Macroeconomic Effects of Progressive Taxation

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Abstract

Policy-makers often claim to face a tradeoff between economic growth and egalitarian wealth distribution. However, this tradeoff is ambiguous; economic theory cannot predict with certainty whether more aggressive redistribution, typically through a more progressive income tax, will lead to lower economic growth. This paper investigates whether such a relationship exists empirically across states within the U.S., for the period from 1979 to 2004. Using the IRS Public Use File and the NBER TaxSim calculator, for each state and year, the average rate and the progressivity (measured by the *Suits index* and *Effective Progression*) of state income tax are first calculated and documented. After controlling for the average tax rate and state/year fixed effects, I find that the current year's income tax progressivity has a strong negative effect on the annual growth rate of real gross state product 3 years later. The results are the same using either gross state products or per-capita values, while net migration does not show any significant relation with income tax progressivity. This suggests that there does exist a negative relationship between income tax progressivity and macroeconomic growth, which can be explained by different migration patterns or labor supply elasticities across different income groups.

JEL classifications: E62, H24, H30, H71, O23

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1 Introduction

The potential tradeoff between economic growth and egalitarian distribution has been at the center of debate ever since modern economic growth began. Policy makers, especially in developing countries whenever there is a major election, believe they face a choice between growth and distribution. In their rhetoric, it seems that we cannot improve the problem of income inequality without hurting economic growth – the famous 'pie' argument. One side argues that if we just make the overall pie bigger, everybody's share will be bigger, too. The other side argues that it is time to focus on equal sharing of the pie, not the size of it.

However, this tradeoff is ambiguous at best. Economic theory cannot tell us whether a more equal income distribution will be associated with a lower economic growth rate.

Kuznets (1955) made the influential hypothesis that, through the economic development process, income inequality would follow an inverse-U shaped course. At the early stage of industrialization, income distribution becomes more unequal. As workers become more skilled in a more developed economy, income inequality is reduced. This hypothesis depends on one particular path of technological innovation. Therefore, Kuznets' hypothesis is really describing the pattern of technological innovation, rather than the relationship between income inequality and economic growth. Furthermore, today's mature, developed economy is quite different from the early stage of capital accumulation and skill development.

Many other researchers followed Kuznets' work, trying to establish the relationship between income inequality and economic development in the modern context. Feenberg and Poterba (2000) focused on the income share of top-income households in the U.S. during the period of 1960-1995. Piketty and Saez (2003) documented income inequality in the US for an even longer period, from 1913 to 1998. Still, this line of work cannot avoid the fundamental problem of endogeneity. Income inequality and economic growth are simultaneously determined by other factors, such as technological change. Depending on the direction of this change – e.g. in which sector technological innovation happens – the relationship between inequality and growth can be either positive or negative.

In fact, income inequality itself is not a policy variable. It is the result of policy decisions, market interaction of economic agents, and other exogenous changes. When we talk about the tradeoff between income inequality and economic growth, what we mean is the *policy* to change the income distribution, not the distribution itself. So we need to ask whether policies

which promote income equality would help or hurt economic growth.

The most effective and wide-spread method of income redistribution is progressive tax and transfer. This paper focuses on the effect of a progressive income tax. More specifically, it studies the relationship between income tax progressivity and gross production. Again, economic theory cannot tell us whether a more progressive tax schedule will bring lower economic growth; it crucially depends on the distribution of income and the elasticity of labor supply for different income groups, among other factors. Migration also can play a key role in determining the relationship, and consumption/savings propensities in different income groups are also important in a closed economy. The question therefore becomes empirical: does the evidence suggest a tradeoff between economic growth and progressive taxation? Using U.S. state-level data from 1979 to 2004 as my panel, I find that such a tradeoff does indeed exist.

The first part of my work is to construct an index representing how progressive a state's income tax schedule is. Two different types of indices are calculated – *Suits index* and *effective progression* – using TaxSim developed at the National Bureau of Economic Research(NBER). This system takes tax payer's income and demographic information as an input and gives the federal and state income tax liabilities as an output. Combined with the annual sample of tax return files published for public use by the Internal Revenue Service(IRS), TaxSim allows me to calculate these progressivity indices for each of 50 US states, for each year from 1979 to 2004.

Next, various regressions are done between the annual growth rate of GDP by state and the progressivity indices. The results show a strong evidence for the tradeoff between economic growth and progressive taxation. After controlling for the average tax rate and other fixed effects, if the current year's income tax is more progressive in a state, the yearly growth rate of this state's gross product is significantly lower in 2-4 years, with the effect peaking at 3 years of lag. This effect is the same whether growth is measured using gross product or per-capita product, and consistent between the two measures of income tax progressivity I consider. This tradeoff can be explained by inter-state migration or change in labor supply, which will be discussed in detail in the later part of this paper.

Compared to the earlier works which investigated the inequality-growth relation in the U.S., this paper distinguishes itself by focusing on the state-level income tax system, rather than that of the entire U.S. Also, several authors studied this question using cross-country data. This paper avoids many of the data problems they faced. It is collected by one agency (IRS) throughout the data period, which provides consistency. Also, institutional

differences between states in the same country are a lot less problematic than similar differences between countries.

Because of data availability (or the lack of it), previous works generally focused on a specific part of the income or tax distribution. For example, as a measure of progressivity, many authors used the top marginal tax rate, or the tax share of the top income group. Thanks to the IRS public use file, I am able to use the entire income and tax distributions to construct a summary index of progressivity. Another merit of this data set is its frequency and accuracy. The IRS collects the data every year, and has done so for a long time. The income and tax fields in this data are in dollar values, without any cap. (In contrast, major census data is collected every 10 years, survey data do not generally cover several decades, and income fields are often top-coded or bracketed in survey data.) And since misreporting can be detected and punished, the data is more reliable than survey or census data.

Calculating and documenting the progressivity index for each U.S. state for 26 years[2] itself is what I consider a valuable contribution to the literature. In this direction, Feenberg and Rosen (1986)'s work can be considered a direct predecessor of this paper. They developed TaxSim to tabulate various aspects of state personal income tax for the period of 1977-83. To show the progressivity of each state's income tax system, they calculated the marginal and average tax rate for three different income levels – 40,000, 20,000, and 10,000 US dollars. Compared to their method, it is better to have a summary index such as the Suits index, which can work as a single measure of progressivity and can be used in other analysis. Thanks to their effort to keep TaxSim updated until now after their seminal works in 1980s, this paper also covers longer period of time. In addition, this paper is the first to connect this comprehensive index to a macroeconomic variable at the U.S. state level. Feenberg and Rosen did not try to evaluate the state income tax system in the macroeconomic context, although they suggested that their work could be used to answer various questions in macroeconomics.

In Section 2, the building process and the characteristics of this panel data set will be explained in detail. Section 3 will show the results of the growth-progressivity regressions. Section 4 will discuss the results, indicating the potential causality of income tax progressivity on economic growth. Section 5 concludes.

[2] IRS record goes a lot longer than 26 years, but the NBER tax calculator has state tax information only after 1979.

2 Data

2.1 Index of Tax Progressivity

My analysis starts with the task of representing the progressivity of each state income tax by a proper index. An important thing to note here is that progressivity crucially depends on the underlying income distribution and demographic characteristics. The statutory tax rate alone cannot show how progressive it is. For example, even if a state is levying 90% marginal tax for any annual income above 1 billion dollars, it has no difference in actual progressivity from a 50% marginal tax rate if no one earns that much income. Similarly, tax codes with the same deduction for dependents could mean different things in states with different typical household sizes. Therefore, in order to calculate tax progressivity, both tax code details and a benchmark distribution of income and demographics are needed.

