro, 2013), as well as allowing the state to not have either an income or sales tax. These omissions are typical in other studies using cross-sectional state data. The results of this second regression can be found in Table 2.

Table 2. Basic regressions results on Total Income Tax Revenue (1991-2008, 48 states)

Variable	Coefficient (T-stat in parentheses)
Income Tax Rate	-592244.9* (-14.8538)
Per Capita Income	415.7289* (199.8706)
Unemployment Rate	-348370.3* (-22.7910)
Party of the Governor	-76753.89** (-2.3077)
Population Growth	-1524854* (-9.58827)
Citizens over age 65	2806157* (35.4266)
Sales Tax Rate	2273605* (43.7335)
Constant	15532745* (6.2958)
N	912
R-square	0.931
Adjusted R-square	0.931
* Significant at 1% level ** Significant at 5% level	

At this point, the model appears to be relatively sound. The sign of three of the variables were properly expected (per capita income, unemployment rate, citizens over age 65) while two held signs that were not predicted but upon further exploration, produced logical results (income tax rate, sales tax rate). The final two variables were not clearly thought to swing either direction (party of the governor, population growth).

The variable party of the governor tells an unclear story. In the first regression, it was positive and significant at 1%, indicating that democratic governors are linked to greater income tax revenue. However, in the second regression after adding sales tax and removing Alaska and Hawaii, the party of the governor was negatively correlated with income tax revenue and significant at the 5% level, indicating that Republican governors are linked to greater income tax revenue. I am inclined to believe that this wild swing based on the removal of two states and addition of a variable probably indicates that party of the governor has little predictive power surrounding income tax revenue; rather each governor is a function of the economic climate during his term.

The percentage of citizens aged 65 or older showed a positive correlation in both regressions as expected. However, this relationship isn't all that it appears. The positive correlation with income tax revenue from those past the standard retirement age is potentially a symptom of an issue with the data set. Because the data set only spans back to 1991, it does not include spans of time during which not retiring at age 65 was rare. In the one hundred years since income tax was introduced in America, life expectancy has grown twenty years longer. I expect that if the data set were to be expanded, this strong positive correlation would regress towards 0. However, because life expectancy is expected to continue to increase, the small data set may actually be a benefit in projecting the long term tax implications of increasing numbers of those over age 65 – assuming some or all continue to contribute to tax revenue via working. If working past age 65 becomes commonplace, the model may actually underrepresent the positive relationship between the percentage of the population over age 65 and income tax revenue.

The relationship between sales tax rate, income tax rate, and income tax revenue is perhaps the most interesting relationship in the model. As expected, the model shows that each rate had a different relationship with income tax revenue. However, per the results in Table 2, the regression indicates that the sales tax rate is positively correlated with income tax revenue and the income tax rate is negatively correlated with income tax revenue, the exact opposite of the predicted relationships. This seems initially counter intuitive. However, after examination, it is actually an interesting case of how tax rate changes reflect the situation of the greater economy. Sales tax is most likely to be increased when total consumption spending is high, as the marginal value of increasing sales tax is lower if consumption spending is lower, and the risks of raising sales tax rates (notably a further decrease in consumption spending) are more substantial when consumption spending is on decline. Thus, if sales tax was a more dynamic rate, one would expect the rate to increase when consumption spending is high and decrease when consumption spending is low. Therefore, a higher tax rate can be seen as an indicator that the economic conditions in that country are good - and it would follow that more people are working and contributing to income tax revenue. The other measures of the health of the economy included in the model, per capita income and unemployment, similarly indicate that income tax revenue increases in a healthy economy; per capita income is positively correlated with income tax revenue, and unemployment rate negatively correlated, showing that as the unemployment rate decreases, more tax revenue is generated.

Meanwhile, the income tax rate isn't as directly a function of economic health as sales tax rate. On some level, a firm will hire if the economy is strong, regardless of the corresponding income tax rate, and on some level a worker will work as long as he or she is being compensated in some amount greater than zero that is equal to each worker's marginal value drawn from the work. However, when income taxes are high, workers are more incentivized to cheat the tax system. A waiter is more likely to underreport tips being taxed at 50% as opposed to 10%, a

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construction worker is more likely to prefer being paid under the table to avoid a 26% tax as opposed to a 6% one, and an accountant is more likely misrepresent or misappropriate income at a tax level of 36% as opposed to 26%. At some point, the gains from avoiding these taxes become more valuable than the potential losses. Thus, it makes total sense that the income tax rate would be negatively correlated with income tax revenue. A lower income tax rate makes the marginal value of cheating the system smaller, and thus lowers incentives to cheat.