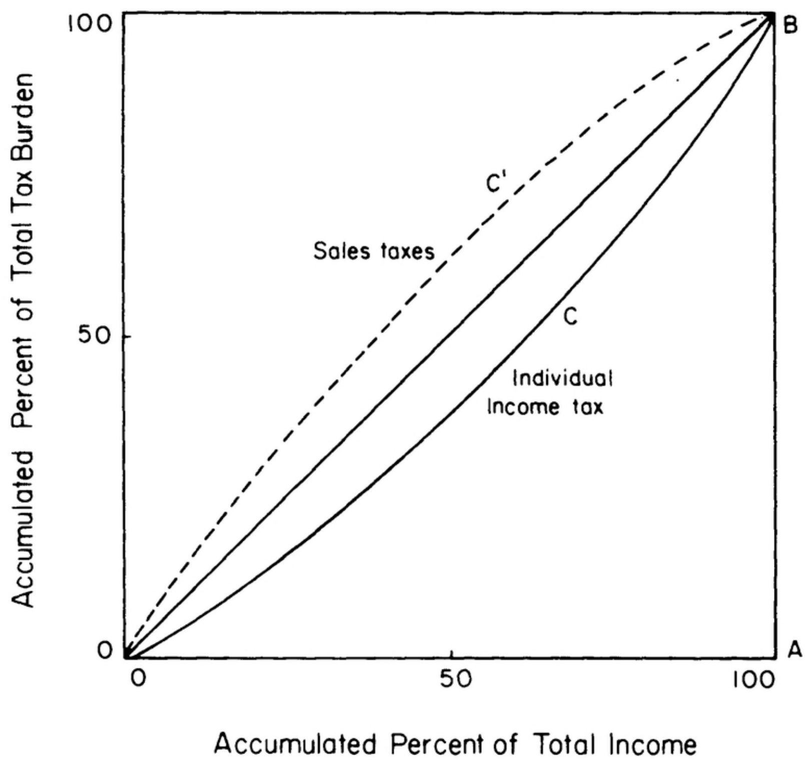
Fortunately, the National Bureau of Economic Research (NBER)'s TaxSim provides both types of data. It consists of two parts. The first part, the Public Use File (PUF hereafter), is a sample of actual tax files, published by the Internal Revenue Services (IRS) every year for public use. It is a nation-wide, stratified random sample, with size varying from 70,000 to 150,000 files each year. Each record contains about 200 data fields for each tax filer – virtually every entry on the Form 1040 is codified. Unlike some other census-type data, the income record is not top-coded, showing the true distribution for even the highest income group.[3] The second part of TaxSim is a tax calculator, which takes the tax file record (such as the PUF) as input and calculates federal and state tax burdens, marginal and average tax rates, and other tax information.

Using TaxSim, I first calculate the hypothetical tax burden for each filer in the PUF for each state. For example, I suppose every filer in the 2004 PUF lived in Alabama, and calculate the federal and state income tax for each filer. This gives me the progressivity index and the average tax rate for Alabama, 2004. Then I move to Alaska, Arizona, etc. When I finish calculating 51 (50 states and District of Columbia) progressivity indices, I move on to year 2003, assume that every filer in the 2003 PUF lived in Alabama, and so on. This process gives a panel data set of progressivity indices and average tax rates for the 51 states, ranging from 1979 to 2004.

I construct two types of progressivity indices. The first one is the Suits index, following the work of Suits (1977). The idea of the Suits index is

[3] In contrast, the U.S. census data has a cap of 1 million dollars in the annual income field.

Figure 1: Lorenz curves for Suits Index, reproduced from Suits (1977)



similar to the Gini coefficient. They both use the Lorenz curve to summarize the distributional characteristics of income or of the tax burden. While the Gini coefficient uses cumulative income share against cumulative population share to construct the Lorenz curve, the Suits index uses cumulative tax share against cumulative income share.

Figure 1 shows three different Lorenz curves used to construct the Suits index. The Lorenz curve for a proportional tax system coincides with the 45-degree line, because everyone's tax share is the same as income share. In the case of individual income tax, which is usually progressive, people with higher incomes bear bigger tax burdens than people with lower incomes. Therefore, for this case, the Lorenz curve lies under the 45-degree line. The Suits index is calculated as the ratio of the area between the 45-degree line and the Lorenz curve to the entire area below 45-degree line, i.e. $OCBO$ divided by $\triangle OAB$. In the case of the sales tax, which is usually regressive,

the Lorenz curve lies above the 45-degree line, as $OC'B$ does in the figure. In this case, the Suits index becomes negative. We can see that the Suits index varies between +1 and -1, where +1 represents the most progressive case – the richest individual pays all the tax in the economy – and -1 represents the most regressive case.

The second progressivity index used in this paper is effective progression, following Musgrave and Thin (1948). This index measures how much income equality is improved by the income tax. Again, this idea utilizes the Gini coefficient, which measures income inequality. A progressive tax will make the Gini coefficient lower for after-tax income than before-tax income. Effective progression is defined as

$$\text{Effective Progression} \equiv \frac{1 - \text{Gini}_{\text{After Tax}}}{1 - \text{Gini}_{\text{Before Tax}}} \tag{1}$$

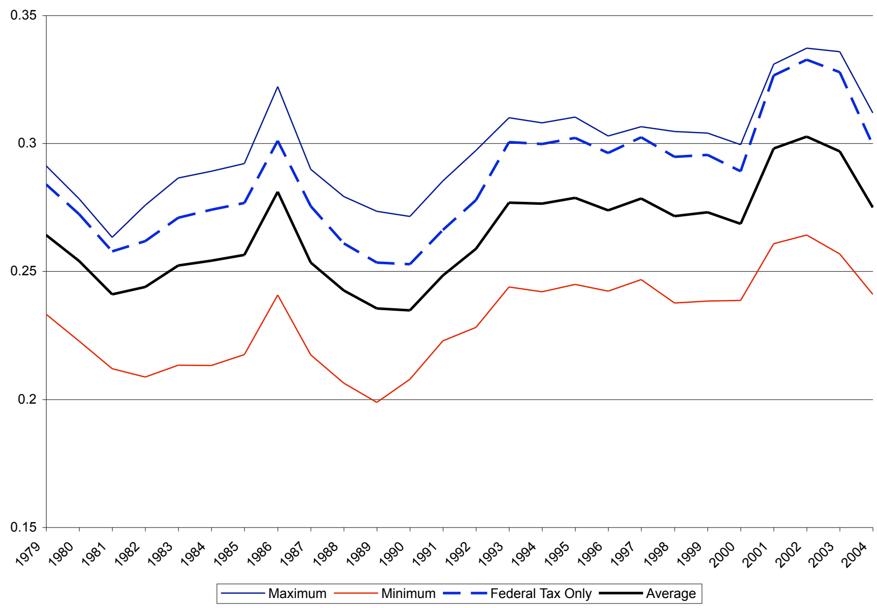
From here on, the income tax burden of a tax filer is defined as the sum of federal and state income tax. To consider economic incentives which depend on an individual's income, the combination of federal and state income tax is better than either one of these. Also, the federal income tax allows deduction of the state income tax for itemizers, and in several states[4] the federal income tax is deductible from the state income tax. Considering only the state tax might distort information regarding the tax burden. Note that there are 7 states[5] which don't have any state income tax. This would introduce a problem, because the Suits index cannot be calculated without any tax; combining federal and state income tax allows calculation of both indices for every state.

Figure 2 shows the trend of the Suits index for the entire period from 1979 to 2004. The average level among 51 states is plotted, together with the maximum and minimum values in each year. Among these 1,326 data points (51 states and 26 years), the average Suits index is 0.265 and the standard deviation is 0.0255, with the coefficient of variation being 9.62%. Note that, without state income tax, the Suits index of federal income tax is above average. Federal income tax is highly progressive compared to state income tax. For the majority of states, adding state income tax to federal income tax makes the overall tax system less progressive, according to the Suits index, than the federal tax alone. In 2004, there were only four states – California, New Hampshire, New Jersey, and Tennessee – where the

[4]In 2004, Alabama, Iowa, Louisiana, Missouri, Montana, Oklahoma, Oregon, and Utah allowed deduction of federal income tax from state income tax.

[5]Alaska, Florida, Nevada, South Dakota, Texas, Washington, and Wyoming.

Figure 2: Suits Index, Federal and State Income Tax (1979-2004)

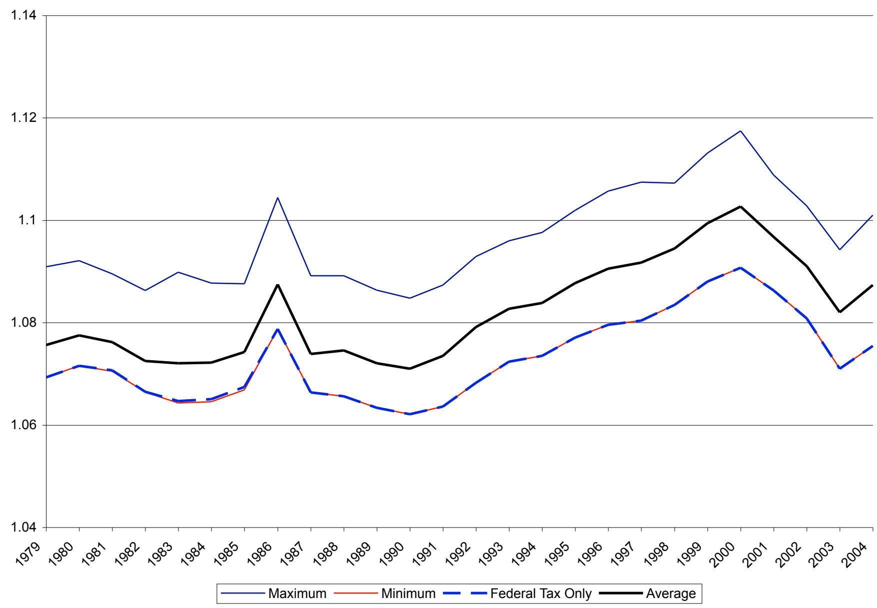


combined federal and state income tax showed a higher Suits index than Florida, which does not have any state income tax.

Figure 3 shows the trend of effective progression. The average effective progression is 1.081 and the standard deviation is 0.0127, with the coefficient of variation being 1.18%. As long as a state income tax is progressive, adding a state tax to the federal tax should always improve after-tax income equality compared to the federal tax alone. Therefore, the states without a state income tax system show the lowest value of effective progression each year. This demonstrates a clear distinction between the Suits index and effective progression. The Suits index is more sensitive to curvature itself, while effective progression is more correlated with average tax rate. For example, for a progressive income tax, doubling the tax rate for each income bracket will not change the Suits index – it is homogeneous of degree zero in the level of tax. However, this same change will obviously improve progressivity according to effective progression. Using these two different types of measures in my analysis and comparing the results will provide robustness for the results.

For the average rate of income tax and both types of progressivity indices, more detailed information is available in the tables at the end of this paper.

Figure 3: Effective Progression, Federal and State Income Tax (1979-2004)



2.2 GDP and Population by State

Annual statistics of GDP by state are retrieved from the regional economic accounts data published by the Bureau of Economic Analysis.[6] There is a discontinuity in the GDP by state time series at 1997, where the industry definition is changed from SIC to NAICS. Although the level of GDP is not compatible between these two groups, it is still legitimate to use the growth rates calculated from this data.[7]

The population estimates for each state and year rely on various tables published by U.S. Census Bureau.[8] Because a major census is done only once every 10 years, the majority of data is intercensal estimates. From 1979 to 2000, these estimates are updated versions using the later census results. For example, intercensal population estimates for the 1990s are updated using the 2000 census. From 2001 to 2004, the estimates projected from the 2000 census are used.

[6]Internet source: http://www.bea.gov/regional/index.htm

[7]1997's GDP by state is given by both definitions. Therefore, the growth rate from 1996 to 1997 can be calculated by GDPs with the SIC definitions, and the growth rate from 1997 to 1998 can be calculated with the NAICS definitions.

[8]Internet source: http://www.census.gov/popest/states/

The number of births and deaths for each state is also used in this paper. The majority of this data comes from tables published by the Census Bureau, too. For missing values, Vital Statistics[9] published by the National Center for Health Statistics is consulted.

3 Results

3.1 Contemporaneous Regressions

I first look at the contemporaneous relation between these progressivity measures and the annual growth rates of gross state product. Denoting the current year as t, the growth rate of state i's gross product is defined by $g_{Y i,t} \equiv \log Y_{i,t+1} - \log Y_{i,t}$. Then, the contemporaneous regression equation is

$$g_{Y i,t} = \alpha + \beta_1 S_{i,t} + \beta_2 A_{i,t} + \delta_t + \gamma_i + \epsilon_{i,t} \quad (2)$$

where S_{it} denotes the Suits index of state i in year t and A_{it} denotes the average tax rate. The purpose of this regression is, controlling for how much income tax is collected on average, to see whether there is any relation between the income tax progressivity and the growth rate. For fixed effects, I use year and state dummy variables. A time trend variable is used instead of year dummies in some regressions. The regression results of these five different specifications are shown in Table 1.

In the absence of the year dummy variables, the coefficient on the Suits index is always positive and significant. It seems that, after controlling for average tax rate, when a state has more progressive income tax system than others, its growth rate is also higher. However, when both the year and state dummy variables are included, the coefficient on the Suits Index is not statistically significant.

From Figure 2, we can see that the federal income tax is driving the time variation of overall progressivity of combined (state + federal) income tax. Although there is no obvious trend, there is significant year-to-year variation[10] in the progressivity of the federal income tax. If there is any shock moving the tax progrssivity and the growth rate simultaneously at the federal level, this should be controlled for in order to focus on the state-by-state variation. Therefore, I believe the result with year dummy variables is the

[9] Internet source: http://www.cdc.gov/nchs/nvss.htm

[10] The coefficient of variation is 7.57%, with standard deviation being 0.0217 and mean being 0.2869.

Table 1: Contemporaneous Regression Results with Suits Index

Variable	Spec I	Spec II	Spec III	Spec IV	Spec V
Dependent variable: annual growth rate (difference in log) of gross state products.					
Constant	-0.009	-0.324			
	(0.019)	(0.300)			
Suits Index	0.174*	0.146*	0.055	0.272*	-0.002
	(0.042)	(0.050)	(0.073)	(0.066)	(0.157)
Average Tax Rate	-0.049	-0.060	-0.017	-0.274*	0.367
	(0.064)	(0.065)	(0.091)	(0.102)	(0.290)
Year Trend		0.000		-0.000	
		(0.000)		(0.000)	
Year Dummy			Included		Included
State Dummy				Included	Included

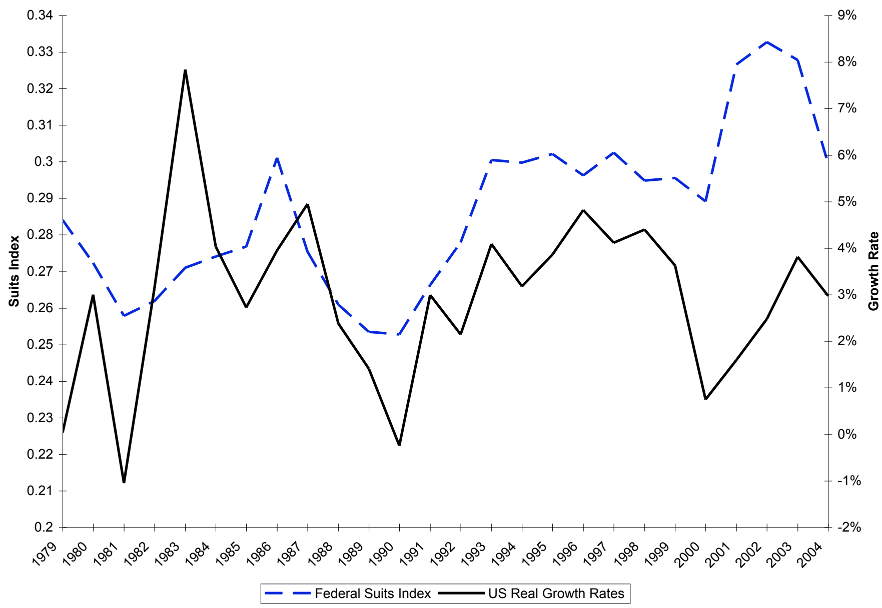
Standard errors are in parentheses. * indicates significance at 1% level.