Thus, if sales tax rate and income tax rate were both perfectly dynamic rates able to change at any time, it is likely that both would increase while the economy is trending upward, and both would decrease when the economy is trending downward. Therefore, although the initial inclusion of sales tax rate in the model was seen as a way to introduce a substitute tax, sales tax rate and income tax rate are actually insufficient substitutes of each other, as they are not reliable hedges against each other in order to maximize tax revenue.

Limitations and future work

While I believe this paper presents an excellent starting point in the discussion of how to structure future tax policy in an evolving world with increasing mobility, it is by no means a completed work. There are several limitations to the study as currently completed that could be expanded in future work.

The primary way to enhance findings would be to increase the sample of time used. Although the eighteen years of complete data allow for nine hundred unique state level observations, in terms of economic history, this is a small sampling that only covers approximately 20% of the time income tax have been collected in the United States at the federal level, although states have inconsistently used income taxes as far back as the Civil War. Expanding back even ten years would give greater insight the relationship between income tax rates and revenue, but preferably an additional twenty to thirty years of data could be acquired, allowing the model to begin around the conclusion of the Vietnam War. I was limited in my time series due to my inability to find some data prior to 1991 – specifically unemployment data for individual states by year. The aggregated data needed to continue this project in a more expansive scope will require a significant data collection time requirement, one that even some major organizations readily admit is not reasonable for them to make[4]. Ideally, data would be able to be pieced together for as long as states have used income taxes as a form of revenue gathering, a roughly one hundred year time frame.

A second issue with this model as constructed is the existence of the federal income tax. Because this model compares state level data, it ignores the existence of federal data. By ignoring federal income taxes, the model ignores an influence on state level policies. In the case of income tax data, federal rates are much higher than state income tax rates. Compared to the highest federal tax rate of 39.6%, the average state rate of 5.15% is only a marginal influence on decision making. Even the highest state rate of 10.12% is relatively small in comparison. This high federal tax rate generally forces state (and local) governments to maintain comparatively low rates and seek their revenue from other sources (such as sales taxes and property taxes).

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[4] In my search for income tax rates for each state, I was told by several major tax research organizations that they would love to have the data I needed, but it was simply not worth committing the time to data mine written organizations of the data (such as the Book of the States). I can only imagine similar attitudes exist for other hard to locate data.

Conclusions

State income taxes are often a decision making factor in relocation decisions of individual citizens (Partnership for New York City, 2011). Thus, it is important for governments to understand how various policy changes will affect the revenue drawn from income taxes in order to structure systems that encourage citizens to relocate to the government's jurisdiction without jeopardizing the government's ability to supply necessary public goods. The balancing act required of governments in this respect can be clearly seen on the state level, where various state governments often exist as realistic substitutes for each other to citizens. The model in this study suggests that this balance can be struck promoting a healthy economy through policies outside the realm of this study (such as promoting a healthy private business and banking sectors) while simultaneously lowering the income tax rate in order to attract new citizens. A robust economy will create many job opportunities on which income taxes can be levied, while the income tax rate reduction removes incentives for workers to cheat the tax system and encourages the relocation of workers from harsher taxing jurisdictions, ultimately resulting in a larger tax base from which to draw the incrementally smaller rate.

Aligning individual incentives to relocate to a jurisdiction is ultimately the most powerful way to increase tax revenue. Although a 100% income tax rate would perfectly capture all income generated in a jurisdiction, no one would suggest it because it is obvious that no one would sanely choose to live in a jurisdiction capturing all income via taxes. However, less obvious are the connections between marginal changes in tax rates – the difference between 5% and 6% rates. Based on this model, as policy maker, the most effective way to increase revenue is to lower income tax rates – or more accurately, to align individual incentives in such a way that your jurisdiction is attractive for a tax payer to live in and contribute to the tax base. Because each individual is better off paying incrementally less, each individual is incentivized to live in your jurisdiction, and the vast reach of the tax base can compensate for the incrementally less revenue collected from each individual tax payer.

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