Table 2: Contemporaneous Regression Results with Effective Progression

Variable	Spec I	Spec II	Spec III	Spec IV	Spec V
Dependent variable: annual growth rate (difference in log) of gross state products.					
Constant	-0.055	-0.899*			
	(0.093)	(0.290)			
Effective Progression	0.109	-0.154	0.031	-0.198	-0.485
	(0.091)	(0.125)	(0.232)	(0.141)	(0.490)
Average Tax Rate	-0.200*	-0.075	-0.078	-0.124	0.552
	(0.070)	(0.081)	(0.105)	(0.131)	(0.311)
Year Trend		0.001*		0.001*	
		(0.000)		(0.000)	
Year Dummy			Included		Included
State Dummy				Included	Included

Standard errors are in parentheses. * indicates significance at 5% level.

Figure 4: Federal Suits Index and US GDP Growth Rate (1979-2004)



most plausible one, concluding that there is no significant contemporaneous effect of the Suits index on growth rate at the state level.

Figure 4 shows the trend of Suits index for the federal income tax and the annual growth rate of U.S. real GDP. When I run the regression of US GDP growth rate on the Suits index and the average tax rate of federal income tax, the point estimate is 0.32, although not significant.[11] This supports the idea that the positive correlation between GDP growth rate and the Suits index at the federal level is driving the positive effect of the Suits index for federal and state income tax at the state level, without year dummy variables.

It is interesting to note that average tax rate does not have a statistically significant contemporaneous effect on growth. Of course, this does not mean there is no effect – for example, the effect might appear with a time lag.

Year trend variable has no significance in this regressions; it's not statistically significant, and the point estimate is near zero. This is just another confirmation of the fact that, in the U.S. economy, the GDP growth rate does not show any trend during the last three decades.

[11]Standard error = 0.247. Constant and year trend are also included as regressors.

Substituting the measure of effective progression for the Suits index, the same type of regression results are shown in Table 2. Here, effective progression does not have a statistically significant effect on the growth rate in the same year, either with or without year dummy variables. This supports the conclusion from the regression using the Suits index. After controlling for average tax rate, in the same year, no systematic correlation between income tax progressivity and production growth rate can be found at the state level.

What about the other direction? One could imagine that this year's growth rate in gross production has a certain effect on this year's income tax progressivity. For example, state legislators might expect a high rate of income growth from year $t-1$ to t induced by a big financial gain for the top income group, and make the income tax more progressive in year t. This would lead to a positive effect from income growth rate to tax progressivity. However, when I estimate

$$S_{i,t}(\text{or } EP_{i,t}) = \beta(\log Y_{i,t} - \log Y_{i,t-1}) + \delta_t + \gamma_i + \epsilon_{i,t} \tag{3}$$

no significant effect of growth rate is found[12] on tax progressivity index. The detailed regression results are listed in Table 8 at the end of this paper.

Figures 5 and 6 illustrate relationships between the growth rate of GDP by state and income tax progressivity, without any control variables. Linear regression lines and kernel regression lines are also included in the graphs. For the Suits index, the relationship seems slightly positive, but it becomes insignificant when the fixed effect for each year is included. For the effective progression, no visible correlation can be found.

3.2 Regressions with Lagged Variables

Even if no significant effect can be found from the income tax progressivity to production growth rate, it does not mean that there is no effect at all. Consider, for example, that it takes some time for an economic agent to gather information and to adjust behavior. It is usually impossible to see the overall progressivity of income tax immediately. The relevant information is available with years of lag. Although a person can immediately see this year's income tax rate for his own income bracket, it takes more time to evaluate this tax rate in the context of expected future income, which

[12] The exception is a positive correlation between the Suits index and growth rate in a regression without any control variables. Again, this seems to be driven by the movement of federal income tax progressivity and the U.S. GDP growth rate, not by state-level variation.

Figure 5: Growth Rate vs. Suits Index

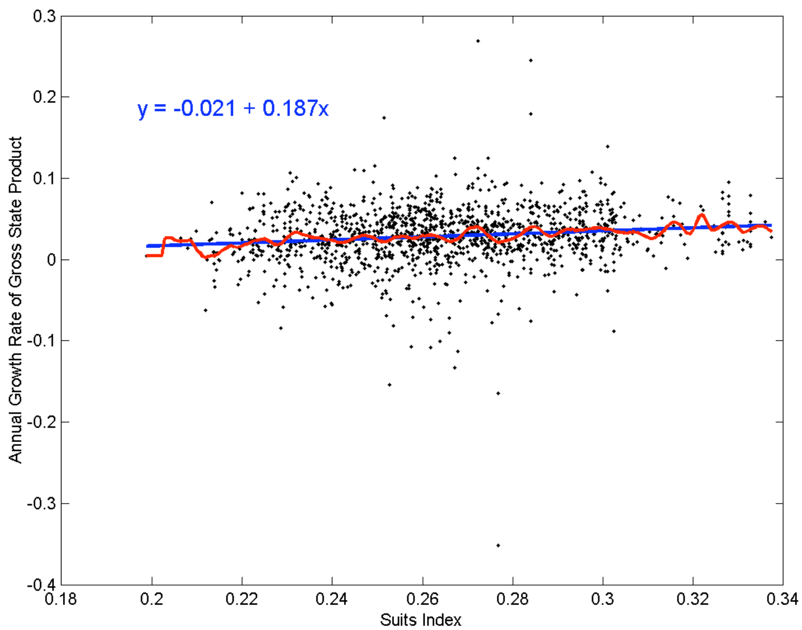
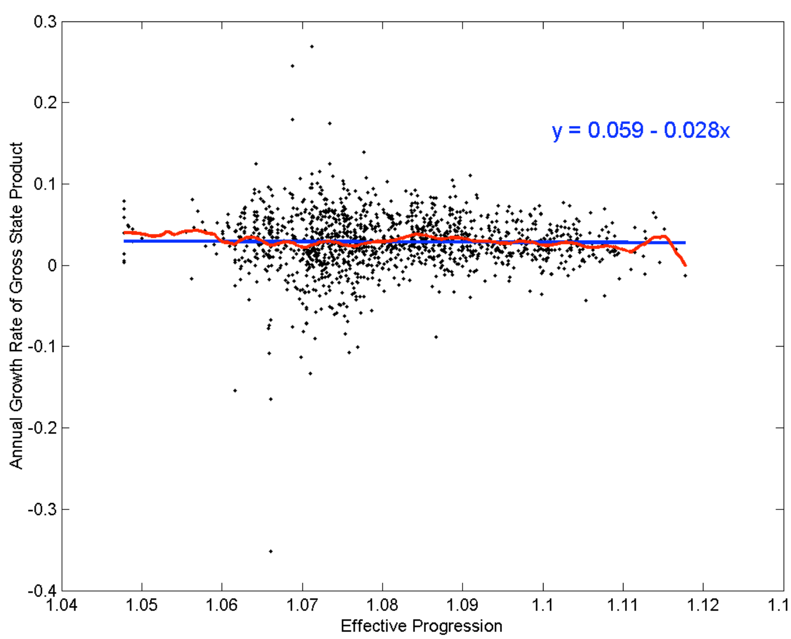


Figure 6: Growth Rate vs. Effective Progression



depends on the inflation rate, interest rate, growth rate of the overall economy, etc. Also, labor supply may be inelastic in the short run, since many people have a job with fixed working hours. Therefore, labor supply change may be associated with turnover. Interstate migration in response to tax rate changes might happen at an even longer lag than job change due to migration costs.

Table 3: Lagged Regression Results

Variable	No lag	1-year lag	2-year lag	3-year lag	4-year lag
Set I: Regressions with lagged Suits index					
Suits Index	-0.002	-0.127	-0.279*	-0.498*	-0.410*
	(0.157)	(0.145)	(0.141)	(0.145)	(0.148)
Average Tax Rate	0.367	0.352	0.239	-0.074	0.011
	(0.290)	(0.269)	(0.262)	(0.269)	(0.271)
Set II: Regressions with lagged effective progression					
Effective Progression	-0.485	-1.172*	-1.722*	-2.138*	-1.788*
	(0.490)	(0.454)	(0.438)	(0.445)	(0.447)
Average Tax Rate	0.552	0.915*	1.146*	1.184*	1.050*
	(0.311)	(0.288)	(0.277)	(0.282)	(0.285)

Dependent variable: annual growth rate (log-difference) of gross state products.
Standard errors are in parentheses. * indicates significance at 5% level.
For each regression, year and state dummy variables are included.

Table 3 shows the results of regressions

$$g_{Y_{i,t}} = \beta_1 S_{i,t-s} (\text{or } EP_{i,t-s}) + \beta_2 A_{i,t-s} + \delta_t + \gamma_i + \epsilon_{i,t} \quad (4)$$

with various lags s, where $g_{Y_{i,t}}$ is defined as before. Contemporaneous ($s = 0$) regression results are reproduced in the first column for comparison. Again, the dependent variable is the annual growth rate of gross state products. In one set of regressions, the Suits index is used as the measure of income tax progressivity. In the other, effective progression is used instead. Lagged average tax rate is also used as a control, as well as current year and state dummy variables.

This table suggests that there is a strong negative effect from the lagged progressivity index on the growth rate of gross state product, which is both economically and statistically significant. For example, a 0.01 increase in

Suits index of a state this year is associated with almost 0.5 percentage point lower growth rate three years later. Considering that the actual gap between the maximum and minimum Suits index in 2004 is 0.07, this effect has huge economic significance. Likewise, moving from the minimum effective progression to the maximum this year is associated with 5.3 percentage point lower growth rate three years later.[13]

This effect, however, is not permanent. The estimated coefficient on tax progressivity is the largest in absolute value when the lag is three years. Using a lag longer than three years, the magnitude of this negative effect gets smaller, until it becomes insignificant with six years of lag. Having an income tax with higher progressivity is associated with a temporary negative growth effect and a permanent level effect on gross production.

Figures 7 and 8 show the lagged regression results between the income growth rates and the tax progressivity, with three years of lag. The vertical axis shows the residual value of growth rates after controlling for the average tax rates and the fixed effects for each state and year. The strong negative correlation can be visually confirmed using these plots. Comparing the linear regression line and the kernel regression line, the linear specification of Equation (4) seems legitimate. Also, the regression results do not seem to be driven by a few outliers.

This effect might be considered unrealistically big. One way of justifying this is an omitted variable bias. State budgets have two sides – revenue and expenditure. Income tax progressivity concerns only the revenue side. How the state spends the collected tax money is not incorporated in this paper's analysis.[14] One could imagine that states with highly progressive income tax systems might also have generous welfare spending. This situation is not hard to imagine, considering the political orientation of the two major parties in the U.S. Now assume that this generous welfare spending has a negative effect on the growth rate of production. (Reduced labor supply, such as longer job-searching periods for unemployed people or shorter working hours for high-income professionals, can be an example of the mechanism.) In this case, the coefficient on the progressivity index is picking up not only the effect of the tax system, but also the effect of welfare spending.

The same omitted variable bias can partly explain the positive coefficient on the average tax rate in the bottom part of Table 3. Suppose that a high-tax state is also a high-spending state. Considering that most states need

[13]The gap between the maximum and the minimum effective progression is about 0.025 in year 2004.

[14]It would be a good topic for further research, if data is available, to combine the effect of progressive income tax and welfare spending.

Figure 7: Growth Rate vs. Suits Index with 3-year Lag

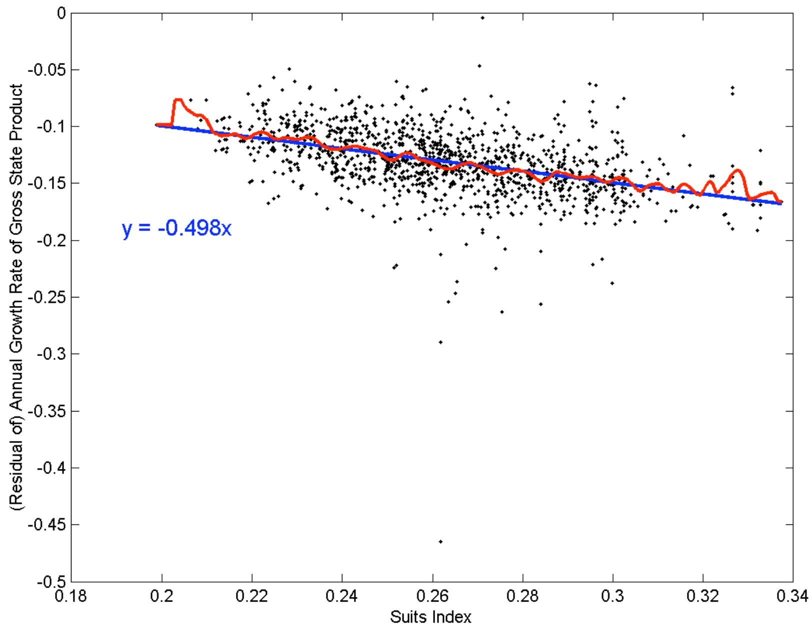
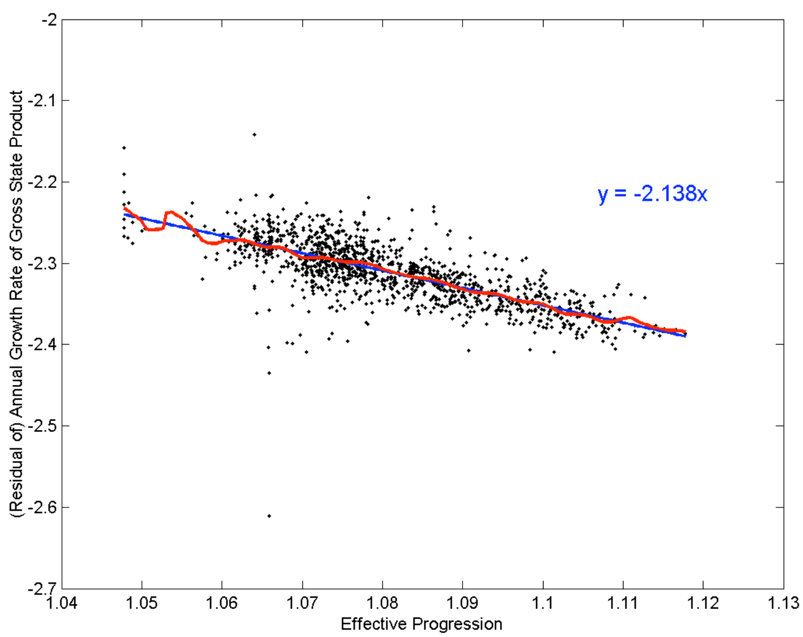


Figure 8: Growth Rate vs. Effective Progression, 3-year Lag



to maintain a balanced budget, a higher average tax rate directly leads to higher spending. This high spending can be a stimulus on the state's economy, by building infrastructure or promoting consumption, for example. If this mechanism works, the average tax rate can have a positive effect on economic growth. However, this positive effect is sensitive to the measure of progressivity used in the regression. The only robust relation found in this set of regressions is the negative effect of income tax progressivity.

3.3 Migration

The natural next step is to look into migration. There is no barrier to migration between states in the U.S., so people can just move to another state if they value lower tax burdens. When this happens, the negative impact on growth rate might merely reflect shrinking population, rather than any change in economic well-being of the residents. Or, the main effect might be coming from the different choices made by economic agents, such as labor supply decisions, while staying in the same state.

Table 4: Per-capita Product Growth Rate and Suits Index

Variable	Spec I	Spec II	Spec III	Spec IV	Spec V
Constant	-0.038*	-0.384			
	(0.018)	(0.289)			
Suits Index	0.164*	0.134*	0.052	0.298*	-0.015
	(0.041)	(0.048)	(0.069)	(0.065)	(0.152)
Average Tax Rate	0.077	0.064	0.153	-0.256*	0.338
	(0.062)	(0.063)	(0.086)	(0.100)	(0.283)
Year Trend		0.000		-0.000	
		(0.000)		(0.000)	
Year Dummy			Included		Included
State Dummy				Included	Included

Dependent variable: annual growth rate (log-difference) of per-capita state products.
Standard errors are in parentheses. * indicates significance at 5% level.

To test these hypotheses, first I run the same types of regressions using annual growth rates of per-capita state products, rather than the gross value. Tables 4 and 5 show the result of contemporaneous regressions using the Suits index and effective progression, respectively. Comparing these tables

Table 5: Per-capita Product Growth Rate and Effective Progression

Variable	Spec I	Spec II	Spec III	Spec IV	Spec V
Constant	-0.082	-0.931*			
	(0.090)	(0.279)			
Effective Progression	0.104	-0.161	-0.005	-0.168	-0.760
	(0.088)	(0.121)	(0.220)	(0.139)	(0.477)
Average Tax Rate	-0.066	0.059	0.109	-0.121	0.639*
	(0.067)	(0.078)	(0.099)	(0.130)	(0.302)
Year Trend		0.001*		0.001*	
		(0.000)		(0.000)	
Year Dummy			Included		Included
State Dummy				Included	Included

Dependent variable: annual growth rate (log-difference) of per-capita state products.
Standard errors are in parentheses. * indicates significance at 5% level.

Table 6: Lagged Regression Results with Per-capita Growth Rate

Variable	No lag	1-year lag	2-year lag	3-year lag	4-year lag
Set I: Regressions with lagged Suits index					
Suits Index	-0.015	-0.130	-0.271	-0.471*	-0.355*
	(0.152)	(0.142)	(0.139)	(0.144)	(0.144)
Average Tax Rate	0.338	0.301	0.154	-0.171	-0.087
	(0.283)	(0.264)	(0.259)	(0.267)	(0.264)
Set II: Regressions with lagged effective progression					
Effective Progression	-0.760	-1.367*	-1.798*	-2.096*	-1.642*
	(0.477)	(0.444)	(0.433)	(0.441)	(0.435)
Average Tax Rate	0.639*	0.940*	1.082*	1.046*	0.847*
	(0.302)	(0.281)	(0.274)	(0.280)	(0.278)

Dependent variable: annual growth rate (log-difference) of per-capita state products.
Standard errors are in parentheses. * indicates significance at 5% level.
For each regression, year dummy and state dummy variables are included.

with Tables 1 and 2, there is no visible difference. It confirms that there is no significant effect of income tax progressivity on the product growth rates in the same year.

Similarly, there is virtually no difference in results when per-capita values are used for the lagged regressions, of which the results are listed in Table 6. Compared to Table 3, the same strong, significant negative effect of the progressivity index on the growth rate can be found here.

Is there any systematic relationship between net migration rate and income tax progressivity? Can we see any specific pattern of net migration for a state, depending on how progressive the state's income tax is? To answer this question, the following equation is estimated

$$\text{Net Migration Rate}_{i,t} = \beta_1 g_{yi,t-s} + \beta_2 S_{i,t-s} + \beta_3 A_{i,t-s} + \delta_t + \gamma_i + \epsilon_{i,t} \quad (5)$$

where $g_{yi,t-s}$ denotes growth rate of per-capita state product for state i from year $t-s$ to $t-s+1$, and $S_{i,t-s}$ and $A_{i,t-s}$ denote the Suits index and average tax rate, respectively, of state i in year $t-s$. Net migration rate in year t is defined by

$$\frac{\text{pop}_{t+1} - \text{pop}_t - (\text{births} - \text{deaths from year } t \text{ to year } t+1)}{\text{pop}_t}$$

for each state i. As before, $s \in \{0, 1, 2, 3, 4\}$.

The top portion of Table 7 shows the results of estimating Equation 5. The bottom part of the table shows the results of regressions using effective progression instead of the Suits index. Here, the result is sensitive to the measure of progressivity used in the estimation.

With the Suits index, the only significant variable is the growth rate of per-capita state products. Neither average tax rate nor the Suits index has any significance. Even if the income tax system has some effect on migration decisions, the per-capita growth rate is the dominant factor. It has positive and significant coefficient both contemporaneously and with some years of lag. Note that, for the income tax progressivity, it is possible that there is two-way migration which cancel out each other. If a state has a highly progressive income tax, high-income population will move out of this state while low-income people will be attracted into this state, other things being equal. This pattern cannot be captured by net migration data. Ideally, the income distribution data should be used instead of net migration. This will be further discussed in the next section.

With effective progression as the measure of income tax progressivity, the per-capita growth rate is still a consistently significant factor. However,

Table 7: Lagged Regression Results with Net Migration Rate

Variable	No lag	1-year lag	2-year lag	3-year lag	4-year lag
Growth Rate per-capita	0.013*	0.080*	0.097*	0.075*	0.053*
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Suits Index	0.019	0.008	-0.005	-0.024	-0.052
	(0.032)	(0.029)	(0.029)	(0.030)	(0.030)
Average Tax Rate	0.035	0.028	0.050	0.070	0.077
	(0.059)	(0.055)	(0.053)	(0.055)	(0.054)
Growth Rate per-capita	0.013*	0.081*	0.098*	0.075*	0.052*
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Effective Progression	0.274*	0.241*	0.126	-0.006	-0.127
	(0.100)	(0.092)	(0.090)	(0.091)	(0.090)
Average Tax Rate	-0.087	-0.070	0.008	0.094	0.172*
	(0.063)	(0.058)	(0.057)	(0.058)	(0.057)

Dependent variable: Ratio of annual net migration rate to population.
Standard errors are in parentheses. * indicates significance at 5% level.
For each regression, year dummy and state dummy variables are included.

income tax progressivity has an effect on migration, too. For contemporaneous and 1-year lagged regressions, the estimated coefficients on effective progression are positive and significant, both statistically and economically. Overall, I cannot find any robust relationship between net migration and tax progressivity at the state level. The only robust relationship found here is the effect of per-capita growth rate on the net migration rate.

4 Discussion

Although it is not the goal of this paper to build a model to explain the relation between economic growth and progressive income taxation, here I suggest a few scenarios which are consistent with the results of the previous section.

First, migration can be a factor in making the growth rate of gross product negatively correlated with income tax progressivity. Average tax rate being equal, a more progressive tax scheme implies a higher tax rate for higher-income people and a lower tax rate for lower-income people. Thus, higher-income people might move out of the state with a more progressive

tax scheme, while lower-income people might move into the state. If the number of migrants are roughly the same in both directions, this state will have lower gross income than before, maintaining the same number of residents. Considering that people do not move instantly, a few years of lag seems reasonable. This scenario is consistent with (a) the negative effect of lagged progressivity on the current growth rate, both in gross and per-capita terms, and (b) the lack of a significant effect of progressivity on the net migration rate.

Ideally, this migration theory should be tested with income distribution data rather than migration data. However, the income distribution for each state and year cannot be easily obtained. To protect privacy, the IRS PUF does not have any state information for individuals with annual income higher than 200,000 US dollars. This prevents me from calculating a reliable Gini coefficient for each state and year. Still, Bakija and Slemrod (2004) found evidence that high state taxes[15] have negative impacts on the number of estate tax returns filed in a state. This finding confirms the notion that wealthy elderly people change their state of residence to avoid high state taxes.

Second, even if people don't migrate at all in response to a lower tax rate, the result can be explained by a change in labor supply in an equally plausible way. Suppose, for example, that the substitution effect is stronger for the higher-income group while labor supply is roughly fixed for the lower-income group. This can be realistic if higher-income professionals are paid by the hours, while lower-income jobs usually pays fixed monthly salaries with fixed hours of work. A progressive income tax effectively lowers the wage of higher-income group, which leads to lower labor supply and lower income through the substitution effect. Because this will not affect the labor supply of lower-income group, more progressive income tax leads to lower gross state product, both in gross terms and in per-capita terms. This scenario does not require any change in migration behavior in response to tax rates.

This theory is supported by evidence in the labor economics literature. For example, Hausman (1985) found that the same amount of increase in a tax rate has a larger negative impact on the labor supply for higher income group than lower income group. This result – higher wage elasticity of labor supply in the higher income group – could lead to the effects observed in this paper.

[15] In their analysis, inheritance and estate tax, sales tax, personal income tax, and property tax were used.

Entrepreneurship can play a role here, too. Starting a new business is risky. The biggest motivation to take this risk is the higher expected income from the start-up than from the current job. A more progressive income tax makes this expected gain smaller after tax, which leads to less risk-taking behavior. This means that a highly progressive tax system might discourage small-scale innovations, leading to lower gross product. Again, this does not require any specific pattern for net migration.

Without more detailed data and an economic model, it cannot be determined which explanation is correct. It might be the case that all of these are true, or that the main effect comes through some other mechanism. This paper gives only a starting point for this line of research. Gathering more data and making models to explain it are the subjects of further work.

5 Conclusion

In this paper, I analyze the progressivity of state income tax in the United States. Using the IRS public use file data and NBER TaxSim, two types of indices – the Suits index and effective progression – are constructed for each of 50 U.S. states and for each year from 1979 to 2004. While federal income tax makes up the bulk of the combined federal plus state tax and drives most of the combined fluctuation over time, the state income tax still has significant variation from year to year and from state to state.

Using these indices of progressivity, the relation between macroeconomic growth and income tax progressivity is investigated. Contemporaneous regressions do not show any significant effect in either direction. However, with three years of lag, income tax progressivity has a significant negative effect on the current year's growth rate, after controlling for the average tax rate and state/year fixed effects. Although these regressions do not prove causality, these findings do support the idea that there is a tradeoff between economic growth and egalitarian redistribution.

Net migration does not show a particular pattern related to Suits index. However, effective progression seems to have a positive effect on net migration. Overall, no robust effect of tax progressivity or average tax rate is found on net migration rate. The per-capita income growth rate is found to have a consistently positive effect on net migration rate, though.

These findings are consistent with several potential explanations. They could be the result of different migration patterns among different income groups, concealed when they are added up into net migration rates. They can also be explained by labor supply reduction (substitution effect) in the

higher income group, or less risk-taking behavior of entrepreneurs. Gathering more detailed data and building an economic model will be a natural next step in explaining this apparent tradeoff.

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Table 8: Regression of Progressivity Index vs. Growth Rate

Variable	Spec I	Spec II	Spec III	Spec IV	Spec V
Dependent Variable: Suits Index in year t					
Constant	0.264*	-3.187*			
	(0.001)	(0.160)			
Growth Rate	0.043*	0.015	0.027	-0.007	-0.000
from $t-1$ to t	(0.019)	(0.017)	(0.015)	(0.012)	(0.006)
Year Trend		0.002*		0.002*	
		(0.000)		(0.000)	
Year Dummy			Included		Included
State Dummy				Included	Included
Dependent Variable: Effective Progression in year t					
Constant	1.081*	-0.758*			
	(0.000)	(0.078)			
Growth Rate	0.005	-0.010	-0.003	-0.006	0.002
from $t-1$ to t	(0.010)	(0.008)	(0.005)	(0.007)	(0.002)
Year Trend		0.001*		0.001*	
		(0.000)		(0.000)	
Year Dummy			Included		Included
State Dummy				Included	Included

Standard errors are in parentheses. * indicates significance at 5% level.

Average Tax Rate: Summary

Year	Average	Maximum	Fed Only
2004	16.23%	19.40% (DC)	13.37%
2003	15.20%	18.32% (DC)	12.43%
2002	16.48%	19.46% (DC)	13.83%
2001	17.24%	20.20% (DC)	14.57%
2000	18.82%	21.83% (DC)	16.05%
1999	18.42%	21.62% (DC)	15.67%
1998	17.95%	21.05% (DC)	15.18%
1997	18.37%	21.17% (DC)	15.69%
1996	17.69%	20.47% (DC)	15.01%
1995	17.35%	20.00% (DC)	14.68%
1994	16.95%	19.55% (DC)	14.30%
1993	16.79%	19.34% (DC)	14.14%
1992	16.40%	19.01% (DC)	13.75%
1991	16.06%	18.66% (DC)	13.52%
1990	16.16%	18.82% (DC)	13.71%
1989	16.31%	18.97% (DC)	13.88%
1988	16.41%	19.06% (DC)	13.98%
1987	16.36%	18.95% (DC)	14.07%
1986	18.08%	20.92% (OR)	15.73%
1985	17.00%	19.60% (DC)	14.79%
1984	16.95%	19.50% (OR)	14.68%
1983	17.00%	19.51% (OR)	14.74%
1982	17.56%	20.33% (MN)	15.50%
1981	18.58%	20.87% (DC)	16.64%
1980	18.05%	20.44% (MN)	16.09%
1979	17.24%	19.83% (WI)	15.23%

State Ranking by Average Tax Rate

Rank	State	Average (1979-2004)	Rank	State	Average (1979-2004)
1	District of Columbia	19.82%	27	California	17.31%
2	Oregon	19.36%	28	Colorado	17.30%
3	Hawaii	18.92%	29	Kansas	17.24%
4	Minnesota	18.88%	30	Ohio	17.20%
5	North Carolina	18.73%	31	New Mexico	17.03%
6	New York	18.61%	32	Nebraska	17.02%
7	Wisconsin	18.56%	33	Alabama	17.00%
8	Maine	18.40%	34	Arizona	16.97%
9	Massachusetts	18.39%	35	Indiana	16.88%
10	Utah	18.34%	36	Illinois	16.64%
11	Idaho	18.28%	37	Pennsylvania	16.61%
12	Georgia	18.11%	38	Mississippi	16.57%
13	Delaware	18.08%	39	New Jersey	16.47%
14	Oklahoma	18.02%	40	Louisiana	16.45%
15	Kentucky	17.97%	41	North Dakota	16.15%
16	West Virginia	17.97%	42	Connecticut	16.08%
17	Iowa	17.90%	43	Tennessee	14.96%
18	Virginia	17.86%	44	New Hampshire	14.87%
19	Montana	17.83%	45	Alaska	14.66%
20	Maryland	17.76%	45	Florida	14.66%
21	South Carolina	17.63%	45	Nevada	14.66%
22	Arkansas	17.60%	45	South Dakota	14.66%
23	Vermont	17.54%	45	Texas	14.66%
24	Rhode Island	17.44%	45	Washington	14.66%
25	Missouri	17.40%	45	Wyoming	14.66%
26	Michigan	17.33%	**Entire Sample**		17.14%

Suits Index: Summary

Year	Average	Maximum	Minimum	Fed Only
2004	0.2749	0.3119 (CA)	0.2410 (OR)	0.2995
2003	0.2969	0.3359 (CA)	0.2568 (OR)	0.3278
2002	0.3027	0.3373 (CA)	0.2642 (OR)	0.3328
2001	0.2981	0.3310 (CA)	0.2608 (OR)	0.3266
2000	0.2686	0.2995 (CA)	0.2387 (OR)	0.2891
1999	0.2731	0.3040 (CA)	0.2384 (DC)	0.2956
1998	0.2716	0.3047 (CA)	0.2376 (HI)	0.2948
1997	0.2785	0.3065 (NJ)	0.2468 (OR)	0.3025
1996	0.2738	0.3029 (CA)	0.2423 (OR)	0.2963
1995	0.2787	0.3102 (CA)	0.2450 (OR)	0.3021
1994	0.2765	0.3081 (CA)	0.2420 (OR)	0.2998
1993	0.2769	0.3100 (CA)	0.2439 (OR)	0.3005
1992	0.2588	0.2973 (CA)	0.2282 (OR)	0.2779
1991	0.2484	0.2854 (CA)	0.2229 (OR)	0.2663
1990	0.2348	0.2715 (CT)	0.2079 (OR)	0.2528
1989	0.2355	0.2734 (CT)	0.1988 (KY)	0.2534
1988	0.2426	0.2792 (CT)	0.2064 (KY)	0.2610
1987	0.2534	0.2899 (CT)	0.2174 (KY)	0.2754
1986	0.2811	0.3221 (CA)	0.2408 (OR)	0.3010
1985	0.2564	0.2921 (CA)	0.2175 (OR)	0.2768
1984	0.2542	0.2892 (CA)	0.2133 (OR)	0.2741
1983	0.2523	0.2865 (CA)	0.2134 (OR)	0.2710
1982	0.2439	0.2759 (CA)	0.2087 (OR)	0.2619
1981	0.2411	0.2633 (CA)	0.2120 (OR)	0.2578
1980	0.2540	0.2784 (NM)	0.2228 (MA)	0.2723
1979	0.2642	0.2913 (NM)	0.2333 (MA)	0.2841

State Ranking by Suits Index

Rank	State	Average (1979-2004)	Rank	State	Average (1979-2004)
1	California	0.2977	27	Arkansas	0.2631
2	Connecticut	0.2885	28	Missouri	0.2609
3	Alaska	0.2867	29	Michigan	0.2600
3	Florida	0.2867	30	West Virginia	0.2581
3	Nevada	0.2867	31	Colorado	0.2581
3	South Dakota	0.2867	32	Delaware	0.2568
3	Texas	0.2867	33	Idaho	0.2563
3	Washington	0.2867	34	Oklahoma	0.2553
3	Wyoming	0.2867	35	Wisconsin	0.2551
10	New Hampshire	0.2847	36	Montana	0.2517
11	New Mexico	0.2842	37	Pennsylvania	0.2514
12	Tennessee	0.2828	38	Iowa	0.2511
13	New Jersey	0.2802	39	Illinois	0.2507
14	North Dakota	0.2787	40	Georgia	0.2506
15	Ohio	0.2772	41	Virginia	0.2499
16	Vermont	0.2766	42	Indiana	0.2495
17	Mississippi	0.2765	43	District of Columbia	0.2468
18	Nebraska	0.2748	44	Maryland	0.2464
19	Rhode Island	0.2727	45	Utah	0.2460
20	Louisiana	0.2711	46	North Carolina	0.2449
21	Maine	0.2705	47	Alabama	0.2446
22	Arizona	0.2669	48	Massachusetts	0.2435
23	New York	0.2668	49	Hawaii	0.2424
24	South Carolina	0.2660	50	Kentucky	0.2394
25	Minnesota	0.2648	51	Oregon	0.2324
26	Kansas	0.2646		**Entire Sample**	0.2650

Effective Progression: Summary

Year	Average	Maximum	Minimum	Fed Only
2004	1.0872	1.1009 (CA)	1.0752 (AK)	1.0752
2003	1.0822	1.0945 (ME)	1.0712 (AK)	1.0712
2002	1.0913	1.1030 (ME)	1.0810 (AK)	1.0810
2001	1.0971	1.1091 (ME)	1.0864 (AL)	1.0864
2000	1.1031	1.1178 (CA)	1.0909 (AK)	1.0909
1999	1.1000	1.1137 (CA)	1.0884 (AK)	1.0884
1998	1.0949	1.1080 (MN)	1.0837 (AK)	1.0837
1997	1.0978	1.1152 (MN)	1.0867 (AK)	1.0867
1996	1.0585	1.0755 (MN)	1.0478 (AK)	1.0478
1995	1.0880	1.1042 (MN)	1.0773 (AK)	1.0773
1994	1.0841	1.0998 (MN)	1.0737 (AK)	1.0737
1993	1.0828	1.0949 (DC)	1.0725 (AK)	1.0725
1992	1.0774	1.0901 (DC)	1.0670 (AK)	1.0670
1991	1.0719	1.0846 (DC)	1.0623 (AK)	1.0623
1990	1.0702	1.0832 (DC)	1.0616 (AK)	1.0616
1989	1.0713	1.0846 (DC)	1.0628 (AK)	1.0628
1988	1.0740	1.0907 (MN)	1.0652 (AK)	1.0652
1987	1.0731	1.0916 (MN)	1.0658 (AK)	1.0658
1986	1.0863	1.1032 (NY)	1.0777 (AK)	1.0777
1985	1.0728	1.0863 (DC)	1.0655 (TN)	1.0660
1984	1.0714	1.0867 (MN)	1.0639 (TN)	1.0643
1983	1.0713	1.0887 (MN)	1.0638 (TN)	1.0641
1982	1.0718	1.0855 (DC)	1.0659 (TN)	1.0659
1981	1.0760	1.0895 (NY)	1.0703 (PA)	1.0705
1980	1.0769	1.0914 (NY)	1.0712 (AK)	1.0712
1979	1.0749	1.0899 (NY)	1.0688 (AK)	1.0688

State Ranking by Effective Progression

Rank	State	Average (1979-2004)	Rank	State	Average (1979-2004)
1	District of Columbia	1.0933	27	Connecticut	1.0816
2	Minnesota	1.0929	28	Michigan	1.0816
3	New York	1.0912	29	Virginia	1.0814
4	Maine	1.0911	30	Montana	1.0813
5	California	1.0910	31	Mississippi	1.0812
6	Wisconsin	1.0877	32	New Jersey	1.0810
7	Vermont	1.0864	33	Arizona	1.0807
8	New Mexico	1.0863	34	Colorado	1.0803
9	Idaho	1.0857	35	Maryland	1.0792
10	Ohio	1.0853	36	Louisiana	1.0789
11	South Carolina	1.0850	37	North Dakota	1.0787
12	Rhode Island	1.0847	38	Kentucky	1.0779
13	Oklahoma	1.0845	39	Indiana	1.0747
14	Hawaii	1.0841	40	Pennsylvania	1.0738
15	North Carolina	1.0841	41	Alabama	1.0735
16	Delaware	1.0838	42	Illinois	1.0733
17	Nebraska	1.0836	43	New Hampshire	1.0723
18	Utah	1.0834	44	Tennessee	1.0722
19	West Virginia	1.0833	45	Alaska	1.0718
20	Arkansas	1.0833	45	Florida	1.0718
21	Georgia	1.0833	45	Nevada	1.0718
22	Oregon	1.0832	45	South Dakota	1.0718
23	Missouri	1.0825	45	Texas	1.0718
24	Kansas	1.0820	45	Washington	1.0718
25	Massachusetts	1.0820	45	Wyoming	1.0718
26	Iowa	1.0817	**Entire Sample**		1.0810